

Why Don't Remittances Appear to Affect Growth?

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Abstract

Although measured remittances by migrant workers have soared in recent years, macroeconomic studies have difficulty detecting their effect on economic growth. This paper reviews existing explanations for this puzzle and proposes three new ones. First, it offers evidence that a large majority of the recent rise in measured remittances may be illusory—arising from changes in measurement, not changes in real financial flows. Second, it shows that even if these increases were correctly measured, cross-country regressions would have too little power to detect

their effects on growth. Third, it points out that the greatest driver of rising remittances is rising migration, which has an opportunity cost to economic product at the origin. Net of that cost, there is little reason to expect large growth effects of remittances in the origin economy. Migration and remittances clearly have first-order effects on poverty at the origin, on the welfare of migrants and their families, and on global gross domestic product; but detecting their effects on growth of the origin economy is likely to remain elusive.

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1. Introduction

Migrants send home colossal sums of money—sums that appear to be soaring. Workers’ remittances to developing countries were just US\$47 billion in 1980 (constant 2011 dollars) in the best estimates we have. After barely rising by 1990 (\$49 billion), they doubled by 2000 (\$102 billion), and from there, *tripled* by 2010 (\$321 billion). Estimated remittances now far exceed the amounts of aid that flow to developing countries and are equal in scale to total private debt and portfolio equity flows (Figure 1).

But this explosive change has left economists surprisingly unsure of its broad development effects. One narrative to policymakers is optimistic:

“Remittances have a large positive effect on national income in many developing countries ... [I]n economies where the financial system is underdeveloped, remittances appear to alleviate credit constraints and may stimulate economic growth” (World Bank 2006, 86).

A competing narrative is strikingly pessimistic:

“Remittances do not seem to make a positive contribution to economic growth . . . Perhaps the most persuasive evidence in support of this finding is the lack of a single example of a remittances success story: a country in which remittances-led growth contributed significantly to its development . . . But no nation can credibly claim that remittances have funded or catalyzed significant economic development” (Barajas et al. 2009, 16–17).

How could such vast and soaring financial flows leave no trace in growth and development? In this paper, we review previous explanations and offer three new ones. The new explanations relate to measurement error, statistical power, and the effect of emigration on domestic labor stocks.

First, much of the increase in remittances across time may be illusory, arising from large changes in non-classical measurement error. To show this we start with macro data on remittances and compare the growth rate in remittances recorded to what one would expect based on the growth in migration and the growth in incomes in destination countries over the same period. Based on

this calculation, we estimate that 79% of the growth in remittances received by developing countries over the 1990 to 2010 period reflects changes in measurement, with only 21% representing changes that can be attributable to the growth in the migrant stock and to the incomes these migrants are likely to be earning. We then turn to time series micro data on remittances for several countries for which several rounds of data are available, and show that the growth in the macro data greatly exceeds that in the micro data at precisely the times changes in measurement have occurred.

Second, cross-country panel regressions may have too little power to detect the effects of remittances on growth—even if remittances are correctly measured, and even if the true effect is large. Here, we begin by measuring typical changes over time in remittances as a fraction of GDP and in the level of real GDP per capita, and estimate the variance in each. From this information we can estimate the power of tests in cross-country panel regressions of growth on remittances. Even if every dollar remitted adds a dollar directly to GDP—a coefficient of 1, a large effect—the available country-periods of data reveal a power of at most 0.3. This is primarily due to low magnitude and high variance in the remittance data.

Third, much of the variance in remittances across countries is caused by differences in migrant stocks. Those migrant stocks have offsetting impacts on home-country economic product, so that greater remittance flows for a given country are necessarily accompanied by a smaller fraction of the labor force working inside the country. We calibrate a very simple model of migration, remittances, and growth. The net effect of remittances caused by new migration need not be positive for many real-world migration corridors. And where it is positive, the net effect is very unlikely to be large enough to detect in cross-country growth regressions.

It should be no surprise, then, that remittances do not appear to affect short-run economic growth. First, across time, the true amounts remitted seem to have grown much more slowly than the measured remittances used in research. Second, even if increases in remittances over time were correctly measured, there would be too little power in cross-country panel data to detect even substantial growth effects of that rise. And third, across countries, there is little theoretical

basis for a substantial correlation between differences in remittance flows and differences in income levels. This is because the main reason some countries receive more remittances than others is that more of their labor force is outside the country—which has countervailing negative impacts on home-country GDP by definition. Plausible parameter values suggest that there was never a good reason to believe that substantial growth effects of remittances could be detected in cross-country data.

Greater efforts to address some of the perceived problems in this literature—such as finding better instruments to isolate causal relationships in cross-country data—are thus unlikely to be fruitful. None of this implies that *migration* has no economic effects: small effects on origin-country growth are fully compatible with large effects on origin-country poverty headcounts and on the incomes of migrant workers and households (regardless of location), as well as global GDP. Rather, it suggests that economists' attention may not be well spent in a search for substantial macroeconomic impacts of remittances on overall economic growth at the migrants' origin.

2. Prior explanations for the lack of detected growth effects

The stunning growth in estimated remittances has not been accompanied by obvious changes in economic growth for the countries that receive them. Figure 2 shows that there is essentially no correlation between the growth in real remittances per capita in a country between 1990 and 2010, and its growth in per capita income over the same period. Countries such as Nigeria, Sierra Leone and Bolivia saw per-capita remittances rise over 8,000% but saw no higher growth in real GDP than countries with little or no increase in remittances.

This is a puzzle if we hold to the simplest possible model of remittances. Suppose that changes in remittance flows are exogenous. Let GDP be determined by $Y = AF(K, L)$, where K is the capital stock, L the labor force, and A total factor productivity. Let subscripts denote the partial derivatives, and define the return on capital $r \equiv F_K$ and wage $w \equiv F_L$. The partial effect of a change in remittances ρ on GDP is

$$\frac{\partial Y}{\partial \rho} = ArK_{\rho} \quad (1)$$

Provided $K_{\rho}(\rho)$ is homogeneous of degree one, a proportional rise in remittances causes a rise in GDP of the same proportion. No simple relationship like this is evident in the data.

Previous explanations for the puzzle have fallen into four categories, all of which are encompassed by considering both direct and indirect effects of remittances on GDP. Replace the partial derivative in (1) with the total derivative

$$\frac{dY}{d\rho} = ArK_{\rho} + AwL_{\rho} + FA_{\rho} \quad (2)$$

Equation (2) offers candidate explanations for why empirical estimates could yield $\frac{\widehat{dY}}{d\rho} \approx 0$: First, perhaps observed remittances are not well correlated with unobserved K_{ρ} . Second, perhaps the effects of K_{ρ} are heterogeneous, and depend on Ar . Third, perhaps there is an offsetting effect $L_{\rho} < 0$, or fourth, an offsetting effect $A_{\rho} < 0$. Prior studies have discussed each of these.

2.1. Observed remittances do not proxy for capital formation

Regressions based on equation (2) could be misspecified in different ways. One well-understood way is that common specifications may not fully account for endogeneity bias. It could be the case that low growth itself causes remittance flows.¹ It could be the case that omitted variables simultaneously cause lower growth and higher remittances. In both cases, remittances become a less reliable proxy for capital formation K_{ρ} because remittances simultaneously proxy for low growth or its determinants.

¹ This basic question remains unsettled. Giuliano and Ruiz-Arranz (2009) find that remittances are typically pro-cyclical for the remittance-receiving country, while Frankel (2011) and Bettin et al. (2014) find that they are typically countercyclical.

This has spurred a series of efforts to find strong and valid instrumental variables for remittance flows. Catrinescu et al. (2009) use a difference-GMM estimator in which current first-differences in remittances are instrumented by lagged levels of remittances. Barajas et al. (2009) use remittances to countries other than the recipient as an instrument for remittance inflows to the recipient. Thus the second-stage coefficients on remittances capture only the effects of remittance increases due to worldwide rises in measured remittances over time. All such efforts face important challenges in cross-country data, where the strongest instruments can be the least valid, and vice versa (Bazzi and Clemens 2013).

A second specification problem is that many of these studies control for overall investment (Chami et al. 2005; Giuliano and Ruiz-Arranz 2009; Singh et al. 2011). Doing so means that the measured coefficient on remittances captures only a subset of the growth effects of remittances: those that pass through some channel other than investment. Rapoport and Docquier (2006) point out that all such regressions “disregard the possibility that, due to liquidity constraints, remittances could affect investments (thus making the investment/GDP ratio endogenous).” In specifications that do not hold investment constant, the coefficient on remittances is more positive (Faini 2006; Fajnzylber and López 2007). More recent work excludes investment per se (Barajas et al. 2009; Ruiz et al. 2009; Rao and Hassan 2011), but controls for various country traits that could be either direct determinants of investment or determined by investment, such as financial depth, inflation, fiscal balance, the quality of governance, and FDI. These have the potential to create similar issues of over-controlling.

A third potential specification issue is that many macro studies use remittances/GDP as their explanatory variable. Chami et al. (2008, p. 74) discuss the reasons why studies use this regressor: other possible denominators, such as GNI, could include remittances themselves as a matter of accounting—so that an increase in remittances could change both numerator and denominator mechanically. The GDP denominator does not include a mechanical effect, as remittance receipts are not counted in GDP. But this denominator could still change due to any contemporaneous effects of remittance receipts on GDP. For example, if a 5% increase in remittances causes GDP to rise by 1% in the same year through economic channels such as

investment, remittances/GDP for that year would only rise 3.96%. Implicitly, then, regressions that use remittances/GDP on the right-hand side assume that remittances arriving in a given year have no effect on GDP in the same year, so that any growth effects arrive the following year or later. This may or may not be true.

2.2. The effects of remittances are heterogeneous

Giuliano and Ruiz-Arranz (2009) find that remittances measurably affect growth only in countries with relatively low levels of financial-sector development, where capital-constraints on investment bind. In equation (2), suppose that the return on capital r is unobserved, and is higher in countries with binding capital-constraints. Then, even if remittance flows do proxy for K_ρ , their effect on GDP is conditional on r . Regressions that fail to allow for heterogeneous effects may then estimate a pure effect of remittances biased toward zero—depending on the correlation between r and ρ . Bettin and Zazzaro (2012) offer evidence supporting these findings.

Similarly, Singh et al. (2011) find more positive effects of remittances on growth in countries with sounder political institutions as measured by an index of political risk. In the language of equation (2), the growth effect of K_ρ could depend on A , and be difficult to detect without accounting for the interaction.

2.3. Offsetting effects on labor supply

A substantial literature has explored the possibility that remittances reduce the incentive for household members to participate in the labor force.² In theory, remittances reduce the relative opportunity cost of labor force withdrawal. Any consequent decline in labor supply could produce an offsetting $L_\rho < 0$, as discussed by e.g. Barajas et al. (2009). On the other hand, it is also possible that non-migrants increase labor supply to help migrants finance migration, and remittance-caused investment generates more employment and thus greater labor supply (Posso

² This strand includes Kozel and Alderman (1990); Gorlich et al. (2007); Shonkwiler et al. (2008); Lokshin and Glinskaya (2009); Cox-Edwards and Rodriguez-Oreggia (2009); Jadotte (2009); Binzel and Assaad (2011); Antman (2012); Powers and Wang (2012); Clemens and Tiongson (2012).

2012).

There are further complications to this story. There is evidence that exogenous increases in remittances cause labor force withdrawal by school-age children, and greater schooling for those children (Yang 2008). In our toy model, this would mean both $L_\rho < 0$ and $A_\rho > 0$, with an ambiguous net effect on output—since there would be fewer but more educated workers. On the other hand, remittances may deter human capital investment by reducing the opportunity cost of leaving school (McKenzie and Rapoport 2011). This could mean both $A_\rho < 0$ and $L_\rho > 0$, since there would be more workers but with less education—again with theoretically ambiguous net effects.

