

Follow the Money: Remittance Responses to FDI Inflows

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Abstract

Migrant networks are an important catalyst for promoting FDI flows between countries. Migrants also send increasingly large remittances to their home countries. This paper considers how these two capital flows are related, specifically examining how remittance flows respond to the amount of FDI inflows to a country. Using a panel of 118 countries over 1980-2010, we estimate a random effects model and find a positive and significant effect of FDI flows on remittances, while controlling for other standard determinants of remittance flows. We account for the potential endogeneity of FDI to remittances by utilizing a two-stage Instrumental Variables approach. These findings are suggestive of a desire among the emigrant community to invest their income earned abroad in their home countries. We find the relationship is strongest for low income countries, highlighting the importance of remittances as a source of investment capital in these countries.

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1. Introduction

Remittances to developing countries in 2013 totaled an estimated \$404 billion (World Bank, 2015). This amount is equivalent to roughly three times the amount dispersed in official development assistance and approximately two-thirds the amount of foreign direct investment (FDI) flows to developing countries. In some countries, remittances represent the largest single source of foreign exchange (World Bank, 2015). Remittances have been widely regarded as a potential source for development financing because they are direct transfers to households and tend to be more stable than other capital flows (Ratha, 2003). While the size of remittance flows depend on migrant networks abroad, such networks have also been shown to stimulate other forms of international capital flows, in particular FDI (Javorcik et al., 2011). Thus, we might expect FDI and remittances to be complementary in nature, providing development finance for those countries sending the largest number of migrants abroad. Conversely, if remittances and FDI are competing for investment opportunities migrants may reduce their remittances in the face of greater FDI flows. Despite a growing literature into the causes and effects of remittances, relatively little research has considered the relationship between remittances and other capital flows.

We focus on the relationship between remittances and FDI inflows to establish whether remittances and FDI inflows are complements or substitutes. Using a wide range of countries across the income spectrum, we aim to understand the relationship between the two flows, since policies directed toward attracting FDI may also affect remittances. If remittances and FDI are substitutes, then increases in FDI may crowd out remittances, potentially adversely impacting the home country and its prospects for growth. In such a case, policy makers with a desire to increase domestic investment might be better served by policies designed to increase local access to investment capital. If, on the other hand, remittances and FDI are complements, then policies

designed to improve the investment climate and to create opportunities in the domestic economy can attract both FDI and remittances. From a development perspective, channeling migrant earnings toward investment (either directly toward domestic investment or via FDI flows) may represent the best path for such earnings to have a positive impact on the receiving economy. By contrast to remittances, official development assistance is disbursed to governments rather than directly to individuals. In our analysis, we explore how aid may impact the relationship between FDI and remittances. However, aid is only received by a subset of countries and may respond more to political considerations (Alesina and Dollar, 2000) than to migrant networks abroad. Thus, we focus first on the FDI and remittance link before introducing aid into the analysis.

We explore the relationship between remittances and FDI on a panel of 118 countries over 1980-2010 using a random effects Instrumental Variable (IV) model, where we focus on how aggregate FDI inflows impact the amount of remittance inflows, both measured as a percentage of GDP. Recognizing that endogeneity is a concern we estimate a two-stage IV model using lagged values of FDI inflows as instruments. The IV method allows us to address endogeneity issues related to reverse causality, helping us to identify the direction of the relationship between the two flows. Controlling for a standard set of variables that others have found to be important for the flow of remittances across borders, we find a positive relationship between FDI and remittance flows, indicating a complementarity between the two. We find the relationship is strongest for low income countries, highlighting the importance of remittances as a source of investment capital in these countries. Thus, remittances may provide a mechanism through which emigrants can capitalize on market opportunities in their home countries.

The paper proceeds as follows. In Section 2, we describe the previous literature on the motivations to remit, along with a discussion of the interrelationship between different forms of

capital flows across countries. In section 3, we develop the empirical approach and describe the data. Section 4 contains the main results and discussion with concluding remarks and policy considerations in Section 5.

2. Motivations to remit and interrelated capital flows

Our primary question in this study is whether inward FDI to a country attracts remittance flows or acts as a substitute capital flow. That is, are migrants following the lead of the international investment community and channeling their own funds toward investment opportunities in their home countries, or is FDI replacing or crowding out migrant investment? Ex ante, the direction of the relationship is unclear, with countervailing impacts depending on the motivations driving remittances.

