THE BRAIN DRAIN: A REVIEW OF THEORY AND FACTS

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ABSTRACT:

Skilled migration has increased in recent years, often stimulated by the explicit use of targeted visa programmes by developed countries. This paper examines the available analytical and empirical literature on the brain drain to try and understand better whether skilled migration from developing countries must always be harmful to the country of origin. We show that early generation models – mostly dating to the 1970s – found that such migration would be harmful, mostly through the impact on wages and employment, as well as through fiscal costs. A more recent literature has argued that a beneficial brain drain can arise if migration has educational externalities. As human capital rises, growth will also be positively affected. However, we show that if screening is applied such benefits may disappear or become smaller. Recent empirical work on the health and software sectors provides some contrasting evidence.

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KEYWORDS: skilled migration, educational externalities, growth.
INTRODUCTION

The migration of skilled personnel has attracted considerable attention in recent years as the developed countries have increasingly and explicitly targeted the recruitment of talented individuals from developing countries. Perhaps the most well known example has been the use by the USA of H1-B visas in the 1990s to import skilled workers – mostly from India – for the booming high technology sector. Other countries have also pursued similar cherry-picking immigration policies. This in turn has opened up debate about the economic and ethical consequences of such strategies. In particular, the view that skilled migration must necessarily be detrimental to developing countries – by definition relatively less well endowed in skills than the developed countries – has gained wide currency, at least in the popular press.

While an earlier literature and policy analysis – dating back to the 1970s – did generally support the view that skilled migration was bad for the sending or developing country, more recent analytical and empirical findings permit a rather more nuanced and potentially different view of the consequences of skilled migration. In particular, it has been argued that skilled migration can be beneficial if the possibility of migration in turn leads to individuals acquiring more skills or education. That acquisition will raise the human capital stock of the sending country and could contribute positively to growth and economic performance. Yet – in common with the earlier literature – attempts at empirical validation have been, as yet, very limited, and the evidence concerning the consequences of skilled migration for developing countries remains not only limited but also largely inconclusive.

This paper provides an overview of the literature on the brain drain but it also adds findings from some recent empirical work that attempts to address some of the main issues indicated above. It is organised as follows. Section 1 concentrates on reviewing an earlier generation of models and their key findings. Section 2 then turns to a more recent class of models that can generate ‘beneficial’ brain drains and the empirical work that this research has prompted. Section 3 then briefly touches upon some of the associated effects of skilled migration, such as remittances, networks and the duration of migration. Section 4 concludes.

1. EARLY MODELS OF BRAIN DRAIN

The welfare implications of brain drain in earlier generation static models crucially depended on the assumptions made about wage setting. Once distortions, such as a gap between social and private marginal product and/or a public subsidy for education, were introduced, a welfare loss for those who do not emigrate could result. Bhagwati and Hamada (1974) – the seminal paper of this era - worked in general equilibrium and introduced distortions in the wage setting and in the financing of education. The model – which was subsequently widely employed - can be boiled down to a fairly simple set of blocs.
The economy produces two outputs with skilled and unskilled labour. The two types of labour are exclusively allocated to their respective sectors. The real wage for skilled workers is determined by unions and includes an element of international emulation whereby skilled wages are partly related to skilled wages abroad. Minimum unskilled wages are fixed by association with the skilled wage or 'leap frogging': a rise in the skilled wage leading to an increase in the unskilled wage. In addition, the supply side reflects the incentive for education to be acquired so long as the expected wage for educated (skilled) labour exceeds the uneducated (unskilled) wage. A fixed educational cost is introduced. Unemployment enters the initial equilibrium. There is also an exogenous flow of educated emigrants. In this model the international integration of the skilled labour market can affect both sectors' wages through emulation and leap-frogging, as well as expected wages through the actual foreign wage and the probability of emigration. The latter will affect education decisions, and education in turn carries a fixed cost.

