

Is the Brain Drain Good for Africa?

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Abstract

The goal of this paper is to comment on some of the recent literature on the Brain Drain, with an emphasis on Sub-Saharan Africa, and the effects on the source countries. Little attention will be paid to the effect on the receiving country. Our main argument will be that contrary to a lot of the worries expressed in the media, the Brain drain is probably a net benefit to the source countries. We indicate ways in which the potential of the brain drain can be harnessed to the advantage of the source countries. The purpose of this paper will not be to provide new models or new data for the Brain drain. It is instead, as previously mentioned, to review some of the models and debates regarding the brain drain in connection to Sub Saharan Africa.

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1 Introduction

Could poor countries possibly obtain a POSITIVE return from the brain drain? We will argue that the answer could be "yes." This would be contrary to most of the received wisdom, and definitely contrary to remarks and comments in the media. We will remark on evidence from data on remittances, and, in particular, we shall look at the migration decisions, both individual and national within the source countries, and show under what conditions the migration may be optimal.

As indicated by lots of data, the brain drain today is most severe in Africa. For this reason, our discussions will focus on Africa. Further, we shall study brain drain in relation to the source country, and not the receiving. Our emphasis will be on the decision making of both individuals and governments. We will

provide a number of back of the envelope calculations indicating that there may be net benefits from the brain drain for the source countries. We will support many of our arguments with macro level country regressions.

2 Characteristics of the Africa Brain Drain

2.1 African Brain Drain Not New: Some History

The African Brain drain started during the times of Slavery. The estimates on the transfer of people from Africa to the United States during the times of Slavery was of an order of magnitude which has consistently been larger than the modern day voluntary brain drain. It is only in the past decade that it seems that the voluntary drain is beginning to catch up to the drain from 2 centuries ago. A recent New York Times article (2/21/05) pointed out that the flow of legal immigrants into the US from Africa, at 50,000 per year is only now attaining the same order of magnitude as during the days of slavery.

There were very small numbers of Africans going abroad during the early 1700's for western education. Many who went to be educated went to study religion. McWilliam (1959) tells us of a Ghanaian with the Dutch name of Jacobus Capitein, sent by the Dutch to at Leyden University in the 1700's. His intellectual activities included translating the book of apostles into the local language Fante and in presenting an argument as to why slavery is consistent with religious doctrines. He was ridiculed by his own people and ignored by the Europeans, and died at 30 years of age. His generation of brain drainers were most probably very influential in translating local languages and spreading the use of the written word.

Kwegyir Aggrey is an exemplar of the brain drain from the early 1900's. He too was a Ghanaian, studying at Columbia University in the 1920's and was connected to the Phelps-Stokes fund and Caroline Phelps-Stokes, a New York philanthropist with a lifelong concern for the educational needs of the underprivileged. This connection resulted ultimately in Ghana's first co-ed, non denominational school, Achimota School, which later on became what is now the University of Ghana, which is Ghana's largest, oldest and most prestigious university. (The Phelps-Stokes foundation itself was important for the building of the Historically Black Colleges and Universities, HBCU's).

Finally, we should recognize that many of the independence leaders in Africa were themselves part of a Brain drain in the early 20th century. Kamuzu Banda, Jomo Kenyatta, and many other African independence leaders were all part of an initial brain drain who met and strategized in the UK and USA and then returned to fight for independence. Azikiwe, the Nigerian independence leader studied at Lincoln University in Pennsylvania, and was instrumental in bringing to the US. Kwame Nkrumah, Ghana's independence leader, to the same institution where he received a Bachelors degree in Economics and Sociology, and subsequently a Master's degree in Philosophy at the University of Pennsylvania. Without that brain drain perhaps independence would have occurred much

later, if at all, in many African Countries. (These independence leaders were also in contact with and in many cases contributing to the dialogue within the American black civil rights movement.)

In discussing the pros and cons of the brain drain, many variables remain unquantifiable. What is economic impact of the early brain drainer who helped with developing writing in the local languages? Or the impact of those whose insights and energies introduced some of the first formal schools in some areas? What is the economic impact of having leaders trained to be able to deliver independence to many African countries? Many of these intangible benefits of the brain drain persist today. What is the value of the returned brain drainer who brings back ideas for setting up modern private investment banks, modern computer software companies, etc.

2.2 The Size of Today's Brain Drain

Africa is a continent with small aggregate outflows of highly educated human capital, but with high flows as a percentage of existing stocks of human capital. Migrants with tertiary education coming to the US constitute large percentages of their home country stocks of tertiary educated citizens (with numbers like 60% for Gambia, 20% for Ghana, 15% for Uganda), according to Carrington-Detragiache (1998). Using more recent data with a larger number of countries, Docquier and Marfouk obtain even higher brain drain rates. According to Docquier and Marfouk (2005), the rate of skilled migration (defined as the college-educated emigration stocks as percent of the total college educated number of people born in the source country) exceeds 50 percent in five African countries: 67.5% in Cape Verde, 63.3% in Gambia, 55.9% in Seychelles, 56.2% in Mauritius, 52.5% in Sierra Leone. They also indicate that state that countries with population above 5 million, high rates of emigration are found in nations such as Ghana (46.9%), Mozambique (45.1%), Kenya (38.4%), Uganda (35.6%), Angola (33%), and Somalia (32.7%). A consequence of this is that Africans to the US are among the highest educated groups in terms of average years of schooling, although they constitute very small percentages of the overall immigrant pool in the US. The Carrington-Detragiache (1998) data set estimates that 75% of the African migrants into the US have tertiary education.

Table: Skilled migration rates for selected African countries	
Country	Rate of emigration
Cape Verde	67.5%
Gambia	63.3%
Seychelles	55.9%
Mauritius	56.2%
Sierra Leone	52.5%
Ghana	46.9%
Mozambique	45.1%
Kenya	38.4%
Uganda	35.6%
ANgola	33.0%
Somalia	32.7%

In terms of percentages above, i.e., tertiary educated migrants relative to total stock, the brain drain is a distinctively African phenomenon. The aggregate numbers are high in countries like India and China. The relative percentages, however, are much smaller than those of Africa.

Table: Skilled migration rates and stocks for selected developing countries		
Country	Rate of emigration	Stock
Philippines	13.7%	1126260
India	4.3%	1037626
Mexico	15.3%	922964
China	3.8%	816824
Korea	5.6%	652894
Vietnam	27.1%	506449
Poland	14.1%	449059
Cuba	28.7%	332673
Iran	14.5%	308754
Jamaica	85.1%	291166
Hong Kong	28.8%	290482
Russia	1.5%	289090
Taiwan	12.7%	275251
Ukraine	3.5%	246218
Colombia	10.4%	233536
Pakistan	12.6%	222372
Romania	11.8%	176393
Turkey	5.8%	174043
Brazil	2.2%	168308

2.3 The Quantity of Brains

For the most part, the supply of education in most of Sub-Saharan Africa is determined by government expenditures. Until up to about a decade or so, there were very few private universities. Governments felt the need to respond to the people's demands for more seats at the country's universities. The number of seats of different types is determined by government. Governments then go through the large expense of training, often without matching increases in demand in the industrial sector.

