

The Economic Consequences of “Brain Drain” of the Best and Brightest:

Microeconomic Evidence from Five Countries^{*}

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Abstract

Brain drain has long been a common concern for migrant-sending countries, particularly for small countries where high-skilled emigration rates are highest. However, while economic theory suggests a number of possible benefits, in addition to costs, from skilled emigration, the evidence base on many of these is very limited and there are doubts about how the experiences of India and China apply to much smaller countries. This paper presents the results of innovative surveys which tracked academic high-achievers from five countries to wherever they moved in the world in order to directly measure at the micro level the channels through which high-skilled emigration affects the sending country. The results show that there are very high levels of emigration and of return migration among the very highly skilled; the income gains to the best and brightest from migrating are very large, and an order of magnitude or more greater than any other effect; there are large benefits from migration in terms of postgraduate education; most high-skilled migrants from poorer countries send remittances; but that involvement in trade and foreign direct investment is a rare occurrence. There is considerable knowledge flow about job and study opportunities abroad, but little net knowledge sharing to home country firms or businesses. Finally, the fiscal costs vary considerably across countries, and depend on the extent to which governments rely on progressive income taxation.

Keywords: Brain drain; Brain Gain; Highly Skilled Migration

JEL codes: O15, F22, J61

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1. Introduction

Two narratives drive discussions of the development impact of high-skilled migration. The first is the idea of a brain drain, whereby the departure of doctors, teachers, engineers, scientists, and other highly skilled workers decimates the human capital and fiscal revenues of sending countries (Bhagwati and Hamada, 1974). Such fears lead to calls for policies to restrict the flow of highly skilled workers, such as demands that developed countries stop recruiting doctors from developing nations, and efforts by developing nations to restrict the ease of their highly skilled individuals migrating.¹ However, contrasting with this is the view of a highly educated diaspora as a potent force for developing the local economy through remittances, trade, foreign direct investment (FDI), and knowledge transfers, with the experience of India and China in setting up technology firms as a result of diaspora working in Silicon Valley a prominent example. (Saxeenian, 2002). Economists have also emphasized that the possibility of migrating may spur human capital accumulation, potentially leading to a net increase in the education levels of those in the home country.²

However, what is sorely lacking in such discussions is empirical evidence as to what the experience has been in practice for countries facing high rates of high-skilled emigration. Recent large-scale data efforts have provided a much-improved evidence base with which to talk about the scale of high-skilled emigration (e.g. Docquier and Marfouk, 2004; Beine et al. 2007), quantitative evidence as to the extent to which the many theoretical channels operate in practice is almost non-existent. In particular, it is unclear whether it is common for highly-skilled emigrants from high migration countries to actually be engaging in knowledge transfers, trade, and FDI, or whether the experience of Chinese and Indian IT companies is so famous because it is the exception, not the rule. We also do not have empirical evidence as to what the size of the fiscal effect is, and how the magnitudes of these different channels compare to the size of the gains experienced by the migrants themselves. The purpose of this paper is to provide the first systematic empirical evidence on these issues.

To do this we chose five countries which represent a range of the types of countries experiencing very high rates of high-skilled emigration. Tonga, and the Federated States of Micronesia (hereafter Micronesia), are small island states, which Beine et al. (2008) show to

¹ For example, in 2009 the Algerian Government said it would restrict study abroad scholarships granted to high achievers in baccalaureate examinations in an effort to stem a worsening brain drain, and Uganda began requiring doctors who wish to pursue further studies abroad to make a written commitment to return to Uganda.

² See Mountford (1997), Vidal (1998), Stark et al. (1997) and Schiff (2006) for this theoretical debate, Beine et al. (2008) for cross-country empirical evidence, and Chand and Clemens (2008) for a case study in Fiji. Kapur and McHale (2005) provide a nice recent review of the literature.

have the highest “brain drain” rates in the world.³ Papua New Guinea is a larger developing country in the Pacific with much lower overall levels of migration, but also a high brain drain rate. Ghana was chosen as one of the best-known examples of a sub-Saharan African country grappling with high brain drain, and New Zealand as the OECD country with the highest brain drain rate. If we care about brain drain, it is precisely the experiences of countries like these, which have the highest rates, which should be informative, rather than the experiences of India and China, for which fewer than 5 percent of the tertiary educated population are living abroad.

In each of these countries we pursue an innovative survey methodology, which consists of identifying a well-defined target sample frame of interest – individuals who were the top academic performers in the country at the time of their high school graduation – and then tracking down these individuals wherever they currently live in the world and surveying them. Altogether this involved collecting data on individuals living in 45 different countries, and asking them detailed questions about their migration and educational histories, and the channels through which they interact with their home countries while abroad. We then form counterfactuals for what these individuals would be doing at home through also surveying academically similar non-migrants and through direct elicitation.

Through this approach we are able to measure and quantify a number of the key economic effects of high-skilled emigration. We estimate that the best and the brightest stand to gain \$40,000-75,000⁴ per year from emigrating from these five countries. This gain to the migrants swamps by an order of magnitude any of the other measured impacts: annual remittances of \$2,000-7,000, trade and foreign direct investment effects which are infrequent and at most of similar net effect to remittances, and fiscal impacts which are at most \$1000 for Tonga and Micronesia, \$6000 for Ghana, \$8000 for New Zealand and \$17,000 for Papua New Guinea. We also find migration to lead to large increases in human capital of the migrants; little evidence of net knowledge transfers to home governments or business, but significant provision of knowledge about study and work opportunities abroad by highly skilled emigrants.

These findings enable us to come close to being able to estimate the first-order net economic effect of highly-skilled emigration on individuals from developing countries.⁵ The one key effect we cannot measure are the uncompensated externalities of high human capital. Such externalities have been at the heart of brain drain debate since the beginning. Grubel and Scott (1966) noted that if labor markets are competitive and individuals paid their marginal product, then if there were no externalities, the departure of highly skilled emigrants would not reduce the welfare of

³ These brain drain rates measure the share of adults with tertiary education born in a particular country who are living abroad.

⁴ All values are expressed in current United States dollars as of January 2010.

