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Scientific mobility and knowledge networks in high emigration countries: Evidence from the Pacific

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ABSTRACT

This paper uses a unique survey to examine the nature and extent of knowledge flows that result from the international mobility of researchers whose initial education was in small island countries. Current migrants produce substantially more research than similar-skilled return migrants and non-migrants. Return migrants have no greater research impact than individuals who never migrate but are the main source of research knowledge transfer between international and local researchers. Our results contrast with previous claims in the literature that too few migrant researchers ever return home to have much impact, and that there is no productivity gain to researchers from migration.

1. Introduction

The highest rates of highly skilled emigration are from small island nations, especially in the Pacific (Gibson and McKenzie, 2011). Possible 'brain drain' effects from researchers leaving such countries may impair local capacity for innovation, and thus matter to local research policy. Offsetting this, a highly skilled diaspora may facilitate knowledge transfer from host countries since ethnic scientific and entrepreneurial channels enhance the transfer of codified and tacit knowledge regarding new innovations. As Kerr (2008, p. 536) notes: "frontier expatriates play an important role in technology transfer".

Famous cases of a skilled diaspora stimulating growth and innovation focus on migrant entrepreneurs returning from Silicon Valley to set up businesses in China, India and Taiwan (Saxeenian, 2006). To the extent these cases generalize, permissive emigration of the highly skilled to build up a diaspora, some of whom then return, is a potentially powerful tool for accelerating technological catch-up. But countries with the highest emigration rates are not like China, India or Taiwan.[1] Hence, the case study evidence may be less relevant to much smaller and peripheral countries, such as those in the Pacific Islands. Indeed, writing about another scientifically peripheral country (Colombia), Meyer (2001, p. 101) notes:

> "For those who attempted to return, the unreliability of colleagues and the weakness of infrastructure have often been huge problems. They felt that conditions were such that their skills and knowledge could not be applied properly."

Whether emigrant researchers from small, peripheral countries provide more benefit to their homeland by being overseas, with better access to research funds and more active scientific networks, remains unknown. It is also not known whether researchers who return to such countries produce any special benefits compared with the researchers who never left. The purpose of this paper is

[1] Comprehensive quantitative evidence shows that the association between knowledge diffusion through ethnic networks and the growth in manufacturing output of countries that share the same ethnicity is especially strong for high technology sectors and for the Chinese ethnic group (Kerr, 2008). Hence, case study evidence on the experience of a skilled Chinese diaspora in Silicon Valley may overstate the general opportunities for positive effects on smaller countries that are losing highly skilled emigrants to the technologically advanced countries.

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to provide the first systematic empirical evidence on these issues for researchers from high-emigration countries. Our unique survey tracks worldwide the best and brightest academic performers from three Pacific countries (New Zealand, Tonga and Papua New Guinea). Here we focus on scientists and other researchers, who make up about one-quarter of the total sample.[2] In addition to detailed questions on migration histories, our sample have provided information on the scientific networks that they belong to, their publishing activity and research funding, and on-going links to the research environment in their home country. Our sample covers rich (New Zealand) and poor (Tonga and Papua New Guinea) countries, allowing us to draw some general conclusions about the net benefits of scientific mobility for small countries with high rates of skilled emigration.

Unlike prior studies of elite 'brain drain' we do not focus on specific scientific disciplines or occupations, such as chemists (Gaulé, 2011), physicists (Hunter et al., 2009), health professionals (Clemens and Pettersson, 2008), or economists (Ben-David, 2009). Individuals wishing to migrate may choose portable occupations and disciplines; for example, law has a high degree of country specificity while mathematics is universal, so a talented student wanting to migrate may choose mathematics over law. Furthermore, migration may be needed in order to train for, or pursue, a particular occupation. Consequently, it is not clear that the right counterfactual for a researcher in a particular discipline abroad is necessarily someone in the same occupation or discipline in the home country.

Instead, our focus is individuals of high academic ability – the top performers in their country at the end of secondary school. This can be objectively measured in terms of national examinations, or by being one of the top academic performers (such as a valedictorian or Dux), in elite secondary schools. With this approach we can ex post define the sample frame in terms of ex ante characteristics, surveying in the present those individuals who were at the top of high school classes in earlier years.[3] Conversely, approaches based on revealed career performance (e.g., Trippl, 2013; Weinberg, 2011) may be subject to a form of survivorship bias; for example, if the odds of being highly cited are lower for non-migrant researchers than for those who migrated to global centers of scientific activity, a survey frame of highly cited researchers may not give valid counterfactuals. A non-migrant who still manages to be highly cited may be drawn from the more extreme tail of non-migrant productivity than an equally highly cited expatriate researcher. In contrast, our approach allows us to identify individuals before they have self-selected into particular careers or migrated overseas for postgraduate education, and thus provides natural comparison groups of highly skilled emigrants, returnees, and individuals of similar academic talent who never migrated.