Africans spend a high percentage of their government spending on education, relative to the rest of the world - the data show that this is around 25% for Ghana, 20% for many African countries, such as Algeria (21.1%), Morocco (26.1%), Togo (26.4%), Cameroon (19.6%), Kenya (17%), Gambia (14.6%), Senegal (26.9%) and Niger (18.6%) (Human Development Report, 2004). There is also great political pressure on the governments to increase the number available seats in secondary schools and universities. The proportion of public expenditure on education spent on tertiary level is above 20% in countries like Cameroon (29.5%), Togo (29%), Kenya (21.6%), Senegal (24%) and Malawi (20.2%).

Table: Public Spending on Education for selected African		
Country	As % of Total Gov. Expenditure	Tertiary Education as % of Gov. Edu. Exp.
Algeria	21.1%	-
Angola	10.7%	3.7%
Botswana	17%	-
Burundi	16.7%	22%
Cameroon	19.6%	29.5%
Congo	14.4%	-
Ethiopia	9.4%	12.1%
Gambia	14.6%	17.8%
Ghana	24.3%	11%
Kenya	17%	21.6%
Lesotho	12.2%	-
Malawi	11.1%	20.2%
Morocco	26.1%	16.2%
Mozambique	12%	9.9%
Niger	18.6%	-
Senegal	26.9%	24%
Swaziland	19.5%	26%
Tanzania	11.4%	-
Togo	26.4%	29%
Tunisia	13.5%	18.5%
Uganda	11.5%	-
Zambia	8.7%	-

African countries have done a phenomenal job at increasing the number of

their citizens receiving education, especially tertiary education. K.Y. Amoako in his lecture published in the Tertiary Education Series (Ghana) has studied the expansion of universities in Sub-Saharan Africa. From six universities in Sub-Saharan Africa in 1960, he records more than 120. Enrollments have jumped, from 1.5 million students in 1980 to 3.8 million in 1995. Francophone West Africa in the colonial era had only one university, the University of Dakar. Now there is at least one for each country. East Africa had only Makerere - now there are more than a dozen. The increase from 1995 to today has been even more spectacular.

Almost all of the universities are run and paid by the government, with tuition accounting for an infinitesimally small amount of the costs. Combined with the small absolute size of the government budgets relative to the needs of the population, we see why many have worried about the Brain drain from Africa. It has only been in recent years that governments have allowed private universities to be established in Africa. The private tuition-based universities still account for a very small percentage of the overall number of students in the tertiary education system. It is often these two facts - the high exodus rate of Africa's educated classes in combination with the high government subsidies of higher education which leads to most of the outcry about the African brain drain.

There is no market to discipline the government in setting the seats of different types. Two kinds of pressures emerge. On the one hand, because of relative ease of filling up seats in the humanities, the production of graduates in these areas exceeds the ability of the economy to appropriately absorb them. On the other hand, one often hears statements in the press that there is a strong desire to have more scientists and mathematicians to help bring Africa to the technological frontier. It is interesting to note that, using Ghana as a case study, most of the seats produced in the newly formed private universities are in business and computer science. Note that this is not quite unlike what often happens in the US higher education market. Graduate degrees in the humanities are often heavily advertised and, at least in my own university, full-funding is given in those fields. There is a lot of soul searching in the humanities departments producing these Ph.D. degrees since there are often no jobs in the academy.

2.4 The Cost of Producing Brains

What is the cost of producing brains - i.e., of providing education to Africa's citizens? We will focus on the production of tertiary educated citizens. The work by Hinchliffe, K (1987) using data for 1979 - 1984, shows unit costs of tertiary education as a multiple of per capita GNP as averaging 8.6 for Africa, with highs of 30 for Tanzania, 13 for Upper Volta and Zimbabwe, 14.2 and 6 for Ghana. The averages for Asia, Latin America and the developed countries are 1.2, 0.9 and 0.5 respectively. By this measure we see that education in Africa is relatively expensive. This leads of course to concern about the brain drain.

The Hinchliffe data is 20 years old. As indicated earlier, there has been

a rapid increase in the number of students in tertiary education institutions. This increased number as well as efficiencies in delivery would be expected to reduce the unit cost of educating students. We did our own computations, using more recent data from the UNDP (2004) Human Development Report, World Development Indicators and UNESCO (2005). Our data show smaller costs, as expected. The numbers we obtain are in the range of 2 and 3 times GNP per capita¹.

Table: Unit costs of higher education as a multiple of per capita GNP		
Country	1979-1984	2000
Botswana	7.0	1.02
Chad	-	4.21
Congo	-	1.96
Gabon	-	1.59
Ghana	5.7	1.78
Lesotho	14.2	7.50
Malawi	15.9	-
Mali	-	2.32
Niger	5.4	2.91
Rwanda	14	5.69
Swaziland	3.2	2.65
Tanzania	30.9	-
Togo	6.3	2.42
Upper Volta	13.2	-
Zimbabwe	12.7	-
Africa	8.6	-
Asia	1.18	-
Latin America	0.88	-
Developed Countries	0.49	-

2.5 Remittances

An interesting feature of the African Brain drain is the desire by many Africans to maintain ties to their home countries. It is impressive to see the large number of Africans who send their savings in the US to slowly build a houses in their home country for when they return. Indeed, we suspect that you can measure a migrants savings by the height to which the building has been completed. Clearly this is a sub-optimal use of the migrants savings since the house is not being used while the migrant is adding to it - a process which may take decades. It is interesting to note that many cities in Mexico have now offered mortgage financing to migrants to enable them to complete their houses and pay off the debts over time.

Further, for the more affluent members of the African diaspora, there are now springing up gated communities in many West African cities, which look

¹Our computations are available upon request.

and feel like equivalent gated communities in the US. These cater not only to the emerging African middle classes, but also to the large African diaspora living abroad.