2.4. Offsetting effects on total factor productivity

Finally, it is possible that remittances have offsetting effects on growth through some other channel such that $A_\rho < 0$. Amuedo-Dorantes and Pozo (2004) find that remittance flows to Latin America increase the real value of the recipient country's currency, in the same manner as a natural resource boom. Through this and other mechanisms, remittances could raise the price of nontradables and allocate resources away from tradable sectors, reducing net exports and thus GDP (Acosta et al. 2009). Remittances also appear to shape the choice of exchange-rate regimes (Singer 2010), with further complex effects on growth.

Abdih et al. (2012) posit another channel by which remittances could reduce total factor productivity A : by eroding the quality of governance. They build a model in which remittances, by expanding the government's revenue base, reduce the cost of rent-seeking by public officials. Remittance-recipient households, in turn, have less incentive to hold politicians accountable since they can use remittances to purchase substitutes for public services. The authors offer cross-country regressions compatible with such an effect, but utilizing instrumental variables of uncertain validity—such as legal origins, which may directly affect governance quality through other channels.

Below, we do not argue that the above explanations are wrong. Rather, we argue that the above explanations are unnecessary. We propose three alternative explanations for the general difficulty of detecting any growth effect of remittances. Regardless of whether or not previous explanations are correct, there may be little hope of reliably measuring growth effects of remittances in cross-country data at this time. Each of the next three sections explains one of these reasons.

3. Remittance growth may be greatly overstated

Growth impacts of remittances would be unexpectedly low if recent estimates overstate the true increase in remittance flows over time. Suppose that rises in measured remittances (ρ) overstate rises in true, unobserved remittances ($\tilde{\rho}$) so that $\frac{\partial \tilde{\rho}}{\partial \rho} = \varphi$, where $0 < \varphi < 1$. The chain rule requires

$$Y_{\rho} = \varphi Y_{\tilde{\rho}} \quad (3)$$

Overstating a change in remittance flows, then, means that the true effect of that flow on GDP is smaller than would be expected without mis-measurement—and smaller in the same proportion. This requires no assumptions about K_{ρ} or the functional form of F . We offer two types of evidence on the extent to which current estimates overstate changes in remittances over time: evidence from macro data and evidence from micro data. We find that roughly 80% of recent rises in measured remittances likely arise from changes in measurement rather than true rises in remittances. Even with extreme assumptions this fraction is no less than two-thirds.

3.1. Evidence from macro data

Macro data on remittances, such as that shown in Figure 1, come from balance of payments data provided by each country to the IMF. Until 2005, the Balance of Payments Manual 5 (BPM5) had three categories related to transfers from migrants: *workers' remittances*, which are current transfers by migrant workers, where migrants are defined as individuals who come to work for at least a year; *compensation of employees* which covers income earned by temporary workers; and

migrants' transfers, which are a capital account transfer reflecting the movement of assets by a migrant from one country to another when he or she migrates (IMF 1993). The World Bank combines workers' remittances and compensation of employees together to form the remittance measure reported in its World Development Indicators, and this has been the definition of remittances used in a number of studies in the literature (e.g. Catrinescu et al. 2009).³

However, in practice it often proved difficult to separate transfers made by migrant workers from their employment income from a number of other transfers. The Balance of Payments Manual 6 (BPM6) therefore replaced the category of *workers' remittances* with *personal transfers* which consist of "all current transfers in cash or in kind made or received by resident households to or from nonresident households" (IMF 2009, p. 20). Personal remittances in the World Development Indicators (and Figure 1) are then the sum of these personal transfers and compensation of employees.

The underlying data that feeds into these aggregates comes from central banks in each individual country. They typically require banks, money transfer operators and other institutions to provide reports on the transactions they process (Orozco 2006). However, in many cases the coverage of this reporting has been partial. De Luna Martínez (2005) reports on a survey of central banks in 40 developing countries that took place in 2004. He finds that 90 percent of the countries collected remittance data from commercial banks, but such data were collected in only 65 percent of the countries in which credit unions and exchange houses processed remittances, in only 38 percent of the countries in which money transfer operators processed remittances, and in only 35 percent of the countries in which post offices process remittances. He notes that this lack of coverage of financial entities was much less of a problem in the 1970s and 1980s when migrants had very few available options to send remittances, but became more of a problem as the number of channels and financial instruments available in the marketplace to transfer money overseas has increased dramatically. Even when financial institutions were reporting remittances, they did not necessarily report all remittance transactions. Orozco (2006) notes that in most cases

³ There has been some debate over this definition with Barajas et al. (2009) just using workers' remittances, and Guiliano and Ruiz-Arranz (2009) using the sum of all three components, but then making adjustments on a country-by-country basis.

money transfer companies only had to provide reports for transactions exceeding US\$3,000—an amount that far exceeds the average remittance transaction undertaken by developing country migrants.

But the measurement of remittances has changed over time. At the global level over the last two decades, one of the most important reasons for this change has been efforts to combat money laundering. This received added impetus in the wake of the September 11, 2001 terrorist attacks in the United States, with the Financial Action Task Force (FATF) developing international standards on anti-money laundering and combating the financing of terrorism (AML/CFT). Among these recommendations were to ensure licensing and registration of money transfer providers, better record-keeping of financial transactions, and know-your-customer requirements to prevent anonymous transfers. These recommendations have been endorsed by over 180 countries (FATF 2012). As a result remittance transactions that previously would not have been reported for balance of payments purposes are increasingly reported.

A related, but distinct change that has occurred over the same time frame has been a change in the methods migrants use to send remittances, with a shift from informal to formal payment methods in many countries. There are at least two reasons for this change. The first is that increases in competition, coupled with reductions in the cost of sending remittances, have made formal remittance providers more attractive to migrants than previously. Secondly, a further consequence of the AML/CFT regulations has been a crackdown on informal remittance providers in many destination countries. The result is that remittance transfers that previously would have gone unreported because of how they were sent are now increasingly sent through remittance channels that show up in the Balance of Payments.

3.1.1. Evidence of Overstated Growth through a Macro Remittance Decomposition

These measurement issues mean that what is being measured by “remittances” in the World Development Indicators or Balance of Payments has been changing over time. This raises the

question of how much of the surge in recorded remittances reflects changes in measurement, and how much reflects genuine changes in remittances.

To address this question, we can carry out a decomposition of remittances. Let $L^* = \bar{L} - L$ be the stock of workers overseas, out of the total stock \bar{L} born in the country of migrant origin. Let w^* be the overseas wage and θ the fraction of migrants' earnings abroad remitted home. The flow of remittances is described by:

$$\rho \equiv L^* w^* \theta \tag{4}$$

This is an accounting identity to the extent that only migrants send remittances. This seems a reasonable assumption to a first approximation, although it ignores remittances sent by second- and third-generation migrants. Existing research suggests second generation migrants are much less likely to remit, and send less remittances when they do than first generation migrants (Lee 2003; Kasinitz et al. 2008).

If we now assume that migrants have not changed the share of income which they remit over the period 1990 to 2010, then (4) implies

$$g_\rho = g_{L^*} + g_{w^*} + g_{L^*} g_{w^*} \tag{5}$$

That is, the growth of remittances should depend on the growth in migration, and on the growth in the incomes that these migrants earn.

3.1.2. Migration growth over the 1990 to 2010 period

We can measure the first term in equation (5) using data from the United Nations Population Division, which has constructed a bilateral migration stock matrix for 1990, 2000, and 2010 using national census records. According to these estimates, there were 123.4 million migrants from developing countries in 1990, growing to 185.0 million in 2010, a 49.9 percent increase.

This is shown in the first row of Table 1, which shows that this growth in migrant stock is only 9 percent of the recorded growth in remittances over this time period.⁴

Figure 3 plots remittance growth against migration growth for the 68 developing countries for which data on both are available over the 1990–2010 period (it drops 5 countries with remittance growth above 5,000% in order to see the other countries). We see there is a positive correlation between remittance growth and migration growth (Pearson correlation of 0.27, Spearman rank-order correlation of 0.39). However, we also see that many countries have remittance growth rates that vastly exceed their migration growth rates, and that there is tremendous heterogeneity across countries in this extent. Table 1 also reports data for the 15 developing countries with the largest absolute increases in recorded total remittances over the 1990 to 2010 period. These countries all have remittance growth rates that exceed their migration growth rates, but the share of remittance growth accounted for by migration growth alone ranges from less than 1 percent in Nigeria to over 79 percent in Egypt.

3.1.3. Growth in the Income that Migrants Earn

Equation (5) shows remittance growth will exceed migration growth if the incomes that migrants are earning grow. Data on the earnings of migrants at a global level over time are not available. We therefore proxy the growth in income earned per migrant with the growth in per capita GDP in the main destination country in which migrants from that country reside in 2010. We use the UN bilateral migration data to determine this country. Then, as an example, we see that the main destination country for Mexicans was the United States, and that U.S. real per capita GDP grew 23.2 percent over the 1990–2010 period. We do the same calculation for all 167 developing countries in the United Nations database, and then construct a weighted average growth in income for developing country migrants by weighting the country-specific migrant income growth rates by the share of their migrants in the developing country total.

⁴ Of course one might also worry about measurement error in the migration stock data. Typically this data comes from national censuses. To the extent that there have been improvements in measurement over time, these improvements are likely to result in greater coverage of migrants in more recent years, making the numbers we use an upper bound of the share of remittances that can be accounted for by growth in the migrant stock.

Table 1 shows that the real incomes of developing-country migrants rose 47.3 percent over the 1990–2010 period. Combining this with the growth in migrant stock, and using equation (5), this gives a predicted growth in remittances of 120.7 percent over the 1990–2010 period. As a result we estimate that only 21.7 percent of recorded remittance growth is due to changes in the fundamental drivers of remittances, with almost 80 percent therefore potentially due to changes in measurement.⁵

The remainder of Table 1 does this also on a country-by-country basis for the 15 developing countries with the highest absolute increases in remittances. We see that for the three countries contributing the most to developing country remittance growth over this period—India, China, and Nigeria—that growth in migrant stocks and migrant incomes can explain less than 4 percent of the recorded growth in remittances.⁶

How reasonable is per capita income growth at destination as a proxy for the income growth of migrants? There are several potential concerns. The first is that in some countries the growth in aggregate income has mostly gone to earners at the very top of the income distribution, with the growth of the remainder of the distribution (in which most migrants will likely fall) being much less. The United States is a stark example of this, with the income of the top 1 percent growing 200.5% between 1979 and 2007, while that of the remaining 99% grew only 18.9% (Sommelier and Price 2014). To the extent this occurs, real GDP growth overstates the income growth of migrants. However, this uneven growth is not a global phenomenon. Using data from 118

⁵ The estimates in Table 1 use the definition of remittances in the World Bank’s World Development Indicators, which includes both the ‘workers’ remittances’ and the ‘employee compensation’ lines of the Balance of Payments. As noted before, there is disagreement in the literature as to which aggregate to use. The main alternative approach is that of Chami et al. (2008, p. 4), who recommend that macroeconomic research use solely the workers’ remittances’ line. Appendix C re-creates Table 1 with this alternative definition. The results barely change: 21.5 percent of remittance growth, by that definition, is accounted for by growth in fundamentals.

⁶ There are two countries in Table 1 for which we estimate higher remittance growth than officially recorded. The first is Colombia, whose main migrant destination Venezuela had rapid GDP growth of 247% over 1990 to 2010 as a result of oil revenues. It seems plausible that Colombian migrants did not share equally in this resource-driven growth, and may have had lower income growth. The second is Egypt, whose main migrant destination was Saudi Arabia. Again it seems plausible that migrants to Saudi Arabia had income growth that was considerably less than GDP growth in Saudi Arabia over this period.

countries, Dollar et al. (2013) show that growth of the incomes of the bottom 20 percent, and bottom 40 percent of the income distribution on average move one for one with average growth. As a result, we should expect on average the incomes of settled migrants to broadly move with those of the countries they are working in, even if these migrants are working in jobs earning below average incomes.

However, temporary migrants moving on work visas often face binding minimum wages that exceed the market-clearing wage. The result is that adjustments to rising incomes at destination can take the form of increases in the numbers of temporary migrants, but little change in the wages these migrants earn (McKenzie et al. 2014). If this is the case, our estimates will be an upper bound on the growth in migrant income.