⁵ There are of course a large number of social impacts from migration, such as changes in access to cultural and travel opportunities, in access to amenities, in opportunities to consume certain products, and in impacts on relationships with family and friends. We do not attempt to value these factors in this paper, but acknowledge their importance in driving migration decisions.

those left behind. Bhagwati and Hamada (1974, p.19) made the case that such externalities could be important with “doctors and exceptionally gifted academics about whose emigration typically the underdeveloped countries seem to worry”, although Bhagwati (1998, p.9) subsequently notes that externalities are the “first refuge of the scoundrels” in policy debates, with the evidence as to their existence, let alone magnitudes, rather scant. What our estimates show is that such externalities would have to be very large, exceeding at least \$50,000 per year per high-skilled migrant to make the net effect negative. This would mean the externalities of high-skilled workers would have to be more than double or triple their private returns in the developing countries studied. Whilst conceivable, this would greatly exceed any measured externality we are aware of in the literature.

The remainder of the paper is structured as follows: Section 2 discusses our unique survey and the incidence of high-skilled emigration seen among the best and brightest, Section 3 estimates the impact of migration on the incomes and human capital of the highly-skilled, and Section 4 attempts to measure the value of impacts on trade, foreign direct investment, and fiscal balance, as well as to provide evidence on the extent of various knowledge transfers. Section 5 concludes.

2. Surveying the Best and Brightest

The small existing microeconomic empirical literature on the brain drain has generally focused on individuals from a selected profession. For example, Hunter et al. (2009) consider Nobel Prize winners and highly-cited scientists, Ben-David (2007) Israeli economists, Clemens and Pettersson (2008) African health professionals, Commander et al. (2004) doctors in the United Kingdom, and Constant and D’Agosto (2008) Italian researchers and scientists abroad. However, there are several concerns with such occupation-specific studies when it comes to looking at the consequences of high-skilled migration. First, the initial decision to become a physician, scientist, economist, or other such occupation may be closely tied to the desire to migrate – with skill-selective criteria for immigration to many countries, high talent individuals who wish to emigrate may select the occupations that offer the best prospects for doing so, while similar individuals who do not wish to emigrate may choose other occupations. Second, training for the occupation may itself only occur through migration. This is particularly the case in small countries, which do not have Ph.D. programs or medical schools. Finally, whether or not individuals remain in an occupation may depend on whether they emigrate or not – low-paid professionals who do not emigrate may move to more remunerative private sector jobs while emigrants may have trouble getting certified to work in their home country professions. For all these reasons it seems unlikely that the right counterfactual for a high-skilled individual abroad is someone in the same occupation in the home country.

2.1 Our methodology

Instead, the methodology we propose is to define a target sample of interest that can be identified *before* migration has occurred, and then to survey these individuals regardless of their subsequent emigration and occupational choices. In our case, we specify the target sample of interest as individuals who were the “best and brightest” in terms of their academic performance at the end of high school in their home countries. This can be objectively measured in terms of top performance in national examinations, or in terms of being named as one of the top academic performers in the school such as a valedictorian or Dux, salutatorian or proxime accessit. Moreover, it can be measured *ex post*, so that we can set our target sample of interest as the individuals who were top of their high school classes for students graduating between 1976 and 2004 and then survey these individuals today.

We are not claiming that this is by any means the only population of interest for looking at the consequences of brain drain, but claim that it is one important subgroup of interest, the academic high achievers. These individuals go on to work in many of the occupations that countries worry about in terms of brain drain: our sample contains individuals who have become doctors, engineers, computer scientists, academics, scientists, and business leaders. Moreover, it is a subgroup whose composition is likely to be much less affected by desire to emigrate than studies focusing on a specific occupation.

Our focus on the best and brightest is also justified because the literature also stresses that it is likely to be the migration of the most skilled and talented individuals for which these negative effects are greatest. Kapur and McHale (2005, p. 97) write that “clearly people of exceptional talent have a highly nonlinear impact.” However, little empirical evidence is available on the migration of the “best and brightest”. The only study which exists is a simple descriptive exercise which examines the emigration rates of graduate students of IIT Mumbai, one of India’s most prestigious tertiary institutions, in the 1970s, finding 31 percent settled abroad, compared to an estimated migration rate of 7.3 percent for engineers in the country as a whole (Sukhatme, 1994).

2.2 Country choice

Brain drain rates, as measured by the share of tertiary-educated individuals born in a given country who are living abroad, are highest in small states and a few sub-Saharan African countries (Beine et al. 2007, 2008), and it is in such places that concerns about the possible negative consequences of brain drain are most common. We therefore chose to focus our survey efforts in such countries. We began by choosing three developing countries in the Pacific – the Federated States of Micronesia, Papua New Guinea and Tonga, since the Pacific Islands are the region with the highest brain drain rate in the world (Docquier and Marfouk, 2005). We then also chose Ghana, which has one of the highest brain drain rates in sub-Saharan Africa and which has been one of the countries most involved in discussions about medical brain drain. Finally, we

chose New Zealand, which is the OECD country with the highest tertiary brain drain rate. The population, GNI per capita in current US dollars⁶, and brain drain rate in the year 2000 for those who entered the destination country after age 18 (Beine et al, 2007) are:

- Ghana: 23.4 million population, \$US670 GDP per capita, 44.9% brain drain rate
- Federated States of Micronesia: 107,000 population, \$US2,340 GDP per capita, 36.9% brain drain rate.
- New Zealand: 4.3 million population, US\$27,940 GDP per capita, 15.8% brain drain rate.
- Papua New Guinea: 6.4 million population, \$US1,010 GDP per capita, 19.8% brain drain rate
- Tonga: 110,000 population, \$US2,560 GDP per capita, 65.1% brain drain rate.

These countries offer an interesting range of population sizes, levels of development, and also opportunities for migration. Micronesia and New Zealand both have free mobility to an important migrant destination - Micronesia to the United States and New Zealand to Australia – whereas the other countries have more restricted mobility.

2.3 The sample frame and survey

In each country we assembled a sample frame of the top academic achievers in the country, for individuals graduating high school between 1976 and 2004, using a mixture of government and school records. A detailed appendix discusses the specifics of sample frame construction for each country.⁷ We then attempted to track down these individuals and survey them in their present country of resident. The tracking effort was extensive, and involved visits to the high schools and home communities, online search, the involvement of school alumni networks where they existed, phone book searches by surname, and asking located students for help in identifying others. Individuals were then administered a survey with detailed questions on their migration and educational histories, their current occupation, and the channels through which they interact with their home countries when abroad. These surveys were carried out online, in-person in the five source countries, and, in some cases, by phone. The survey efforts began with the Tongan sample in late 2007, and finished with the Ghanaian sample in late 2009.