As regards numerical values of the size of the remittances, there is a wide range of estimates. Let us use Ghana as an explicit example. On the high side are many press accounts which put the remittance number at \$400M per year, an amount which, if correct, would make these remittances of the same order of magnitude of the two biggest exports of the country, Cocoa and Gold, and which would account for close to 25% of the foreign exchange earnings of the nation. It would also make this of the same order of magnitude as the foreign aid receipts of Ghana (which for 2002 was \$650M). Other press accounts, which corroborate the above, assert that the Western Union transmissions of money from migrants to family in Africa averages about \$300 per month for the typical African abroad. With estimates of per capita income of the same magnitude per **year** for many African countries, the remittances of the typical African abroad is around 12 times the per capita GDP of the typical African in Africa. On the low side the IMF figures for remittances for Ghana are around \$44M. However, the official data underestimate the true size of remittance receipts, a significant share of which are transmitted by travelers or other informal channels. Correcting for these informal channels, some Bank of Ghana studies put the figure as high as \$1bn.²

Regardless of the exact value of the remittances, there may be considerable scope for increasing remittance flows by reducing transactions costs associated with sending remittances. Mexican banks and municipalities seem to be moving in this direction to capture more remittances from Mexican migrants living in the US.

3 What Precisely are the Questions in this literature?

There are many press and media stories about the tragedy of the African Brain drain. It is useful to pause to reflect on what precisely is the issue. What precisely are the questions and concerns by those who worry about the African Brain Drain? We note some of the questions below. The principle ideas of this paper can be summarized around these questions.

1. **Would Decrease in the Brain Drain Reduce Poverty?** First and foremost there is the issue of the poverty in Africa, which is clearly revealed in the official statistics, as well as in the daily reminders in the media. In the media accounts, there then is the jump from the poverty to the lack of adequate trained personnel. Pictures of sick children are usually put

²See page 5 of the Ghana Country Study by the Centre of Migration, Policy and Society (Ref. RO2CS008) by Adam Higazi (Univ. of Oxford)

together with headlines of the migration of doctors and nurses to Europe. The absence of an industrial base is typically associated with the lack of trained engineers. The poor state of the public sector is often linked with the lack of adequately trained people in the country to make and administer public policy. One often reads "There are so many skilled people abroad, yet Africa is doing so poorly." The basic premise of these assertions is that if only there was less migration out of Africa of the skilled, there would be less poverty. Below we note a number of ways in which these seemingly obvious assertions should be tempered:

- (a) Unemployment among existing educated citizens in home countries. In many African countries, especially those with high rates of brain Drain, there is unemployment or underemployment of many graduates of tertiary institutions.
- (b) Incentives to Acquire Human Capital: Without the possibility of high returns when educated are drained, there may be weakened incentive to acquire the human capital in the first place. In other words, if the brain drain were to be stopped immediately, the consequence may be that so many will stop acquiring human capital that the new stock of human capital in the economy would be less than the non-drained human capital in the regime where brain drain was allowed. We review some of the literature on this in a later section.
- (c) Growth Regressions do not show a relationship between poverty and the Brain Drain.

2. On a Cost-Benefit basis are the Educated Are Wasting Government Resources because of the Brain Drain

One often hears the fact that the tertiary education is free or heavily subsidized in Africa, so recipients of the education should pay back the government for their education. In the local African media, there is the outrage that government money is spent on educating citizens only to see them drained to the west to help build those countries and not Africa. "There are more doctors in the US than in Ghana." or "There are more Ghanaian nurses in US than in Ghana." These concerns must be calibrated against a number of issues often not mentioned by those making the assertions of outrage. We list a few here which we discuss in varying detail below.

- (a) Remittances. The cost-benefit arguments ignore remittances. We provide some back of the envelope calculations below to show that the cost-benefit analysis, when remittances are added, may argue that African countries should be net exporters of its educated.
- (b) Increase Tuition: If the issue is with the repayment of government monies for private education, why is there not also not an accompanying cry for increase tuitions, or tuition loans to be repaid at later dates? In no sub-saharan country have we noticed strong public demand to increase the tuition levels in government run universities.

- (c) Incentives to Acquire Human Capital: (as mentioned above)
- (d) The Internal Brain Drain. Many who are trained in occupations by the government do not remain in those occupations. There are famous stories of university graduates driving taxis, skilled professors in academic fields moving into private businesses unrelated to their area of training.
- (e) The Rural to Urban Brain Drain. This is similar to the issue of the internal brain drain. If, say, the government is spending large amounts of money to produce doctors to cater to the rural areas, to the extent that doctors do not stay in the rural areas, we obtain a brain drain loss similar to that asserted for the brain drain abroad. Obviously, to the extent that residents of rural areas have access to the services of trained personnel in the cities this becomes less of a loss. The loss is also mitigated to the extent that the central planner imputes value to having larger than planned trained personnel in the cities. However, for the typical rural dweller who does not have access to these services the loss is equal to that of the overseas brain drain. Our motivation here is to point out the fact that the overseas brain drain receives much more attention than the perhaps bigger drain away from rural areas.
- (f) Within Africa brain drain. How does one measure the impact of African educated people going from one African country to the next. On the one hand, if a nurse goes from Ghana to Nigeria, chances are that poor people in Nigeria are better off while those in Ghana are worse off. This is perhaps bad for the Ghanaian government, but if we were to aggregate across poor people in Africa, how would the scorecard look?

3. **Would Government Revenues have been better spent if not spent on Education?** Many of the African countries with large flows of educated migrants are also countries which have been associated in the recent past with high levels of corruption. It is an open question what those countries would have spent their resources on if there had not been a high demand for education in those countries. Suppose that the percentage of government revenues spent on education fell from the high levels of 20% and more to 10%. Would those resources have gone to improved infrastructure or just ended up being consumed by the governing elites.

4. Measuring the Intangible Benefits of the Brain Drain

- (a) Above we mentioned aspects of the early brain drain and how they assisted in the development of writing in the local languages, the establishment of formal educational institutions and the production of the Independence leaders. Given the history of many African countries, slavery then colonialism and poverty, perhaps the optimal strategy for the national planners was to send as many of its people

abroad to have a percentage come back with newly acquired skills, human capital, and simply knowledge about how things are done overseas. We believe that was indeed a desire of many of the post independence leaders, who encouraged students and educated people to travel abroad to learn the way foreign economies are run.

- (b) Brain Circulation: When travelling go to many West African cities it is obvious to many observers that a lot of new economic activity is being generated by people who have lived abroad for a long time and then returned to their home countries. Even more interesting are those who maintain residences both in their home country and in the country they drained to. Finally there are those whose primary residence is abroad but who return to their home countries every year to assist in some way or the other with economic development. Many have used the terminology of brain circulation rather than brain drain to describe the current day movement of educated Africans between their homes and the west.
- (c) Finally, one should include in the computation the implied subsidy foreign countries provide in the education of Africans going abroad. American universities regularly provide scholarships for Africans to study abroad. This increases the human capital of those Africans. This is of direct benefit of course to the person receiving the education and, via remittances, his or her family back in Africa. Those who return to their country will provide a benefit to their local economies. Those who do not return to their country will provide benefits via remittances, which in principle could be higher when they receive higher income. Countries with higher brain drain rates are better able to benefit from this subsidy. They have more educated people abroad who can learn the system and also share their insights with their friends and relatives back in Africa.