A further concern could be that the selection of migrants changes over time. For example, if in 1990 it was largely low-skilled migrants moving, and in 2010 the migrants moving were of higher skill, then the incomes earned by migrants may increase as a result of the increased skill level, in addition to any increase in wages for individuals of a given skill level. This would only bias our results if migrants were becoming skilled at a different rate than the native population. Using data from Brücker et al. (2013) on the educational breakdown of migrants to 20 OECD countries, we calculate that the share of developing country migrants who were low-skilled (having no schooling, primary, or lower secondary education only) fell from 48.6% in 1990 to 34.4% in 2010. So it is the case that migrants have become more skilled. But during the same period, the share of the native-born in these 20 OECD countries with low-skill fell from 35.2% to 16.6%. Thus in relative terms, migrants became increasingly low-skilled relative to natives over the period we look at. This suggests that growth in migrants' earnings should not be greater than the growth of their destination economies, a hypothesis we can test.

Table 2 uses data from the United States Census and American Community Survey to compare the income growth of migrants in the U.S. to U.S. GDP growth. The income of developing country migrants working in the U.S. rose 19.3 percent in real terms over 1990 to 2010, which is close to the growth in real GDP of 23.2 percent. When we look at the growth of the incomes of

the countries in Table 1 for which the U.S. is the number one migrant destination in the UN data, we see that at the individual country level real GDP per capita growth also appears to be a reasonable first-order approximation for most countries. Thus we think any biases in proxying migrant income growth with real GDP growth are likely to be small on average, and typically be such that our estimates are upper bounds.

3.1.4. *What if remittance shares change?*

Unfortunately there are few data sets which measure both the income and remittances of immigrants, making it difficult to assess empirically how the share remitted may have changed over time. One exception is the Mexican Migration Project, which asks returnee migrants about the incomes they earned abroad and how much they remitted. Amuedo-Dorantes et al. (2005) use these data to show monthly remittances per migrant made by Mexican immigrants actually fell between the 1990s and 2000s, which given rising incomes, means the share of income remitted actually fell. They attribute this to rising living standards in Mexico reducing the need for remittances, and to migrants staying abroad for longer. Although this is just one country, and there are concerns about representativeness, it does not suggest widespread increases in the share of income being sent to the home country during the 1990 to 2010 period.

If the share of income which migrants remit changes, then equation (5) becomes:

$$g_p = g_L^* + g_w^* + g_\theta + g_L^*g_w^* + g_w^*g_\theta + g_L^*g_\theta + g_L^*g_w^*g_\theta \quad (6)$$

Where g_θ is growth in the share of income remitted by migrants. Table 3 examines the robustness of our accounting in Table 2 to a range of potential changes in this share. We see that a 10 percent change in this share would result in a 22 percent change in total remittance growth over the 1990 to 2010 period, which is small relative to the 557.8 percent measured growth. Even if the remittance share increased by 25 percent, which would be a very large increase, the combination of migrant growth, income growth, and this change in the share remitted will still only account for less than one third of measured remittance growth.

3.2. Evidence from micro data

An alternative source of data on remittances comes from household surveys in the remittance-receiving countries. These surveys directly ask households how much they have received as remittances. They have the advantage of capturing remittances through both formal and informal channels. Potential concerns are that households may misreport amounts received and that nationally representative surveys may contain relatively few households with migrants. Nevertheless, there is no reason to strongly suspect these potential issues change sharply over time, and so even if household surveys understate the levels of remittances, they may provide a reasonably accurate picture of the growth rates. At the very least, they provide a further check against which to compare the surges in remittances in the macro data.

Unfortunately few developing countries have frequent household income and expenditure surveys that extend back to the 1990s, and not all of those that do ask separately about remittances. For example, India only introduced survey questions about international remittances in the 64th round of its National Sample Survey, undertaken in 2007–08. We were able to obtain data from nine developing countries which satisfied the criteria of having at least five waves of household survey data, with data from the 1990s or 2000s. For each we then compare real remittances per capita (in 2011 USD) based on the household survey data to that based on the Balance of Payments/World Development Indicators.

Figure 4 plots the data for Mexico, the country for which we have the longest span of data, comprising of 12 rounds between 1984 and 2010. We see that the micro and macro data track each other closely over the 1984 to 2000 period. They then diverge dramatically starting in 2002, with the macro data showing remittance growth of 182 percent over the 2000 to 2006 period, compared to growth of 37 percent in the micro data over the same period. There is no evidence of an important change, at this time, in the average amount remitted by a Mexican in the U.S., or in the costs of sending those remittances (Hernández-Coss, 2005).

Canales (2008) shows that the Balance of Payments remittance data from Mexico also starts to

diverge from the U.S.-based estimates by the Bureau of Economic Analysis around this same time period. We can trace this surge in the macro data directly to a change in reporting regulations in Mexico. De Luna Martínez (2005) notes that before 2002 only commercial banks reported their remittance transactions to Mexico's central bank, but then in 2002 a new regulation required all money transfer companies to register at the central bank and report their remittance transactions on a monthly basis.

Figure 5 A to D plot the data for Peru, Honduras, Pakistan and El Salvador. Peru follows a similar pattern to Mexico, with micro and macro remittances having similar trends in the 1990s, and then the macro growth surging in the 2000s. Macro remittance growth was 154 percent between 1999 and 2010, compared to 75 percent in the micro data. Honduras is even starker, with the macro data showing growth of 679 percent over 1997 to 2010, compared to -3 percent growth in the micro data. Pakistan has growth of 294 percent in the macro data between 1998-99 and 2007-08, compared to 24 percent in the micro data. The difference is less in El Salvador, but the 109 percent macro remittance growth over 1999 to 2008 still exceeds the 79 percent growth in the micro data.

All four countries in Figure 5 appear to have been affected to various extents by the AML regulations coming into place after September 11, 2001. Endo et al. (2010) report that Honduras enacted an AML in 2002 which regulated money transfer companies and imposed know-your-customer laws. CEMLA (2009) reports that El Salvador changed its reporting of remittances with the 2001 monetary integration law and 2003 AML, and CEMLA (2010) reports on a number of new regulations on remittances in Peru in the early 2000s. Kock and Sun (2011) report that in the wake of the 2001 terror attacks, there was increased scrutiny of Pakistani nationals' bank accounts, and a crack-down on informal hawala systems of sending money, which are likely to have increased formal remittances.

However, there appear to have been other notable changes in measurement apart from those arising from the FATF recommendations for AMLs. Figure 6A shows the rarer case of Turkey, where the macro data show a 50 percent *decrease* in remittances between 2002 and 2006, despite

the micro data showing remittances increasing over this same period. Köskal (2006) notes that in 2003 Turkey changed its method of accounting for remittances, with spending by migrants during their visits as tourists to Turkey now entered under “tourism” in the balance of payments, whereas prior to this date they were counted as remittances. This sum was estimated to exceed US\$2 billion in 2003. Figure 6B shows Jamaica, which designated Building Societies as financial institutions that the Bank of Jamaica could supervise and examine in 1994 (McLean 2008). Macro remittances grew 167 percent between 1993 and 1996, compared to 34 percent growth in the micro data.

Figure 7 shows micro and macro remittance growth for Ghana, the only African country for which we were able to find data. Macro remittances grow an astounding 5,138 percent in real terms over 1987 to 2005. Yet the household survey data measures of remittances fluctuate around a constant value in real terms over this period, with remittances per capita in 2005 actually 3 percent lower in real terms than those in 1987. Ghana is the only one of our nine countries for which macro remittances per capita are consistently lower than micro remittance data. The macro data for many African countries are widely believed to undercount remittances due to poorer statistical systems and a higher incidence of informal transfers. Mohapatra and Ratha (2011) report that there are even sizeable discrepancies in official data, with Ghana’s central bank reporting remittance inflows in 2009 that are more than 10 times the levels reported in its balance of payments statistics.

Remittance growth for Paraguay, the last of our nine countries, is shown in Figure 8. In contrast to the other cases, the macro and micro remittance data exhibit similar trends over most of the 2000s, only diverging somewhat in 2010. We were unable to find any discussion of major changes in regulations affecting remittance reporting to the central bank in Paraguay during this time, and the fact that Paraguayan migrants are more likely to go to Argentina than the United States may have meant that remittance transactions were less affected by changes in U.S. AMLs than Mexico or countries in Central America.

3.3. Implications of the Macro and Micro Evidence

Taken together, this evidence suggests that much of the aggregate growth in remittances during the 1990 to 2010 period was the result of changes in measurement, rather than changes in actual remittances. Many countries had remittance growth that far exceeds what would be predicted from the growth in their migrant stocks and the growth in the income that these migrants were receiving. Large surges in the macro remittance data also do not appear to be accompanied by corresponding surges in the micro remittance data in many countries.

If most of the measured growth in remittances at the global level is illusory, resulting from changes in measurement, rather than genuine growth, then we should not expect to see changes in GDP growth coming from it. Nevertheless, if remittance growth was overstated in a consistent way across countries, then countries with higher measured remittance growth would be the ones with higher actual remittance growth, and so this would still offer the hope of correctly establishing the correlation between remittance growth and GDP growth, even though the estimated magnitude of the effect would be understated. But a second implication of our macro and micro estimates above is that there appears to be lots of heterogeneity in the extent of changes in remittance measurement across countries. Countries which saw the highest growth in recorded remittances therefore need not be those with the highest growth in actual remittance flows. As such, even establishing the correlation between remittance growth and GDP growth will be problematic. Furthermore, it seems highly likely that changes in the extent of measurement error will be correlated with institutions and financial infrastructure in the remittance receiving countries, raising further complications for studies endeavoring to examine the heterogeneity in remittance effects.

Finally, it is frequently claimed that the presence of informal transfers and measurement concerns lead recorded remittances at the macro level to be an undercount of true remittances (e.g. World Bank, 2006; Mohapatra and Ratha, 2011). The implicit assumption is then that over time we are getting closer to the truth. However, there are also a number of reasons why macro data can overstate remittances, by recording other types of transfers as remittances. For example, IMF (2009) notes that many other types of small transactions such as transfers to family

members studying abroad, transfers to travelers undertaking trips, and small trade transactions are often transferred through the same money transfer operators as remittances, and can be difficult to distinguish in the data. Some of these types of transactions are likely to be increasing over time, as the internet facilitates person-to-person trade across borders, and the popularity of study abroad programs grows. Conversations with officials in charge of monitoring remittances also reveal the suspicion that property market booms in some developing countries lead to large surges in measured remittance flows, even though the purpose of these transactions was often for migrants to buy property for themselves. As a result we should not automatically conclude that recorded remittances are necessarily getting closer to the truth in levels over time.

4. Growth regressions may have too little power to detect the effects

Disregard for a moment the previous section, and suppose instead that the estimates are accurate: true remittances have risen as much as the estimates indicate. If that were correct, and those increases caused growth, could we detect that effect in cross-country data? Would feasible hypothesis tests have sufficient power?

Here we first estimate typical standard deviations in the same cross-country data on growth and remittances used above. Table 4 shows these statistics for two different periodizations of the 1990–2010 data: as a cross-section of changes over 20 years, and as a panel of changes during two 10-year periods. (Prior to 1990, remittance data coverage becomes poor.) We then use these estimates as an input to power calculations. We estimate the power of a test of the null hypothesis that, in a regression of $\Delta \ln(\text{GDP}/\text{capita})$ on $\Delta(\text{remittances}/\text{GDP})$, the coefficient on remittances is zero. We use the power estimates for linear regression derived by Dupont and Plummer (1998).

Power is very low in a bivariate regression with 20-year periods. The upper portion of Figure 9 shows power estimates for this regression at various sample sizes. For example, suppose that about half of remittances translate directly into additional GDP per capita—an optimistic assumption—so that the coefficient on $\Delta(\text{remittances}/\text{GDP})$ is 0.5. Even if we had data on 150 countries (more than currently available), in this bivariate setting there is only about a 10%

chance, at the 5% level of statistical significance, that we would be able to reject the null that the effect is *zero*.

