Income per natural:
Measuring development for people rather than places

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Abstract: It is easy to learn the average income of a resident of El Salvador or Albania. But there is no systematic source of information on the average income of a *Salvadoran* or *Albanian*. We estimate a new statistic: income per natural—the mean annual income of all people *born* in a given country, regardless of where those people now reside. Income per natural often differs substantially from income per resident, both in its mean and its distribution. The lion's share of the difference is *caused* by movement across borders, meaning that departing one's country of birth is today one of the most important sources of poverty reduction for a substantial part of the developing world. If economic development is that which raises human well-being, then crossing international borders is not an alternative to economic development; it is a form of economic development.

(*Includes three tables, numbered 1a, 1b, and 2; and five figures, numbered 1-5*)

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1 INTRODUCTION

Most people were born in a "low-income" or "lower middle-income" country (World Bank 2007). How much money do those people earn each year? No one knows. Statisticians have spent decades carefully estimating and tracking how much people *in* poor countries earn or produce. To learn the income or output of a person who resides in Albania or El Salvador or Zambia one only needs to look it up in widely available tables. But no one has made systematic estimates of the income of a typical person born in Albania, El Salvador or Zambia. The standard measures of income per capita (that is, per resident) are often used to indicate material welfare or as a goal of development, but this is clearly unsatisfactory if people frequently change their welfare by changing where they reside. While production has a place, it is people, not patches of earth, which have well-being.

Using income per resident as a measure of welfare it leads to untenable conclusions about changes in well-being and hence, potentially, about policy. If a Salvadoran moves from the countryside to San Salvador and gets a factory job that raises her income 30% this will be recorded as progress. But if that same person moves to Texas, gets an identical factory job, and increases her income 500% this does not increase income per capita in El Salvador. (At best, only the portion of her income gain that is remitted to residents of El Salvador will appear in its national accounts). Worse, if her wage was above the average in El Salvador then income per capita goes down.

Moreover, if her new job in Texas is at less than the average US wage then income per resident in the US goes down as well. Income per capita could go down in both sending and receiving places as the place-based national accounts measures exclude

the gains to the person who moved. The near exclusive focus on income per resident as a measure of development or progress is not based on conceptual or welfare-theoretic foundations but rather on statistical cost and convenience (the spread and use of national accounts data).

Here we suggest and estimate a new statistic: *income per natural*, the mean income per person *born* in a given country, regardless of current residence.[1] Predictably, income per natural differs substantially from income per resident in small countries with large emigration—GDP per capita in Jamaica is only US$3,500 but the income of Jamaicans is US$6,500.[2] But the differences extend beyond a handful of tiny nations: 43 million people live in countries whose income per natural is 50% higher than its income per resident; 235 million people live in a group of countries where the difference is 20% or more, and for 1.1 billion people the difference is 10% or more. The estimates of differences in income per natural are consistent with estimates of the differences in other indicators calculated on residence or natural basis such as poverty or child mortality.

National accounts are enormously useful, and GDP per capita retains interest for a wide variety of purposes. Our effort is not to replace it in its standard uses, but to supplement this measure where it gets things wrong. Other measures of progress supplement GDP per capita where it otherwise would miss important elements of human well-being: to account for the environment ("green accounting"), or for the distribution of income, or for resource depletion (measures of "true savings"), or for non-money

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[1] The *Oxford English Dictionary* defines a "natural", in this sense, as a "person … of or from a designated region". It notes that this usage is rare in modern times, but we resurrect it here because no other word fits. We prefer "income per natural" to "income per national", since "national" is often a synonym of "citizen", and we prefer it to "income per native", which connotes those who are *not* foreign-born rather than those who are native to a given foreign country.

[2] Both are measured in dollars of purchasing power at US prices.

measures of well being (the Human Development Index). In the same way we propose *income per natural* as a supplement to income per resident, which captures changes in income from any source *except* international movement.[3]

2 METHOD

As we are the first to estimate income per natural we have to rely on the information currently available and a reasonable set of methods to create what we regard as a plausible first cut, not a polished diamond. We hope that the value of measuring income per natural is recognized, permitting more and better data to be collected and finer, more sophisticated methods to be used. But anyone familiar with the realities of national accounts estimation (particularly in its early phases and in current practice in poorer countries), or the construction of estimates of purchasing power parity, is aware of the necessary limitations of any results, including ours.[4]

Our method is simple. First we estimate household income per person by country of birth for the foreign-born in the US using data from the "long form" of the 2000 US census, which asked respondents to provide their annual household income. Second we use this information to construct regression-based estimates of household income per person for the foreign-born in the rest of the high-income OECD countries by country of birth. Third, we use estimates of populations in the OECD by country of birth to estimate the average income of naturals residing in the high income OECD countries. Finally, we combine these data with GDP per resident at purchasing power parity to achieve estimates of income per natural for almost all countries on earth.

[3] In principle, income per natural could be extended to any other measure as well, such as HDI per natural.
[4] The Purchasing Power Parity conversion factors, which have been the subject of decades of work, have recently undergone substantial retrospective revisions, and herein we use the factors available in 2007. The most important revisions to sending countries' income per capita, however, have been downward—making our estimates of the difference between income per natural and income per resident conservatively low.

We begin with the United States out of expediency; the data on the incomes of the foreign-born by country of birth are readily available in the US Census.[5] The 2000 US census 5% Public Use Microdata Sample (PUMS) provides country of birth, household income, and household size for 1,256,341 individuals between the ages of 18 and 64 (inclusive) born in 147 countries. The median respondents per country is 1,887, the fewest is 315 (unweighted) respondents (Kosovo) while there are 364,936 Mexican born respondents in the sample. We calculate self-reported household income[6] and calculate per person income in any household containing foreign born individuals in order to capture individuals who do not earn income—such as spouses who work in the home and dependents. We compute weighted averages by country of origin using the Census person-weight.

2.1 Correlates of average foreign-born income per capita by country

The major data limitation to overcome in estimating income per natural is that, while most OECD censuses contain demographic information on the foreign born, few contain information on their income. So, for example, while we can estimate how many Albanians are in the US, France, Germany, Japan, and so forth, we do not know the income of Albanians in all of those countries. We work around this lacuna by estimating a simple (reduced-form) regression that relates the average household income per person for the foreign-born in the US to a list of variables plausibly associated with

[5] No such question exists in the last censuses of the United Kingdom and France, the next two most important destination countries in the OECD. Smaller surveys in other important destination countries collect income information alongside country of birth, such as the Luxembourg Income Study (LIS) surveys in France and Germany, but the comparatively small samples cover very few countries of origin. Most LIS surveys contain no data on country of birth.

[6] Bound and Krueger (1991) use individually-matched income data from the US census and Internal Revenue Service to establish that census self-reported income differs on average from actual income by only around 1%.

characteristics of the country of origin and the diaspora of that country of origin. The right hand side of the regression equation contains variables specific to the migrant-sending country (e.g. average education) and the migrant-destination pair (e.g. distance between the countries). We then use the combination of the coefficients from the US equation with data from other OECD countries and sending countries to estimate household income per person by country of birth in all OECD destination countries.

The staring point for the calculations is, then, an Ordinary Least Squares regression, whose coefficient estimates are presented in a technical appendix that accompanies this paper. The dependent variable is the natural logarithm of mean household income per person of foreign-born residing in the US, one observation for each country of birth for the 118 countries for which all of the data were available. Our regression is simply a prediction equation. We are deliberately profligate in including variables that have been proposed as correlates of migrant income. We are not asserting that the regression coefficients represent structural parameters or tests of particular theoretical or behavioral models of migration. The regressors and the resulting (partial) associations with the average income of people from that country in the US are:

- GDP per capita in the country of origin, in Purchasing Power Parity dollars. Higher origin country income is associated with higher income in the US.
- Fraction of the foreign-born in the US from the origin country that have completed tertiary education.[7] This is associated with higher incomes in the US.

[7] For this variable we happen to use the estimates of Dumont and Lemaître (2005), which cover the 2000 census round. A closely related but more ample database, covering two census rounds, has been compiled by Docquier and Marfouk (2005). For our purposes, which focus on the 2000 census round, the choice between the two was arbitrary.

- Fraction of the foreign-born in the US from the origin country that have completed only primary education or less. This has a very weak positive association with incomes.
- Origin-country gross tertiary enrollment, intended as a rough measure of the strength of education systems in the migrants' countries of birth. This has a positive association with incomes in the US.
- Using the data from Parsons et al. (2007) on all bilateral stocks of sending and host country populations we calculate the fraction of the all naturals from a given country who live in the US. This is positively associated with average origin country income in the US.
- Also from Parsons et al (2007), the fraction of the foreign-born from the origin country living in the OECD who live in the US. This is negatively associated with income in the US.[8]
- Land area of the country of birth. Migrants from larger countries earn more in the US, all else equal, possibly as size (land area) in the country of origin is a proxy for the availability of domestic migration opportunities which exerts selection on the composition of international migrants.

[8] The estimates suggest income in the US is positively correlated with the worldwide diaspora fraction in the US but negatively correlated with the OECD-wide fraction. Either of these might be positively or negatively correlated with destination-country income: a larger diaspora might provide better information to other migrants about job opportunities in the destination, but it might also lower the barrier to migration for those with less earning potential. A large diaspora also allows formation of origin-specific agglomerations in destination countries, with potential positive and negative effects on earnings (e.g. Cutler, Glaeser, and Vigdor 2007).

- The absolute size of the diaspora from that country in the US. This is negatively correlated with income of the foreign-born in the US, consistent with a large diaspora lowering risk and informational barriers to lower-earning immigrants.
- The fraction of the diaspora in the US comprising refugees. This is negatively correlated with income, as several studies have documented (e.g. Husted et al. 2000).
- Distance to the US has almost no association with average origin country income in the US, controlling for the other factors.
- A dummy indicating whether or not the origin country is contiguous with the US, which is weakly negatively associated.
- A dummy for origin in a country with English as an official language is weakly positively associated.
- A set of six regional dummy variables.
- A dummy variable for high-income Middle East petroleum exporters (Bahrain, Kuwait, Qatar, Saudi Arabia, and United Arab Emirates). This is strongly negatively associated with average incomes in the US and is included to account for the extreme concentration of national income in the hands of a few individuals. Without this dummy the model overestimates income for the Saudi-born and Kuwaiti-born by about 40%.

This simple regression does remarkably well and predicts 89% of the cross-country variance in the average origin country naturals' income per person in the United States

for the 118 countries for which all data are available.[9] Using the estimated coefficients from this regression to predict in-sample values of income per natural in the US gives an average error for any given country of origin of 0.65%, with a standard deviation across countries of 11.52% and a maximum absolute value of 28.7% (Cameroon). Figure 1 shows the predicted and actual income per person of foreign naturals by country of birth as a fraction of US-average income per person. The correlation between the two is 0.937. The dashed lines show estimation errors of ±20%. Positive errors are of special interest since they will lead to *over*estimates of income per natural. The figure suggests that the model does not overestimate income per capita of the foreign-born by more than a third.