Table 1 summarizes the results of this surveying effort. Our total sample frame consisted of 4,131 individuals from the five countries, of which we were able to interview 1,240 (30%). 40% of those interviewed are female. The survey interviewed individuals who are now living in 45 different countries. The survey success rate varied across source countries, ranging from 15 percent in Ghana to 73 percent in Tonga. This reflects both differences in our ability to track individuals from different countries, as well as in differential survey response rates, with fears

⁶ Population and GNI per capita are World Bank 2008 estimates.

⁷ See also Gibson and McKenzie (2010) for more details on the New Zealand, Papua New Guinean, and Tongan samples

about identity theft making some high achievers reluctant to participate in an online survey. Even in cases where we could not survey the individual, we endeavored to identify their current location, either directly from them, or from friends and family. Current location is known for the majority of the sample frame from Tonga, Micronesia and New Zealand.

We view these response rates as incredibly high, given the logistics of tracking individuals over multiple countries based only on a name and the high school they attended. This is particularly the case given the sample of interest are individuals with very high opportunity costs of time, who typically have lower survey response rates. Nevertheless, we are sensitive to the possibility of potential bias caused by incomplete tracking. In particular, we can examine how sensitive the measured migration rates are to survey non-response, using both the known characteristics (age and gender) of the individuals not surveyed, as well as through comparison of the individuals who it took more effort to locate to those located more easily. The results suggest relatively little bias from non-response, at least with regard to migration status.⁸ In terms of looking at the consequences of migration, we believe that if there is any bias, it will be towards not being able to locate the less successful individuals. We will keep this in mind in interpretation, but it should mean we are obtaining upper bounds on the extent to which migrants are engaging in certain activities such as trade and investment.

2.4 Migration rates

Table 1 demonstrates that the incidence of migration is very high among this highly skilled population. In our sample, 65 percent of the best and brightest aged 22 and over have ever migrated overseas since graduating high school, and 36 percent are current migrants. Comparing these numbers also indicates a high rate of return migration. The highest rates of ever migrating are in Tonga and Micronesia, the two smallest countries. Both countries have very limited tertiary education options at home, and so migration is needed for education. The lowest current migration rate is seen in Papua New Guinea, whose citizens have rather limited options for migration. Educational scholarships which bond individuals to return are one additional factor limiting the extent to which individuals who go abroad to study can stay on and work afterwards in this case. Overall, the sample gives us a good sized sample of migrants with which to examine at the micro-level the consequences of high-skilled emigration, along with individuals of similar ability who are located in the home country and which can be used in forming counterfactuals.

3. Impacts on the migrants themselves

In general, the largest gains from migration accrue to the migrants themselves. Yet measurement of these gains has been relatively neglected in the literature, with the labor literature focusing on the impact of immigration on natives and the development literature focusing on the impact of emigration on individuals remaining in the source country. However, ignoring the impact on the migrants themselves will lead to a very distorted view of the

⁸ See Gibson and McKenzie (2010) for details of this for New Zealand, Papua New Guinea and Tonga.

economic benefits and costs of migration for source countries, since the most major effect could be to make natives of these source countries considerably better off. We therefore begin with estimation of the gains in income and education that high-skilled individuals gain through migration.

3.1 The income gains from high-skilled emigration

Panel A of Table 2 presents the mean, standard deviation, and median annual gross income earned by individuals who are currently non-students and employed abroad.⁹ We convert all currencies to US dollars at the exchange rates prevailing at the time of the survey. The mean annual income earned by emigrants is \$57,000 for Micronesians, \$88,000 for Tongans, \$93,000 for Papua New Guineans, \$102,000 for Ghanaians, and \$116,000 for New Zealanders. These are many multiples of per capita income for the developing countries, and considerably higher than the incomes being earned in the home country by return migrants and non-migrants (Table 2, panel B). A simple estimate of the income gain from migration is then just obtained by comparing these two means (A – B mean in Table 2), and shows an annual income gain ranging from \$US33,000 for the New Zealanders to US\$79,000 for the Ghanaians. At a discount rate of 5% per year, the gains from spending 30 years working abroad rather than at home would thus range from \$532,000 to \$US1.27 million.

Typically a simple comparison of migrants and those in the home country would not be very informative about the gains to be had from migration because of concerns about selectivity. In our case, such concerns should be a lot less severe, since are looking at a group of individuals who are all very similar in terms of ability. To a first-order the non-migrants and return migrants may therefore be a reasonable counterfactual for what the migrants would be earning were they in the home country. Nevertheless, we employ several approaches to examine how robust these estimates are. The first is to control for observable differences through a regression:

$$INCOME_i = \alpha + \beta MIGRANT_i + \gamma'X_i + \varepsilon_i \quad (1)$$

We begin by just controlling for age and sex, estimating equation (1) for each of the five source countries, with estimates shown as Regression 1 in Table 2. We then also control for country of birth (since some of the top students are themselves emigrants), mother's and father's education, and self-assessed family wealth at the end of high school (above average wealth, average wealth, or below average wealth). These additional variables control for family background characteristics which might plausibly affect both income earned and migration choices. The results are shown as Regression 2 in Table 2. Comparing the regression estimates to the simple comparison of means gives similar estimates of the income gains to the raw difference in means, except for Papua New Guinea, where the estimated gain falls from US\$68,000 per year to US\$43,000 per year.

⁹ The employment rate is very high among our sample once we exclude students, so we ignore selection into employment.

A second approach is to ask the migrants directly what income they would expect to earn if they were instead working at home. This approach has the advantage of setting the counterfactual as exactly what we would like: the identical individual working at home. But of course, the downside is that it relies on self-assessments of income that would be earned at home rather than actual market rates. Panel C of Table 2 summarizes these answers, while the difference (A - C) is the mean self-assessed income gain from migration. In Ghana, Micronesia and Tonga this difference is very similar to the regression estimates. It is higher for New Zealanders, perhaps indicating positive self-selection into migration even among this elite sample for this country, and lower for Papua New Guineans, perhaps indicating negative self-selection for that case.

Finally, we attempted to construct instrumental variables for migration. We examined three classes of potential instruments. The first was macroeconomic shocks and political events such as coups; the second was birth-order; and the third was shocks such as parental illness and extreme weather events that occurred when the individual was aged 18 to 22. The latter two categories of variables were only collected for Ghana and Micronesia. We found these types of variables had very low predictive power for predicting current migration, with the only significant first-stage being in Micronesia, where individuals who experienced a typhoon in their home region when aged 18 to 22 were more likely to have migrated (F-statistic of 3.63). The two-stage least squares estimate using this as an instrument gave a similar income gain to that obtained using the other two approaches.