Power remains low in a multivariate regression. Suppose that the dependent variable is now $\Delta \ln(\text{GDP}/\text{capita} \mid X)$, where X is a vector of covariates. Typically in such regressions R^2 is around 0.4 (e.g. Barajas et al. 2009, Table 2), so that $\sigma_{\Delta \ln(\text{GDP}/\text{cap}) \mid X} = \sqrt{(1 - 0.4)\sigma_{\Delta \ln(\text{GDP}/\text{cap})}^2}$. The lower portion of Figure 9 shows the power calculation with this adjustment. The probability of detecting the growth effect of remittances rises to 17% in the example above: a true effect of 0.5, with 150 countries, at the 5% level of statistical significance.⁷

The power of the test remains similarly low in a higher-frequency panel. Figure 10 repeats the exercise in Figure 9, now with two 10-year periods in the data. The power of the tests decline slightly. Intuitively, shorter periods mean a larger number of observations (tending to raise power) but also more short-term fluctuations in the growth data (tending to reduce power). The latter is evident in Table 4: the standard deviation relative to the mean is much higher with 10-year periods than with 20-year periods.

This exercise suggests that there is little hope of reliably detecting the growth effects of changes in remittances/GDP in cross-country panel data. Even with the extreme assumption that remittances translate dollar-for-dollar into growth in real GDP/capita, in Figures 9 and 10 with reasonable sample sizes, power hovers around 0.3. This is too low to reliably interpret a null result as an informative test of the effect of remittances on growth.

5. Remittances rise as diasporas grow, with offsetting macro effects

One of the principal determinants of rise in remittance flows is a rise in the stock of migrants (Freund and Spatafora, 2008). But a rise in the stock of migrants is by definition a fall in the

⁷ This test is conservative because it is stacked in favor of higher power by assuming the covariates in the multivariate regression are independent of the remittances variable. To the extent that the covariates explain some of the variance in remittances, then $\sigma_{\Delta(\text{remittances}/\text{cap}) \mid X} < \sigma_{\Delta(\text{remittances}/\text{cap})}$, and power declines.

stock of labor at home, which necessarily reduces GDP as long as the marginal product of labor is positive. Bertoli and Marchetta (2014) show this offsetting effect at the micro level: in Ecuador, the household-level effects of migration-and-remittances are positive (comparing migrants households to non-migrant households), but much smaller than the effects of remittances among migrant households (comparing migrant households that receive remittances to migrant households that do not receive remittances).

This offsetting effect at the micro level could likewise offset growth effects at the macro level. When rising remittances are caused by rising numbers of migrants, which of the countervailing effects dominates? In what circumstances would we expect an increase in the diaspora to raise growth at all?

5.1. The growth effect of remittances that result from new migration

In equation (2) we assumed that changes in remittances were exogenous. Suppose now that changes in remittance flows are caused only by changes in the stock of migrants. As above, let L^* be the stock of workers overseas, and remittance flows $\rho \equiv \theta w^* L^*$. Equation (2) for the instantaneous effect of remittances on GDP growth becomes⁸

$$\frac{dY}{d\rho} = \frac{dY/dL^*}{d\rho/dL^*} = A \left(rK_\rho - \frac{w}{\theta w^*} \right) + \frac{FA_{L^*}}{\theta w^*} \quad (7)$$

The two terms in parentheses capture two competing effects of migration.⁹ The positive term captures the growth effect of investment caused by remittances; the negative term captures home labor income forgone when workers are overseas.

Equation (7) offers the starting point for the simplest back-of-the-envelope calculation of when

⁸ Derivations in Appendix.

⁹ Of course migration can also influence economic growth through a number of other channels, both positive and negative, including potentially spurring FDI and technology adoption, transmitting knowledge, preventing or spurring changes in governance, etc. These are all further reasons why trying to study the impact of remittances, rather than the overall impact of migration, is problematic (McKenzie, 2005).

we might expect *any* positive effect of remittances caused by new migration. Suppose that remittances can only be spent on consumption (C) of domestically-produced goods, on consumption of imported goods, or on savings. Then $C_\rho = 1 - \mu - s$, where μ is the marginal propensity to consume imported goods from each dollar remitted, and s is the marginally propensity to save. It is straightforward to derive a necessary and sufficient condition for a rise in remittances caused by new migration to have a positive growth effect in the country of origin:¹⁰

$$\frac{dY}{d\rho} > 0 \Leftrightarrow \frac{w^*}{w} > \left(\theta \left(1 - \frac{\mu}{1-s} \right) \right)^{-1} \quad (8)$$

Intuitively, the gain to migrants must be so great that the amount sent home more than compensates for their absence. The condition is more likely to be met when migrants send home a greater fraction of income, and less likely to be met when remittance recipients spend more on imports or savings.

In this highly simplified setting, it is not at all clear that remittances caused by new migration will have a positive marginal effect on GDP. Assume, for example, that migrants remit one fifth of their income ($\theta = 0.2$), their families consume 90% of remittances ($1 - s = 0.9$) of which 10% is spent on imported goods ($\mu = 0.1$). Condition (8) then suggests that new migration has a positive marginal effect on GDP if and only if $\frac{w^*}{w} > 5.625$.

Wage gains on this order are common, but in many settings the gain may not be high enough to meet condition (8). Migration from Tonga to New Zealand causes $\frac{w^*}{w} \approx 3.4$ in exchange-rate dollars (McKenzie et al. 2010). Skilled emigrants from Ghana experience $\frac{w^*}{w} \approx 4.5$ in exchange-rate dollars (Gibson and McKenzie 2012). Lower-skill immigrants to the United States exhibit a range of $\frac{w^*}{w}$ in exchange-rate dollars, from roughly 20 for immigrants from Yemen and Cameroon to roughly 5 for immigrants from the Dominican Republic and Morocco (Clemens et

¹⁰ Assuming $\frac{\partial L}{\partial \rho} = 0$ and abstracting from effects of migration on TFP such that $A_L^* \equiv 0$. Derivation in Appendix.

al. 2008). Indian computer programmers working temporarily in the U.S. experience $\frac{w^*}{w} \approx 6$ in exchange-rate dollars (Clemens 2013). In short, the condition for a positive marginal effect on growth may be met for some countries, but for many it may not be met. The consequence for macro-empirics is that a large portion of the cross-country variance in remittances is variance that cannot be presumed to have positive net growth effects.

5.2. How large would the effect be? A back-of-the-envelope example

Moreover, even for countries where the net effect is positive, it is likely to be much too small to detect in macroeconomic data. Here we continue the highly simplified, back-of-the-envelope calculation with plausible parameters, and find that the growth effect could be undetectable in a growth regression.

Suppose that migrants come from a lower-middle income country like Ghana, Bolivia, or Moldova where GDP per capita (at exchange rates) is about US\$2,000/year. In the destination country each migrant earns \$15,000/year and sends home \$3,000/year.¹¹ Thus $\theta = 0.2$ as above, and assuming again $1 - s = 0.9$ and $\mu = 0.1$, we expect a positive effect of migration on GDP/capita of the home country via remittances, since in this case $\frac{w^*}{w} = 7.5 > 5.625$.

But how large is the positive effect? If the migrant supports a household of four back home—such as a spouse and three children—the remittance per remaining household member is \$750/year. The opportunity cost of the migrant’s absence, again per remaining household member, is \$500/year (that is, \$2,000/4 other household members). The net benefit per member of the migrant’s household in the home country equals the difference: \$250/year.

That amount could make a big difference to the families in question, but not to overall economic growth at the origin. Suppose the above migrant’s country of origin experienced a sudden, large

¹¹ \$3,000/year is at the upper end of the range of typical remittances per migrant household among African households in the OECD (Bollard, McKenzie, and Morten 2010, Figure 5). This average includes non-remitters.

exodus of migrants: 2.5% of the population cumulatively over just 10 years.¹² Still assuming 4 household members per migrant remaining back home, this means that 10% of the population inside the country of origin would gain a remitting migrant over 10 years, or 1% of the population per year. For each of them the net benefit is \$250/year, as above; spread across the whole population that is \$2.50/person/year, or an increase of just 0.13% of GDP/capita per year. Such an effect would be very difficult to reliably detect in macro data on GDP/capita growth, whose standard deviation is on the order of fifty times as large.¹³

We can see the difficulty of detecting such small effects by estimating the implied coefficient in a growth regression. Suppose for example that the country started the period in question with a migrant stock of 5% of its population, like Colombia or Bangladesh. Under our assumptions, initial remittances/GDP were 0.075 ($= [5\% \times \$3,000] / \$2,000$). The above ten-year flow of migrants raises the migrant stock by 50% ($= 2.5\% / 5.0\%$), raising remittances/GDP by 0.0375 ($= 0.075 \times 0.50$). The cumulative effect on GDP/capita over those 10 years would be 0.013 ($= 1 - (1.0013)^{10}$). In other words, the coefficient on remittances in the 10-year-period growth regression of Section 4 would be $0.013 / 0.0375 = 0.347$. A coefficient of that magnitude, we have seen in Figures 9 and 10, could not be reliably detected. With the number of countries and years available now and for many years to come, growth regressions do not have sufficient power.

5.3. Extensions

This back-of-the-envelope calculation requires numerous assumptions, of course. For example, the very simple model we use here abstracts away from any multiplier effects arising from consumption of domestically-produced goods and services caused by remittances provided that such consumption would not have occurred from the worker's wage income at home. The calculation abstracts away from returns on invested savings, and effect of migration on total factor productivity such as through the transfer of ideas.

¹² This would be a very fast flow: the world average cumulative emigrant outflow across 2000–2010 as a fraction of the origin-country population was about 1.6%, roughly the flow rate of Peru and Benin. We conservatively assume that every new migrant is from a different household.

¹³ An effect on the order of 0.1% of GDP/capita per year means roughly a cumulative effect over 10 years on the order of 1% of GDP/capita. The standard deviation in the growth data is around 50 times as large (Table 4).

The results may also be quite different for temporary and permanent migration. There is evidence from some migration corridors that temporary migrants remit much more: permanent, settler migrants from Tonga to New Zealand remit on the order of NZ\$2,500–3,000/year, or about 11–13% of their earnings abroad (Gibson, McKenzie and Stillman 2011) whereas temporary, seasonal agricultural workers in the same migration corridor remit about NZ\$5,500/year or 46% of their earnings (Gibson and McKenzie 2014b). This difference determines whether the opportunity cost of absent labor, for the GDP of the origin country, is positive or negative. Gibson, McKenzie, and Stillman (2011) find that for settler migrants from Tonga to New Zealand, the flow of remittances “does not compensate for the large reduction in labor earnings these households face.” The opposite is true for temporary migration: seasonal workers’ remittances of NZ\$5,500/year are many times as large as the opportunity cost of their absent labor in Tonga.

Furthermore, this discussion concerns impacts at the margin and in the short term. What about average, longer-term effects? Should we not be able to detect the growth impact of many decades or generations of migration and remittances? In principle, if equation (11) yields a positive effect of remittances on investments at the margin, over long periods the average effect on growth could add up. But in practice the potential for such analysis is not high. We do not have reliable data on remittances going back generations. And even if we had these, it is difficult to establish a clear counterfactual. What would Tajikistan’s economy look like if—rather than mass migration and remittances at 42% of GDP—there had been no migration for the past half-century? Much else has happened in Tajikistan during that period, including Soviet rule followed by civil war, that is very difficult to control away with standard regressors in ultimately arbitrary specifications. This undermines the ability of low-remittance countries like Angola or Suriname to serve as a meaningful counterfactual for Tajikistan in long-term analysis. Country fixed effects do not help in this instance, unless the time periods are decades long to capture effects of similar gestation (Temple 1999, p. 132).

This exercise suggests that remittances caused by rising emigration, if they have a positive

growth effect at all, might have typically small effects—too small to be detected by growth regressions. There may never have been a good reason to think that growth regressions could find that small signal amid the noise.