We illustrate the proposed method with the construction of the estimate of the income of Albanians in France. We begin with the prediction regression just described. We then plug into that model the data for Albania (e.g. resident income per capita, distance to France), characteristics of Albanians in France (e.g. fraction with tertiary education), and characteristics of Albanians worldwide (e.g. fraction of all Albanians not in Albania who reside in France). This allows prediction of the ratio of Albanians' income in France as a fraction of the income of native-born French. Multiplied by average income of the French-born, this gives an estimate of average income of Albanians in France.

A close look at two very different countries whose naturals have similar average household incomes per person in the US shows how the different observed characteristics

[9] Because the regressand comes from an average based on samples of different sizes—notably a much larger number of Mexican-born than other countries' naturals—we might be concerned about inefficiency of OLS relative to weighted least-squares. Worse, if the model is substantially misspecified, alternate weightings might meaningfully alter the coefficient estimates. When the regression model is re-estimated with each country weighted by the inverse of the log of its naturals' sample size in the US census microdata, however, the coefficient estimates barely change, and then only in the second decimal place by one or two points.

affect predicted income. Mexicans and Somalis have similar incomes in the US ($9,991 versus $9,472). While GDP per capita in Mexico at PPP ($9,197) greatly exceeds that in Somalia ($600), which would correlate with higher incomes, the fraction of Somalian-born US residents with tertiary education (0.147) is almost triple that of the Mexican-born (0.053), which raises predicted incomes of Somalis in the US. Of secondary importance are the greater fraction of Somalian-born in the US who are refugees (lowering predicted Somali) and the much greater absolute size of the Mexican-born diaspora in the US (lowering predicted Mexican incomes). The net result is that the prediction regression works to predict that, in spite of the very different origin country GDP per capita, the similar values of income per person for Mexico-born in the US (predicted $10,014, or 0.289 of the US average) and Somalian-born in the US (predicted $8,879, or 0.257 of the US average).

2.2 Estimating foreign-born income per capita in other OECD countries

In order to estimate naturals income we make the heroic assumption that this prediction regression is roughly accurate for all other high-income OECD destination countries. For example, the observed average household income of a Cambodian-born person in the US in 2000 was $12,952. The model predicts $13,159, which is 38% of US income per capita in 2000 ($34,599). We estimate the income of Cambodians in France by using the estimated coefficients with Cambodian data for the Cambodia specific variables (e.g. tertiary enrollment) and Cambodia-France-specific data for the bilateral right-hand side variables (e.g. fractions of Cambodia in France with tertiary degree, distance Cambodia to France).

That is, we estimate $y^*_{i,j}$, the income per capita of those born in origin country *i* living in destination country *j*, by $\hat{y}^*_{i,j} = \left(y_j / y_{USA}\right)\left(e^{X\hat{\beta}}\right)$, where y_j is GDP per capita at PPP in *j*, $\hat{\beta}$ is the vector of coefficient estimates from the regression described above, and *X* is a vector of sending-receiving country characteristics $x_{i,j}$. The model predicts that average household income per person of the Cambodian-born living in France was 37% of French income per capita ($25,944 at purchasing power parity) thus $9,593.

We do have an extraordinarily clean test of our assumption that the prediction regression from the US can be used "out of sample." After completing the first draft of this paper, hence after the prediction regression was finalized, the data from the 2001 Australian census, which does ask questions about both household income and country of birth, became available to us. There are 108 countries for which the Australian Bureau of Statistics can estimate household income per capita by country of birth based on a sample of 1,000 individuals or more, and of these we have sufficient data to predict income for 99 countries.[10] There are three points.

First, Figure 2 compares the true ratios of household income per capita among the foreign born to the national average, by country of birth, and the model's estimates. The correlation between predicted and actual household income per capita of the foreign-born as a fraction of the national average is 0.749.

Second, the model works in explaining the variation in Australia across country of birth because the model works—the country specific regressors make a difference--not just because the country-of-birth predictions are the same for the US and Australia. The

[10] We made a similar request to Spain's Instituto Nacional de Estadística, but the small survey on which they based their estimates of household income per capita by country of birth only allowed them to produce such estimates for six foreign countries (four outside of Europe).

correlation between the US predicted and the Australia actual wage ratios is only 0.594, which means that the specifics of the Australian-country of birth data are adding to the predictive power.

We illustrate the out-of-sample estimation by considering its predictions for income-per-person among the foreign-born in Australia, returning to the cases of Mexico and Somalia. True average annual household income per person in Australia in 2000 was A$19,292, while among the Mexican-born it was A$22,360 (1.16 of national average) and among the Somalian-born it was A$7,748 (or 0.402 of national average). The regression estimates suggest that if the Mexican-born diaspora in the US had the same right-hand side characteristics of the Mexican-born diaspora in Australia, their income per person would be estimated as 0.757 of the US average; if the Somalian-born in the US had the same traits as the Somalian-born in Australia, their income per person would be estimated as 0.329 of the US average. The regression coefficients obtained from US data alone thus successfully predict that incomes among the Mexican-born in Australia are more than double those among the Somalian-born, even though incomes in these two groups are similar in the US.

This is primarily because the fraction of Mexican-born in Australia with tertiary education (0.561) is tremendously higher than for Mexican-born in the US (0.053). [11] Also important is the scarcity of the Mexican born in Australia (home to just 0.01% of the OECD-resident Mexican diaspora) compared to the US (98.4% of the OECD-resident Mexican diaspora). The example points out a key feature of the estimation technique: its results are not driven only by differences between the US and Australia (in which case the predicted ratio of Mexican-born incomes to Somalian-born incomes would be

[11] This calculation is described in detail in the Technical Appendix.

identical in the two destinations), but rather rest to an important degree on variance in sending-country characteristics.

Third, our procedures do not "center" the results and it turns out the model tends to underestimate wages of foreign-born in Australia. The model overestimates in only five cases, with a maximum overestimate of 6.6% (Taiwan), and underestimates in 94 cases. Thus the US-based model does not produce large systematic overestimates of income per capita among the foreign born in a major non-US destination country.

In the end our use of the US prediction regression is the best we can do with the available data. That is, we do not assert that the regression model is an identified structural model that estimates behavioral or deep parameters, or that we have any reason to believe that the estimated coefficients can be extrapolated to other contexts. That said, we have no reason to believe that they *cannot* be extrapolated to other contexts. The alternative to using the US prediction regression might to be to implicitly assume that all of the regression coefficients (except the constant) are zero and predict exactly the same ratio of income for all countries of birth in France, Spain etc. as observed in the US. But we see that is rejected by common sense and the comparison with Australian data. So, while we would prefer to have country-specific data (which would mean that we would not need coefficients) or country-specific parameters (which would improve the quality of the prediction for each country), or draw on reduced form parameters from a large number of countries, it seems more plausible to use coefficients from the US than nothing at all.

2.3 Global estimates of income per natural

Let y_i be income per resident in the origin country at purchasing power parity, $y^*_{i,j}$ be income per capita of those born in origin country *i* living in destination country *j*, N_i be the population of origin country *i*, and $N^*_{i,j}$ be the stock of people born in *i* living in *j*.

Income per natural is simply $\tilde{y}_i \equiv \left[y_i N_i + \sum_j \left(y^*_{i,j} \right) \left(N^*_{i,j} \right) \right] \Big/ \left[N_i + \sum_j N^*_{i,j} \right]$. Letting y^*_i represent population-weighted average income per capita of those born in origin country *i* living in an OECD country, N^*_i represent the number of people from *i* living abroad, and abbreviating $\theta_i = N_i / \left(N_i + N^*_i \right)$ and $\theta^*_i = N^*_i / \left(N_i + N^*_i \right)$, then $\tilde{y}_i = y^*_i \theta^*_i + y_i \theta_i$ and the percent difference between $\tilde{y}_i$ (income per natural) and y_i (GDP per capita) simplifies to

$$\frac{\tilde{y}_i}{y_i} - 1 = \theta^*_i \times \left(\frac{y^*_i - y_i}{y_i} \right). \qquad (1)$$

Table 1a gives $\tilde{y}_i$ and y_i, with the percent difference (1) for 211 countries. (Table 1b repeats the same information, sorted by region and descending percent difference between income per natural and GDP per capita.) We deliberately choose GDP per capita rather than GNI per capita as y_i to avoid double-counting workers' remittances.[12]

Figure 3 plots these percent differences against origin-country population. Predictably, income per natural departs most substantially from GDP per resident for

[12] Income per natural is fundamentally different from Gross National Income per capita. The former includes income to all people living outside their country of birth regardless of how long, while the latter includes only income to nationals of a country who reside temporarily abroad for less than one year. According to the OECD (2007), "GNI is defined as GDP plus net receipts from abroad of wages and salaries and of property income. Wages and salaries from abroad are those that are earned by residents, that is, by persons who essentially live and consume inside the economic territory but work abroad (this happens in border areas on a regular basis) or for persons that live and work abroad for only short periods (seasonal workers) and whose centre of economic interest thus remains in their home country. Guest-workers and other migrant workers who live abroad for twelve months or more are considered to be resident in the country where they are working. Such persons may send part of their earnings to relatives at home, but these remittances are treated as transfers between resident and non-resident households and do not enter into net receipts from abroad of wages and salaries."

small nations. For instance, note that GDP per resident for Guyana is similar to that of Guatemala and Paraguay, but income per natural is similar to that of Brazil and Malaysia. Less predictably, the difference is notable in several countries that are quite large, such as the Philippines, Vietnam, and Morocco. In 12 countries income per natural differs from GDP per resident by more than 30%, in 20 countries by more than 20%, in 39 countries by more than 10%, and in 62 countries by more than 5%.

Figure 4 considers the difference between collective income per natural and collective GDP per resident for groups of countries. The countries are ordered left-to-right by descending country-level difference between income per natural and GDP per resident. The leftmost point in the graph shows Guyana, the country with the highest percent difference (104%). The second-highest country-level percent difference belongs to Samoa, so the next point to the right shows the difference between income per natural and GDP per resident in Guyana and Samoa collectively, as if they were a single country. The points proceed rightward adding one country at a time to the group.

The line connecting these points crosses the 50% mark at a collective population of above 42.8 million. This means that 42.8 million people in the year 2000 lived in a group of countries whose collective income per natural differed from their collective GDP per resident by more than 50%. Further to the right, we see that 235 million people lived in a group of countries where the difference was 20%, and for 1.1 billion people the difference was 10%. Clearly, income per natural departs substantially from GDP per resident for a large fraction of the world's population, not solely for a handful of tiny states.

2.4 Robustness

There are several reasons to believe that these estimates of income per natural are conservative and are likely to understate, rather than overstate, the true gaps between income per natural and GDP per capita. First, due to lack of data, we omit consideration of non-OECD middle- to high-income destination countries, such as Saudi Arabia, Singapore, and South Africa. Since a substantial fraction of Asian migration goes to Singapore (e.g. Indonesian workers) or the Gulf (e.g. Nepali and Bangladeshi) income per natural for these countries will be particularly understated. Second, we omit consideration of emigrants' children born in the destination country, as we consider only that portion of each household with foreign-born members that was in fact born in the origin-country. Third, the census data on diaspora stocks we use are likely to omit large numbers of undocumented migrants who, although they might be making lower wages than documented and recorded workers in the destination country, are making more in the destination country than they would at home. Fourth, comparison of the model's predictions to true foreign-born household income per capita in Australia—the most important non-US destination country where data permit the comparison—suggests that if anything the model substantially underestimates those incomes.