The fact that we get similar answers using a variety of different (and reasonable) approaches suggests that the estimates we obtain are likely to be reasonably accurate. The income gains of \$35,000-\$75,000 per year from emigrating are thus a large economic benefit to the high-skilled individuals from migrating, and will provide a point of reference for the impacts through other channels seen in the remainder of the paper.

3.2 Human capital formation

In addition to the gain in income from migrating, another important benefit of migration for the migrants is the additional education they can gain abroad. The income gains from migration already include one measure of the economic benefit to the migrants of this additional education, but it is also of interest to look directly at the extent to which education is accumulated through migration. Panel A of Table 3 summarizes the educational levels of the migrants in our sample, focusing on individuals aged 22 and over, who might be expected to have finished their undergraduate studies. We see that almost all these individuals who were academic high achievers in high school have gone on to receive bachelors degrees, the exception being Micronesia, where 2-year associates degree were the highest educational qualification of many. In Tonga and Micronesia, 100 percent of the migrants had received their bachelors education abroad, reflecting the limited tertiary education options in these countries. It is also common for our sample to have gone onto to achieve a more advanced degree such as a masters degree or

Ph.D., medical doctorate, or law degree.¹⁰ These advanced degrees are almost exclusively earned abroad: 100% of the Tongan and Papua New Guinean migrants in our sample with advanced degrees earned them abroad, 86% of the Ghanaians, 83% of the Micronesians, and 75% of the New Zealanders. This is despite both Ghana and New Zealand having domestic education systems which offer the possibility of these degrees.¹¹

Panel B summarizes the corresponding educational achievements of the individuals currently resident in the five source countries. The proportion with a bachelors degree is similar to that of the migrant group, but lower proportions in each country have an advanced degree. In Tonga and Micronesia the bachelor degrees were mostly earned abroad, whereas in the other three countries they are mostly earned domestically. With the advanced degrees, 28 percent of those in Ghana and 49 percent of those in Papua New Guinea had earned them abroad.

Panel C then reports the results of estimating a probit for having a bachelors degree, and for having an advanced degree as a function of having ever migrated, and the same set of individual controls as used in regression 2 in Table 2. We confirm the association between migration and higher levels of undergraduate degrees in Tonga and Micronesia, and between migration and higher levels of advanced degrees in each country except Micronesia (where few have advanced degrees). While part of this might reflect selection, the more limited set of educational choices in the home countries suggests that if many of the individuals had not migrated, they would not have obtained the education that they now have. This is confirmed by directly asking the migrants who are currently studying what they would be doing now in their home country if they hadn't migrated: 0% of the Papua New Guineans, only 12% of the Ghanaians, 13% of the Tongans, and 18% of the Micronesians aged 22 and older who are abroad and currently studying say they would be studying now if in the home country. In contrast, 37% of the New Zealanders say they would still be studying even if they hadn't migrated. This leads us to believe that most of the measured difference in education rates in Table 3, panel C is indeed the true impact of migration on human capital attainment for the individuals from developing countries.

Finally, the recent literature on brain gain (e.g.) has emphasized that the mere prospect of migration can induce individuals to undertake additional human capital investments, even if they don't end up actually migrating. If individuals are obtaining bachelors or advanced degrees for this purpose, then comparing migrants to non-migrants will understate the gain in education attributable to migration. More generally, there may be other improvements in human capital aside from degrees. Our survey asked whether people had taking any additional classes, or changed the subjects they studied in any way during high school to improve their prospects of being able to work or study overseas. The last column of Table 3 shows some evidence of people undertaking such actions, particularly in Ghana, and to a lesser extent in the other developing

¹⁰ We classify law degree as an advanced degree as in some countries it requires an undergraduate degree first, whilst in others it is a longer length undergraduate program than arts or sciences bachelors degrees.

¹¹ The Micronesians with Masters earned at home had earned masters in theology by remote study.

countries. The main actions taken were to take private lessons, study a language, and take test preparation classes to help pass tests such as the SAT.

4. Empirical evidence on the channels through which high-skilled emigration affects the sending country

We now turn to measuring the economic impacts of migration on the sending countries, attempting where possible to quantify these impacts and evaluate them relative to a counterfactual of what the individual would have been doing had they not migrated.

4.1 Remittances

Remittances are the most salient and researched contribution of emigrants to their home countries. However, there is debate as to the extent to which highly-skilled emigrants remit. Cross-country studies based on macro data have been used to claim the high-skilled remit less (Faini, 2007) whilst recent microeconomic evidence based on surveys of immigrants in a number of destination countries suggests that more educated individuals remit more, with tertiary-educated migrants from poorer countries being more likely to remit than those from richer developing countries (Bollard et al, 2009).

Panels A and B of Table 4 show the incidence and level of monetary and goods remittances that the non-student migrants in our sample are sending to their home countries. Our survey data does show a high incidence of remitting among the migrants from developing countries, with migrants from New Zealand being much less likely to remit. For the Ghanaian sample we can compare our results to the remitting patterns of all Ghanaian migrants in the OECD (Bollard, McKenzie and Morten, 2009). 86 percent of all Ghanaian current migrants are remitting, which increases to 93 percent if we exclude current students. This can be compared to a remitting rate of 66 percent among all Ghanaian migrants in the OECD. The mean annual amount remitted in monetary remittances conditional on remitting for Ghanaians in our sample is US\$4,314, compared to US\$3,614 for all Ghanaian migrants in the OECD. Thus the high-skilled migrants in our sample are remitting more frequently and sending more when they do remit than average migrants, even if the amount remitted as a share of income is lower.

The unconditional mean and median amount remitted then include the zero remittances for those not remitting. The appropriate counterfactual here is that these individuals would not be remitting if they had not migrated. So the net effect of migration on remittances is simply the unconditional mean. Adding together the monetary and goods remittances gives a total impact of \$5,000 annual remittances for Ghanaians, \$2,100 for Micronesians, \$625 for New Zealanders (monetary remittances data only), \$7,232 for Papua New Guineans, and \$4,300 for Tongans. These amounts are significant relative to the per capita incomes of the developing countries, with Ghanaian and Papua New Guinean remittances equivalent to about seven times per capita GDP. Nevertheless, the amounts remitted are only a fraction of what the migrants would have been earning at home (Table 2).