With respect to unemployment, emigration may act directly to lower skilled unemployment, but it also exerts two other effects. First, it can raise the expected wage by lowering unemployment (and hence may have a supply side effect) and this can be amplified if the emigration wage enters the expected wage. The net result depends on the elasticity of demand for skilled labour which determines whether the skilled labour wage bill increases or not. If the elasticity is lower than unity, an x% increase in skilled wages will increase the wage bill and thus be associated with a less than x% fall in employment. Thus the expected wage will have increased and the supply of skilled workers will tend to rise as a result. To the extent that the acquisition of skills through education is subsidised, this will similarly raise the cost to the sending country.

Second, if the skilled wage increases because of emigration, this may also spill over into other sectors and hence have an impact on unemployment in those other sectors. Wage leap-frogging – letting unskilled wages follow skilled wages – would simply tend to extend unemployment to the unskilled and amplify the welfare reducing consequences of skilled labour migration. With respect to national income, a rise in the skilled wage tends to reduce national income because of the decline in the employment of skilled labour without any offsetting effect from the unskilled sector (in the case of no associated effect on unskilled wages), while the cost of education will also tend to increase. However, with the assumption of wage 'leap-frogging', the implications for national income are not so clear cut. Further, to the extent that emigration raises the wage of the emigrant, this implies that emigrants were receiving less than their marginal product. This surplus – as measured over the group – would be lost to the sending country in the event of emigration. The size of the loss depends on the extent to which such workers are replaceable.

Hamada and Bhagwati (1975) extended the model by introducing a number of refinements to labour markets in the sending countries. For example, if emigration induced a ladder effect with remaining skilled workers now better matched to skilled, rather than
unskilled, jobs thereby reducing unskilled unemployment – a variant of Harris-Todaro – then the effects of emigration could indeed be positive. By contrast, while emigration of skilled workers – such as doctors - might reduce labour market slack, it could also reduce the flow of doctors from urban to rural areas and limit any positive diffusion effect. To the extent that the external labour market is more efficient at screening workers, the result would be the loss of the most efficient to the sending country¹.

These early generation models treat the demand side for emigrants as exogenous and have a range of assumptions regarding education costs. At their heart, lies the specification of the sending country’s labour market: under wage rigidity, emigration tends to lower sending country employment with the distribution over sectors being contingent on relative wage setting and ex ante employment levels.

What were the empirical foundations for such models? With regard to wage differentials, the few extant (and generally biased) estimates of wage differentials across countries signal substantial wage gaps for most categories of skilled workers. Indeed, other evidence confirms that skilled workers systematically earn less – adjusted for purchasing power - in developing than in developed countries. A recent study of new immigrants to the USA, for example, finds that the average immigrant realized major earnings gains over their last job abroad. For men this increase was 68 percent and 62 percent for women. New immigrants who came primarily for work reasons experienced by far the largest increases in earnings².

In terms of the impact of migration on labour markets in the sending countries, evidence has remained even more limited. Arora et al (2001) and Kumar (2000) have found that one of the major problems perceived by Indian ICT firms is a shortage of skilled labour. The late 1990s boom in the Indian software sector was clearly associated with increased demand for engineers and there is evidence of this forcing up skilled wages. But even here, the consequences may not have been that lasting or necessarily that widespread as work reported in Commander et al (2004) indicates.

There is more information concerning lost educational investment. In most developing countries at least some part of the cost of education is borne by the government, partly because the social return from education is higher than the private one. In recent times, there has been an increase in the provision of private educational services in many developing countries where the cost is largely, if not exclusively, borne privately. However, even when this is the case, any additional social returns to education, as well as public investment in primary and secondary education, are lost when an individual emigrates.

² See also Arrow (1973) and Spence (1974).
¹ Jasso, Massey, Rosenzweig and Smith (2000); Jasso, Rosenzweig and Smith (2000).
Estimating the exact cost of education is very difficult and the result depends on the approach that is taken in allocating fixed costs across outputs. There are some available cost estimates. For example, the total cost of a medical degree in India has been estimated to be eight times annual GDP per capita (Jayaram 1995), and for an engineering degree four times annual GDP per capita (Salim 1996). World Bank/UNESCO data show that average government expenditure per student on tertiary education varies a lot, but mostly lies in the range of 1000-3000 (international) dollars. In both China and India the expenditure is around 2000 dollars per student.