It is nonetheless hypothetically possible that for an important destination country the out-of-sample predictive power of the model is very poor, and that estimates of income per natural in major origin countries for that destination country are correspondingly biased—in some cases possibly biased upwards.

We check this by repeating the entire exercise omitting the predictive model entirely, with a highly simplifying and conservative assumption: that the income per capita of all foreign-born persons living in high-income OECD countries is 35% of the

destination country's GDP per capita. This is equivalent to assuming that all of the estimated coefficients in the predictive model (besides the constant term) are zero. We expect this assumption to be extraordinarily conservative, given that the typical gap between foreign-born earnings and native-born earnings in the US is, for most origin countries, less than 25% (Hendricks 2002). In our data, this conservative restriction under predicts true income per capita of foreign-born in the US for 121 out of 130 countries of origin; among those countries where income per capita is under predicted, the average error is –30.0 percentage points. For Australia this under predicts for *all* countries in the sample, with an average error of –60.5 percentage points.[13]

In other words, the data reveal that this assumption about migrant earnings is hyper-conservative. But even in this case, the broad results of the exercise still reveal large differences between income per natural and income per resident. Under this assumption there are 10 (rather than 12) countries in which income per national differs from GDP per resident by more than 30%, 18 (rather than 20) where it differs by more than 20%, 36 (rather than 39) by more than 10%, and 51 (rather than 62) by more than 5%. And under this conservative assumption, there are 41 million (rather than 42.8 million) people living in a group of countries whose collective income per natural differs from their collective GDP per resident by more than 50%; 139 million (rather than 235 million) in a group of countries where the difference exceeds 20%, and 0.9 billion (rather than 1.1 billion) in a group for which it exceeds 10%. This suggests that the prior

[13] The lowest is Somalia, whose naturals' average household income per capita in Australia is 40.2% of the Australian average. Two countries have lower values in the Australian census data but are dropped from the sample due to very small samples: Federated States of Micronesia (30.0%, N = 3) and São Tomé & Príncipe (30.5%, N = 12). Figure 2 retains only countries whose estimates arise from samples of 1,000 individuals or more.

estimates cannot be biased upwards to a very large degree by unobserved deficiencies in the US regression equation's out-of-sample predictive power.

2.5 Distribution of income: Poverty headcounts and income per natural

Until now we have considered only mean income per natural, without regard for its distribution. Like the traditional and universally used measure of income per resident, income per natural can exhibit substantial changes in the mean if the rich simply get richer. It is of great interest, therefore, to explore how measuring income per natural instead of per resident would affect lower portions of the distribution. We do this with poverty headcounts.

Table 2 explores how poverty headcount estimates might change if income per natural were the standard rather than income per resident, using only a single destination country. Since for poverty calculations we need estimates of the distribution of income we consider *only* those people from each country of birth—Haiti, India, and Mexico—who live either in their home country or live abroad in the United States, and for which sufficient observations exist in the US data, omitting consideration of those who reside abroad in other destination countries and other source countries.

The table uses three different standard of "poverty"—the $1/day[14] (destitution) and $2/day (low poverty) standards commonly used by the World Bank, and the $10/day standard of "global poverty" advocated by Pritchett (2006a).[15] We stress that these are

[14] We use the accepted nomenclature of "dollar a day" even though with inflation these are all about 50 percent higher in current PPP versus the 1993 base.

[15] The 10$/day is an upper bound for poverty as it corresponds to the lower bound of OECD country poverty on the principle that a global poverty line should not be discriminatory by nationality and what OECD countries consider poor for their own citizens ought to be applied at the global level (Pritchett 2006).

global, absolute, uniform poverty thresholds, separate from the different poverty lines used by the respective national governments.

By the $2/day standard, the number of non-poor people increases about 36% for Haiti, 17% for Mexico, and about 1% for India if we consider the population residing in both the country of origin and the US together rather than the country of origin alone. At the $2/day standard for poverty, around a quarter of non-poor Haitians live in the US and about one seventh of non-poor Mexicans.

At the $10/day standard of "global poverty" the number of non-poor increases 457% for Haiti, 74% for Mexico, and 37% for India when naturals are considered rather than just residents. At a global poverty standard 82% of the non-poor Haitian-born reside in the US; so do 43% of non-poor Mexicans, and 27% of non-poor Indians. About half of all Mexicans who have achieved even a standard of living unthinkably low to most readers of this paper have done so while living in the US. Four out of five Haitians who have escaped poverty by this global standard have done so in the US.

These differences are substantial, and all underestimate the differences in poverty rates that would arise if all destination countries were included. For many important developing countries, then, international migration is not an alternative to poverty reduction; it is today among the *principal sources* of poverty reduction.[16] This assumes,

[16] Beegle et al. (2008, Table 4) give remarkable evidence that the same may be true *within* very poor developing countries. They track 4,432 people surveyed while living in the rural Kagera region of Tanzania between 1991 and 1994, and then recontacted in 2004. Over this period, real consumption per capita increased among those who had left Kagera by an amount over nine times greater than that by which it increased among those who had stayed in their villages. Although real consumption per capita in the early 1990s of those who would later leave Kagera was very similar to that of those who did not, by 2004 real consumption per capita among the leavers was about 2.5 times that of those who had stayed in their villages. While selection could explain a small portion of these differences, it is difficult to imagine what even the most able individuals could have done to raise consumption growth by 800% if obliged to stay in their remote villages. Beegle et al. also employ instrumental variables based on rainfall and family structure to address selection bias and arrive at substantially identical results.

of course, that emigration has had no negative impact on the incomes of people in the source country. This is a reasonable assumption in the current context. The burden of proof would lie on anyone who asserted that large numbers of Haitians in Haiti would have risen out of poverty if even more Haitians who want to leave Haiti had been prevented from doing so than already are.

3 THE EFFECT OF MIGRATION ON INCOME PER NATURAL

The simple gap between GDP per resident and income per natural is a raw fact, intended to provide an alternative measure to provide a balance to the perspective of the ubiquitous use of GDP per capita. But neither the use of GDP per capita, nor other alternatives like Green GDP or the HDI, as a metric of progress immediately implies the desirability of any specific policy. One still has to have a causal model that relates actions and outcomes to inform policy choices. The measure of income per natural does not, in and of itself, indicate anything causal or lead to policy conclusions—such as that there are available welfare gains by expanding the opportunity to emigrate. For policy implications one needs to consider a counterfactual: what would have happened if these people had not moved.

There are two reasons why counterfactual income per capita for the diaspora, had they not been able to leave, might differ from origin-country GDP per resident: labor supply effects and selection effects. The labor supply effect is that emigrants' departure from the origin country might have affected GDP per capita there, either positively or negatively, and their arrival in the destination country might have affected income per capita there, either positively or negatively. The selection effect is that emigrants might

be selected, either by themselves or by migration regulators, to have more or less earning potential than the average origin-country resident. We consider each of these in turn.

Let $\bar{y}_i$ be counterfactual income per capita of those remaining behind *if* those living abroad had not left, and $\bar{y}_i^*$ be weighted average counterfactual income per capita of those living abroad *if* they had not left. Rearranging identity (1) gives the decomposition

$$\frac{\widetilde{y}_i}{y_i} - 1 = \underbrace{\left(\frac{\theta_i^*}{\bar{y}_i} \left(y_i^* - \bar{y}_i^* \right) \right)}_{\text{True effect of emigration}} \underbrace{\left(\frac{\bar{y}_i}{y_i} \right)}_{\text{Labor supply}} \underbrace{\left(\frac{y_i^* / y_i - 1}{y_i^* / y_i - \bar{y}_i^* / y_i} \right)}_{\text{Selection}}. \tag{2}$$

The first parenthetical term in (2) is the percent change in income per natural *caused* by migration, i.e. compared to the counterfactual of no migration. This term can differ from (1), the strictly factual percent difference between income per natural and income per resident, for two reasons, captured by the following two terms. The second term of (2) gives the degree to which (1) departs from this *causal* percent difference due to labor supply effects, and the third term gives the difference due to selection effects. Intuitively, if $\bar{y}_i < y_i$ then emigration may have pushed up the incomes of those remaining behind by decreasing the labor supply at home, which makes the factual percent difference (1) an underestimate of the causal difference. On the selection side, if $\bar{y}_i^* / y_i > 1$, then emigrants would have been making much more than non-migrants even if they had not left, so the factual difference *over*estimates the causal impact.

3.1 Labor supply

To the extent that emigration raises average incomes in the sending country, the labor supply term in equation (2) is less than unity. For the mass of unskilled workers in

developing countries, departure of a substantial fraction of the workforce might be expected to exert upward pressure on the wages of those who remain.

Anecdotes of this phenomenon are abundant. O'Rourke (1994) finds that mass emigration from Ireland in second half of the 19th century—roughly one third of the population—caused per capita income there to increase by between 5 and 25 percent by 1908 compared to a no-emigration counterfactual. Lucas (2005, p. 90) presents evidence that large-scale emigration from Pakistan and the Philippines in the late 20th century has raised sending-country wages by roughly one third within specific sectors such as construction and manufacturing. Mishra (2007) finds that massive migration from Mexico to the US in the decades leading up to the year 2000—roughly 16% of working age males—caused an 8% rise in the national average wage of Mexican workers in Mexico. Borjas (2008) finds evidence that emigration from Puerto Rico to the US, amounting to about 30% of the Puerto Rican population by 2000, may have raised low-skill wages in Puerto Rico by roughly 10%.

It is theoretically possible, particularly in the case of skilled workers, that large-scale departures could alter the productivity of those remaining behind and materially decrease average incomes there. There is great concern in many circles that this is indeed the case and the rhyme "brain drain" is often recited. The consequences of skilled-worker movement are potentially a major issue, about which it is worth making several points.

First, it is important to avoid a crude confusion about the impact of the departure of skilled workers from comparing before and after averages. Mechanically, if a person of above average wages leaves this lowers average wages; if Bill Gates were to move out of Medina, Washington, average income there would fall. But this says nothing about

whether the people who remained in Medina were better or worse off if Bill Gates were to move. The key question is whether skilled-worker departures lower income of those who remain in the sending country relative to what their income would have been had the person remained. This depends crucially on the *externality* that these workers have on other workers, which could be either positive (as in the pecuniary externality observed for unskilled workers) or negative (because the skilled worker was making less than his contribution to the economy).

Second, the essence of the argument that the departure of skilled workers is negative for those who remain behind is *not* that education raises wages but rather that skilled workers do not receive as income their total contribution to the economy. That is, if skilled workers have positive externalities they must make less than their social marginal product. While the evidence that education raises wages is massive and compelling, the evidence that education raises wages by *less* than it raises a worker's social marginal product is scant indeed. In fact, while there have been thousands of studies of economic growth, and hundreds of the relationship between economic growth and education, not a single one has demonstrated a statistically significant positive externality of education—in these studies education is, at best, as correlated with the level or growth of income as one would expect given its impact on individual wages (Pritchett 2001; Pritchett 2006b).