4 Brain Drain Pluses and Minuses: Computing Individual and Family Utility and Remittances versus Social Losses

One aspect of the brain drain that is often not mentioned is the fact that those who successfully migrate abroad often enjoy markedly improved standards of living. Parents who care about their offspring also enjoy increased utility with successful brain drain of their offspring. They may choose optimally to have taxes imposed on them to improve the school system with the sole purpose of increasing the chances that their own offspring will be able to migrate one day. These desires by parents are no different from parents in rural or small towns in the US who fund their school systems knowing full well that there will be next to complete brain drain of the educated from those school systems to big cities in the US. Those parents understand fully that perhaps the only benefit

of those tax payments is see their own offspring better educated and therefore better able to drain to other regions. Many Africans may share this view.

It is, of course possible, that **holding fixed** the given the migration outcome of their offspring they would prefer other parents kids not to drain away. This of course would lead to better public and private goods for themselves - better hospitals, better government administration, shorter waits for doctors, etc. Ex ante, however, it may in each parent's interest to vote to allow a brain drain even if her own offspring has a less than probability one chance of being able to drain away. This section will illustrate this with some back of the envelope calculations. In subsequent sections we shall provide calculations which indicate that the same may be true of the society as a whole - in particular, taking into account all the externalities a country may decide it is in its best interests to allow and encourage a brain drain.

Below we provide a simple framework for performing precisely the calculation mentioned above. We do this in a very simple stripped down model, to get the key ideas across. We then provide some back of the envelope computations using numbers from a variety of data sources. The message is clear: given a vote, many may decide to vote to continue the brain drain or even increase it. Later on, we will discuss ways in which our numbers could be disputed, in our robustness section.

Our calculations underestimate the positive aspects of the brain drain for the many reasons outlined in the earlier section. Here we look only at utilities, remittances and some proxy for the public goods created by educated people who stay in their home countries rather than being drained away.

First we sketch a simple model. Think of their being two types or ages of people in the economy, the young and the old. Suppose that there is a unit of the population that is young. Let us perform a simple static or one period exercise. In particular, suppose that the government has resources of G which it spends on two different activities: roads and education. Let e denote the resources spent on education and H that on roads. The government therefore has the budget constraint

$$H + e = G. \tag{1}$$

Let $\psi = \Psi(e)$ denote the fraction of the young who will be educated when education spending is e . The function Ψ will of course be increasing in e , so that higher e results in a higher percentage of the young being educated. Of the educated a fraction d will be drained off to foreign countries, with the residual fraction $1-d$ remaining in the home country. There will therefore be three types of young: the fraction ψd who are educated and drain; the fraction $\psi(1-d)$ who are educated and remain in their home countries; and the fraction $(1-\psi)$ who receive no education. We now specify the utility levels of each of these three groups of young.

The educated young who do not drain, and therefore remain in their home countries, produce public goods for all in the society to consume.. The precise amount y of the public good produced depends upon spending on infrastructure,

H, as well as the total number of educated young available, $\psi(1-d)$, via the production function f:

$$y = f(G - e, (1 - d)\psi). \quad (2)$$

We will think of y as being the doctors and nurses, teachers and professors, engineers, etc, in the country who could have migrated but did not. We will not think of this similar to our thoughts of independence leaders, since it is unclear that by merely increasing the number of educated you significantly increase the chance of such once in a generation leaders.

Since increasing either the infrastructure or the educated young available in the economy would be presumed to increase the output of the public good, we suppose that f is increasing in both arguments. Notice that we suppose that only the educated produce public goods. In particular, we ignore the role of the uneducated in producing the public good. There are a number of reasons for this modeling. (a) We use this simplification to highlight the effect of the brain drain. Note that as the drain fraction d goes up, the production of the public good goes down. It is this important effect that we want to study. Adding the uneducated into the production function would not change our principal conclusions. (b) Further, when looking at tertiary education, which is what we are doing here, in many African countries the educated are a very small proportion of the uneducated. Introducing the unskilled into the production function f will add few interesting insights not already captured by the first two arguments of f .

Now we describe the payoffs of the three different types of the young. The fraction $\psi(1-d)$ of the young who are educated and stay within the economy receive the payoff $u^E(y)$, which depends upon the quantity y of the public good produced. Let us set $u^E(y) = cy$, where c denotes a form of "skill premium." The fraction $(1-\psi)$ of the young who do not receive an education will be modeled as having the utility or payoff of y . The fraction ψd of the young who are educated and drain each receives an income of w^D in the countries in which they work. They also send the amount R back as remittances to their family back home. The net income of the drainers is therefore $u^D \equiv w^D - R$. We use these very crude and simplified assumptions on the payoffs of the different types of young to enable us to focus on the brain drain aspects of interest to us.

Now think of a typical young person, "behind the veil", not knowing which of the three types of young they will end up being in. The expected income, u^Y , of that young person is of course the weighted average of the three payoffs, weighted by the probability of being in each class:

$$u^Y = \psi d(W - R) + \psi(1-d)cy + (1-\psi)y. \quad (3)$$

Of course, one could argue that for the very rich say, they could be sure that their offspring will be educated and may even drain. In particular, it may be better to model the three probabilities as being a function of wealth. We will argue later that we could indeed include this feature without doing much harm to our basic results.

As regards the old, they receive an income equal to y plus whatever they receive as remittances from their offspring who successfully get an education and drain, which in expected value terms is given by:

$$u^O = y + \psi dR \quad (4)$$

All types of the young care also about their parents utility, U^O . This enters the utility function discounted by the factor δ^Y - in particular, the total ex ante Payoff of Young is as below:

$$U^Y = u^Y + \delta^Y U^O. \quad (5)$$

Similarly, the old also care about the utility of their offspring - this enters their utility function additively but discounted by δ^O - in particular, the ex ante utility level of the old is as below:

$$U^O = u^O + \delta^O U^Y \quad (6)$$

The values of U^Y and U^O will be determined in an equilibrium where both (6) and (5) hold simultaneously. Solving those two equations simultaneously implies that³,

$$U^Y = \kappa \left(\delta^Y u^O + u^Y \right) \quad (11)$$

and

$$U^O = \kappa \left(\delta^O u^Y + u^O \right) \quad (12)$$

where

$$\kappa \equiv \frac{1}{1 - \delta^Y \delta^O}. \quad (13)$$

Note that if either δ^Y or δ^O is 0, $\kappa = 1$.

We now have all the ingredients to make some observations.