Yet simply assuming that the education costs in developing countries are largely publicly financed misses some important innovations in educational services supply and financing that has occurred in the 1990s. These may in turn have been positively influenced by the emigration of the skilled. For example, in India private institutions have begun training specialists for the software industry. According to Arora et al (2001) while the supply of engineering graduates from the main public educational institutions is relatively inelastic in the short run, privately the trained supply of software professionals has increased substantially, dampening the wage effect of the demand side changes.

In China there is also a number of private institutions. It has been estimated that there has been a strong expansion of private education since the 1980's. According to the official figures in 1998 there were 1274 private tertiary institutions, the majority of which prepare students for national exams rather than confer degrees. However, an estimated 4 million students study in private tertiary institutions, not recognised by the Ministry of Education. (Dahlman and Aubert 2001.)

Of course, such innovations have had little or no impact in sectors where certification and regulation have been tighter, as, for example, with healthcare and teaching. Indeed, it is still broadly correct to assume that the bulk of doctors, nurses and teachers in developing countries receive substantial public subsidy to their training. Although the question of new methods of financing higher education has been raised strongly, in most developing countries students' own contributions to the costs of higher education are still small (Johnstone et al, 1998; Tilak 1996 and Jayaram 1995).

This early literature on the brain drain lacked any significant empirical component. There was no attempt at disaggregation beyond skilled-unskilled categories. Sectoral differences were ignored and there was no attempt to take the analysis to the level of the firm. Finally, there was little attention to heterogeneity between sending countries. The literature also arguably over-emphasised the dichotomy between those who emigrate and those who stay. Modern communications technology has had radical implications for the ways in which work can be done across space. For example, the recent growth in software activity has been striking for its high network content, linking firms and individuals in developing and developed countries without necessarily inducing migration or inducing only temporary mobility. Return migration can also
be a significant source of positive effects. For example, Dos Santos and Postel-Vinay (2003) show that it is rational for some migrants to return having enhanced their human capital and that this may be associated with narrowing the technological gap between developed and developing countries.

Finally, it is also worth mentioning that positive consequences of a brain drain for the sending country could arise from changes in the terms of trade as the sending economy's output falls along with the decrease in its endowments. For example, Winters et al. (2002) find these to be quite significant in a CGE model of migration. Davis and Weinstein (2002) point out that if a country has a Hicks-neutral technical advantage, there will be incentives for all factors to migrate towards it. If such migration left relative factor abundance unchanged, incumbent factors from that country would lose as their own physical marginal productivity would remain unchanged while the prices of their output fell.

2. Endogenous Growth and the 'Beneficial Brain-Drain'

A more recent literature has evolved following a decade and more of liberalisation. This literature has located the brain-drain in explicitly dynamic models and has, on the whole, come up with significantly more optimistic results than the earlier work. The central proposition is that if the possibility of emigration encourages more skill-creation than skill-loss, sending (or home) countries might increase their stocks of skills as opportunities to move or work abroad open up. If, in addition, this accumulation of skills has beneficial effects beyond the strictly private gains anticipated by those who acquire the skills, the whole economy can benefit. Examples of such benefits include enhanced intergenerational transmission of skills and education (Vidal, 1998) and spillovers between skilled workers (Mountford, 1997).

There are two critical features of these models. The first is the nature of the social benefit resulting from higher skills, for which several approaches are evident. In the simplest form Stark, Helmenstein and Prskawetz (1997, 1998) and Stark and Wang (2002) merely assume that increasing the average skill level of the sending economy is desirable. Mountford (1997) postulates a production externality whereby the productivity of current labour depends positively on the share of the population who had education in the previous period. Beine, Docquier and Rapaport (2001a) formalise this by allowing the average skill of one generation to pass directly to the next, who can then build on it by taking education. In all these cases, emigration has a negative direct effect by draining skilled labour out of the sending economy - a 'drain' effect - but a potentially beneficial effect in encouraging human capital formation - a 'brain' effect.