Third, the size of the relevant externalities is likely to be the lowest in the countries most in need—because so much else is wrong there. Forcing skilled engineers to stay in Mugabe's Zimbabwe or Ceausescu's Romania would be unlikely to spark economic growth in those places, because the forces that made many professionals wish

to leave those places are the same forces that cripple their power to do good. People became much less concerned about the international movements of India's skilled workers after policies improved at home and many of them wished to return, or not to leave at all.

This issue is very far from settled and much more evidence is required. But currently, there is no reliable evidence in the social science literature that any poor country's average income would be substantially higher than it now is, if nothing at all had changed except that fewer skilled workers had left—which is to say, if some of them had been forcibly prevented from leaving. (If they had been induced to stay by choice rather than by force, then by definition something else in the country would need to have been different besides their departure.)

On the contrary, there are three reasons to believe that skilled worker movement across borders has contributed to income per resident in many sending countries. First, a substantial literature documents instances in which skilled emigration has contributed directly to the formation of important growth industries in the sending country, such as in Taiwan and India (Saxenian 2002). Second, emigration itself can encourage the formation of domestic human capital stocks: Although 24% of Cape Verde-born university graduates live abroad, Batista et al. (2007) give suggestive survey evidence that the stock of university graduates *in* Cape Verde would be *lower* in the counterfactual of no emigration—opportunities abroad appear to encourage study for a substantial fraction of those who do not end up leaving. Likewise, although the Philippines is by far the number one origin country of nurses working abroad, the World Health Organization's *Global Health Atlas* shows that the Philippines despite its poverty has

more nurses per capita than Austria. Third, for the poorest countries, other forces unequivocally dominate as determinants of GDP per capita: It is ludicrous to suppose that incomes in Liberia would be much higher now if skilled workers had been trapped there for the past decade (Pritchett 2006c). All of these suggest that the labor supply term in equation (2) may be less than unity, often or even generally. There is no strong evidence to suggest that it is generally greater than unity.

There is another, very different way in which international movement could lead to declines in sending-country income per resident. There is substantial evidence that remittance receipts can reduce labor supply in some recipient households, which tends to raise $\bar{y}_i / y_i$ and make the left-hand side of (2) tend to overestimate the pure effect of migration. This tendency, however, is too small to be substantial for the present purpose. Hanson (2005) and Amuedo-Dorantes and Pozo (2006) find that remittance receipts cause declines in labor force participation and hours supplied by rural Mexican women, on the order of 5-10%. Consider that 1) the effect is not observed among rural men or among urban men or women, 2) only 5.5% of the individuals in the 2002 National Household Income and Expenditure Survey of Mexico live in remittance-receiving households, and 3) income per capita among remittance-receiving households is substantially lower than average income per capita. Together, these mean that the reduction in overall GDP per capita due to remittances, even in one of the world's top migrant-sending countries, can only be a tiny fraction of one percent. This phenomenon, therefore, could only cause the left-hand side of equation (2) to overestimate the true effect of migration by an insubstantial amount. The effect would be even further attenuated if withdrawals from the labor force exert upward pressure on wages in general

equilibrium, or if remittances cause investments that raise the productivity of rural land, as has been found in Mexico (Taylor and López-Feldman 2007) and Morocco (de Haas 2006).

3.2 Selection

Equation (2) suggests that positive selection of migrants makes the factual difference between income per natural and GDP per resident tend to be larger than the strictly *causal* effect of migration on income per natural. It also shows, however, that this difference can be small when international wage gaps are large, even in the presence of very strong positive selection. Here we use examples of estimated counterfactual wages from Mexico, India, and Tonga to show that this difference is typically smaller than about 20%.

Mexican laborers in the US. Fernández-Huertas (2006) finds that counterfactual wages for male Mexicans working in the United States are in fact slightly lower than non-emigrant wages, using a nationally-representative longitudinal dataset allowing for the construction of counterfactuals based on both observed and unobserved migrant characteristics. This would suggest that for Mexicans in the US, the difference between income per natural and income per resident in Mexico slightly underestimates the causal effect of migration on income per natural as there is negative rather than positive selection. Fernández-Huertas' estimates differ from those of Chiquiar and Hanson (2005), who find that migrants' counterfactual wages are slightly higher, using less desirable cross-sectional data and thus constructing their counterfactual wages using only observed migrant traits such as education. They find that Mexican male wage earners' average hourly wage in the US is roughly $8.7, for Mexican residents it is roughly $1.2, and the

emigrants' counterfactual wage is on the order of $1.8.[17] Under these conditions the selection bias term in (2) is 1.087. For Mexicans in the US, then, if selection is in fact negative, the difference between the factual and causal estimates is less than one; even if the selection is positive, the difference due to selection on observables is less than 9%.

Indian software industry workers in the US. Commander et al. (2004) report the results of a firm survey on the wages of comparable workers in the US and Indian software industries. This allows a rough measure of counterfactual income for workers in this industry if they had not left India. Indeed their earnings are much higher than those of the typical Indian, but the gap between Indian wages in or out of the software industry and American wages is so large that even this very positive selection does not greatly bias our estimates. The figures of Commander et al. suggest that for all workers except top management, the difference term is on the order of 1.2. This is very likely a substantial overestimate of the difference term for *all* Indian workers in all industries, since selection among software engineers relative to the whole Indian population is very likely to be much larger than selection among Indian emigrants in all industries relative to the whole Indian population. It does, however, only capture selection on observable traits.

Tongan workers in New Zealand. McKenzie, Gibson, and Stillman (2006) report careful measures of the income gains to Tongan migrants to New Zealand, utilizing a visa-lottery natural experiment that allows selection effects to be excised from aggregate effects, including selection on unobservable migrant traits. They find that lottery-winning migrants earn NZ$424.5/week, lottery-losing non-migrants earn NZ$104.1/week, and

[17] Chiquiar and Hanson (2005) do not explicitly calculate a counterfactual average wage. We take the factual wages from their Table 2 (p. 249), and estimate the counterfactual wage by 1) noting that their Figure 4 (p. 266) suggests a the natural logarithm difference between the modal counterfactual emigrant wage and resident wage is on the order of 0.4, thus 2) the counterfactual average wage is roughly equal to $1.2+e^{(\ln 1.2)+0.4} = 1.8$.

non-applicants earn NZ$41.4/week. The selection term in equation (2) is then 1.197. They find that 52% of the difference between lottery-applicants' wages and non-applicants' wages can be explained by observable age, education, gender, marital status, height, and migrant network. Thus the difference term using counterfactual wages constructed solely on observable traits would be 1.094.

All of these suggest that the value of the selection term in equation (2), including selection on unobserved traits, is probably less than 1.33 in most poor developing countries. Put differently, in poor developing countries a conservative estimate is that more than three quarters of the difference between income per natural and income per resident reflects the *effect* of migration on income per natural.

4 INFANT MORTALITY PER NATURAL

A similar exercise to the comparison of income per natural can be performed for any common development indicator. We calculate infant mortality per natural simply as

$$\widetilde{m}_i = \left[m_i b_i N_i + \sum_j m^*_{i,j} b^*_{i,j} N^*_{i,j} \right] \Big/ \left[b_i N_i + \sum_j b^*_{i,j} N^*_{i,j} \right] \qquad (3)$$

Where $m^*_{i,j}$ is infant mortality for parents born in country *i* residing in *j*, and $b^*_{i,j}$ is the crude birth rate per person born in country *i* residing in *j*. Here we assume $m^*_{i,j} = m_j$, i.e. that the infant mortality rate of the foreign-born is that of their country of destination. Regarding crude birth rates we present two cases: We give alternate results assuming $b^*_{i,j} = b_j$, i.e. that foreign-born people have the same crude birth rate as the country of destination, or assuming $b^*_{i,j} = b_i$, that foreign-born people have the same crude birth rate as the country of origin.

The assumption $m^*_{i,j} = m_j$ tends to underestimate the difference between infant mortality per natural and per resident for developing countries, since infant survival and other health outcomes are typically *better* among the foreign-born than the native-born in rich countries. This somewhat counterintuitive phenomenon is known as the "healthy immigrant effect" (Hyman 2001) or the "epidemiologic paradox" (Markides and Coreil 1986). Mortality among infants born to Mexican immigrant women in the US is roughly 10% lower than that among infants of non-Hispanic, white native-born women (Hummer et al. 2007). Similar results have been found for US immigrants from other low-income countries besides Mexico (Singh and Yu 1996), for immigrant women's perinatal health in Canada (Ray 2007), and for many other destination countries and health indicators. Here we err on the side of a smaller difference between infant mortality per natural and per resident by denying the health immigrant effect and simply assuming that infant mortality among the foreign born is equal to that among the native born.

Figure 5 shows what Figure 4 would look like if the same exercise were carried out for infant mortality per natural, for both versions of equation (3). All countries on earth have been ordered from left to right, starting with the country with the highest differential between infant mortality per natural and per resident (Guyana). Countries are added to the group one by one, such that the country added at each step is the one among the remaining countries that maximizes the collective differential between infant mortality per natural and per resident. The horizontal axis shows cumulative population of these groupings. The vertical axis shows the absolute difference between the infant mortality rate per natural for each grouping collectively—as if it were a single country—and the rate per resident. The upper line assumes that naturals' crude birth rate is identical

to that of the country they reside in; the lower line assumes that their crude birth rate is that of the country in which they were born.

The figure suggests that several hundred million people live in a group of countries whose collective infant mortality per natural is roughly three points lower than their collective infant mortality per resident. This difference, for all developing countries collectively, amounts to between 19,000 infant deaths (assuming $b^*_{i,j} = b_j$) and 43,000 infant deaths ($b^*_{i,j} = b_i$) every year.

To what degree does migration itself *cause* infant mortality per natural to differ from infant mortality per resident? These correlations *understate* the causal relationship to the degree that migration itself has lowered infant mortality in the country of origin; Donato el al. (2001) and Frank (2005) find that migration causes improved child health in Mexican households. On the other hand, the correlations *overstate* the purely causal portion of the relationship to the extent that parents whose children are less likely to die are more likely to emigrate. While there is evidence of such selection on observable and unobservable characteristics (Landale 2000), Singh and Yu (1996) find that poor-country immigrants' advantage in infant mortality changes very little when they control for a variety of observable traits such as maternal age, marital status, education, birth plurality/order, place of residence, and prenatal care. The public health literature generally finds that a large portion of the difference is *caused* by migration: "[E]xplanations ascribing immigrants' mortality advantage to migrant selectivity, pre-modern cultural practices, or an artifact of population recording practices are insufficient" (Anson 2004).

We can approximate the magnitude of selection via income-disaggregated infant mortality levels. In India, average infant mortality is about 62 per thousand live births, but for the richest quintile of the population it is only 38 (UNDP 2007, pp. 309, 317). In the United States, average infant mortality is about 7 but for the *poorest* quintile it is approximately 14 or less.[18] Thus while the gap between average infant mortality in India and the United States is 55 points, an average person from the top income quintile of India who moved to the *bottom* quintile of the US would experience a drop of only 24 points. We interpret this to mean that selection can account for no more than about half of the gap between infant mortality per natural and per resident for India; the other half likely represents a causal relationship between movement and the decline.