6. A way forward

This analysis suggests that economists likely do not have the tools at this time to reliably measure the effects of remittances on broad processes of growth and development. Our time-series data on changes in remittances are likely to reflect changing measurement practices more than they reflect changes in true flows. Even the overstated changes in existing estimates would not have large enough growth effects to be reliably detected in panel growth regressions. And while very recent remittance estimates may be getting more accurate, for many reasons it is difficult to measure their growth effects in cross section. One of these reasons is that in cross section, greater remittance inflows go hand-in-hand with greater labor outflows—the net effect of which is unlikely to be large or even necessarily positive for many countries.

None of this, however, means that remittances do not have broad effects on growth and development. It simply means that the empirical hunt for any such effects is likely to remain quixotic for the time being. Remittance measurement and accounting practices appear to be converging toward more accurate measures in the last few years (although there are some reasons why they may now over-count remittances in some cases), and remittances continue to (genuinely) grow. There may thus come a time many years in the future when we have cross-country panel data on remittances of sufficient great magnitude and sufficiently little noise to measure any effects on growth that remittances may have.

There is large and rich research agenda on the poverty and development effects of remittances, discussed by Rapoport and Docquier (2006), Yang (2011), and Clemens and Ogden (2014), among others. There is mounting evidence that migration and remittances have first-order economic impacts on poverty in origin countries, on migrants and their families, and on global GDP. There is little evidence, however, that substantial growth in the GDP of migrants' origin countries has been caused by remittances. The relatively small size of remittances, the noise in

growth data, and the local opportunity cost of migrant labor—separately and jointly—mean that the growth effects of remittances will likely remain undetectable in cross-country growth regressions for a long time. For the time being the best approach may remain that of calibrated structural models, despite the disadvantage of the many and jointly untestable assumptions they embody.

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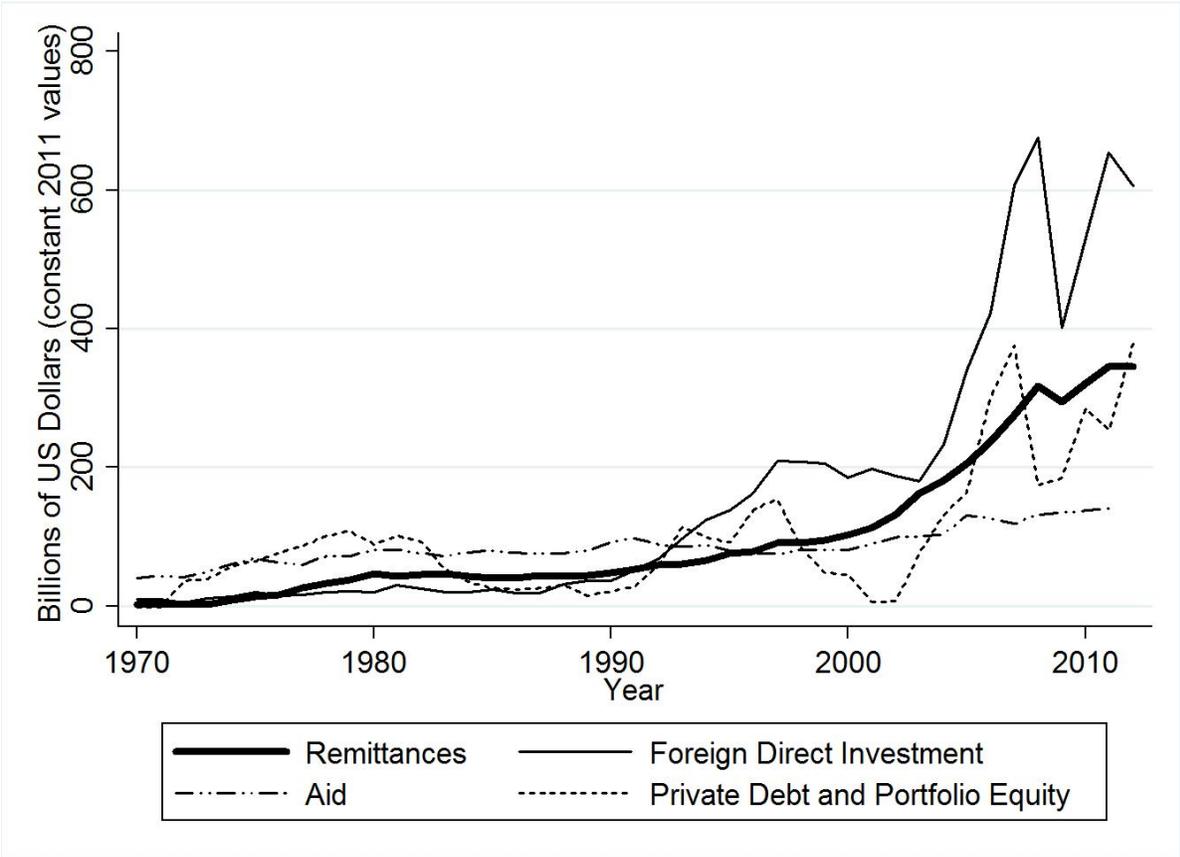
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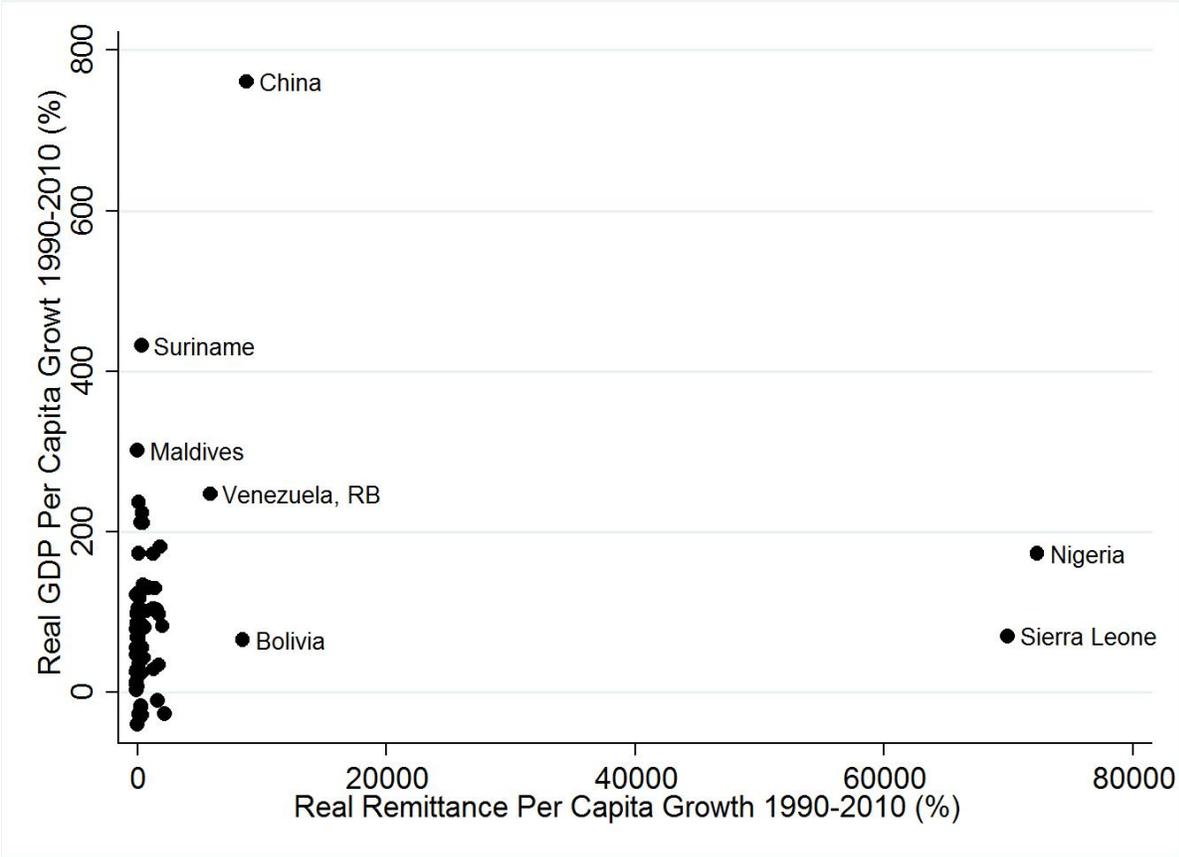
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Figure 1: Financial Flows to Developing Countries 1970-2012 (billions of 2011 US\$)



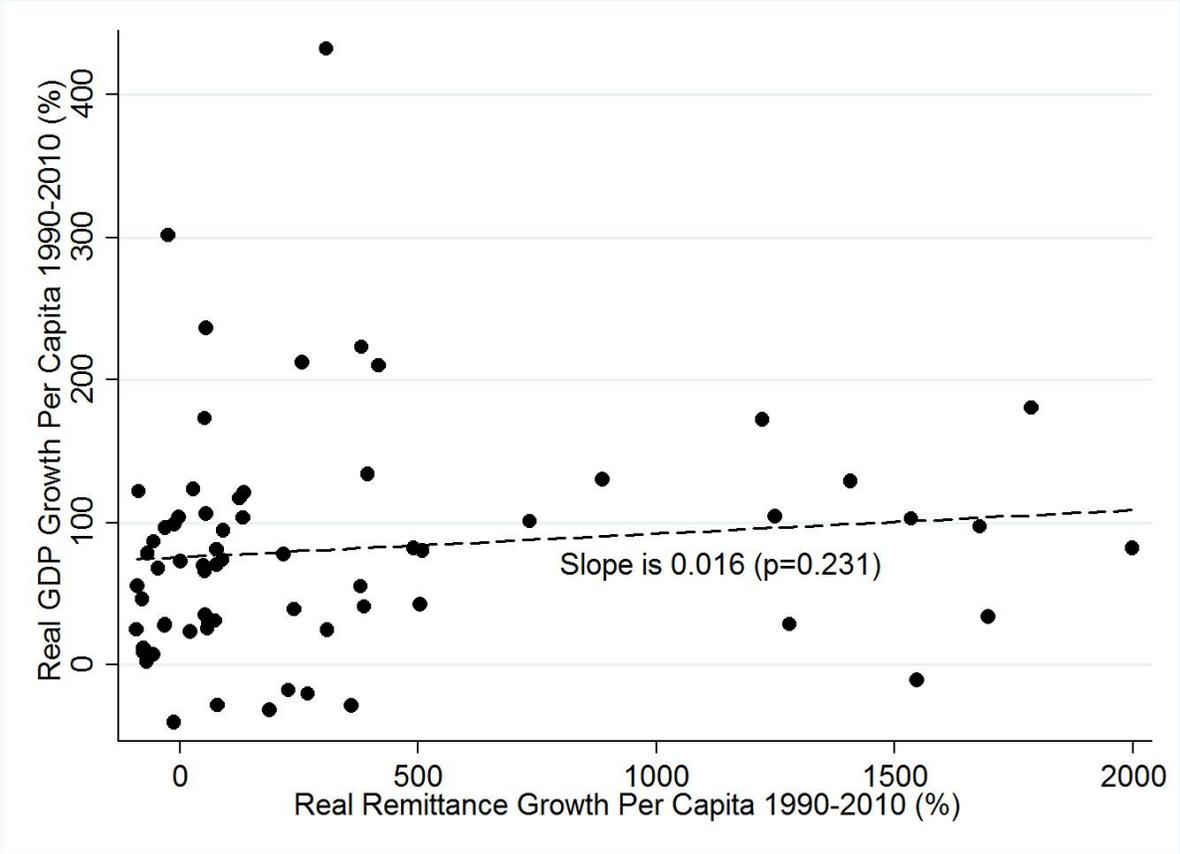
Source: World Development Indicators. See data appendix for variable definitions.