4.2 Involvement in Trade and Foreign Direct Investment

After remittances, the financial channels through which high skilled emigrants are often thought to have most positive economic benefits for their home countries are through their involvement in trade and foreign direct investment. The experience of Indian, Taiwanese, and Chinese information technology firms has been used to suggest that a highly skilled diaspora can use their knowledge of the destination country to lower the costs of transacting across countries (Rauch and Trinidad, 2000; Kugler and Rapoport, 2005), and that emigrants can provide venture capital for starting new firms (Saxenian, 2001, 2002). However, such studies and anecdotal evidence tends to focus on the cases where these linkages have occurred, and do not provide any information as to how common such experiences are, or to whether the experiences of high skilled IT workers from large economies are translatable to the types of countries where brain drain rates are much higher and domestic markets much smaller.

Our survey directly asked emigrants whether, in the past year, they had helped a home country firm make a trade deal, and if so, the value of this deal, and whether they had themselves directly exported goods from their home country to sell overseas, and the value. Panel C of Table 4 summarizes the results. We see that involvement in trade is very uncommon for this group of the best and brightest, with none of the non-student migrants from Tonga, 3 percent of the Ghanaians, 4 percent of the Micronesians, and 6 percent of the New Zealanders being involved in trade – the 10 percent figure for Papua New Guinea represents only 1 out of the 10 non-student migrants from this country who answered this question carrying out such activities. One might argue that a low incidence of involvement may still have large overall impact if the occasions where deals are made involve large transactions. For example, one of the Ghanaian migrants in the sample facilitated a 500,000 cedi (\$350,000) trade deal with a Ghanaian company, using his knowledge of Ghana to carry out due diligence on the company and his own company abroad to provide concessionary terms in the deal.

We therefore report the conditional mean and median value of these transactions, although note these are based on only one transaction for Papua New Guinea, 4 transactions in Micronesia, and 6 transactions in Ghana. There are a couple of large transactions, one in Papua New Guinea and one in Ghana, which push the conditional means up for these countries. Nevertheless, when we look at the unconditional means, the low frequency of such transactions occurring reduces these means considerably.

Given how rare such trade transactions are, we do not attempt to formally construct a counterfactual for what trade transactions these individuals would have been doing had they not migrated through regression analysis. Instead, we asked the non-migrants the same questions, and take the mean values among non-migrants as the counterfactual. The last column of Table 4 then presents our estimate of the net impact of being a high-skilled emigrant on trade from the

home country. For Tonga and Micronesia this net effect is negative, but close to zero: trade was uncommon among the non-migrants and the migrants, but the mean among non-migrants was slightly higher than that above migrants. For Ghana, the mean effect is \$5,346, although we can not reject equality to zero. For Papua New Guinea, the one migrant making a trade deal made a large deal, but a non-migrant reported an even larger deal, so the net effect is a large negative one – but again we cannot reject equality to zero.

Panel D provides the related answers for whether migrants are providing the capital to start up enterprises at home. Again this is infrequent, with 5 percent or fewer of the emigrants from New Zealand, Micronesia and Tonga doing this, and 8 percent of the Micronesians. It is more common in Ghana, but the amounts invested are relatively small – a conditional mean of \$17,920 and median of \$2,100 for Ghana, suggesting that most of the businesses being invested in are very small, or that the migrant is not providing the main source of financing. Nevertheless, migrants are more likely to be making such investments in most countries than non-migrants are, and so our net effect in the last column, after taking out the mean for non-migrants is typically positive, although we typically cannot reject that it is zero.¹² In addition, in answer to a separate question, none of the developing country migrants in our sample report holding shares in home country firms, showing that they are not making large investments in existing formally established companies.

In contrast, high-skilled emigrants are much more likely to be consumers of traded products from their home countries, often through what Orozco et al. (2005) term nostalgic trade. 87 percent of Ghanaian non-student migrants in our sample report having purchased Ghanaian food, drink or goods in their destination country, or having ordered goods directly from a Ghanaian retailer for their personal consumption. However, the mean (unconditional) value of goods ordered directly is only \$183 and that of Ghanaian products purchased by migrants abroad is \$443. Such nostalgic trade is also common among the New Zealand sample, with 87 percent of emigrants engaging in it,¹³ but less common amongst migrants from the small island nations: 47 percent of Micronesians engaged in such trade, with an unconditional mean value of such transactions of \$337, and only 13 percent of Tongans did, with an unconditional mean value of \$36. Given the small numbers of high-skilled migrants in any particular emigrant destination and the small size of these transactions, these high-skilled emigrants are therefore unlikely to spur trade by serving as a significant export market in of themselves.

4.3 Non-financial flows of knowledge

In addition to providing financial support to households and firms in their home countries, high-skilled emigrants are often argued to benefit their home countries through knowledge transfer (e.g. Saxeenian, 2002, Newland, 2004, Kugler and Rapoport, 2005).

¹² We formally test for equality to zero by regressing the unconditional amount invested on a dummy for being a current migrant, restricting analysis to the current migrant and non-migrant samples of non-students.

¹³ The value of such trade was not asked for the New Zealand sample.

Although we are unable to place a monetary value on this knowledge transfer, our surveys at least allow us to provide empirical evidence on how common different types of knowledge flows are among the best and brightest, and to ask whether in fact emigrants engage in more of these types of knowledge flows than they would be doing had they not migrated.

Panel A of Table 5 presents the results of questions which asked current migrants whether they had engaged in each of a number of different knowledge transfer activities in the past year. The same questions were asked of non-migrants, and panel B therefore presents the net impact, taking non-migrants as the counterfactual for what the migrants would be doing had they not migrated. The first two rows of each panel look at knowledge transfer to the national Government and to home country companies. It is not very common for the best and brightest migrants to be providing this advice: only 4 percent of Ghanaian and New Zealand emigrants, 8 percent of Papua New Guineans, and 13 percent of Micronesians and Tongans had advised their governments. The greater incidence in the smaller countries may reflect the greater likelihood of migrants directly knowing policymakers in these small countries, rather than a greater tendency of these governments to reach out actively to their high-skilled emigrants. In panel B we see the net effect is, if anything, negative in four of the five countries, showing that migrants engage in such interactions with the home government less often than non-migrants. Knowledge transfer to home companies through migrants advising them is similarly infrequent, and has a negative net effect in three of the five countries.