Vidal (1998) assumes an intergenerational transfer whereby the higher the human capital level of one generation, the more effective is the human capital formation of the next generation. This too would seem to be a force for divergence, for skilled emigration
would appear to make future human capital acquisition cheaper in the receiving country and dearer in the home country. But, in fact, Vidal prevents this by assuming that, for the purposes of the spillover, migrants' human capital remains at home. This makes no sense for permanent migration - the traditional and main concern of the brain-drain literature - but it may be plausible for temporary migration, an area of more recent interest – see Winters et al (2002).

The second critical issue for the beneficial brain-drain is the mechanism that generates an increased incentive to acquire education but leaves some skilled workers back at home. All the current literature starts with wages for given levels of skills/ability being higher abroad than at home. From there, the predominant approach – Mountford (1997), Stark, Helmenstein and Prskawetz (1998), Vidal (1998), Beine, Docquier and Rapaport (2001a) and Stark and Wang (2002) – has been to assume that there is uncertainty about the ability to migrate, so that of \( N \) who acquire education only \( \pi N \) (\( \pi < 1 \)) actually emigrate. If \( \pi \) were unity, a permanent brain-drain could not be beneficial as all the incremental education would be lost. A further critical assumption is that the probability of migration is fixed and exogenously given for any individual educated would-be migrant. This implicitly arises because foreign firms cannot screen migrants to distinguish the able from the less able and it is this market failure that makes it possible for the brain-drain to be beneficial.

We can illustrate the importance of this assumption, using a highly simplified model which nonetheless captures Mountford’s (1997) insight. Following Beine, Docquier and Rapaport (2001a), assume that ability is uniformly distributed between \( A_{\text{min}} \) and \( A_{\text{max}} \) and that education yields private net returns that increase with ability, as in the line XX’ in Figure 1. With a given private cost of education, indicated by the horizontal line, people with ability between \( A^* \) and \( A_{\text{max}} \) find it profitable to take education. At point \( A^* \) private cost of education equals expected returns. Now, allow for the possibility of migration for educated people. If an individual can migrate, her private returns increase to YY’. With a probability of migration \( 0 < \pi < 1 \), the expected returns to education lie between the domestic and emigration rates of return - say along ZZ’, and individuals between \( A^{**} \) and \( A_{\text{max}} \) will take education. Of these, however, a proportion, \( \pi \), will emigrate leaving the domestic economy with \( (1 - \pi) (A_{\text{max}} - A^{**}) \) educated people, which may or may not exceed \( (A_{\text{max}} - A^*) \). Adding social returns to education is conceptually simple, because they have no immediate effect on private decisions. For simplicity, let social benefits be proportional to the stock of educated remaining at home, i.e. \( \delta (A_{\text{max}} - A^*) \) with no migration, and \( \delta (1 - \pi) (A_{\text{max}} - A^{**}) \) with migration.
The possibility of migration raises expected welfare for anyone who takes education. Hence there is an increase in aggregate private income, although, of course, some individuals who do not manage to emigrate will regret their education decisions *ex post*. The uneducated see no direct change in private returns and welfare and consequently gross private income rises when migration is permitted. What happens to aggregate welfare, of course, also depends on the social benefits of education.