³The calculations follow from noting that if

$$U^Y = \alpha_Y U^O + c_Y \quad \text{and} \quad U^O = \alpha_O U^Y + c_O \quad (7)$$

then

$$U^Y = \alpha_Y \left(\alpha_O U^Y + c_O \right) + c_Y \quad \text{so} \quad (8)$$

$$U^Y = K [\alpha_Y c_O + c_Y] \quad \text{and} \quad (9)$$

$$U^O = K [\alpha_O c_Y + c_O]. \quad (10)$$

where $K = \frac{1}{1 - \alpha_Y \alpha_O}$.

4.1 Too Many Educated People? The Optimal Choices of ψ and e

The function Ψ is that which maps education levels e to the fraction of the young who are educated, ψ . Since Ψ is by assumption strictly increasing, there is a one to one mapping between e and ψ , so when studying optimal choices we can look at either variable. To study the effect of increasing ψ , we first note the following derivative:

$$\frac{\partial u^Y}{\partial \psi} = d(W - R) + (1 - d)cy - y + [\psi(1 - d)c + (1 - \psi)] \frac{\partial y}{\partial \psi}; \quad (14)$$

When W and d are very high relative to y , as would be expected to be the case in many poor countries, we see that $\frac{\partial u^Y}{\partial \psi}$ is positive. This is not surprising. An increase in the general education levels should be expected to benefit the young more than the old. As regards the old, it is easy to see that

$$\frac{\partial U^O}{\partial \psi} = \kappa \left(\delta^O \frac{\partial u^Y}{\partial \psi} + \frac{\partial y}{\partial \psi} dR \right). \quad (15)$$

If the old care about the young, and if $\frac{\partial u^Y}{\partial \psi}$ is large (which we just argued may be the case when W is large), then $\frac{\partial U^O}{\partial \psi}$ would be positive. This is the case even when $R=0$. Hence we see that if the old are decision makers and they care for their offspring they will set ψ as large as possible. We repeat here that this may be the same motivation behind why parents in many rural but affluent countries pay for school systems knowing full well that their offspring will leave and not help directly their communities.

If both $\frac{\partial u^Y}{\partial \psi}$ and $\frac{\partial y}{\partial \psi}$ are positive over their relevant domains, we obtain the conclusion that the old would prefer very high levels of education, almost to the exclusion of monies spent on roads.

To check our modeling we ask under what conditions this would both be true and be violated. Well, if $y = f(G - e, (1 - d)\psi)$ an increase in ψ , and equivalently e , will have a negative effect via the first argument and a positive effect through the second effect. This can be seen by writing

$$\frac{\partial y}{\partial \psi} = (-f_h + (1 - d)f_e) \frac{\partial e}{\partial \psi}. \quad (16)$$

In a poor country each argument of f will most probably be small, so the usual Inada conditions will work on each argument in opposite directions. When the stock of infrastructure is very small relative to the stock of educated people, one would expect the an increase in ψ to reduce y via its effect on decreasing even further the infrastructure level.

This of course begs another question: despite the absurdly low levels of educated people in the country, are there too many of them relative to the size of their country? I believe that this is an issue the Yoweri Museveni has spoken about often. High education spending takes away from other infrastructure

spending, which may not be optimal for the poor country with small stocks of both educated people and roads and infrastructure. One of the principle reasons for the brain drain is the lack of adequate compensation for skilled workers in their home countries relative to being abroad. The existence of a brain drain suggest that there is a larger stock of human capital than may be optimal for the economy. Perhaps there should be more spending on roads.

As an aside, we note that the above begs a bigger question: Are there too many people in Africa? In particular, are there too many people in the country relative to the "optimal" stock of people given the countries endowments and ability to find jobs for them. This interesting topic will not be pursued here. Interesting work on this has been done by Lant Pritchitt (2004).

4.2 Too Big a Brain Drain?

Let us now ask a related question. Suppose that all parameters excluding d are fixed. Does an increase in d help or hurt individuals in the economy? If either the source nation or the receiving nation can increase the rate of brain drain, everything else remaining the same, would this be for the better or for the worse?

First, note that since $y = f(G - e, (1 - d)e)$ we have

$$\frac{\partial y}{\partial d} = -f_e. \quad (17)$$

An increase in the rate of the brain drain, d , has the obvious negative effect on the public goods provision. The effect of the increase in d on the utility of the young will be made up of two parts: (a) the first is via the effect of reduced levels of the public good on the utilities of the young who are educated but non drained and the the uneducated; (b) the second is the increased probability of draining, which affects only the educated since only they drain, resulting in an increase in the income from that from being educated and drained versus educated and not drained. These two effects are represented in the two bracketed expressions in the equations below:

$$\frac{\partial u^Y}{\partial d} = -\{f_e [\psi (1 - d) c + (1 - \psi)]\} + \{[\psi (W - R)] - [\psi c y]\}. \quad (18)$$

Clearly, if the wage of those who drain, W , is sufficiently large as we expect it to, and if ψ is sufficiently large, then the first term in square brackets will dominate the other two, so that increasing d will have a net positive effect.

As regards the effect on the old of an increase in the rate of the brain drain d , there are 3 effects of the model: the effect of d on the utility of the young who they care about; the effect of d on the remittances the old will receive; and the effect of d on the public goods provision y which is related to the income that the old receive. These three effects are represented by the three terms on the right of the derivative equation:

$$\frac{\partial U^O}{\partial d} = \kappa \left(\delta^O \frac{\partial u^Y}{\partial d} + \psi R + \frac{\partial y}{\partial d} \right).$$

We have already argued that it is plausible to believe that the young would benefit from an increase in the brain drain - in particular that the first term above, $\frac{\partial w^Y}{\partial d}$ may be positive. Similarly, the effect on remittances of an increase in d is positive and will be a benefit to the old. The one negative term is the last one, the effect of the increase in d on the public good provision. This will be negative because an increase in d implies a reduction in the stock of the educated remaining within the country, which lowers the public good provision. If this is small relative to the other effects, then the net effect of an increase in d will be positive.

5 Would the Central Planner or Government Also Advocate a Brain Drain?

The computations above have taken into account the perspective of the representative old person and representative young person. We cast this in terms of someone choosing, from their individual perspectives, whether to advocate a brain drain. When we were analyzing the utilities of these representative individuals we took into full account the effect of the brain drain on the provision of the public good. If we take the central planner as someone who cares about the utilities of representative old and young people, as described above, then it should be clear that the central planner solution will look a whole lot like the individual optimization exercises for the young and old described above.

We now consider the perspective of a national government. On the one hand, we could think of the government as aspiring to optimize, as does the central planner. After all, this is what governments should be doing. In that case, by caring about the utilities of the local citizenry, the governments may advocate the brain drain as outlined above.

On the other hand, one could argue that the goal of the government is to optimize the output within the economy. Governments may care only about the output within the economy, and will not care at all about the utility of its citizens who successfully eventually migrate out of country, and it may also not be too concerned about the utility of the parents of such emigrated people.