A much more common form of knowledge transfer involves migrants transferring the knowledge about opportunities to study and work abroad. Between 30 and 50 percent of high-skilled emigrants from these countries had advised someone in their home country about such opportunities in the past year, thereby aiding others in their migration decisions. A more intensive form of migration facilitation is to act as the sponsor for a home country national wishing to work or study abroad. This is most common among Tongans, with 20 percent acting as a sponsor. It is least common amongst New Zealanders, with only 4 percent doing this. Since this is something that can only be done when abroad, the net effect of sponsoring is the same as the gross effect.

Another frequent form of knowledge transfer involves migrants using their knowledge of their home country to advise people abroad about taking a holiday in their home country. 91 percent of New Zealanders, 75 percent of Papua New Guineans, 66 percent of Ghanaians, 56 percent of Tongans and 44 percent of Micronesians have done this. Although our surveys do not permit quantification of the value of new tourism created by such advice, they do show migrants engaging in this type of tourism promotion much more frequently than non-migrants (with the exception of Micronesia).

Finally, we can examine whether migrants are transferring knowledge to home country researchers through research collaborations. This is not common for Tonga (4%) and Micronesia (8%), where there is little tertiary infrastructure and thus not a large local research community.

However, it is somewhat common in Ghana (14%), New Zealand (16%), and Papua New Guinea (25%), showing that there is some evidence of this knowledge transfer. However, of course it is also possible for domestic researchers to work with researchers abroad, but panel B shows that even accounting for this, migrants are more likely to be engaged in a research collaboration involving researchers in the home country and an abroad country than are non-migrants.

4.4 Fiscal Impacts

In one of the first academic studies on the brain drain, Bhagwati and Hamada (1974) drew attention to the possible fiscal cost. They noted that highly-skilled emigrants take their education with them, which was funded by taxes on existing residents, but then do not contribute back into the tax system. We would argue that whether or not education is publicly funded is ex post immaterial, since it is a sunk cost when it comes to the time of making a migration decision – what matters is whether the country loses more in the tax revenue it would collect from these individuals than it would spend on them going forward in terms of public services. This depends on how progressive the income taxation and benefits systems of the countries are. We attempt to provide some indication of the likely range of such costs for the countries in our study.

Table 6 details our attempts to calculate the first-order fiscal impact of emigration of the best and brightest. We begin by calculating the income tax that these individuals would be paying if at home. To do this we take the counterfactual income which migrants tell us they would be earning if at home (which we have seen appears to be reasonably accurate), and then use each country's income taxation schedule to calculate the tax per migrant, after which we present the mean and median tax in the table. The countries differ substantially in both tax rates and in the progressivity of their tax schedules. The lowest taxed and least progressive are Tonga and Micronesia. Tonga has a flat tax rate of 10%, and Micronesia has a tax rate of 6% on the first \$11,000 and 10% thereafter. Ghana, Papua New Guinea and New Zealand all have higher tax rates with more steps and progressivity. Ghana's has five tax rates, with a top tax rate of 25% on income above \$6,700. Papua New Guinea has six tax rates, with the first step beginning at 22% and with a top tax rate of 42% on income above \$89,000. New Zealand has 4 tax rates, with a top tax rate of 38% on income above \$57,000. As a result of these low tax rates and low home country incomes, the loss in income tax revenue is only \$1000-1200 for Tonga and Micronesia per high-skilled migrant. It is higher in the other three countries: \$5,000 in Ghana, \$14,000 in Papua New Guinea where the migrants believe they would be earning relatively high incomes at home and getting charged high tax rates, and \$17,000 in New Zealand.

Next, we calculate the sales tax these migrants would have paid at home if they were consuming these counterfactual incomes in their home country. All five countries have sales taxes or goods and services taxes, with tax rates ranging of 5% in Micronesia, 10% in Papua New Guinea, 12.5% in Ghana and New Zealand and 15% in Tonga. The Tongan government estimates that its goods and services taxes apply to approximately 60 percent of household

consumption.¹⁴ We assume the same applies to the other four countries, and that all income is spent to arrive at the sales tax figures in the next two columns of Table 6. This is highest in New Zealand at \$4703 per migrant, reflecting the higher incomes in this country, and lowest in Micronesia where the low tax rate and lower incomes means the lost sales tax revenue is only \$383 per migrant.

Offsetting these fiscal costs of high-skilled emigration are two main fiscal benefits. The first is that if monetary remittances are spent on consumption items and the government has a sales tax, then the government gains a share of these remittances. We assume that 100 percent of monetary remittances are spent, and that again 60 percent of this spending is taxable. Whilst there is debate in the literature as to the extent to which remittances are used for non-consumption purposes, surveys typically find at least 80 percent of remittances are consumed, and even investments in say materials for starting a business may be taxable. Nonetheless, because high-skilled migrants remit back considerably less than they would be earning in the home country, the effective sales tax revenues on remittances are quite small – ranging from only \$38 in New Zealand and \$41 in Micronesia, to \$130-132 in Tonga and Ghana.

In most cases the larger fiscal benefit from emigration will be that the Government does not have to spend on government services for individuals abroad or the family members accompanying them. Table 6 gives the mean household size for the emigrants, which ranges from 2.5 to 4. We then form an upper bound on the fiscal savings by taking the total per-capita government expenditure – this would be the savings if government expenditure was equally distributed across all households in the home country and all spending was variable costs. A possible lower bound on the fiscal savings in many countries can be obtained by taking the per-capita government health and expenditure expenditure, which might be more variable in costs. This may be a lower bound because it ignores the possibility that children of the highly skilled may be more likely to use expensive higher levels of education, and that it ignores any deductions or exemptions that reduce the tax that the highly educated actually pay.

Comparing these costs and benefits leads to our estimates of the approximate net fiscal cost of high-skilled emigration, given in the last two columns of Table 6. We get quite tight ranges on the likely first-order fiscal effects for the four developing countries. In both Tonga and Micronesia the net fiscal cost is at most \$500-1000, and would be negative if we used full government expenditure in the calculations. The fiscal costs are low in these countries because they have low income tax rates that are not very progressive, sales taxes are quite small because of low rates and low incomes, and the government per-capita spending is not much less (Tonga) or greater (Micronesia) than the estimated income tax take from even these highly skilled individuals. This reflects the reliance of Micronesia on grants from the U.S. (tax revenue is only 21% of total government revenue) and of Tonga on indirect taxes and grants.