Figure 2A: Lack of Relationship between Real GDP Per Capita Growth and Per Capita Remittance Growth 1990-2010 – All Developing Countries



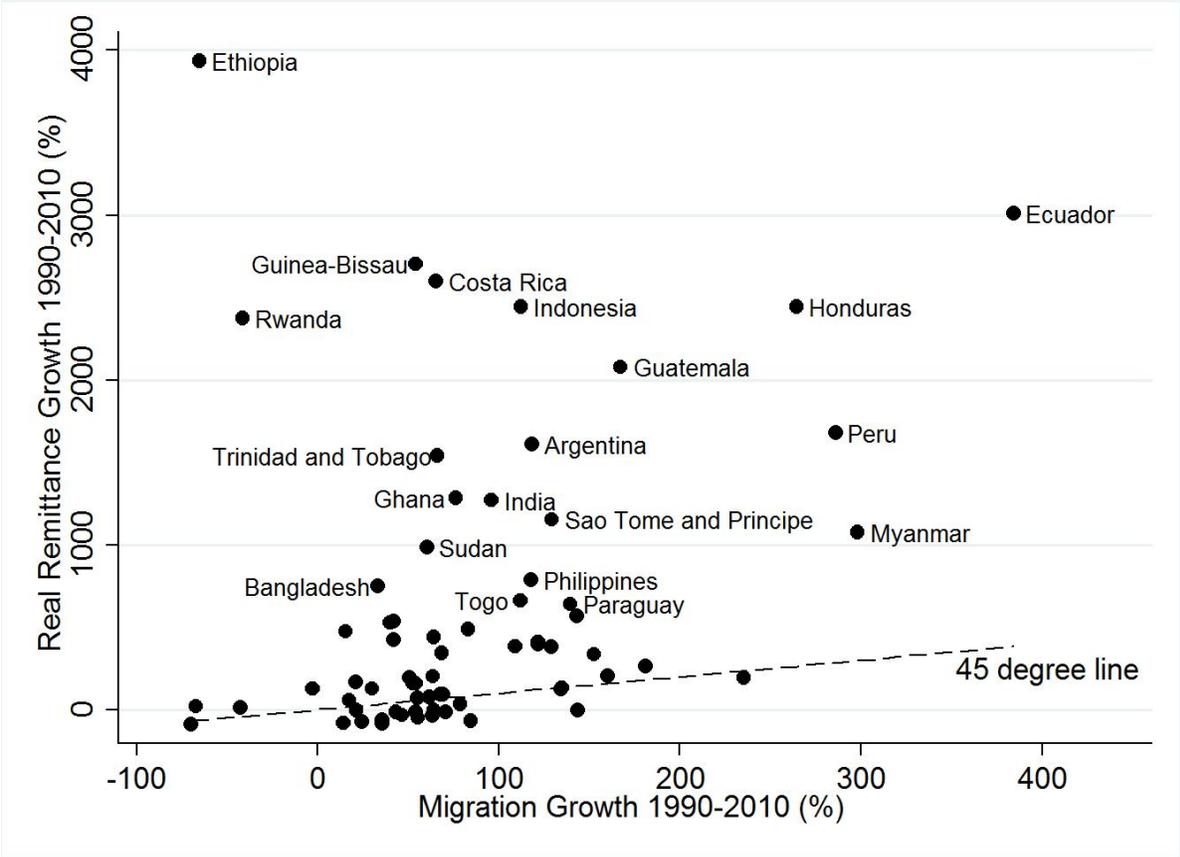
Source: Vertical axis shows real growth in per capita GDP cumulatively over 1990–2010. Data from World Development Indicators. See data appendix for variable definitions.

Figure 2B: Lack of Relationship between Real GDP Per Capita Growth and Per Capita Remittance Growth 1990-2010 (developing countries with remittance growth below 2000%)



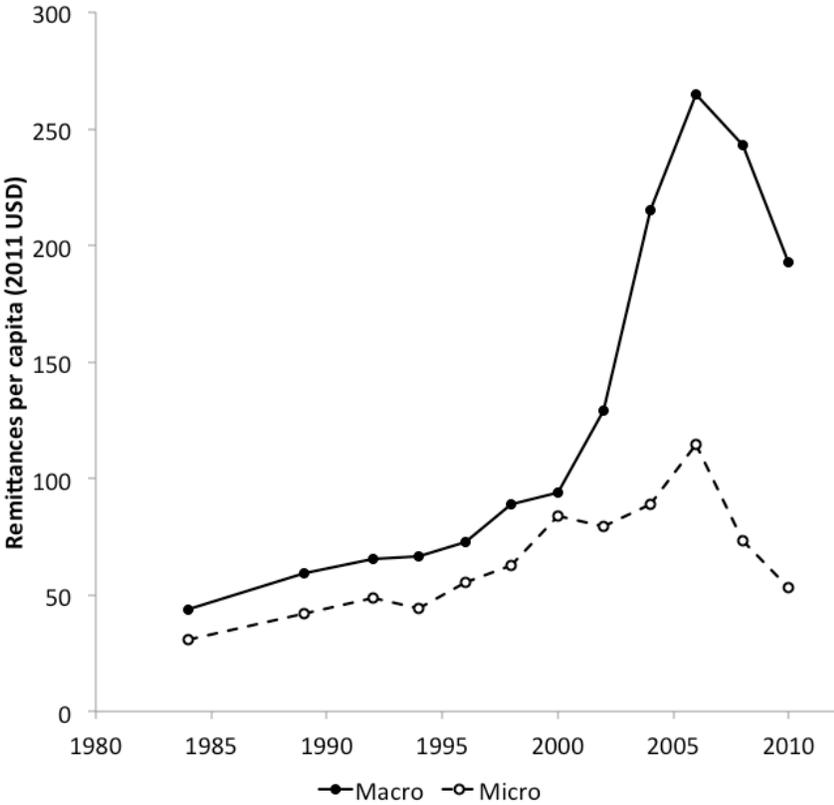
Source: Vertical axis shows real growth in per capita GDP cumulatively over 1990–2010. Data from World Development Indicators. See data appendix for variable definitions.

Figure 3: Real Remittance Growth for Many Developing Countries Greatly Exceeds Their Growth in Migrant Stocks over the 1990 to 2010 period



Source: Vertical axis shows real growth in dollar-value remittances cumulatively over 1990–2010. Remittance data from World Development Indicators. Migration data from United Nations. See data appendix for variable definitions.

Figure 4: Micro Versus Macro Growth in Mexican Remittances 1984–2010



Source: Micro data are from ENIGH, Macro data from World Development Indicators. Details in Appendix.

Figure 5: Countries where Anti-Money Laundering Laws Post 2001 Appear to Result in More Rapid Macro than Micro Remittance Growth

Figure 5A: Peru

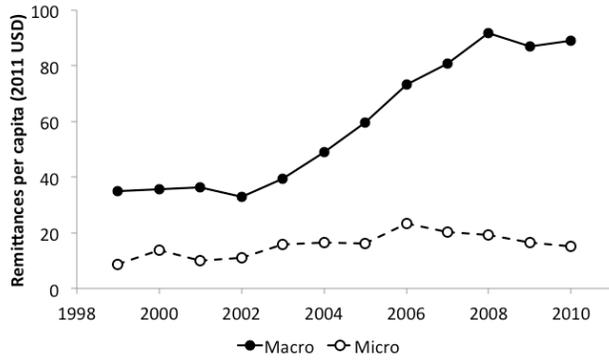


Figure 5B: Honduras

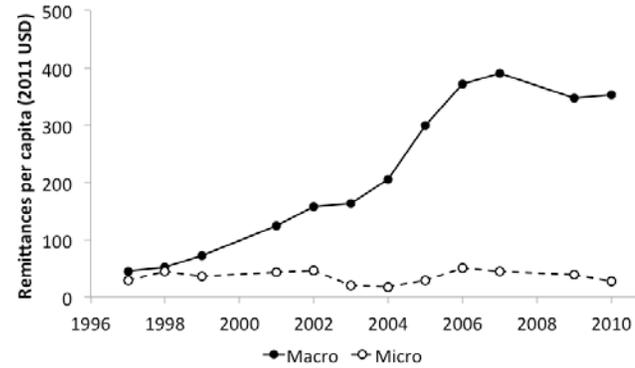


Figure 5C: Pakistan

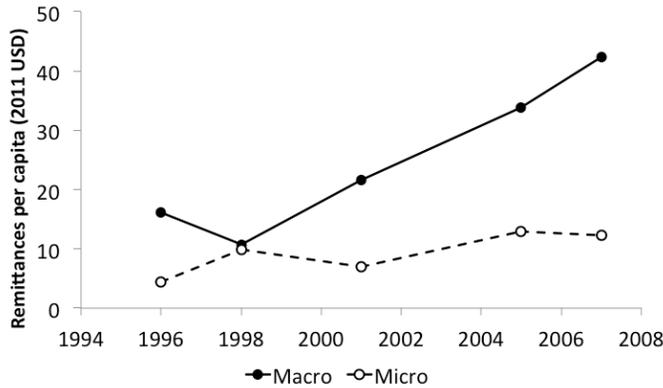
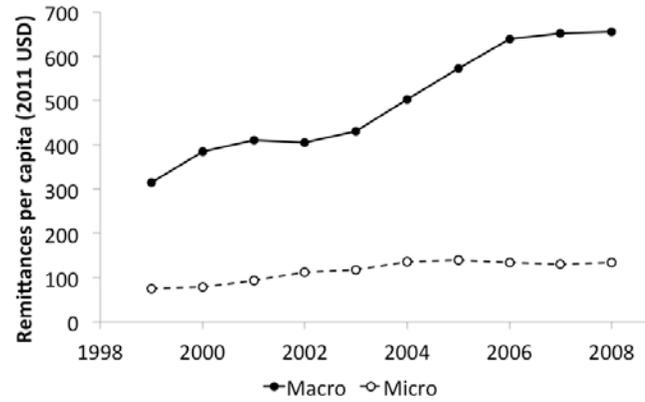


Figure 5D: El Salvador



Source: Micro data are from household surveys, Macro from World Development Indicators. See Appendix for details.

Figure 6: Micro and Macro Remittance Growth in Countries where changes in recording happened on other dates

Figure 6A: Turkey (measurement change in 2003)

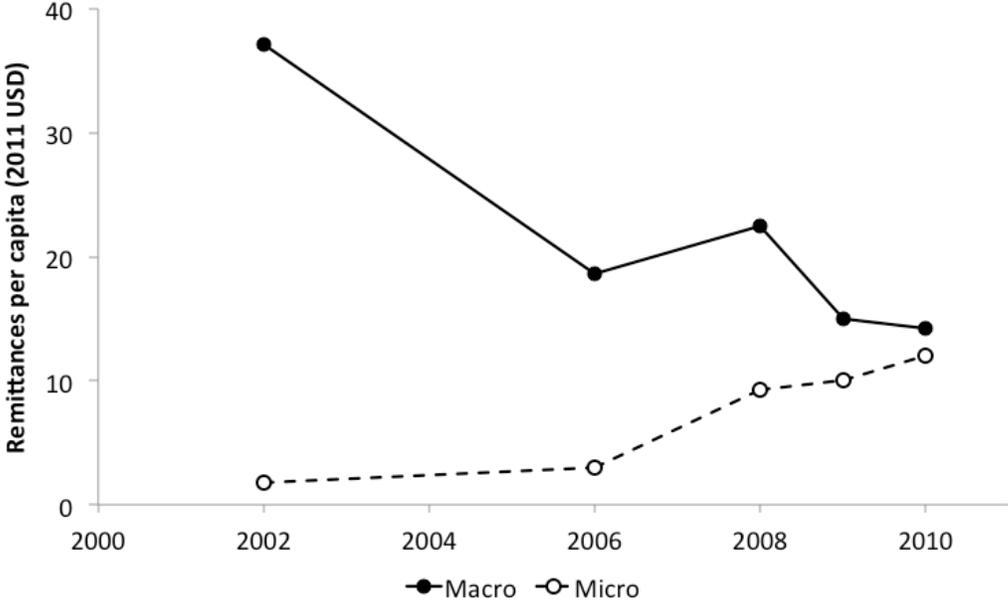


Figure 6B: Jamaica (measurement change in 1994)

