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## On the value of foreign PhDs in the developing world: Training versus selection effects in the case of South Africa

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### ABSTRACT

When seeking to improve science in emerging economies, uncertainty exists whether PhD training in an emerging economy can yield comparable results to PhD training in the developed world. Scientific achievements may vary because of excellent training at good universities, but also because excellent students select (and are selected by) good universities. This paper compares the career effects of overseas and domestic PhD training for scholars working in an emerging economy, South Africa. We differentiate between and examine both selection and training effects for PhDs from three tiers of South African and two tiers of foreign universities. South African academics with PhDs from universities in industrialised countries generally achieve greater career success than those with local PhDs, but training by universities in industrialised countries is not necessarily better than local training. Our results suggest that the perceived superiority of foreign PhD training stems from selection rather than do training effects, and pure selection effects in fact explain career outcomes better than training effects. Focusing on training rather than selection, PhDs from top South African universities produce a similar quantity and quality research output to those trained by the leading universities in the developed world. From the perspective of an emerging economy with limited resources wishing to advance science, the development of local universities should thus be stressed, although it is clear that individuals who are able to study for a PhD abroad gain personally when they return.

### 1. Introduction

The importance of universities in technological and economic development has long been recognised (Mowery and Rosenberg, 1999; Murmann, 2003; Rosenberg and Nelson, 1994) and in the context of increasingly knowledge-intensive economies, it is likely that universities will play an even greater role in the future upgrading of less developed countries (Altbach, 2013; Brundenius et al., 2011).

Although a common policy goal is to develop the research capacity of their countries, local institutions are often not in a position to train young scientists in sufficient number and quality. Upgrading relevant local institutions is a lengthy and costly process and limited by the existing scientific work force (Heitor et al., 2014; Horta, 2010). Not only is it not clear whether developing countries have the capacity to provide quality training to PhDs, it also takes years before the contribution of a scholar to his or her field becomes clear. This makes it

hard to judge whether scholars can be trained locally, or whether they should rather seek PhD training abroad.

In this paper, we focus on the scientific contribution of academics working in a developing country, comparing the scholarly success of those who received their PhD training locally with those who were trained abroad. We examine two key explanations for quality differences in the scientific achievement of academics across PhD granting universities: selection effects (since universities with better reputations are likely to attract better students) and training effects (the impact of doing a PhD in a certain university).

The limited available scholarship about the capacity of universities in developing countries is often not very optimistic. In particular, the scientific competence of local research faculty is thought to stem mainly from advanced training abroad. The statement by Nelson (2005:27) exemplifies such a view:

*“Indigenous universities will play a key role as the source of students who*

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*take advanced training abroad, and as the home of faculty who have been trained abroad.”*

This paper contributes to the literature on universities in developing countries by examining scholars working in a developing country, South Africa, exploring whether there is a systematic relationship between where scholars have received their PhD training (locally or abroad) and the quality of their scholarship as judged by their peers. We thus examine the relative contribution of local and foreign scientific training to scientific excellence in local research faculty.

We do not address the issue of the academic diaspora, or brain circulation. Rather we explicitly focus on researchers working in their home country, and ask what contributes to their differential career success. In particular, we seek to understand for those who stayed in or returned to their home country, to what extent their different career paths can be explained by where they did their PhDs.

We (unsurprisingly) find a quality hierarchy of universities both locally and abroad. Foreign universities demonstrate a very strong selection effect with the top local students preferring to study at top global universities. Even the foreign universities of a somewhat lower rank exert a strong selection effect. However, in terms of impact on subsequent scientific achievements, for those who eventually have careers in the home country, the leading local universities have a training effect that is equivalent to that of globally recognised universities.

This finding offers an alternative to the sometimes narrow view of the relative contribution of local and foreign scientific training to the quality of local research faculty in the context of a middle income economy (e.g. Nelson, 2005). The main policy implication for universities in developing countries is that real benefits can be achieved by investing in improved PhD training, and we conclude with some recommendations about how that might be achieved.

## 2. The value of quality scholarship at developing country universities

There is by now an extensive body of work on the role of universities in upgrading (Mowery and Rosenberg, 1999; Murmann, 2003; Rosenberg and Nelson, 1994). Moreover, work on the growing importance of scientific knowledge to economic growth suggests that the role of universities will continue to increase in importance (Conceição and Heitor, 1999; Deiacio et al., 2012). Scholars (Altbach, 2013; Brundenius et al., 2011) have thus emphasized that universities in developing countries are likely to play an especially important role in the future.