Fundamental to this story is that every educated individual has probability $\pi$ of emigrating - hence all of them experience the increase in expected returns, so that in our linear example line ZZ' lies uniformly above XX'. But now suppose that the country of immigration can screen migrants perfectly for ability. They admit immigrants but only from the top echelons, so that if, say, they want $M$ people from our target country, they get the top $M$ lying between $AM$ and $A_{\text{max}}$ in *Figure 1*. If this is known, the incentives for individuals with ability below $AM$ are unchanged. The private returns to education follow the thick line XX''Y''Y. ($A_{\text{max}} - A^*$) are educated, of whom $(AM - A^*)$ remain. The increment to total private income is larger than if the migrants had been randomly selected, because the same number of migrants makes gains but no-one makes education decisions that they regret *ex post*. However, there is a loss of social welfare of $\delta M$, as $M$ educated people are lost and the social welfare was proportion $\delta$ of the number of educated individuals.
Clearly perfect screening is implausible, but even with imperfect screening all that would happen is that the vertical section of $XX''Y''Y$ would become sloped. But for so long as it meets $XX''$ above $A^*$, offering migration would affect no-one’s education decisions. Thus, a necessary criterion for a beneficial brain drain to apply is that the marginal person in education has a positive probability of emigrating\(^1\).

The importance of effective screening is also evident in Stark, Helmenstein and Prskawetz (1997) who distinguish between education and innate ability. For them, the increased incentive to acquire education among less able workers is that, while foreign firms can recognise educational qualifications they cannot, at first, distinguish high from low ability workers. As a result, for a period they offer all migrants with a given level of education the same wage (the mean level averaged over ability for that level of education), with the consequence that less able workers are ‘over-paid’. Over time foreign firms may discern workers’ true ability and offer ‘appropriate’ wages, at which time the benefits of emigration erode and, at least with finite probability, the workers return home. Even if they have acquired no skills or networks abroad, they are better educated than they would have been in the absence of migration. In this case it is the imperfections in screening that create the incentives to acquire education.

A possible development of the screening model is that the sending or home country has some unexploited capacity for education, in the sense that the returns to education are primarily determined by the demand for skilled workers rather than the ability of the population. In this case even a perfectly screened emigration would generate net benefits. Suppose that as the workers between $AM$ and $A_{max}$ migrated, they left openings for newly educated workers to take jobs with precisely the same returns. The net effect on the home economy would be to have the same number of educated workers as without migration and hence the same spillovers, but $M$ fewer uneducated workers. This would raise average incomes slightly (and average skill-levels). In addition, the migrants would record positive private gains.

**Empirical findings**

An important step forward in the literature on the beneficial brain drain is due to Beine, Docquier and Rapaport (2001a, b) who test the model empirically using cross-sectional data. They suggest that the probability of emigration does appear to boost human capital formation and that the stock of human capital does appear to influence growth positively\(^2\).

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\(^1\) Of course, actual decisions about education are taken with respect to subjective probabilities of migration not \textit{ex post} observed probabilities. Thus, if individuals are overly optimistic about their prospects, marginal candidates may believe they face improved expected returns even when they do not.

\(^2\) This latter finding is, of course, rather different from the results of much of the empirical growth literature, see Pritchett (2001).
They also decompose the effects of migration into a ‘brain’ effect - human capital accumulation - and a ‘drain’ effect - losses due to actual emigration. They identify several countries which would benefit from a decline in the stock of skilled emigration (i.e. reducing the outflow and receiving some nationals back). These countries typically have high rates of emigration coupled with relatively ineffective education and training systems. Some would even benefit from a complete ban on skilled migration. Interestingly, however, the loss of growth due to emigration appears to be rather small, of the order of 0.05% p.a. The obverse of these results is that countries would typically gain from higher emigration if they currently have low rates of emigration and low levels of human capital. (That is, where the costs of further emigration are relatively low and the benefits in terms of incentives relatively high.) There are limited numbers of countries in this class, but they include the larger developing countries, such as Brazil, China and India.

Cases of Health and Software

In Commander et al (2002) we review various data as they pertain to the beneficial brain-drain hypothesis. We illustrate the increasing rate of skilled migration over the 1990's, resulting in quite large cumulative outflows in some cases. There is evidence of such increased migration being accompanied by increased take up of education – especially in technical areas (like ICT where migration occurs - and often at private expense. We also find, however, prima facie evidence of strong screening mechanisms, which raises the possibility that the increased education is being substantially drained away. Further, we argue that there are likely to be important sector-specific effects at work. As such, our work focusses on two distinct sectors, medicine and software.