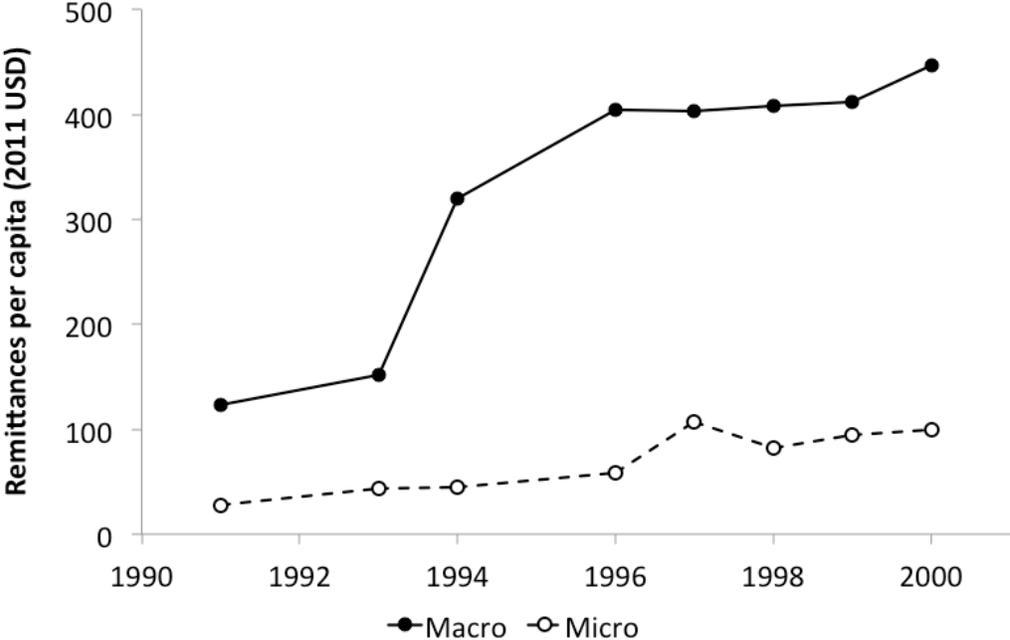


Figure 7: Macro and Micro Remittance Growth in Ghana

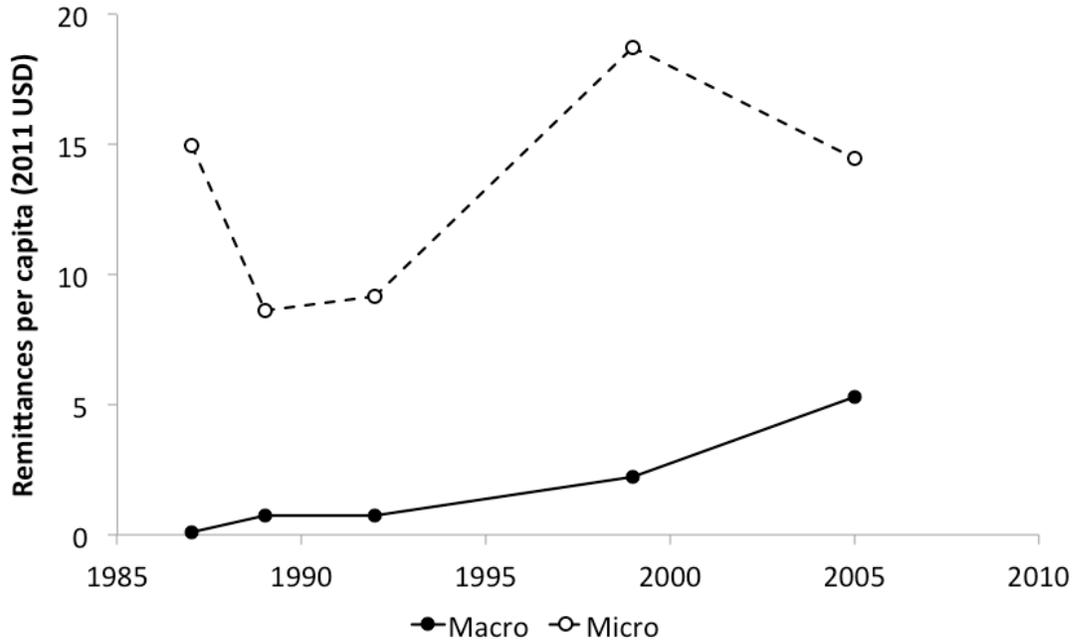


Figure 8: Macro and Micro Remittance Growth in Paraguay

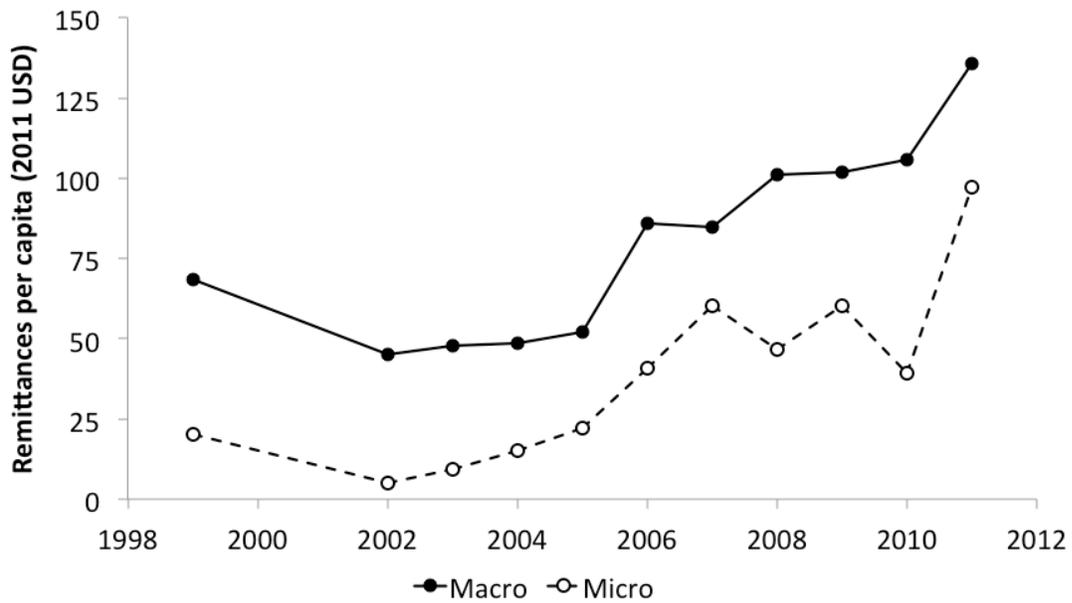


Figure 9: Power calculations with 20-year periods

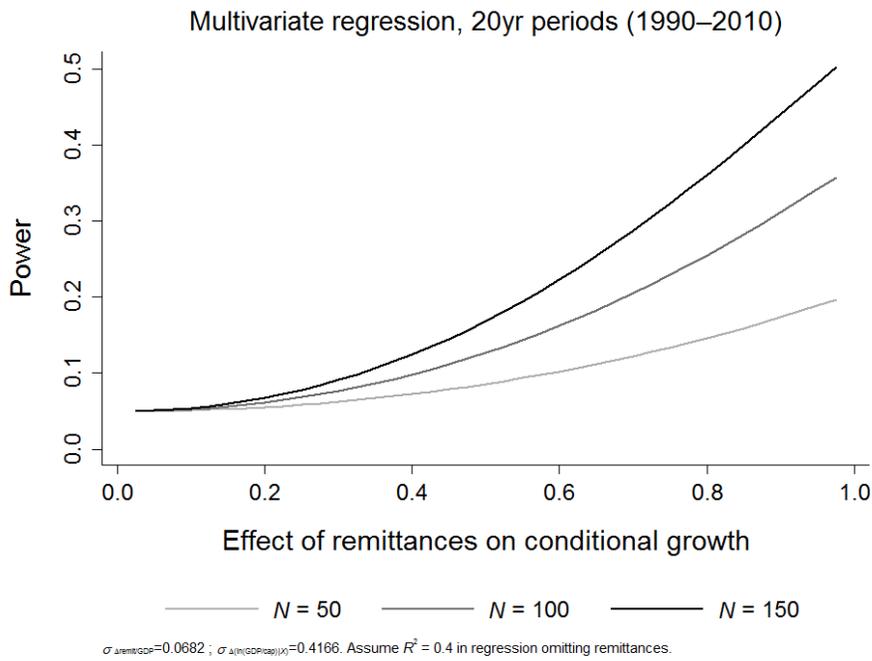
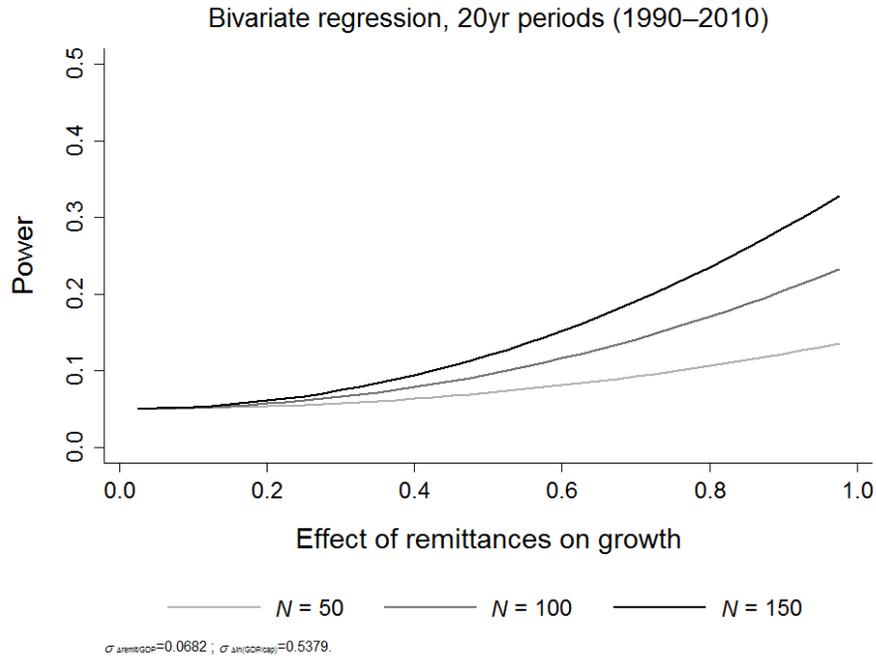


Figure 10: Power calculations with 10-year periods

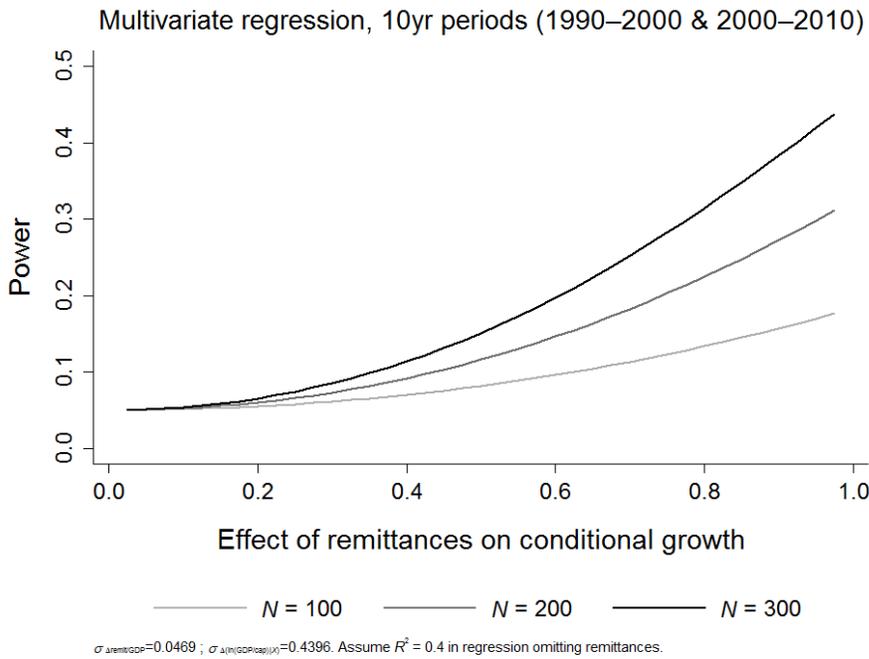
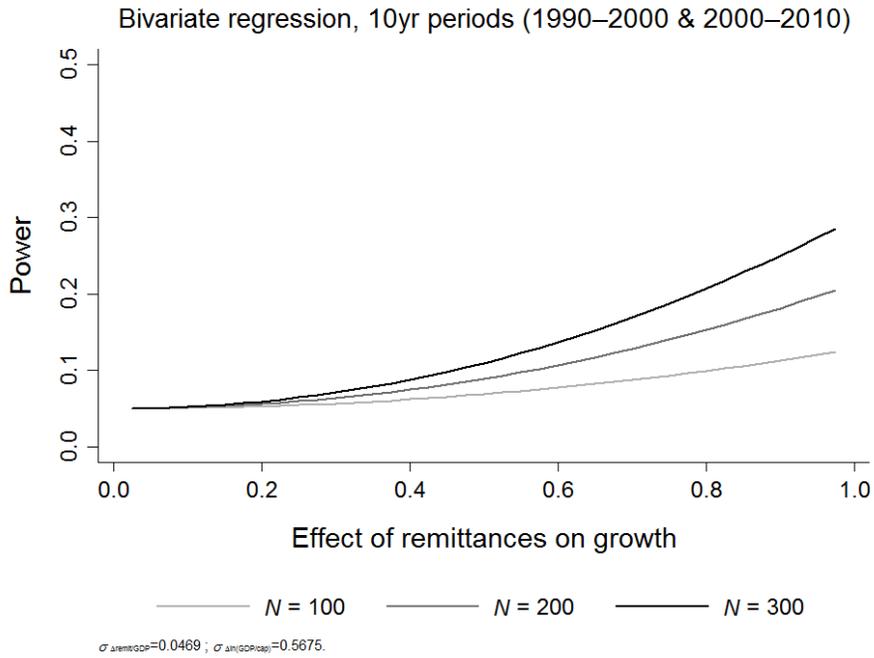