Implicit in the body of work on the role of universities in upgrading, whether through university-industry linkages (De Fuentes and Dutrenit, 2012; Giuliani and Arza, 2009), spinoffs (Benneworth and Charles, 2005; Chen and Kenney, 2007; Kroll and Liefner, 2008), or simply the creation of a skilled workforce (Bell and Pavitt, 1997), is that the university is a key source of new and useful knowledge. This suggests that the quality of scholarship conducted there is foundational to the societal benefits that universities can provide.

A large body of research exists examining the research behaviour (especially productivity) of foreign-trained scholars in scientifically peripheral countries (Delicado, 2010; Gibson and McKenzie, 2014; Jonkers and Cruz-Castro, 2013; Li et al., 2015), and there is also a substantial body of literature on the return intentions (or not) of those scholars (Grogger and Hanson, 2013, 2015; Kim et al., 2011; Soon, 2012). Another part of the literature highlights the potentially virtuous interaction between locally-trained and foreign-based scholars of developing countries (Baruffaldo and Landoni, 2012; Jonkers and Tijssen, 2008).

Although much is known about the publication and work patterns of scholars based on where they have studied, less is known about how this translates to the systemic level (see Zhang et al., 2013, for an exception). In developing our understanding of universities in developing

countries, we simultaneously consider scholars working there who have been trained abroad and those who have received their training locally. If a systematic difference can be seen between these two groups, it should help policymakers in deciding whether to prioritise one group over the other.

PhD students get selected at universities in a process where the preferences of students to join a certain doctoral programme must be matched with the requirements of PhD admission committees. This results in a process of (self-)selection such that characteristics of PhD students vary with the PhD granting university. Once students have been accepted, they undergo training, which is likely to also vary by university.

The close relationship between selection and training has long been recognised: In his article on the “Matthew effect”, Merton (1968) pointed out a virtuous effect by which many Nobel Prize winners had themselves been trained by Nobel Prize winners. But selection and training are conceptually distinct: Selection reflects the innate ability (“raw material”) of a student who selects and is selected by a given university, and is likely to be influenced by the perceived mutual desirability. Training reflects the transformation that the student undergoes while being at that university, and is more likely to be influenced by available resources such as equipment and supervisory capacity.

Our question is thus not only whether there are differences in the career success, measured over time, of academics working in developing countries who received their PhDs locally versus in industrialised countries, but also how selection and training effects respectively explain those differences. The distinction matters, because training effects will vary based on the human and organisational resources of the university, whereas selection effects reflect a perceived view of quality, both the student’s view of the university, and vice versa.

### 2.1. Selection effects

The available scholarship about the research capacity of universities in developing countries is often not particularly optimistic, with Nelson (2005), for example, suggesting that the main role of universities in developing countries is to absorb foreign-trained faculty who can prepare students for advanced training at leading academic centres abroad. In other words, in much extant work, cutting-edge science is not perceived as happening at developing country universities. Instead, in terms of their contribution to the advancement of science, the most likely contribution of scholars working at universities in developing countries is argued to be in preparing promising students for academic success elsewhere.

A similar idea is elaborated via the notion of a “social technology” (Nelson, 2004). Nelson argues that a primary purpose of the university in a developing country context is to establish the “social technologies” that support a given scientific field. Nelson and Sampat (2001) argue that social technologies, i.e. the customs and codes of practice in a field, are an essential complement to physical technologies and enable institutions to be effective. They give the example of gaining mastery of the research methods of organic chemistry, and describe the relevant social technology as “the system of training young chemists in the relevant physical technology” (2001:50). Likewise, Bell and Pavitt (1997) view the university as part of the “infrastructure” within which firms operate.

All of these views are quite limiting. They suggest that the value of universities in developing countries should be measured in terms of their contribution to a generally more enabling environment for knowledge-intensive activities, rather than in terms of scientific advancement per se. This literature is silent on the role of developing country universities in the training of PhDs, because it is understood that “serious scholars” will seek to go to universities where knowledge creation is central, i.e. abroad. This kind of (largely implicit) view strongly suggests that a selection effect will drive top students to go abroad for PhD training.

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