¹⁴ 'Utoikamanu (2006) "Consumption tax: The Tongan experience"
<http://archives.pireport.org/archive/2007/July/07-27-rp.htm>.

In Ghana we estimate a net fiscal cost of between \$5,450 and \$6,300 of high-skilled emigration. These bounds are quite tight, since Ghana's per capita government expenditure is so low – Ghana has a progressive income taxation system which collects far more in income taxes from the highly skilled than it is paying out in benefits. Our bounds are even tighter in Papua New Guinea, ranging from \$16,500 to \$16,900. Again in this case per capita government expenditure is extremely low, and income tax rates on high incomes are quite high – so the fiscal cost greatly exceeds the fiscal benefits.

Our range of estimates is much wider for New Zealand, ranging from -\$8,447 to \$10,618, depending on how much of per capita government expenditure actually goes to the highly skilled. Crawford and Johnson (2004) provide a more detailed analysis of the receipt of government benefits by decile in New Zealand for the year 1997/98. Because of New Zealand's highly progressive government spending patterns, households in the top three deciles were estimated to receive only approximately \$6,700 per household. Health and expenditure spending approximately doubled between 1998 and 2008, so doubling this figure gives a per household expenditure of approximately \$13,400 – which is relatively close to our proxy of \$11,302 when using per capita health and education spending. This gives our best estimate of the fiscal loss to New Zealand of high-skilled migration at \$8000 per high-skilled migrant who leaves.

We acknowledge that there are a number of simplifying assumptions in making these calculations, but we believe they capture the first-order magnitudes. They show how much the fiscal cost depends on the progressivity of the income tax system, the role of sales taxes in allowing migrant-sending countries to receive some fiscal benefit from remittances, and some sense of the fiscal benefits. What is noticeable is how small these fiscal costs are relative to the income gains estimated to the migrants themselves in Table 2.

5. Conclusions

The number of highly educated emigrants from developing countries living in the OECD doubled between 1990 and 2000 (Docquier and Marfouk, 2005), and has continued to grow over the past decade as developed countries have increasingly made their immigration criteria more skill-selective. As policymakers in high emigration countries watch the departure of many of their most talented citizens, they both worry about the potential costs of this “brain drain” for development in their country as well as wonder about the possibilities offered by having a diaspora of the elite who can send remittances and facilitate trade, investment, and knowledge exchanges. Our goal in this paper has been to provide the first systematic microeconomic empirical evidence as to how common these key channels of interaction between migrants and their home countries are, and what the economic costs and benefits appear to be in practice.

Our results show large positive benefits of high-skilled migration for citizens of high emigration countries. The largest benefits are to the migrants themselves, who benefit through

massive gains in income and through greater human capital. High-skilled individuals from poorer countries do typically remit, but it is rare for them to engage in trade or foreign direct investment. They engage in plenty of knowledge transfer in terms of helping others learn about study and work opportunities abroad, but do not frequently advise their local governments or businesses in their home countries. The main cost we measure is the fiscal cost of emigration. We show how this varies significantly with the progressivity of the tax system and size of government expenditure, with minimal tax implications in Tonga and Micronesia, and possible fiscal losses from high-skilled emigration of \$6,300 per high-skilled migrant per year for Ghana, \$8,000 for New Zealand, and \$16,900 for Papua New Guinea. These measured benefits greatly exceed the measured costs, and thus require the uncompensated externalities of high-skilled individuals at home to be much higher than commonly assumed in order for one to conclude that high-skilled migration is having a negative net impact.

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Table 1: Sample Sizes, Response Rates, and Migration Rates

Country	Number in Sample frame	Number of Survey respondents	Survey Rate	Current Location known: Number	% %	% female	Number of Current Migrants	% of 22+ who ever migrated
Ghana	1851	283	15.3			36.6	106	59.9
Micronesia	472	157	33.3	319	67.6	59.2	61	84.1
New Zealand	851	371	43.6	476	55.9	39.9	155	67.8
Papua New Guinea	691	236	34.2	298	43.1	34.2	22	36.8
Tonga	266	193	72.6	245	92.1	52.3	98	85.7
Total	4131	1240	30.0	1338		39.4	442	64.6

Notes:

% female, number of current migrants, % of 22+ who ever migrated and who are current migrants pertains to the sample, not the population.

Table 2: Annual Gross Income Gain from Migrating

Country	A: Annual income abroad of current migrants (USD)		B: Annual income at home of return and non-migrants (USD)		C: Annual income current migrants expect to earn at home (USD)		Estimate of Annual Income Gain				
	Mean	Median	Mean	Median	Mean	Median	A-B Mean	A-C Mean	Regression Estimate 1 (Std. Err.)	Regression Estimate 2 (Std. Err.)	2SLS Estimate
Ghana	101696 (87543)	76986	22565 (30468)	13712	24627 (38159)	14064	79131	77069	74601 (13039)	73883 (12524)	n.a.
Micronesia	57181 (45082)	44200	22286 (15631)	18200	17205 (9716)	20000	34895	39977	38740 (7815)	35538 (7596)	40773 (33245)
New Zealand	115505 (89287)	83707	82225 (90163)	61077	65614 (33696)	60753	33279	49890	34208 (12031)	37391 (12144)	n.a.
Papua New Guinea	92660 (60187)	73500	24623 (27655)	13710	43061 (36373)	28599	68038	49599	44025 (18429)	42942 (18647)	n.a.
Tonga	88156 (96201)	60991	12593 (15986)	8772	11325 (10099)	9640	75563	76832	68877 (18345)	68991 (22536)	n.a.

Note:

All estimates are for individuals currently employed and who are non-students

Regression Estimate 1 controls for 5-year age groups and sex. Regression Estimate 2 also controls for country of birth, mother and father's education, and self-assessed family wealth at the end of high school

Instrumental variable for Micronesia is experiencing a typhoon in their home region when aged 18 to 22, first stage F-statistic is 3.63 (p=0.06).