This speaks in part to one possible concern about the income per natural estimates. In comparing income of naturals at home and abroad there is a suspicion that the reported income differences—even though they are adjusted by purchasing power parity exchange rates—somehow overstate income differences and that "real" income of a Haitian in the US at 10$/day is not actually as high as a Haitian in Haiti at the same PPP adjusted income. While certainly the overall utility must take into account dimensions of living abroad, possible discrimination, alienation, and relative position in the income distribution with whatever feelings that may cause. But on the narrower question of

[18] The most recent systematic survey of infant mortality by income level in the United States is reported in CDC (1995), which finds that in 1988 infant mortality in households below the poverty level was 13.5. In that year the overall US infant mortality rate was 9.0 (CDC 2007, Tab. 23). This is probably an overestimate of infant mortality in the lowest quintile, since the poverty line in 1988 was a household annual income of $12,092 for a family of four, but in 1988 the lowest quintile of US household incomes were those below $18,047 (US Census Bureau 2007). According to CDC (2007, Tab. 23) the country average infant mortality was 6.9 for the period 2001-2003. If the same ratio of infant mortality in the lowest quintile to average infant mortality holds in 2001-2003 as in 1988, this suggests an infant mortality in the lowest quintile of 10.3. As a check on this estimate, CDC (2007, Tab. 23) reports that infant mortality among African-Americans in Mississippi during 2001-2003 was 14.7. We therefore assume, conservatively for the present purpose, that bottom-quintile infant mortality in the US is 14.

material well-being the question is whether PPP somehow, in spite of its best efforts, gets it wrong and material well-being is not as different as reported. One way to address this is to compare objective indicators of material well-being and compare those at similarly measured levels of PPP income. So, for instance, do Haitians at 10$/day in the US have a lower or higher child mortality rate than Haitians at 10$/day in Haiti? By all indicators we have compared, there is no evidence that income measures *over*state material well-being, and in fact, as the relative prices of publicly provided goods (e.g. security, education, health, sanitation) are almost certainly much lower in developed than developing country settings, existing PPP differences that focus on private goods alone almost certainly substantially *under*state material well-being.

5 DISCUSSION

Income per natural is simply a number. Like traditional measures of income per resident, by itself it has no policy implication. Regardless of one's opinions about the costs and benefits of migration, it is sensible to measure people's average income by their average income, not by their average income if and only if they remain rooted to one spot.

In particular, nothing about the calculation of this number suggests that international migration is somehow superior to domestic economic growth in the country of origin as a way of improving the material welfare of people from poor countries. Income per natural is raised by *anything at all* that raises the average living standard of people from a poor country. Traditional income per capita (that is, per resident), is raised by *anything except international movement* that raises their living standards. We do not perform the calculation in order to rank different ways of improving living standards of

the poor. Rather, we point out that the preferred measure of living standards of the poor should be a measure of their living standards, period—not a measure of their living standards if and only if they do not move. Income per natural is this preferred measure.

Purely domestic economic growth in a poor country is capable, in certain circumstances, of greatly raising income per natural. One year of Chinese-style 10% growth in real income per resident, for example, would raise income per natural more than all cumulative emigration has raised income per natural for the large majority of countries. The problem is that no one really knows how to spark Chinese-style growth in countries like Guyana, which is one of the principal reasons why so many people have left Guyana. Roughly one quarter of developing countries had zero or negative growth on average between 1970 and 2005.[19] If a policy can be found to quickly and substantially raise income per natural for those countries via domestic economic growth, then certainly it should be adopted. There may be certain situations, however, in which the movement of people compares favorably to the other feasible ways of raising income per natural, and perhaps the movement of people should be considered as one of many tools to do this. Defining the welfare of the poor as income per resident of the origin country, as is traditional, immediately and strictly defines the welfare-enhancing power of international movement to be zero. Income per natural does not do this.

Our calculation of this number also does not suggest that there is no limit to the capacity for international movement of people to raise income per natural. Estimating this

[19] Of the 82 low- and middle-income countries for which the *World Bank Development Indicators 2007* contain data on GDP per capita at constant 2000 US dollars in 1970 and 2005, 18 countries have zero or negative average growth during this period. This is 22% of the countries. Data coverage is poor, however, precisely for those countries in the worst straits (e.g. there are no data for Afghanistan, Guinea, or Somalia), thus we attribute roughly zero or negative growth to approximately a quarter of developing countries.

capacity would be the subject of a different analysis. It is likely that the ability of any realistic degree of future movement to raise income per natural for many countries is limited. But the world is clearly very far from this limit. Our estimates suggest that international movement has raised income per natural by large fractions for a large number of countries; meanwhile, there is no evidence that international movement has lowered income per capita at all in the major destination countries.[20] If there is a tipping point, we are well to one side of it.

Migration policy is set by governments, and certainly most governments are primarily responsible to people who live *in* a delimited geographic space, rather than people born in that space. Income per resident, then, has a certain claim on politicians' attention that income per natural does not. But a major determinant of income per natural is international movement, and the major policy barrier to international movements is the policies of the destination countries. Voters in the destination countries are capable of voting in their own higher, long-term interest. If destination-country voters did not care at all about raising the incomes of people from poor countries, there would be no point in the international dissemination of any development-related statistics whatsoever. To the extent that destination-country voters do care about the material well-being of people from other countries—and a great deal of evidence suggests that they do—they should be interested in income per natural. If such voters care about non-voter's welfare only when it does *not* involve movement, they would do well to ask themselves why their altruism is spatially delimited.

[20] Borjas, Grogger, and Hanson (2008, Table 5) show that the cumulative effect of all legal and illegal immigration to the US over 1990-2004 on the wages of the average American worker was precisely zero.

No economist has ever claimed that traditional measures of income per resident were the sole normative criterion for development. Rather, economists judge policy interventions by their effect on a social welfare function. Attempts to simply and tractably incorporate other social welfare objectives into transparent statistics have given rise to a series of modified versions of income per resident, including "genuine" national accounts that correct for natural resource depletion, the United Nations' Human Development Index which incorporates information about the health of the population, and measures of "pro-poor" growth that account for income distribution. All of these represent skirmishes in a larger battle for the meaning of "development". If development is a change in how people interact with each other such that general material welfare increases, then any measure of "development" requiring immobility is inadequate. Movement has made important contributions to general material welfare all over the world.

6 CONCLUSION

It is common to suppose that poor countries have such high populations that emigration can never occur at levels high enough to meaningfully raise the average standard of living of those born there. By this reasoning, migration cannot be a "development" strategy any more than the lottery can be a savings plan.

Eubulides of Miletus, a Greek logician of the 4th century BCE, formulated a paradox known as the *sorite*s ("heaps"): One grain of wheat is not a heap of wheat, and if one grain is not a heap then two grains are not a heap, and if two are not then three are not—therefore ten million grains of wheat do not constitute a heap. Eubulides' purpose

was to point out the inherent indeterminacy of the word 'heap'. Of course there is a point, an inescapably arbitrary one, at which a collection of grains *is* a heap.

By the same token, there is a certainly a degree of migration at which migration becomes a form of economic development for the people from a particular place. If sea levels were to rise just 7½ feet (2.3m), all 300,000 current residents of the low-lying nation of the Maldives would become emigrants. Income per *resident* (zero) would cease to contain information about Maldivians' welfare, or the degree to which they produce, consume, or exchange goods and services. The question is not whether migration *can* be economic development, but rather *at what point* do we consider migration an important form of economic development? Only numbers can suggest an answer to this species of question.

The initial estimates made here do point toward an answer. Over a billion people live in countries whose collective income per capita would rise more than 10% if considered as income per natural rather than income per resident. Put differently, for those billion people *departure from the country* is one of the largest national "industries" in terms of its contribution to average material well being of its naturals. It is likely that by a reasonable international standard of poverty, two of every five living Mexicans who have escaped poverty did so by leaving Mexico; for Haitians it is four out of five. And on the order of tens of thousands of infant deaths are prevented each year for the sole reason that those infants' parents left poor countries. Although there is no clear point at which migration becomes development, we suggest that by any reasonable standard a very large part of the developing world is already past that point.

This is not at all an abstract observation. Measuring economic progress as if migration is not a form of development leads to bizarre conclusions by making a line in the sand the only consideration. If a Nicaraguan woman working in Arizona sends $200 a month to her impoverished spouse in Nicaragua, that can spur 'development' by common wisdom. But if her spouse goes to join her in Arizona and acquires a $2,000 per month lifestyle, that is not considered 'development'. The woman and her spouse would likely disagree. On the sending-country side, should the Federated States of Micronesia be subsidizing education that prepares its workers for the local labor market or the global labor market? The government will arrive at very different policies depending on whether or not it sees migration as a form of development.

James Scott's (1998) *Seeing Like a State* profoundly illustrates how nation-states use statistics to reduce people's lived reality to statistics amenable to state enumeration and control. Few developing-country governments arrange their interventions in such a way as to maximize the welfare of their people rather than their place. Likewise, few rich-country governments set their policies related to immigration or development assistance in due consideration of their effect on people rather than places. As long as most people stayed put and international welfare disparities were small, acting as if patches of ground had welfare of their own made little difference to people's lives. But that era is ending, and we need to prepare the statistics to see the real, not imagined, world.