There are a number of ways of computing the output in the economy. The narrowest definition would be to define the objective of the governments to be that of optimizing the size of the public good y . If that is the case, then it should be fairly clear that such governments will not advocate a brain drain, since, in our model, the public good increases with the number of educated people who remain in the economy. However, a very slightly less narrow view include the remittances of migrants back to the home economy. We perform some back of the envelope computations to show that if we use this definition of the objective of a government, we will conclude that the government itself may want to encourage the brain drain.

One often hears, especially in the African press statements of the kind "the government is wasting its money since it spends on students only to have them

leave. Those who benefit from the schooling provided by the government ought to pay back to the government the value of those benefits." Well, let us do some back of the envelope computations to study this.

In the literature on the Rates of Return to Education, the present value of the cost of university education for the typical person is something like 6 times the GDP per capita of the economy. Let X denote the annual remittances of the typical person who is drained out of the economy. The net present value of this flow is about $20X$ at 5% rate of interest. Hence so long as $X > 6/20 = 0.3$, the remittances exceed the cost of education. Hence so long as the remittances of the typical person exceeds 30% of GDP per capita, the remittances exceed cost. GDP per capita is often put at \$300 or \$400 per year, so 0.3 of this would be between \$100 and \$130 per year.

We mentioned earlier that some estimates put the remittances at \$300 per month. That would be 10 times the per capita GDP of Ghana. Let us take the official statistics, at \$44M, for Ghana and assume that these are correct (we believe they are under-estimated by a factor of 10). The same data puts Malawi's remittances at a paltry \$800,000. Let N be our guess for the number of people in the brain drain. The per capita remittances using the official remittance figure would then be \$44million / N . What would N be if we assume that the remittances equal the per capita GDP of roughly \$440 say? Well, you get 100,000. To get average remittances to equal 1/3 of GDP per capita, you would need 300,000. This is in excess of most of the estimates of the number of Ghanaians in the west, where one would expect most of the official remittances to come from..

In other words, on a straight cash basis, remittances exceed costs of training tertiary educated brain drained citizens, even under exceptionally conservative assumptions.

We could go further. Suppose that the government starts charging tuition fees. The universities are currently exceptionally over crowded, with insufficient seats for those who would like to enter and for those who are in the system, large classrooms, "perchers" in dorm rooms (students staying in dorm rooms of friends unofficially). This would make the net return to government even higher since the cost of educating students would be lower.

Then there is the new phenomenon of private universities in Africa. Although they currently do not hold large numbers of students, they are poised to become much more important in the higher education of African students. Education remains one of the most closed markets, especially in the third world. There is floating around now the idea of opening up education markets for outsiders to compete - after all, the provision of education is a service which perhaps should be subject to the same free trade rules as physical commodity trades.

6 Leadership/Middle Class Losses due to Brain Drain

One other argument that is often made about the brain drain is that it causes the loss of leadership of a vibrant middle class. The argument is that many of those who are drained away are the most vibrant and entrepreneurial members of their respective societies. If only they would stay in their home countries, they would be the engine of growth. Their mere presence would lead to the development of a vibrant middle class, who would insist on western values, transparent government, etc.

First, the exposure to outside ideas is itself an engine of growth. Having a significant portion of the population abroad means that those resident in the home countries are able to benefit via information flows - either through visits, discussions, etc with those who have drained. Many of those who do initially drain, often come back with new ideas to help develop their respective societies. It was mentioned in the introduction the influence of the independence leaders of Africa, many of them who were initially drained but who returned to their societies later on in life.

As has been stressed by the recent growth literature, it is ideas and knowledge which form a big part of the engine of growth of nations. Our independence leaders, who were initially brain drained, realized this. Ghana had a scheme, started by Kwame Nkrumah, of what was called "Chartered flights." These were government subsidies to encourage Ghanaian youth in secondary schools or universities to visit the UK. Kwame Nkrumah said bluntly that he wanted his people to see how things were abroad to get an idea of where he wanted to take his country.

This circulation of brains helps in the diffusion of knowledge which is precisely what is needed in our developing economies. Those who are part of the brain drain may be those who are the most adept at change - they after all are the ones who successfully migrated, perhaps they are better at implementing the change in their home country.

Some of the more exciting things going on in Ghana involve many of the Drained/Circulating Brains:

- Private Universities: Ashesi University - based on the Swartmore Model, by a former Microsoft employee.
- Investment Banks: DataBank - one of Ghana's first investment Banks;
- Academic Exchanges: NYU in Ghana

6.1 Robustness Section

One could ask what types of considerations could make the analysis above be incorrect. We discuss below some of those that come to mind.

1. Unequal access to the school system: One could imagine a situation where only the elite class has access to higher education. The elite class may

therefore advocate a brain drain while the rest of the people without access would prefer that the educated not be allowed to drain away.

In many African countries, the education system is perceived to be on the whole meritorious, at least the progression from secondary school to the universities. In that progression, there are usually nationwide examinations administered centrally, and therefore with somewhat small room for abuse.

If it is the rich who have access to the school system, then the modeling assumption which is harmed will be the assumption that the probabilities of being different types of young - educated and drained, educated and non-drained and non-educated - may depend upon wealth. However even in this case, the basic structure above remains the same; what changes are the values of the probabilities. One would have to re-work the numbers to see the total effect. At this time, we believe that our basic results continue to hold and in particular that there will continue to be a push toward more brain drain.

Some entry points into the school system are restricted by income - primary schooling for example is difficult for the very poor. On the other hand, being poor often translates to lower voting power. Our result would then say that the voting system would result in encouragement of the brain drain.

2. Remarks on the Calculations: In our computations, we suggest that it may be optimal to set d to 1, in which case the provision of the public good could be zero, if a positive stock of the educated within the country is required for positive public good production. One may object to the implication of zero consumption. We do stress here that since we model utilities as linear (everything is in terms of incomes) it may be appropriate to think of y as a public good, as opposed to thinking of y as a consumption good. Furthermore, one would expect the government to impose restrictions if their populations started leaving in such numbers that the remainder begins to approach zero. The Rawlings administration in Ghana in the early '80s imposed exit visas during the height of the economic decline at the beginning of his rule of Ghana, and the communist Eastern Bloc countries have had them in place for a long period of their history.

If we do change and move to a concave utility function with utility of zero public good being equal to zero, how would things change? The basic insight would remain the same - there would be pressure to increase the drainage levels. There would also be pressure to make sure that the public good remains at a minimal level. The purpose of our calculation is just to emphasize the positive aspects, which is sometimes lost in the discussions on the African brain drain.