A first step in understanding the relationship between remittances and FDI is understanding the motivations to remit. Unlike FDI inflows, remittances are not necessarily determined by a profit motive. Lucas and Stark (1985) outline three potential motivations for sending remittances: pure altruism, pure self-interest, and tempered altruism or enlightened self-interest. Remittances based on pure altruism are typically linked to increased consumption expenditures of receiving households. Remittances based on self-interest of the migrant are more likely to be linked to domestic investment or saving behavior. Tempered altruism or enlightened self-interest lies somewhere between the two. For instance, a migrant may send remittances to increase family members' consumption (altruistic), with the underlying motivation being that they wish to maintain a good reputation in the community should they decide to eventually return home (self-interest). Subsequent empirical research has found evidence of all three motivations under varying

circumstances.¹ For the purposes of this study, we are particularly concerned with the relationship between remittances and investment, where the self-interest motive may be more important.

Numerous studies have explored the extent to which remittances are invested by receiving households. Microeconomic studies have found that remittances are used to increase land holdings, purchase livestock, and invest in small businesses (Adams, 1998; Wouterse and Taylor, 2008; Yang, 2008; Woodruff and Zenteno, 2007). Macroeconomic studies exploring the relationship between remittances and economic growth have found remittances to be pro-cyclical in countries with low levels of financial development (Giuliano and Ruiz-Arranz, 2009; Mundaca, 2009). The fact that remittance inflows increase during periods of economic growth may indicate that remittances are being channeled toward investment in the absence of formal credit markets, thus overcoming liquidity constraints. Microeconomic evidence also supports this claim. Coon (2014) matches household survey data with community-level financial development indicators and finds that Mexican households in communities without banks are significantly more likely to use remittances for asset accumulation and to invest in productive activities.

Rather than remittances being used to overcome liquidity constraints, Clemens and Ogden (2014) argue instead that migration is more likely to arise due to a lack of investment opportunities in the home community, and migration represents the most profitable use of their resources. While it is indeed true that households may choose to migrate because migration yields the highest return on investment, it is also true that households are limited in their ability to continue to invest in migration by the number of household members who are able to migrate. Thus, given that migration has occurred, as investment opportunities arise in the home community, remittances may be a more attractive method of financing these investments. It is through this channel that we

¹ Hagen-Zanker and Siegel (2007) provide a comprehensive review.

may expect to see complementarity between remittances and FDI. As market opportunities arise in a particular country both foreign investors and migrants may channel capital towards these investments.

Previous literature has shown that migration and FDI are positively related. In a study that accounts for the endogeneity of FDI to migrant stocks, Javorcik et al. (2011) show that previous emigration from a particular country to the US is positively related to FDI flows from the US to that country. Leblang (2010) shows a similar result using a broader range of source and destination countries, with both portfolio capital flows and FDI responding positively to the number of migrants from those countries. Kugler et al. (2013) use a gravity model framework to show that migration stimulates bilateral financial flows, with an emphasis on cross-border loans. This previous literature argues that migrants stimulate financial flows by reducing information asymmetries across borders, leading to lower communication and transaction costs. As such, this literature largely portrays migrants as facilitators to FDI, opening the channel for others to take advantage of market opportunities in their countries of origin. Of course, this is not to say that emigrants are necessarily excluded from direct investment in their home countries. To the extent that emigrants have a desire to invest in their home country, policy briefs by Terrazas (2010) and Rodriguez-Montemayor (2012) explore why “Diaspora Direct Investment” (DDI) may, in fact, be more desirable than other investment inflows. Emigrants investing in their home countries often have country-specific knowledge relating to culture and business climate that may make their ventures more successful than similar projects led by foreign investors. Also, since they have a sentimental attachment to their home countries, they may be less inclined to disinvest during economic downturns, which can help reduce economic instability. Although Terrazas (2010) and

Rodriquez-Montemayor (2012) provide descriptive examples of the types of DDI that occur, data limitations make it difficult to measure the extent to which DDI occurs.

While FDI and DDI are important sources of capital for exploiting economic opportunities, the majority of international migrants, particularly those from less developed countries, likely lack access to the large amounts of capital required to undertake large-scale, long-term investments typically associated with FDI. However, market opportunities come in all shapes and sizes and not all investment opportunities require large amounts of capital. Therefore, in addition to channeling FDI and DDI to their home countries, migrants may also exploit market opportunities for their own benefit by funding small-scale investments vis-à-vis remittance income.