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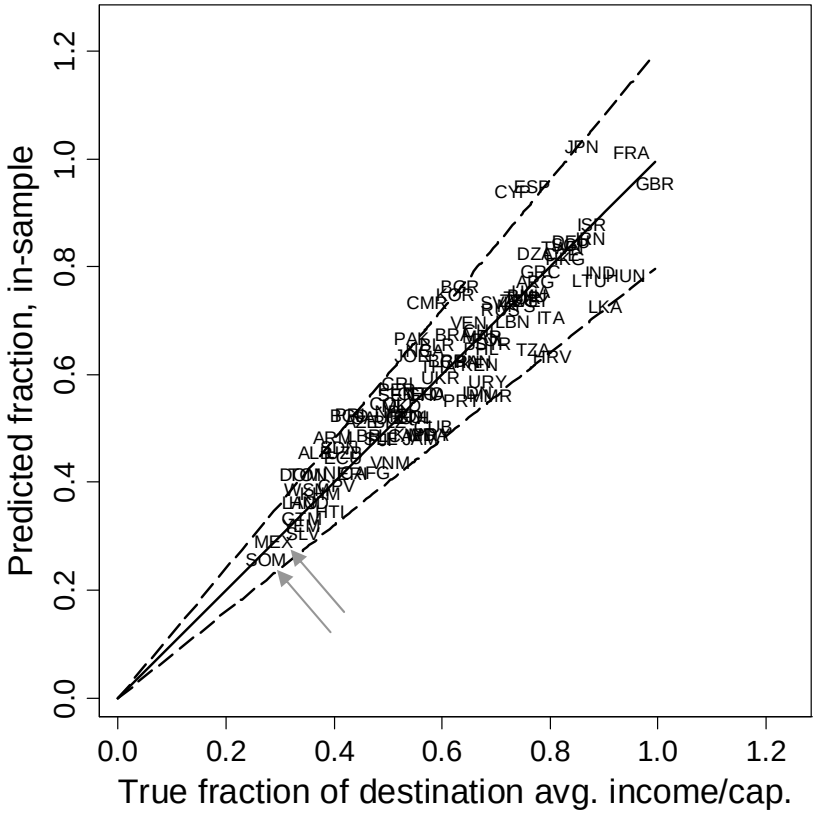
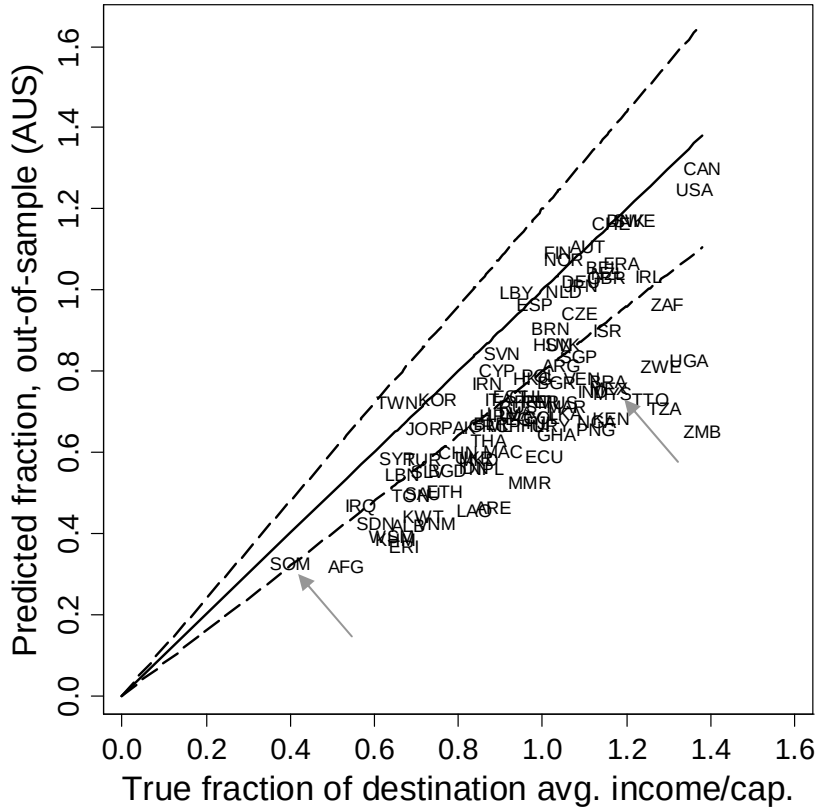
Figure 1: In-sample predictive power of the model of foreign naturals' income per capita in the United States as a fraction of American-born income per capita



Gray arrows point to Somalia and Mexico. The solid line is a 45 degree line, flanked by dashed lines showing a ±20% error. The horizontal axis shows the true ratio of household income per capita for residents of the United States in 1999 by country of birth to household income per capita of native-born Americans. The vertical axis shows the ratio predicted by the regression model.

Figure 2: Out-of-sample predictive power of the model of foreign naturals' income per capita in Australia as a fraction of Australian-born income per capita



Gray arrows point to Somalia and Mexico. The solid line is a 45 degree line, flanked by dashed lines showing a ±20% error. The horizontal axis shows the true ratio of household income per capita for residents of Australia in 2000 by country of birth to household income per capita of native-born Australians. The vertical axis shows the ratio predicted by the regression model. The graph only shows countries of birth for which the true average income per capita is based on a sample of 1,000 or more individuals in the Australian census.

Table 1a: Global estimates of income per natural in the year 2000, compared to sending-country GDP per capita at purchasing power parity.

Country	GDP/cap.	inc/nat.	% diff
AFGHANISTAN	800	867	8.4
ALBANIA	1,650	2,641	60.0
ALGERIA	5,327	5,782	8.6
ANGOLA	1,462	1,573	7.6
ARGENTINA	12,090	12,175	0.7
ARMENIA	2,417	2,796	15.7
ARUBA	21,800	22,091	1.3
AUSTRALIA	25,619	25,728	0.4
AUSTRIA	28,619	28,423	-0.7
AZERBAIJAN	2,474	2,510	1.5
BAHRAIN	13,700	13,683	-0.1
BANGLADESH	1,543	1,571	1.8
BARBADOS	18,400	18,871	2.6
BELARUS	4,801	4,892	1.9
BELGIUM	27,166	27,071	-0.3
BELIZE	5,680	7,497	32.0
BENIN	974	1,007	3.4
BERMUDA	31,500	29,535	-6.2
BOLIVIA	2,386	2,528	5.9
BOTSWANA	8,349	8,398	0.6
BRAZIL	7,193	7,230	0.5
BRUNEI DARUSSALAM	25,600	25,496	-0.4
BULGARIA	6,064	6,271	3.4
BURKINA FASO	986	1,002	1.6
BURUNDI	650	672	3.4
CAMBODIA	1,730	1,921	11.1
CAMEROON	1,877	1,956	4.2
CANADA	27,507	27,735	0.8
CAPE VERDE	4,555	5,291	16.2
CAYMAN ISLANDS	24,500	24,312	-0.8
CENTRAL AFRICAN REP.	1,209	1,251	3.5
CHAD	801	811	1.3
CHILE	9,128	9,278	1.6
CHINA	3,939	3,962	0.6
COLOMBIA	5,945	6,149	3.4
COMOROS	1,718	2,027	18.0
CONGO, REPUBLIC OF	1,055	1,337	26.7
COSTA RICA	8,170	8,417	3.0
CÔTE D'IVOIRE	1,582	1,644	3.9
CROATIA	9,112	9,512	4.4
CUBA	4,000	5,056	26.4
CYPRUS	19,167	19,233	0.3
CZECH REPUBLIC	15,222	15,337	0.8
DENMARK	28,676	28,604	-0.3
DJIBOUTI	1,857	1,999	7.7
DOMINICAN REPUBLIC	5,400	6,137	13.7
ECUADOR	3,229	3,660	13.4
EGYPT	3,526	3,609	2.4
EL SALVADOR	4,597	5,356	16.5
EQUATORIAL GUINEA	5,103	5,355	4.9
ERITREA	1,022	1,163	13.8
ESTONIA	9,388	9,814	4.5
ETHIOPIA	814	844	3.7
FIJI	4,991	6,397	28.2
FINLAND	25,912	25,750	-0.6
FRANCE	25,944	25,907	-0.1
GABON	6,175	6,330	2.5
GAMBIA, THE	1,631	1,802	10.5
GEORGIA	1,998	2,134	6.8
GERMANY	25,343	25,312	-0.1
GHANA	1,920	2,040	6.2
GREECE	17,059	17,164	0.6
GUATEMALA	4,048	4,379	8.2
GUINEA	1,974	2,006	1.6
GUINEA-BISSAU	863	1,012	17.3
GUYANA	3,922	7,985	103.6
HAITI	1,619	2,234	38.0
HONDURAS	2,872	3,305	15.1
HONG KONG	26,203	25,907	-1.1
HUNGARY	12,815	13,079	2.1
ICELAND	28,385	28,765	1.3
INDIA	2,364	2,405	1.7
INDONESIA	2,904	2,924	0.7
IRAN	5,804	5,999	3.4
IRAQ	2,900	3,053	5.3
IRELAND	20,300	20,449	0.7
ISRAEL	23,006	23,140	0.6
ITALY	21,400	21,170	-1.1
JAMAICA	3,596	6,517	81.2
JAPAN	26,089	26,128	0.1
JORDAN	4,109	4,341	5.6
KAZAKHSTAN	4,343	4,368	0.6
KENYA	1,033	1,140	10.4
KOREA, REPUBLIC OF	13,300	13,504	1.5
KUWAIT	19,599	19,500	-0.5
KYRGYZ REPUBLIC	1,496	1,509	0.9
LAOS	1,505	2,028	34.7
LATVIA	7,972	8,325	4.4
LEBANON	4,336	5,708	31.6
LESOTHO	2,592	2,603	0.4
LIBERIA	463	703	51.8
LIBYA	12,300	12,395	0.8
LITHUANIA	8,715	8,950	2.7
LUXEMBOURG	34,200	33,319	-2.6
MACAU	19,078	18,967	-0.6
MACEDONIA	6,053	6,586	8.8
MADAGASCAR	843	919	9.1
MALAWI	583	600	2.9
MALAYSIA	8,570	8,684	1.3
MALDIVES	3,900	3,922	0.6
MALI	785	825	5.1
MALTA	17,628	17,766	0.8
MARSHALL ISLANDS	2,900	4,193	44.6
MAURITANIA	1,894	1,964	3.7
MAURITIUS	9,673	10,309	6.6
MEXICO	9,197	9,276	0.9
MICRONESIA	6,464	7,057	9.2
MOLDOVA	1,311	1,433	9.3
MONGOLIA	1,530	1,567	2.4
MOROCCO	3,578	4,092	14.4
MOZAMBIQUE	799	838	4.9
MYANMAR	1,800	1,820	1.1
NAMIBIA	5,838	5,876	0.7
NEPAL	1,325	1,341	1.2
NETHERLANDS	28,576	28,413	-0.6
NETHERLANDS ANTILLES	16,000	15,981	-0.1

Table 1a, continued

Country	GDP/cap.	inc/nat.	% diff
NEW ZEALAND	19,849	20,702	4.3
NICARAGUA	3,110	3,640	17.0
NIGER	678	687	1.3
NIGERIA	854	900	5.3
NORWAY	34,264	34,096	-0.5
OMAN	12,602	12,626	0.2
PAKISTAN	1,880	1,957	4.1
PALAU	7,600	9,063	19.2
PANAMA	6,046	6,811	12.7
PAPUA NEW GUINEA	2,343	2,421	3.3
PARAGUAY	4,094	4,145	1.2
PERU	4,722	4,960	5.0
PHILIPPINES	4,030	4,475	11.0
POLAND	10,548	10,842	2.8
PORTUGAL	15,300	14,881	-2.7
PUERTO RICO	22,243	21,143	-4.9
QATAR	17,000	17,002	0.0
RUSSIA	7,006	7,066	0.9
RWANDA	931	957	2.8
SAMOA	2,100	3,957	88.4
SÃO TOMÉ AND PRÍNCIPE	1,801	2,258	25.4
SAUDI ARABIA	9,000	9,017	0.2
SENEGAL	1,427	1,616	13.3
SIERRA LEONE	463	602	30.0
SINGAPORE	23,563	23,524	-0.2
SLOVAKIA	11,126	11,287	1.4
SLOVENIA	16,829	16,846	0.1
SOMALIA	600	775	29.1
SOUTH AFRICA	8,764	8,905	1.6
SPAIN	22,313	22,230	-0.4
SRI LANKA	3,442	3,652	6.1
ST LUCIA	5,895	7,208	22.3
SUDAN	1,506	1,527	1.4
SURINAME	5,530	8,163	47.6
SWAZILAND	4,167	4,205	0.9
SWEDEN	26,359	26,440	0.3
SWITZERLAND	27,100	26,924	-0.6
SYRIAN ARAB REPUBLIC	3,161	3,284	3.9
TAIWAN	16,100	16,313	1.3
TAJIKISTAN	809	817	1.0
TANZANIA	524	559	6.7
THAILAND	6,319	6,378	0.9
TOGO	1,358	1,411	3.9
TONGA	6,568	7,926	20.7
TRINIDAD AND TOBAGO	9,078	10,984	21.0
TUNISIA	6,276	6,676	6.4
TURKEY	6,470	6,539	1.1
TURKMENISTAN	3,414	3,420	0.2
UGANDA	1,167	1,230	5.4
UKRAINE	4,035	4,165	3.2
UNITED ARAB EMIRATES	17,700	17,669	-0.2
UNITED KINGDOM	26,558	26,581	0.1
UNITED STATES	34,599	34,583	0.0
URUGUAY	8,777	8,966	2.2
UZBEKISTAN	1,497	1,516	1.3
VANUATU	3,127	3,273	4.7
VENEZUELA	5,756	5,889	2.3
VIETNAM	2,016	2,249	11.6
YEMEN, REPUBLIC OF	822	843	2.6
ZAMBIA	785	841	7.1
ZIMBABWE	2,498	2,613	4.6

Table 1b: Global estimates of income per natural in the year 2000, compared to sending-country GDP per capita at purchasing power parity. Sorted by region and descending order of percent difference between income per natural and GDP/capita.