Table 3: Human Capital Formation of individuals aged 22 and older

	Bachelor's Degree		Masters, Law, Medical Doctor, or PhD Degree		Proportion
	Proportion	Proportion of those	Proportion	Proportion of those	who took actions
	who have	with this qualification	who have	with this qualification	due to prospect
	this qualification	who earned it abroad	this qualification	who earned it abroad	of migration
Panel A: Migrants					
Ghana	0.99	0.39	0.73	0.86	0.29
Micronesia	0.50	1.00	0.18	1.00	0.19
New Zealand	1.00	0.13	0.77	0.75	0.07
Papua New Guinea	0.91	0.25	0.64	1.00	0.10
Tonga	0.84	1.00	0.42	1.00	0.14
Panel B: Individuals in Home Country					
Ghana	0.98	0.06	0.49	0.28	0.32
Micronesia	0.40	0.90	0.16	0.83	0.16
New Zealand	0.99	0.01	0.57	0.19	0.08
Papua New Guinea	0.89	0.10	0.31	0.49	0.16
Tonga	0.69	0.95	0.34	1.00	0.20
Panel C: Estimates of the Impact of Ever Migrating on Educational Attainment					
	Likelihood of having a bachelors degree		Likelihood of having an advanced degree		
	Coefficient	Standard error	Coefficient	Standard error	
Ghana	0.021	0.024	0.258	0.070***	
Micronesia	0.197	0.091*	0.019	0.018	
New Zealand	n.a.		0.218	0.058***	
Papua New Guinea	0.073	0.058	0.352	0.085***	
Tonga	0.698	0.122***	n.a.		

Notes: Panel C estimates are marginal effects from probit estimation for the sample aged 22 and above, with 5-year age groups, gender, country of birth, parental education, and family wealth while in high school as controls
 *, **, and *** indicate significance at the 10%, 5% and 1% levels respectively.
 n.a. indicates estimate not available due to almost all New Zealand sample having bachelors, and to there being no Tongan with an advanced degree not earned through migration.

Table 4: Annual Monetary Flows from Migrants to Home Country

	Proportion who sent flow		Conditional Mean	Annual Value in USD			Net effect after subtracting mean for non-migrants (USD)
	All current migrants	Non-student current migrants		Conditional Median	Unconditional Mean	Unconditional Median	
Panel A: Monetary Remittances (annual)							
Ghana	0.86	0.93	4314	2100	3715	1750	3715
Micronesia	0.69	0.68	2187	1000	1359	500	1359
New Zealand	0.24	0.26	2476	486	625	0	625
Papua New Guinea	0.89	0.90	6099	2681	6085	2681	6085
Tonga	0.63	0.76	4682	2651	3122	1446	3122
Panel B: Goods and In-kind Remittances (annual)							
Ghana	0.74	0.75	1927	700	1284	350	1284
Micronesia	0.67	0.68	625	450	577	400	577
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Papua New Guinea	0.90	0.91	1355	536	1232	357	1232
Tonga	0.63	0.61	2506	1446	1319	482	1319
Panel C: Help a home country firm make a trade deal or exported goods from home country to overseas in last year							
Ghana	0.02	0.03	100275	25550	5571	0	5346
Micronesia	0.07	0.04	2918	325	307	0	-139
New Zealand	0.04	0.06	n.a.	n.a.	n.a.	n.a.	n.a.
Papua New Guinea	0.14	0.10	250244	250244	25024	0	-46108
Tonga	0.02	0.00	0	0	0	0	-186
Panel D: Invested in a business start-up in the home country in last year							
Ghana	0.14	0.19	17920	2100	3733	0	3502
Micronesia	0.04	0.05	30050	30050	1582	0	1355
New Zealand	0.02	0.02	n.a.	n.a.	n.a.	n.a.	n.a.
Papua New Guinea	0.14	0.08	537	537	45	0	-5
Tonga	0.05	0.04	4844	4844	404	0	404

Notes: Values are for sample of migrants who are not currently students.

Goods remittances and the value of trade deals and value of business start-ups were not asked of the New Zealand sample.

Table 5: Annual Non-financial flows

Panel A: Proportion of current migrants who are not students engaging in activity in last year

	Ghana	Micronesia	New Zealand	Papua New Guinea	Tonga
Provided advice to national Government	0.04	0.13	0.04	0.08	0.13
Advised a home country company	0.16	0.10	0.06	0.25	0.08
Provided advice about study abroad	0.53	0.54	0.26	0.58	0.36
Provided advice about work abroad	0.42	0.44	0.42	0.83	0.44
Sponsored home country national to work/study abroad	0.08	0.13	0.04	0.08	0.20
Carried out research with people in home country	0.14	0.08	0.16	0.25	0.04
Acted as an official representative an overseas event	0.10	0.08	0.05	0.25	0.16
Advised people overseas about a holiday in home country	0.66	0.44	0.91	0.75	0.56
Member of a diaspora or emigrant organization?	0.23	0.18	0.18	0.09	0.00

Panel B: Proportion of current migrants less proportion of non-migrants engaging in activity in last year

	Ghana	Micronesia	New Zealand	Papua New Guinea	Tonga
Provided advice to national Government	-0.10	0.08	-0.08	-0.06	-0.01
Advised a home country company	-0.10	0.05	-0.27	-0.12	0.08
Provided advice about study abroad	0.10	-0.11	0.11	0.29	0.03
Provided advice about work abroad	0.13	0.04	0.29	0.60	0.11
Sponsored home country national to work/study abroad	0.08	0.13	0.02	0.08	0.20
Carried out research in a home/abroad collaboration	0.04	0.08	0.03	0.11	-0.10
Acted as an official representative an overseas event	0.08	-0.11	0.00	0.18	0.09
Advised people overseas about a holiday in home country	0.28	-0.16	0.41	0.39	0.09

Table 6: Annual Fiscal Effects

	Fiscal Costs of Emigration				Fiscal Benefits of Emigration					Approx. Net Fiscal Cost	
	Income Tax Migrants		Sales tax migrants		Sales tax if		Mean	Per-capita	Per-capita	Using full	Using health
	Would pay if at home		Would pay if at home		remittances consumed		Household	Govt.	Govt. health &		
	Mean	Median	Mean	Median	Mean	Median	Size	Expenditure	education expenditure	govt. exp.	& edn. Exp.
Ghana	4999	2430	1655	791	280	132	3.12	290	20	5469	6312
Micronesia	965	600	383	300	41	15	3.08	1378	259	-2939	509
New Zealand	17255	14450	4703	4253	38	0	2.50	12147	4521	-8447	10618
Papua New Guinea	14537	8547	2588	1719	131	58	4.00	134	21	16458	16910
Tonga	1204	964	1083	868	281	130	3.60	784	257	-815	1081