7 Unemployment of Skilled Labor in Source Countries and the Internal Brain Drain

Now let us add the internal brain drain. In particular, suppose a fraction d_2 of those educated choose to work in occupations different than those for which they

were trained. Let us suppose that the output, as measured by the government, is less than if they had gone into their intended occupation. The example we have in mind here is where a university professor decides to drive a taxi, or, perhaps, politics! The reduction in output could also capture the fact that they may be unemployed skilled workers.

7.1 Can Africa Absorb the Drainers?

7.2 Salaries Paid to Skilled Labor and the Internal Brain Drain

Related to this is the question of how salary levels are determined for skilled labor. Take university professors as a case in point. The governments are unable to resist the pressures of students to keep tuition close to zero. The government is therefore unable to pay university professors adequate salaries. Indeed, the salaries paid are to a large degree determined by how much they can squeeze out of tuition and the performance of the general budget. There were newspaper accounts that only 1% of the population of Ghanaians pay taxes - so there is very little room in the government budget for salaries of professors (especially if you add fuel subsidies, health subsidies, etc., which take their piece of the small government pie). As new private universities come into play, there may be room for market forces to affect the price of skilled labor. In the short run, the low salaries paid to professors results in both pressures for the brain drain, as well as the internal brain drain.

These two forces have become so severe in the academy, that there is beginning to be quite a bit of concern in Ghana about the looming problem of faculty at the universities. They are greying at a fast rate, and it appears that there are not being replaced. An immediate symptom of this is in the exceptionally large classes that faculty are teaching at the Ghanaian universities.

Now think of Professors at the University of Ghana. It is very clear that there is a big flow out of the academy into private and semi-private practice, such as quasi intellectual activities like the donor consultancy reports. The looming crisis in the universities is almost a replay of the looming disaster in 1960's with primary school teachers (McWilliam p. 105). In 1960 there were large numbers of students being pushed through primary schools. Salaries of teachers had to be massively increased to stem the internal drain of primary school teachers into other activities.

8 Incentives to Form Human Capital

Several papers (Oded Stark and others) have pointed out how, via the incentive effect on forming human capital, the possibility of a brain drain and subsequent higher wages can increase investments in human capital so much as to outweigh the negative effects of any brain drain.

Given the substantial apparent unemployment among graduates of universities in Ghana, it is clear that the potential to drain away is a huge incentive for many African students to work hard in school. African students have to overcome huge hurdles to get their education these days even after they are admitted into the universities. These range from lack of textbooks, large class sizes, often distracted faculty who need to make ends meet with auxiliary activities, poorly maintained residential facilities, labs, etc. What keeps most of the students going is the prospect that they may land an opportunity abroad. If this prospect is closed to tightly, this may have an effect on the effort levels of students in the system, and therefore the quality of the graduates of the school system.

What is the value of a Kofi Annan in motivating Ghanaians?

8.1 The theoretical arguments about the brain drain and the quantity of human capital

The theoretical arguments that the brain drain could have a positive effect on total human capital creation are well known. Most obviously, if the return to skills is increased by the chance at earning skilled wages abroad that are higher than those available at home, then the brain drain will create positive incentives to form human capital at home. This means the brain drain will have offsetting effects on human capital residing in the home country: it will increase the total stock of human capital of home country nationals, while shifting the composition of that stock towards those who reside outside the home country.⁴

In the standard infinite-horizon optimizing neoclassical growth model, with no mobility of human capital, agents invest in human capital until its marginal product is equal to the discount rate. Compared with this benchmark, an (exogenous) drain of human capital out of the country raises the marginal product of the human capital still left at home by making it scarcer. In the model, the higher marginal product of human capital would lead to more investment in human capital at home until its marginal product is once again driven down to equal the discount rate. Hence in this simple benchmark model, the prediction is that brain drain would have zero effect on the stock of human capital left in the country – new human capital creation and brain drain cancel each other out exactly.

8.2 Testing the Net Effect on Human Capital of Brain Drain

We explore these predictions in a simple empirical framework. Let HD be skilled labor that stays at home, HF skilled labor that is abroad, and H total skilled

⁴Beine, Docquier and Rapoport (2001, 2003) are important previous works that also consider the positive theoretical effect of migration on human capital creation, and test these effects empirically both in human capital accumulation and growth. We extend and update this work to develop the theoretical predictions more precisely, and to cover many more countries with more up-to-date data.

labor (=HD+HF) all in stocks, and all originating in the country in question.

Then

$$dHD = dH - dHF \quad (19)$$

where dHD means the change in skilled labor at home from 1990 to 2000. Divide through by H (initial value in 1990), so we have

$$\frac{dHD}{H} = \frac{dH}{H} - \frac{dHF}{H} \quad (20)$$

Now suppose that the formation of new skilled labor H is a positive function of the population growth rate, but also of the possibility of emigration because that raises the return to becoming skilled. So suppose

$$\frac{dH}{H} = a + bn + c \frac{dHF}{H} \quad (21)$$

where n is the growth rate of the whole population (or labor force), and c is positive if there is a positive incentive effect of brain drain on new human capital creation.

To get to the equation that we will estimate, substitute (21) into (20):

$$\frac{dHD}{H} = a + bn + (c - 1) \frac{dHF}{H} \quad (22)$$

We will instrument for dHF/H to address reverse causality (such as omitted factors that might determine dH/H but also raise dHF/H). The interesting thing will be whether the coefficient on dHF/H is greater than -1 (because c is positive).

We measure dHF/H and dHD/H as the change in the stock of tertiary educated nationals outside and inside the country, respectively, from 1990 to 2000, divided by the total stock of tertiary educated population in 1990. The instruments for dHF/H are variables that we think are likely to influence brain drain to the main destination countries (the US, the UK, and France): a Dummy for Former Colony of Great Britain, a Dummy for Former Colony of France, the Log of distance from US, the Log of distance from France, the Log of distance from UK. We also include the Log of population size in 1990 as an instrument for brain drain, since small countries are usually less constrained by restrictions on immigration into the destination country. The first stage regression is shown below:

Table: First-stage regressions						
Dependent variable: dHF_H	coef.	std. err.	t-stat	p-value	95% conf. int.	
Population growth	0.119	0.159	0.75	0.456	-0.196	0.434
Dummy for Colony of UK	0.024	0.048	0.49	0.623	-0.072	0.120
Dummy for Colony of France	-0.008	0.059	-0.14	0.890	-0.125	0.108
Log of distance from US	-0.109	0.040	-2.73	0.007	-0.188	-0.030
Log of distance from France	0.026	0.227	0.11	0.911	-0.424	0.475
Log of distance from UK	0.041	0.240	0.17	0.864	-0.433	0.515
Log of population size in 1990	-0.052	0.011	-4.84	0.000	-0.073	-0.031
Constant	1.374	0.384	3.58	0.000	0.615	2.134
Observations	157					
R-squared	0.267					
p-value of F-test	0.000					

We might have wished for more significant results on the individual instruments. The significant variables are the distance from the US and the population size. However, the instruments do a reasonable job explaining the variation in dHF/H with an R-squared of .27, so we move to the second stage.