EAST ASIA/PACIFIC

Country	GDP/cap.	inc/nat.	% diff
SAMOA	2,100	3,957	88.4
MARSHALL ISLANDS	2,900	4,193	44.6
LAOS	1,505	2,028	34.7
FIJI	4,991	6,397	28.2
TONGA	6,568	7,926	20.7
PALAU	7,600	9,063	19.2
VIETNAM	2,016	2,249	11.6
CAMBODIA	1,730	1,921	11.1
PHILIPPINES	4,030	4,475	11.0
MICRONESIA	6,464	7,057	9.2
VANUATU	3,127	3,273	4.7
PAPUA NEW GUINEA	2,343	2,421	3.3
MONGOLIA	1,530	1,567	2.4
MALAYSIA	8,570	8,684	1.3
MYANMAR	1,800	1,820	1.1
THAILAND	6,319	6,378	0.9
INDONESIA	2,904	2,924	0.7
CHINA	3,939	3,962	0.6

EASTERN EUROPE/CENTRAL ASIA

Country	GDP/cap.	inc/nat.	% diff
ALBANIA	1,650	2,641	60.0
ARMENIA	2,417	2,796	15.7
MOLDOVA	1,311	1,433	9.3
MACEDONIA	6,053	6,586	8.8
GEORGIA	1,998	2,134	6.8
ESTONIA	9,388	9,814	4.5
CROATIA	9,112	9,512	4.4
LATVIA	7,972	8,325	4.4
BULGARIA	6,064	6,271	3.4
UKRAINE	4,035	4,165	3.2
POLAND	10,548	10,842	2.8
LITHUANIA	8,715	8,950	2.7
HUNGARY	12,815	13,079	2.1
BELARUS	4,801	4,892	1.9
AZERBAIJAN	2,474	2,510	1.5
SLOVAKIA	11,126	11,287	1.4
UZBEKISTAN	1,497	1,516	1.3
TURKEY	6,470	6,539	1.1
TAJIKISTAN	809	817	1.0
KYRGYZ REPUBLIC	1,496	1,509	0.9
RUSSIA	7,006	7,066	0.9
CZECH REPUBLIC	15,222	15,337	0.8
KAZAKHSTAN	4,343	4,368	0.6
TURKMENISTAN	3,414	3,420	0.2

HIGH INCOME

Country	GDP/cap.	inc/nat.	% diff
NEW ZEALAND	19,849	20,702	4.3
KOREA, REPUBLIC OF	13,300	13,504	1.5
ARUBA	21,800	22,091	1.3
ICELAND	28,385	28,765	1.3
TAIWAN	16,100	16,313	1.3
CANADA	27,507	27,735	0.8
MALTA	17,628	17,766	0.8
IRELAND	20,300	20,449	0.7
GREECE	17,059	17,164	0.6
ISRAEL	23,006	23,140	0.6
AUSTRALIA	25,619	25,728	0.4
CYPRUS	19,167	19,233	0.3
SWEDEN	26,359	26,440	0.3
SAUDI ARABIA	9,000	9,017	0.2
JAPAN	26,089	26,128	0.1
SLOVENIA	16,829	16,846	0.1
UNITED KINGDOM	26,558	26,581	0.1
QATAR	17,000	17,002	0.0
UNITED STATES	34,599	34,583	0.0
BAHRAIN	13,700	13,683	-0.1
FRANCE	25,944	25,907	-0.1
GERMANY	25,343	25,312	-0.1
NETHERLANDS ANTILLES	16,000	15,981	-0.1
SINGAPORE	23,563	23,524	-0.2
UNITED ARAB EMIRATES	17,700	17,669	-0.2
BELGIUM	27,166	27,071	-0.3
DENMARK	28,676	28,604	-0.3
BRUNEI DARUSSALAM	25,600	25,496	-0.4
SPAIN	22,313	22,230	-0.4
KUWAIT	19,599	19,500	-0.5
NORWAY	34,264	34,096	-0.5
FINLAND	25,912	25,750	-0.6
MACAU	19,078	18,967	-0.6
NETHERLANDS	28,576	28,413	-0.6
SWITZERLAND	27,100	26,924	-0.6
AUSTRIA	28,619	28,423	-0.7
CAYMAN ISLANDS	24,500	24,312	-0.8
HONG KONG	26,203	25,907	-1.1
ITALY	21,400	21,170	-1.1
LUXEMBOURG	34,200	33,319	-2.6
PORTUGAL	15,300	14,881	-2.7
PUERTO RICO	22,243	21,143	-4.9
BERMUDA	31,500	29,535	-6.2

Table 1b, continued

LATIN AMERICA/CARIBBEAN

Country	GDP/cap.	inc/nat.	% diff
GUYANA	3,922	7,985	103.6
JAMAICA	3,596	6,517	81.2
SURINAME	5,530	8,163	47.6
HAITI	1,619	2,234	38.0
BELIZE	5,680	7,497	32.0
CUBA	4,000	5,056	26.4
ST LUCIA	5,895	7,208	22.3
TRINIDAD AND TOBAGO	9,078	10,984	21.0
NICARAGUA	3,110	3,640	17.0
EL SALVADOR	4,597	5,356	16.5
HONDURAS	2,872	3,305	15.1
DOMINICAN REPUBLIC	5,400	6,137	13.7
ECUADOR	3,229	3,660	13.4
PANAMA	6,046	6,811	12.7
GUATEMALA	4,048	4,379	8.2
BOLIVIA	2,386	2,528	5.9
PERU	4,722	4,960	5.0
COLOMBIA	5,945	6,149	3.4
COSTA RICA	8,170	8,417	3.0
BARBADOS	18,400	18,871	2.6
VENEZUELA	5,756	5,889	2.3
URUGUAY	8,777	8,966	2.2
CHILE	9,128	9,278	1.6
PARAGUAY	4,094	4,145	1.2
MEXICO	9,197	9,276	0.9
ARGENTINA	12,090	12,175	0.7
BRAZIL	7,193	7,230	0.5

MIDDLE EAST/NORTH AFRICA

Country	GDP/cap.	inc/nat.	% diff
LEBANON	4,336	5,708	31.6
MOROCCO	3,578	4,092	14.4
ALGERIA	5,327	5,782	8.6
DJIBOUTI	1,857	1,999	7.7
TUNISIA	6,276	6,676	6.4
JORDAN	4,109	4,341	5.6
IRAQ	2,900	3,053	5.3
SYRIAN ARAB REPUBLIC	3,161	3,284	3.9
IRAN	5,804	5,999	3.4
YEMEN, REPUBLIC OF	822	843	2.6
EGYPT	3,526	3,609	2.4
LIBYA	12,300	12,395	0.8
OMAN	12,602	12,626	0.2

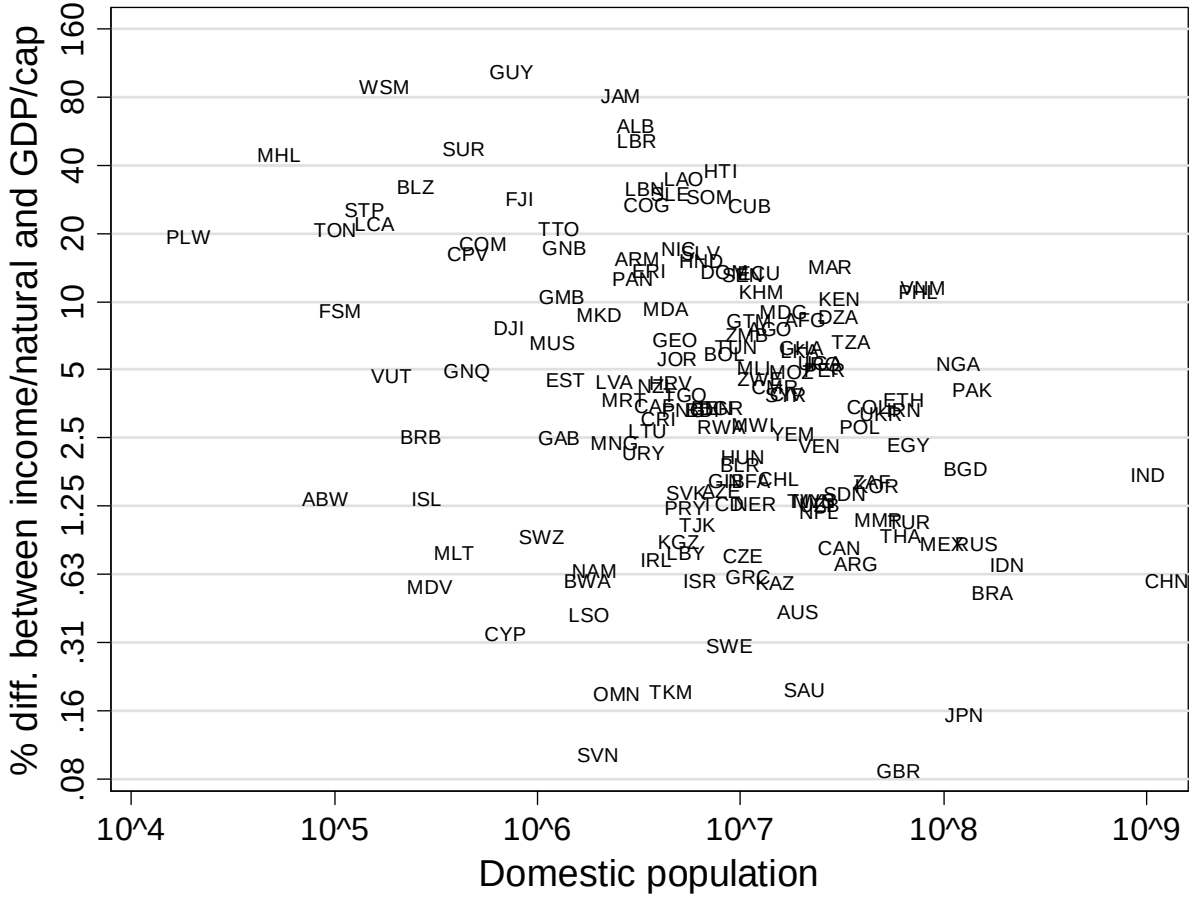
SOUTH ASIA

Country	GDP/cap.	inc/nat.	% diff
AFGHANISTAN	800	867	8.4
SRI LANKA	3,442	3,652	6.1
PAKISTAN	1,880	1,957	4.1
BANGLADESH	1,543	1,571	1.8
INDIA	2,364	2,405	1.7
NEPAL	1,325	1,341	1.2
MALDIVES	3,900	3,922	0.6