Assuming that improved economic conditions foster both large and small market opportunities simultaneously, it follows that FDI and remittance inflows serve to complement one another. Additionally, an increase in employment and income resulting from FDI can increase demand for goods and services in the local economy, further increasing investment opportunities for the diaspora, who increase remittances in response (i.e., via the self-interest motive to remit). Along similar lines, increases in FDI can serve as a signal or provide validation that investment opportunities are on the rise. On the other hand, if remittances are being used to overcome capital constraints, FDI inflows may relieve those constraints, thereby reducing the flow of remittances. Similarly, if remittances are compensatory in nature (i.e., related to the altruistic motive to remit), an increase in employment and income associated with an increase in FDI would reduce the demand for remittances. To tease out the relationship between remittance flows and FDI flows, we use aggregate data to look for broad trends in terms of the response of remittances to FDI flows.

Within the growing literature on the relationship between remittances and capital flows, the majority of these papers explore the flows' impact on some other variable. For instance,

Hossain (2014) examines the extent to which both FDI and remittances impact domestic savings rates, showing that remittances tend to displace domestic savings. Wang and Wong (2011) examine how inward FDI and remittances affect out-migration. While they find that FDI reduces out-migration among the more educated population, their study stops short of exploring how that might affect future remittance streams. Nwaogu and Ryan (2015) examine the impact of FDI, foreign aid, and remittances on economic growth in developing countries of Africa, Latin America and the Caribbean but do not examine how the different capital flows may affect each other. Others (e.g., Selaya and Sunesen, 2012) focus on the relationship between aid and FDI, but leave out any consideration of remittances.

In one of the few studies to consider correlations between remittances and other capital flows, Buch and Kuckulenz (2010) find no significant relationship between remittances and private capital inflows for 87 developing countries between 1970 and 2000. They do find, however, a positive correlation between remittances and official capital inflows. They empirically examine the determinants of each of these three individual capital flows separately: remittances, private capital flows, and official development assistance. However, they exclude the alternative flows in the set of possible determinants for each. Thus, it is unclear whether and how one flow is affecting the others. Mallay and Yogo (2011) examine the relationship between FDI, aid, and remittances but only focus on a panel of 33 “fragile states” over the period between 1995 and 2008. In a framework similar to ours, they show that FDI complements remittances while aid substitutes for remittances. We take this question further by focusing on the relationship between FDI and remittances, while also taking account of official capital flows, for a larger set of countries across the income spectrum.

Basnet and Upadhyaya (2014) hypothesize that remittances lead to increases in human capital, which in turn attracts FDI. Their results, however, show that remittances do not tend to drive FDI flows. On their sample of 35 middle-income countries between 1980 and 2010, they find no significant effect of lagged remittances on FDI. Conversely, Garcia-Fuentes et al. (2016) find that remittances may influence FDI flows to Latin American and Caribbean countries. In our study, we take seriously the possibility that FDI may respond to prior migration and to the amount of remittance flows. Consequently, we first consider the direction of causality between FDI and remittances using Granger causality tests. We then examine the relationship between these two capital flows by explicitly modeling the impact of FDI flows on remittance flows. We also ask how official development assistance may impact remittances. Importantly, adding aid flows to our regressions does little to change the relationship between FDI flows and remittances. Thus, while we consider the role of official development assistance, we find that the important relationship is between remittances and FDI.

3. Empirical Approach and Data

Our primary question of interest is whether aggregate inward FDI flows and inward remittance flows are related for country i . To get at this question, we employ an unbalanced panel of 118 countries for the years 1980-2010 to estimate the following model

$$R_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 Emigrant_i + \Gamma Z_{it-1} + \Phi X_{it} + \epsilon_{it} + u_i \quad (1)$$

where R_{it} is the log of remittances received by country i as a percentage of GDP in year t . FDI is the log of net FDI inflows to country i in year t as a share of GDP. *Emigrant* is the emigrant stock in country i as a share of the population. Z is a vector of variables related to the degree of openness of each country and is measured by trade and financial openness. We include lagged measures of

capital account and trade openness since remittances are likely to be affected by the ability to send both capital and goods across borders. X_{it} is a vector of additional control variables that have been shown by previous literature to be the primary determinants of remittances. Several studies have examined the macroeconomic determinants of remittance flows, primarily to explore the extent to which domestic macroeconomic policy can increase the inward flow of remittance income. We use this previous literature to specify the baseline determinants of remittances, which we use as control variables to capture the marginal impact of FDI inflows on remittances. Our main set of determinants (X_{it}) of remittance flows include measures of home and host country income (Freund and Spatafora, 2008; Adenutsi, 2014), as well as human capital and age dependency (Buch and Kuckulenz, 2010), political stability (Adams, 2009), and the level of financial development (Guiliano and Ruiz-Arranz, 2009; Mundaca, 2009) in the country of origin.² Our model also includes an error term, ϵ_{it} , and a random effect, u_i , specific to country i . Thus, this model extends the previous literature to focus on the role that FDI inflows play in encouraging or discouraging remittance inflows.