One consequence of our sampling approach, and the age range we use to balance the practicality of tracking people with the need to see sufficient career development, is that many of the researchers we study are early in their career and may not yet have had much research success. Thus, our approach can be thought of as yielding a sample of 'ordinary' scientists rather than the elite researchers previously studied (e.g., Trippl, 2013). While some of the researchers in our sample publish in world class journals within their disciplines, such as *Science*, *Nature*, the *British Medical Journal*, *Lancet*, *Thorax*, the *Journal of the American Chemical Society*, *Transactions of the American Mathematical Society*, the *SIAM Journal of Computing*, and the *Quarterly Journal of Economics* others are yet to publish much and are rarely cited. However, ex ante, policy makers in emigrant source countries do not know which researchers are going to be successful, so it is likely to be researchers such as the ones we study that policy makers have in mind when they reform research policy so as to either restrain emigration or else attempt to attract emigrant researchers back.

Our findings should be most informative for small, emigrant-sending countries grappling with issues related to the mobility of their scientists.[4] But policy makers in destination countries also may have an interest in these issues since the appropriate stance of host countries to the return home of foreign research students is currently a topic of debate (Bloomberg, 2011). Similarly, some destination country researchers, especially in the medical field, want to limit the scope for emigration of health professionals from developing countries, under the guise of 'ethical recruitment'. The view of these researchers is that recruiting by wealthy countries is threatening the viability of health programs in poor countries, especially in sub-Saharan Africa (Scott et al., 2004).

2. Previous literature

Several recent papers describe 'brain drain' rates for researchers. For example, Gaulé (2011) studies career histories for scientists with undergraduate degrees from outside of the US who were ever faculty of US PhD-granting chemistry departments between 1993 and 2007. Only five percent had returned to the country of undergraduate degree in the observation period, suggesting that the return migration channel is weak. This low return rate implies that claims of a substantial benefit from returnees (e.g., Mayr and Peri, 2009) may be overstated. More broadly, Weinberg (2011) examines ISI highly-cited researchers from 21 scientific fields, and finds that 1-in-8 highly cited researchers was born in a developing country but only 1-in-40 now lives in a developing country.[5] Even richer regions may suffer these 'brain drain' effects, with Docquier and Rapoport (2009) finding rates of European emigration to the US for science and technology researchers that are five times higher than the emigration rate of the tertiary educated (the typical measure of 'brain drain' adopted in cross-country studies).

Similarly, Hunter et al. (2009) study 158 physicists in the ISI highly-cited database, from 32 different countries of birth, narrowing to 22 countries of PhD study and 16 countries of current residence (with two-thirds currently in the US, though only 30% were born there). To test for positive impacts of migration on productivity they calculate the *h*-index (the author has written *k* papers that are each cited at least *k* times) and find that separating the sample by whether they had migrated – since either birth, bachelors, or PhD – shows no statistically significant difference in the *h*-index. The conclusion drawn from this comparison is that migration does not raise the productivity of elite scientists; a point which was argued more forcefully in an earlier working paper (Ali et al., 2007, p. 28)[6]:

[2] In Gibson and McKenzie (2011a) we used the full sample to investigate the determinants of migration and return migration decisions by the highly skilled, but without any special focus on those who are researchers, while Gibson and McKenzie (2012) examine impacts through standard channels like remittances and trade.

[3] The results below focus on students graduating high school between 1976 and 2004, compromising between the better records on more recent students and the longer work histories for earlier students.

[4] There are over 110 countries with a population below that of New Zealand, so these issues of the appropriate policy response to scientific mobility from small countries are likely to have widespread salience.

[5] Moreover, an expansive definition of developing countries is used which includes Israel – the home to more highly cited researchers than any other country classified by Weinberg as part of the developing world.

[6] Whether migration raises researcher productivity is important for evaluating the welfare consequences of this mobility. As Kuhn and McAusland (2009) note, migration with sufficiently higher productivity of the emigrants may compensate any economic loss to the source country, through the mechanism of source-country consumers benefiting from the knowledge-intense products derived from the work of these emigrant researchers.

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