SUB-SAHARAN AFRICA

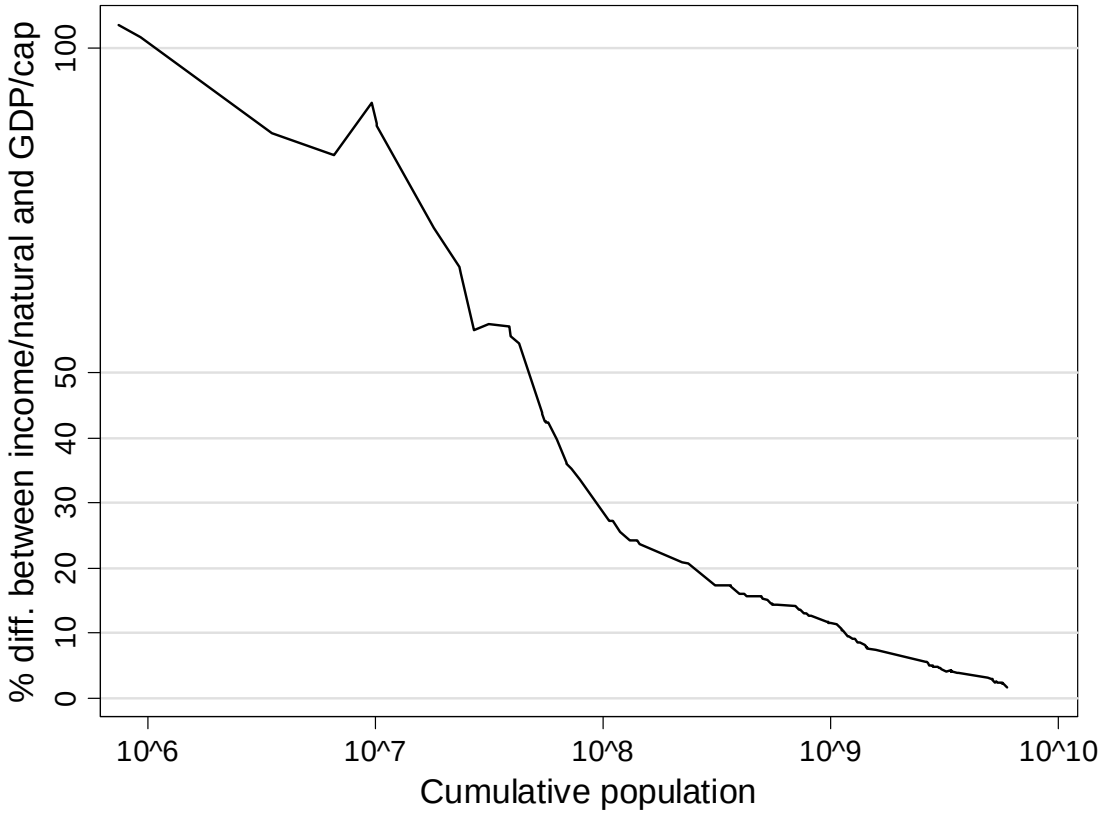
Country	GDP/cap.	inc/nat.	% diff
LIBERIA	463	703	51.8
SIERRA LEONE	463	602	30.0
SOMALIA	600	775	29.1
CONGO, REPUBLIC OF	1,055	1,337	26.7
SÃO TOMÉ AND PRÍNCIPE	1,801	2,258	25.4
COMOROS	1,718	2,027	18.0
GUINEA-BISSAU	863	1,012	17.3
CAPE VERDE	4,555	5,291	16.2
ERITREA	1,022	1,163	13.8
SENEGAL	1,427	1,616	13.3
GAMBIA, THE	1,631	1,802	10.5
KENYA	1,033	1,140	10.4
MADAGASCAR	843	919	9.1
ANGOLA	1,462	1,573	7.6
ZAMBIA	785	841	7.1
TANZANIA	524	559	6.7
MAURITIUS	9,673	10,309	6.6
GHANA	1,920	2,040	6.2
UGANDA	1,167	1,230	5.4
NIGERIA	854	900	5.3
MALI	785	825	5.1
EQUATORIAL GUINEA	5,103	5,355	4.9
MOZAMBIQUE	799	838	4.9
ZIMBABWE	2,498	2,613	4.6
CAMEROON	1,877	1,956	4.2
CÔTE D'IVOIRE	1,582	1,644	3.9
TOGO	1,358	1,411	3.9
ETHIOPIA	814	844	3.7
MAURITANIA	1,894	1,964	3.7
CENTRAL AFRICAN REP.	1,209	1,251	3.5
BENIN	974	1,007	3.4
BURUNDI	650	672	3.4
MALAWI	583	600	2.9
RWANDA	931	957	2.8
GABON	6,175	6,330	2.5
BURKINA FASO	986	1,002	1.6
GUINEA	1,974	2,006	1.6
SOUTH AFRICA	8,764	8,905	1.6
SUDAN	1,506	1,527	1.4
CHAD	801	811	1.3
NIGER	678	687	1.3
SWAZILAND	4,167	4,205	0.9
NAMIBIA	5,838	5,876	0.7
BOTSWANA	8,349	8,398	0.6
LESOTHO	2,592	2,603	0.4

Figure 3: Percent difference between income per natural and GDP per resident, versus origin-country population



Both axes in $\log_{10}$ scale. The horizontal axis shows population residing in each country. The vertical axis shows the percent difference between income per natural and GDP per capita at PPP.

Figure 4: Difference between income per natural and GDP per resident in a cumulative population ordered left-to-right by the single-country percent difference



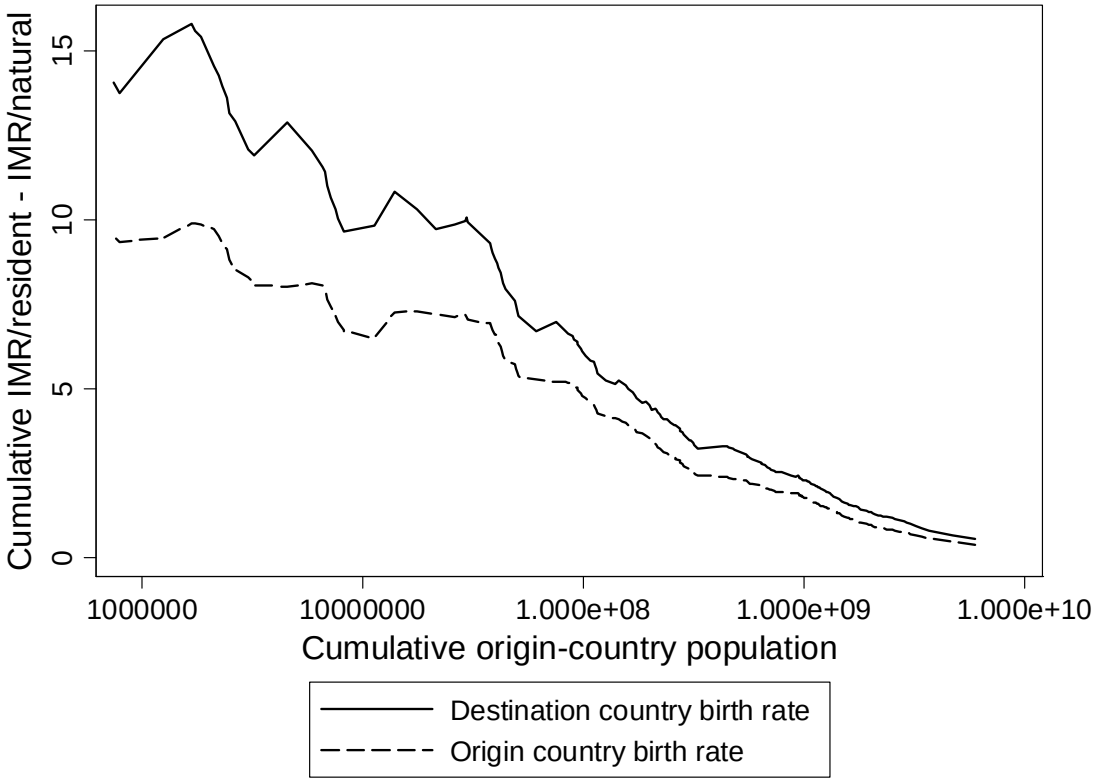
Horizontal axis in $\log_{10}$ scale, vertical axis in linear scale.

Table 2: Nonpoor people residing in origin country and in the United States, by country of birth

Country of birth	Population (millions)			Nonpoor (millions)						% of all nonpoor residing in US
	At origin	In US	Total	At origin	*% nonpoor*	In US	*% nonpoor*	Total	*% nonpoor*	
Poverty line $1/day										
Haiti	7.9	0.6	8.5	3.5	*44.0%*	0.6	*96.0%*	4.1	*47.7%*	14.1%
India	1015.9	1.3	1017.2	631.7	*62.2%*	1.3	*97.7%*	633.0	*62.2%*	0.2%
Mexico	98.0	13.1	111.1	90.8	*92.7%*	12.7	*96.8%*	103.5	*93.1%*	12.3%
Poverty line $2/day										
Haiti	7.9	0.6	8.5	1.6	*20.2%*	0.6	*95.1%*	2.2	*25.4%*	26.2%
India	1015.9	1.3	1017.2	175.8	*17.3%*	1.3	*97.4%*	177.0	*17.4%*	0.7%
Mexico	98.0	13.1	111.1	73.4	*74.9%*	12.6	*96.0%*	86.0	*77.4%*	14.6%
Poverty line $10/day										
Haiti	7.9	0.6	8.5	0.1	*1.4%*	0.5	*81.9%*	0.6	*7.0%*	82.0%
India	1015.9	1.3	1017.2	3.2	*0.3%*	1.2	*93.4%*	4.4	*0.4%*	27.2%
Mexico	98.0	13.1	111.1	13.4	*13.7%*	9.9	*75.5%*	23.3	*21.0%*	42.5%

Poverty headcount estimates from 2001 (Haiti), 1997 (India), and 2000 (Mexico) are from the World Bank's Povcalnet. US-resident population and income estimates for 1999 are from the US Census 5% Public Use Microdata Series for the year 2000. Following standard practice, the "$1/day" standard is $32.74/month, "$2/day" is $65.48/month, and "$10/day" is $327.40/month. "% of all nonpoor residing in US" means the percent of the nonpoor who collectively reside in either the country of origin or the United States who reside in the United States.

Figure 5: Absolute difference between infant mortality per natural and per resident in a cumulative population, chosen left-to-right to maximize the collective differential for each new grouping



Vertical axis shows the absolute differential between the infant mortality rate per natural measured for the cumulative group of countries and the infant mortality rate per resident for the same group. Countries are added to the group left to right, beginning with the country for which the differential is greatest (Guyana), and adding one country at each step to the right, chosen from among the remaining countries so as to maximize the differential from among all possible aggregations at that step. The solid line assumes that naturals abroad have the destination-country crude birth rate; the dotted line assumes they have the origin-country crude birth rate.