In the case of medicine, our evidence is not generally supportive of a beneficial brain-drain through increased through increased incentives to obtain education6. Using a small telephone and postal survey of overseas doctors working in the UK to look at both the issue of screening and the influence of migration possibilities on educational decisions, we find that while there are clear grounds for supposing that screening is implemented, there is little evidence to suggest that migration possibilities have played any significant role in driving educational decisions6. With respect to screening, evidence both with regard to the institutions in the sending countries in which they had trained, as well as information regarding subsequent – post-migration – ability to find a job, clearly support the view that screening in the case of migrant doctors is actively applied. Turning to the influence of migration on education decisions, survey responses do not support the view that migration has exerted a systematic, positive effect on education decisions. Nor does there appear to be any association between migration having an influence on education and the individual characteristics of migrants. The negative effect will, if anything, be

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4 The survey comprised 137 responses. Thus, not only is the survey size small but there are other shortcomings. We are, for example, not able to compare migrant doctors with their peers who did not move. Nevertheless, the survey provides some useful insights.
amplified by the fact that most of the doctors in the sample had received free or highly subsidised education, thereby entailing a clear fiscal cost. In part offsetting these features, doctors – like most migrants – do generally send remittances back to their home countries. Under some plausible assumptions, we argue that the net benefit of migration may have been negative in the case of doctors. However, it should be taken into account that a fairly large proportion – around half – of doctors from low income countries indicated that they intended to return home. Further roughly three quarters of doctors from low income countries also believed that they were easy to replace. Indeed, 19% of Indian doctors in the sample had actually experienced a unemployment spell prior to migrating. These responses suggest migration does not necessarily run alongside skill shortages at home.

The software case provides a rather more nuanced example and one that appears generally more supportive to the beneficial brain drain argument, although in a number of ways that go beyond the effect of migration on education decisions. Drawing on a firm level survey of 225 firms in India and an additional 98 software firms in the USA, we find that there is strong evidence of screening aimed at ensuring that the upper end of the talent distribution gets poached by US firms. Screening occurs through a variety of mechanisms including repeated contact with a migrant’s prior employer but – crucially – screening has also gone alongside relatively large cross border movement of Indian software workers. Although, it appears that part of the top talent in the sector has indeed moved out of India, this has been accompanied by substantial temporary migration of skilled workers. Indeed, the share of skilled workers with some foreign work experience is strongly and positively correlated with the current and lagged incidence of skilled migration in the Indian firms in the sample. This suggests the presence of network effects. Further, the data provide no evidence of any significant negative impact of migration on performance in the Indian firms. The survey also provides evidence that migrants send remittances, engage in return investment as well as firms benefiting from enhanced commercial and other links with firms in developed countries. Putting these factors together suggests that despite the high skill content of software migration, the net consequences have been positive for the sending country, India. Moreover, the survey also provides some additional support for the view that the industry’s growth in India has been accompanied by a strong educational response, not least through the entry of new private providers targeting the provision of sector specific skills. While this is not the same as relating migration directly to education decisions, it seems reasonable to suppose that migratory flows have played a positive role in raising educational enrolments and supply. In short, the software example – unlike that of the doctors – provides a more positive view of the consequences of migration, as well as highlighting the different types of migration.

\[\text{See Commander et al (2004).}\]
3. Remittances, Diasporas and Return Flows

It is has long been recognised that any adverse consequences of skilled emigration might be partly or wholly offset by remittances, the creation of diasporas and return migration. The software case dealt with above provides an instance of why these factors may be important. However, to look at these questions more systematically is less easy, given data limitations.

Concerning remittances, aside from considerable imprecision in the aggregate numbers, it is not possible to separate out the volume of remittances coming from migrants of different skill groups. Such information as is available confirms that remittances vary systematically with respect to income, conditions in the sending country, planned duration of stay and household attributes. It is likely that remittances from highly skilled migrants follow a very different pattern from those of low skilled migrants.