The second-stage regression in 2SLS for equation (22) is as follows:

Table: Instrumental variables (2SLS) regression						
Dep. variable:dHD_H	coef	std. err.	t-stat	p-value	95% conf. int.	
dHF_H	0.303	0.525	0.58	0.565	-0.734	1.341
Population growth	1.837	0.567	3.24	0.001	0.716	2.958
Constant	0.241	0.196	1.23	0.219	-0.145	0.628
Observations	157					

The coefficient on dHF/H is actually positive, indicating that brain drain increases the stock of skilled people left at home. However, it is very imprecisely estimated, so we cannot reject that it is zero. We can reject that the coefficient is -1, which is excluded by the 95% confidence interval for the coefficient. Since the coefficient is equal to c-1, this is equivalent to c being significantly greater than zero, indicating we do have evidence of a positive effect of the brain drain on human capital formation. The simple theory sketched above predicted a coefficient (c-1) of zero, and the data do nothing to reject that prediction.

8.3 Brain drain and growth regressions

A more indirect way to test the effect of brain drain is to assess its effect on economic growth. Standard growth accounting would yield one component of growth (dY/Y) explained by human capital accumulation. Assuming neutral technical progress (A) and estimating shares from US data of .3 for physical capital (K), .23 for human capital (measured as college educated persons) at

home (HD), and .47 for unskilled labor (L), we get the following standard growth accounting equation:

$$\frac{dY}{Y} = \frac{dA}{A} + 0.3\frac{dK}{K} + 0.23\frac{dHD}{HD} + 0.47\frac{dL}{L} \quad (23)$$

Manipulating the equations above, we get an expression for dHD/HD as a function of a brain drain variable:

$$\frac{dHD}{HD} = \frac{dH}{HD} - \frac{dHF}{HD} \quad (24)$$

If we assumed that there was zero positive incentive effect on human capital accumulation, then the predicted loss in growth due to brain drain is then:

$$\text{Loss in growth} = -0.23\frac{dHF}{HD} \quad (25)$$

The predicted loss of growth based on the growth accounting calculation is quite large in some countries.

Top 15 countries with largest hypothetical loss in annual growth from brain drain according to growth accounting

Country	Growth loss per annum for 1990-2000
Guyana	3.4%
Jamaica	2.8%
Haiti	2.8%
Trinidad and Tobago	2.1%
Cape Verde	1.8%
Gambia	1.5%
Bahamas	1.3%
Sierra Leone	1.3%
Mozambique	1.2%
Fiji	1.1%
Barbados	1.0%
Liberia	1.0%
Ghana	0.9%
Angola	0.8%
Suriname	0.6%

We can enter the brain drain term (dHF/HD) on the right hand side of (25) into a growth regression for all countries with available data and see whether it has the predicted growth effect. We will also include labor force growth from (23), but assume that all the other terms in (23) (as well as dH/HD) are

endogenous to policies and other controls that we will explore in the growth regression.

The results of the growth regression may also capture more indirect ways by which brain drain could have a positive or negative effect. Brain drain could affect any of the other components of growth accounting like physical capital accumulation or technical change, and hence we could possibly get a coefficient that is more negative than -.23. This approach is also more robust if there is mis-measurement of total human capital H, or if the skills that are draining have a differential contribution to growth than those that stay at home (due to selective migration, as would be predicted by many theories). And of course, the effect on growth is really the bottom line for whether brain drain has a negative effect on countries' economies. For all of these reasons, we supplement the exercise above with growth regressions.

When we do so, we find no negative effect of brain drain on growth. First, we do ordinary least squares:

Table: Ordinary least squares growth regression with brain drain				
Dep. variable: growth90_03	coef.	std. err.	t-stat	p- value
brain drain	-0.00373	0.00325	-1.15	0.255
population growth	0.01240	0.01567	0.79	0.431
log income per capita 1990	-0.00887	0.00469	-1.89	0.063
primary enrollment, 1990	0.00013	0.00011	1.19	0.238
secondary enrollment, 1990	0.00044	0.00015	2.98	0.004
tertiary enrollment, 1990	-0.00033	0.00019	-1.75	0.084
openness variable, 1990	0.01245	0.00564	2.21	0.03
civilwar	-0.00634	0.00626	-1.01	0.314
cons	0.04982	0.03223	1.55	0.126
Observations	86			
R-squared	0.2179			

We also explore possible reverse causality by doing two-stage least squares, using the same instruments as above.

Table: 2SLS growth regression instrumenting for brain drain				
Dep. variable: growth90_03	coef.	std. err.	t-stat	p-value
brain drain	-0.00271	0.004892	-0.55	0.581
log inome per capita 1990	-0.00942	0.00463	-2.04	0.045
primary enrollment, 1990	0.00016	0.00011	1.49	0.141
secondary enrollment, 1990	0.00041	0.00015	2.76	0.007
tertiary enrollment, 1990	-0.00032	0.00020	-1.6	0.114
openness variable, 1990	0.01373	0.00534	2.57	0.012
civilwar	-0.00631	0.00627	-1.01	0.317
cons	0.05586	0.03106	1.8	0.076
Observations	86			

The bottom line is that we fail to find any evidence for a negative effect of brain drain, either on the stock of human capital remaining in the country, or on the country's growth rate. Since we have also covered in this paper some potential beneficial effects of brain drain through remittances and brain circulation, it looks like the case against the brain drain is weak indeed.

9 How to Enhance Positive Aspects of Drain

- Form an Africa-US Science Foundation to help with the Brain Circulation. This could provide funding for a leave policy where Africans can go back to assist in their home countries. This may assist in the looming problem of lack of faculty strength in the African Universities that we mentioned earlier.
- As part of the outreach activities of our own university, NYU, our Dental school runs clinics in Tanzania and the Dominican republic. Our nursing faculty help in South Africa and Uganda in HIV/AIDS. Why not have an international fund to enable members of the diaspora with professional skills, perhaps through their professional societies.
- Funding for African professional societies based abroad (e.g., the African Finance and Economics Association for US based economists).

10 Concluding Remarks

We have provided some remarks on the question of the Brain drain with particular reference to Africa, and using Ghana as a case study. Of course much more work needs to be done in firming up many of the conjectures made. On balance, theory and empirics suggest that the ability of some people in the country to go abroad and form part of the Brain circulation has had a net positive effect on the economy, *ceteris paribus*. We think the Brain Drain is good for Africa.

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