Table 1: Remittance Accounting

	Recorded Real Remittance Growth 1990-2010 (%)	Growth in Migrant Stock 1990-2010 (%)	Growth in Real Income in Main Destination 1990-2010 (%)	Share of Recorded Remittance Growth Accounted for (%)
All Developing Countries	557.8	49.9	47.3	21.7
<i>Countries with Largest Absolute Growth in Remittances</i>				
India	1269.6	96.1	-25.9	3.6
China	10318.3	114.5	47.4	2.1
Nigeria	120879.8	102.9	23.2	0.1
Philippines	790.4	117.8	23.2	21.3
Mexico	335.1	152.6	23.2	63.1
Bangladesh	750.4	33.3	130.5	27.6
Indonesia	2443.4	112.1	121.1	15.1
Pakistan	194.8	50.6	63.7	75.2
Egypt	77.5	61.5	63.7	212.3
Guatemala	2076.4	167.2	23.2	11.0
Sri Lanka	528.0	39.9	63.7	24.5
Colombia	397.1	121.6	247.5	168.7
Morocco	95.4	69.2	12.3	94.4
Dominican Republic	565.1	143.1	23.2	35.3
El Salvador	474.6	15.2	23.2	8.8

Notes: Share of Recorded Remittance Growth Accounted for is the share accounted for by growth in the migrant stock combined with the growth in real income earned in the main destination country for that country's migrants.

Table 2: Checking the Approximation that Migrant Income Growth Equals GDP Growth

	Nominal Total Household Income		Real Household Income		Real Income Growth (%)
	1990	2010	1990	2010	1990-2010
All Developing Country Migrants	14561	28455	24559	29298	19.3
Mexico	9442	17851	15926	18380	15.4
Nigeria	17063	39210	28778	40372	40.3
Philippines	18624	36743	31411	37832	20.4
Guatemala	10107	18570	17046	19120	12.2
El Salvador	9583	20829	16163	21446	32.7
Dominican Republic	10301	20525	17373	21133	21.6
US Real GDP Growth					23.2

Source: IPUMS database from 1990 US Census and 2010 ACS.

Table 3: Sensitivity of Remittance Accounting to Changes in the Share of Income Migrants Remit

Assumed Change in Share of Income Remitted	Additional Growth in Remittances Due to Change in Share (%)	Total Share of 1990 to 2010 Remittance Growth Accounted for (%)
-25%	-55.2	11.8
-10%	-22.1	17.7
-5%	-11.0	19.7
0%	0	21.7
5%	11.0	23.6
10%	22.1	25.6
25%	55.2	31.6

Table 4: Descriptive statistics of growth and remittances data for power calculation

Variable	Periods	<i>N</i>	Mean	Std. Dev.	Min	Max
$\Delta \ln(\text{GDP}/\text{cap.})$	20 year	177	0.521	0.538	-0.884	3.415
$\Delta(\text{remit}/\text{GDP})$	20 year	100	-0.003	0.068	-0.509	0.146
$\Delta \ln(\text{GDP}/\text{cap.})$	10 year	373	0.267	0.568	-1.535	1.957
$\Delta(\text{remit}/\text{GDP})$	10 year	244	0.002	0.047	-0.343	0.258

Appendix

A. Derivations

Equation (7): First, $\frac{dY}{d\rho} = \frac{dY}{dL^*} \frac{dL^*}{d\rho} = \frac{dY/dL^*}{d\rho/dL^*} = \frac{dY/dL^*}{\theta w^*}$. Second, $\frac{dY}{dL^*} = A \left(\frac{\partial F}{\partial K} \frac{dK}{dL^*} + \frac{\partial F}{\partial L} \frac{dL}{dL^*} \right) + F \frac{\partial A}{\partial L^*}$
 $= A \left(r \frac{dK}{d\rho} \frac{d\rho}{dL^*} + w(-1) \right) + F \frac{\partial A}{\partial L^*} = A \left(r \frac{dK}{d\rho} \theta w^* - w \right) + F \frac{\partial A}{\partial L^*}$. Combine these two results.

Equation (8): $C(Y) \equiv (1 - s)Y \rightarrow C_\rho = (1 - s)rK_\rho$. Then substitute into $C_\rho = 1 - \mu - s$ to get $K_\rho = \left(1 - \frac{\mu}{1-s}\right) \frac{1}{r}$. Substitute this into (7) and assume $A_{L^*} \equiv 0$.

B. Data sources

B.1. Macro data

Macro data are sourced from the World Development Indicators of the World Bank and was downloaded on February 15, 2014. Data in current US dollars was converted to real 2011 US dollars using the December value of the Consumer Price Index provided by the US Bureau of Labor Statistics <ftp://ftp.bls.gov/pub/special.requests/cpi/cpiiai.txt>

Aid is defined as Net Overseas Development Assistance (ODA) and Official Aid Received. Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients.

Foreign Direct Investment is net inflows of investment to acquire a lasting interest in or management control over an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvested earnings, other long-term capital, and short-term capital, as shown in the balance of payments.

Gross Domestic Product (GDP) per capita is gross domestic product divided by midyear population.

Remittances: Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities.

Private Debt and Portfolio Equity is the sum of net inflows of portfolio equity, portfolio investments in bonds, and commercial banks and other lending. Portfolio equity includes net

inflows from equity securities other than those recorded as direct investment and including shares, stocks, depository receipts (American or global), and direct purchases of shares in local stock markets by foreign investors. Bonds are securities issued with a fixed rate of interest for a period of more than one year. They include net flows through cross-border public and publicly guaranteed and private nonguaranteed bond issues. Commercial bank and other lending includes net commercial bank lending (public and publicly guaranteed and private nonguaranteed) and other private credits.

Migrant stocks: International migration stock data by origin and destination for the years 1990, 2000 and 2010 was obtained from the United Nations Population Division <http://esa.un.org/unmigration/TIMSO2013/migrantstocks2013.htm?msdo> [downloaded February 15, 2014]

Migrant income: Data on incomes of migrants from developing countries living in the United States used in Table 2 are constructed from the 1990 US Census and 2010 American Community Survey, using the public use data of Ruggles et al. (2010).

B.2. Micro data

Micro data on remittances were constructed from national household surveys. In each case remittances per capita was constructed by using survey weights (where available) to obtain nominal remittances per capita in local currency. When the period of recall for remittances differs from one year, the data are converted to an annual amount. This was then converted into current US dollars using the average exchange rate for the year from the World Bank World Development Indicators, and then into real 2011 US dollars using the December value of the Consumer Price Index as was done for the macro data.

El Salvador: We use the annual *Encuesta de Hogares de Propósitos Múltiples* (EHPM) 1999–2008.

Ghana: We use rounds 1 through 5 of the Ghana Living Standards Survey (GLSS), conducted in 1987, 1989, 1992, 1999, and 2005.

Honduras: We use the *Encuesta permanente de hogares de propósitos múltiples* (EHPM) for the years 1997 through 2010, excluding 2000 and 2008 (data unavailable).

Jamaica: We use data from the Jamaica Survey of Living Conditions for the years 1991 to 2000 (excluding 1995).

Mexico: We use the *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH), which was conducted for the years 1984, 1989, and then biannually from 1992 to 2010.

Pakistan: We use data from the Pakistan Household Income and Expenditure Surveys for the years 1996-97, 1998-99, 2001-02, 2005-06, and 2007-08 as tabulated in Irfan (2011).

Paraguay: We use data from the *Encuesta Permanente de Hogares* (EPH) for the years 1999 and annually from 2002 through 2011.

Peru: We use the *Encuesta Nacional de Hogares* (ENH) annually 1999–2010.

Turkey: We use harmonized datasets based on the Household Income and Consumption

Expenditures Survey, taken from the World Bank databank for the years 2002, 2006, 2008, 2009 and 2010.

C. Alternative measure of remittances

The macro measure of remittances used throughout this paper is drawn from the World Bank’s World Development Indicators, which comprises both personal transfers and compensation of employees. There is debate in the literature as to whether this is the best measure, with Chami et al. (2008, p. 4) recommending that macroeconomic research use solely the “workers’ remittances” line of the Balance of Payments, because it alone “most closely conforms to the notion that researchers and policymakers have in mind when discussing remittance flows: periodic, unrequited, nonmarket transfers between residents of different countries.”

If this measure of remittances is used instead, the results in the main text barely change. Appendix Table A1 carries out the same analysis as Table 1 using only workers’ remittances (line 2391) only from the IMF Balance of Payments Statistics, accessed April 9, 2014 and deflated to 2011 dollars with the US Consumer Price Index. The measure thus omits employee compensation. With this alternative measure, the growth of recorded real remittances to all developing countries 1990–2010 was 561.6% (Table A1) instead of the 557.8% (Table 1). The fraction of remittance growth accounted for by growth in migrants stocks and real incomes at the destination accounted becomes 21.5% (Table A1) instead of 21.7% (Table 1).

Appendix Table A1: Remittance Accounting Using Workers' Remittances

	Recorded Real Remittance Growth 1990-2010 (%)	Growth in Migrant Stock 1990-2010 (%)	Growth in Real Income in Main Destination 1990-2010 (%)	Share of Recorded Remittance Growth Accounted for (%)
All Developing Countries	561.6	49.9	47.3	21.5
<i>Countries with Largest Absolute Growth in Remittances</i>				
India	1276.8	96.1	-25.9	3.5
Nigeria	119757.0	102.9	23.2	0.1
China	9649.5	114.5	47.4	2.2
Mexico	421.9	152.6	23.2	50.1
Philippines	3684.4	117.8	23.2	4.6
Bangladesh	749.3	33.3	130.5	27.6
Indonesia	2376.8	112.1	121.1	15.5
Pakistan	194.1	50.6	63.7	75.5
Egypt, Arab Rep.	77.5	61.5	63.7	212.3
Guatemala	2283.7	167.2	23.2	10.0
Sri Lanka	526.9	39.9	63.7	24.5
Colombia	399.9	121.6	247.5	167.5
Morocco	95.4	69.2	12.3	94.4
El Salvador	485.9	15.2	23.2	8.6
Honduras	3085.6	264.3	23.2	11.3

Notes: Share of Recorded Remittance Growth Accounted for is the share accounted for by growth in the migrant stock combined with the growth in real income earned in the main destination country for that country's migrants.