As to return migration, a positive channel would occur when migrants return with experience, financial resources, links to networks and skills from a stay abroad that are then productively deployed at home. There is some evidence that return migrants tend to choose self-employment or entrepreneurial activity not least because their savings diminish credit constraints. For example, Dustmann and Kirchkamp (2001) have studied returning Turkish migrants and their choice of activity and migration duration as a simultaneous decision. They find that most returnees choose self-employment or non-employment, and that highly educated individuals are more likely to be active after return. Ilahi (1999) finds that the level of savings is positively correlated with the choice of self-employment on return, while McCormick and Wahba (2001) use survey data to show that duration of stay overseas along with savings increases the probability of becoming an entrepreneur for literate return migrants, which would suggest that skills obtained overseas have are useful on return. Positive effects from return migration obviously also depend in part on a variety of factors, including government policy in the sending or home country (see Castles (2000); Dustmann (1996), or concern for the offspring's future, Dustmann (2001).

Another important aspect of return migration is the possibility that it is a result of screening of the migrants. Borjas and Bratsberg (1996) have studied the out-migration decisions of foreign-born people in the USA, and conclude that return migration accentuates the type of selection that generated the immigrant flow. In other words, if emigrants represent the high end of the skill distribution in the source country, the returnees are the least skilled of the emigrants. Cohen and Haberfeld (2001) also find that Israeli immigrants returning from the United States are likely to be negatively selected from those Israelis who emigrated in the first place. Reagan and Olsen (2000) on the other hand do not find any skill bias in return migration in their study on the National Longitudinal Survey, when skill is measured with Armed Forces Qualifying Test.

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1 Remittances are discussed in detail and existing research reviewed in Puri and Ritzema (2000). The World Bank (2001) offers some recent data and discussion.
2 For example, Straubhaar (1986) for a study of remittances to Turkey.
Other related research suggests that aspects that do not require return migration of skilled individuals, can be of major importance. Such channels for beneficial effects are exports, business and network links related to diaspora populations. There is evidence that such diaspora can have very beneficial effect on exports — for example, (Rauch 1999, Rauch and Trinidad, 2000). Similarly, foreign direct investment and venture capital — particularly in the recent period - have often been related to ethnic networks. An example of this is the Hsinchu Science park in Taipei, where a large fraction of companies have been started by returnees from the United States (Luo and Wang 2001). There is evidence — already alluded to - of these types of network effects being quite powerful in the Indian software industry.

CONCLUSION

The brain drain and its consequences for developing countries continues to attract discussion and debate. This paper has reviewed the ways in which economists have thought about skilled migration over the last forty years. While early generation models were mostly static and focussed on the labour market consequences of migration, they also placed emphasis on the fiscal implications of migrants having had their education provided for by public funds. Depending on the precise structure of the model, both such financing costs and labour market distortions could generate a negative effect of skilled migration. Interestingly, however, this literature was largely devoid of empirical content and validation. Proposals for the use of tax instruments to limit migration or, at the least, ensure that the benefits were not appropriated completely by the migrant and developed country, similarly found little, if any, application in practice.

The revival of discussion of the brain drain — mostly in the latter half of the 1990s — was prompted in part by the explicit use of visa and other programmes to encourage skilled workers to move to developed countries. However, the linking of migration to endogenous growth theory — through changes in education incentives and their implications for human capital formation — also permitted new insights and suggested that skilled migration need not necessarily be adverse for the sending country. However, this literature has also suffered from having limited empirical support or content.

A number of recent attempts to implement empirical work in this area are reported in the paper. The findings — probably not surprisingly — are far from conclusive. They do however strongly suggest that both sector and country size are likely to matter in determining whether skilled migration has had positive or negative consequences for the sending country. At risk of simplification, smaller countries are likely to be hit harder than large ones by skilled migration. In terms of sector, the cases of health (doctors) and software give rather different results. In the first, it is hard to sustain the view that education incentives are strong enough to offset other effects. In the software instance, this is not the case, not least because the nature of the migration that is occurring has itself been changing. The challenge remains to give greater empirical content to this discussion.
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