Prior studies have shown that migrant networks (which are highly correlated with remittances) encourage FDI (e.g., Javorcik et al., 2011; Leblang, 2010). Thus, we must first establish that causality runs from FDI to remittances before we can place remittances as the dependent variable. To identify the direction of causality we employ a Granger (1969) style

² Others have also considered money supply (Vargas-Silva and Huang, 2006) and interest rate differentials (El-Sakka and McNabb, 1999; Aydas et al., 2005) but these do not appear to be the main determinants. We also considered the effects of the real exchange rate on remittances (Alleyne et al., 2008; Adenutsi, 2014). Those results show that remittances are negatively related to the real effective exchange rate. As the home country faces real currency appreciation, emigrants send less since their remittances lose value in the home country. Inclusion of this control variable, however, resulted in a loss of approximately half of our observations but did not significantly alter the relationship between FDI and remittances. Thus, we present findings without the real exchange rate included, even though the exchange rate could certainly impact the timing and size of remittances. These results are available upon request.

causality test utilizing the following VAR framework adapted to a panel setting as proposed by Holtz-Eakin, et al. (1988):

$$R_{\{i,t\}} = \alpha_i + \sum_{k=1}^p \gamma_k R_{\{i,t-k\}} + \sum_{k=1}^p \beta_k FDI_{\{i,t-k\}} + v_{i,t} \quad (2)$$

and

$$FDI_{\{i,t\}} = \alpha_i + \sum_{k=1}^p \gamma_k FDI_{\{i,t-k\}} + \sum_{k=1}^p \beta_k R_{\{i,t-k\}} + v_{i,t} \quad (3)$$

We can establish causality by rejecting the null hypothesis that causality is not present if

$$H_0: \beta_k = 0, \forall k = 1, \dots, p \quad (4)$$

in favor of the alternative hypothesis that for at least one value of k ,

$$H_a: \beta_k \neq 0 . \quad (5)$$

As we show below, these Granger causality tests indicate that we can reject the null of non-causality for both Equations (2) and (3). Thus, causality appears to run both from FDI to remittances, and from remittances to FDI. Consequently, while we are able to assign remittances as the dependent variable, we must control for endogeneity due to the potential for reverse causality.

We estimate the model in equation (1) first using a random effect GLS model as a baseline. We then control for the endogeneity of FDI to remittances by estimating a two-stage IV model using lagged values of FDI inflows as instruments. Recognizing that capital flows may also be related to GDP, we also estimate a model controlling for potential endogeneity of both FDI and GDP. The results are robust to these specification changes. Additionally, we provide specification test results below, which indicate both that the random effects model is appropriate and that the instruments used are valid.

Data for this study are collected from several sources. Data for remittances and emigrant stocks are taken from the World Bank's Migration and Remittances Fact Book (2011). Our

measure of capital account openness is the KAOPEN index developed by Chinn and Ito (2006). Human capital data are from Barro and Lee (2013). Our measure of political stability comes from the Major Episodes of Political Violence (MEPV) and Conflict Regions database (Marshall, 2016). All remaining data come from the World Bank's World Development Indicators (2012).

Remittances to country i (R_{it}) are the primary focus of the regression analysis. Aggregate remittance inflows to each country i over each year are reported in dollars. To be able to compare the magnitude of flows across countries, we normalize remittance flows as a share of GDP.³

Our key explanatory variable is the FDI inflows that country i receives from the rest of the world. Net inflows of FDI are calculated as FDI inflows to country i (i.e., net inward direct investment from the rest of the world to country i). We are interested in how much FDI is flowing into the country and thus we do not account for FDI outflows (i.e., outward direct investment from country i). Yet, the net FDI inflows variable may be negative, which can be described as the reversal of previous flows. To account for negative values of FDI we take the log of the absolute value of net FDI inflows and use the negative of this value for any observation with $FDI < 0$.⁴

One of the primary determinants of remittances is the number of migrants from country i that live abroad. The accumulated emigrant stock, denoted $Emigrant_i$ above, is measured as the number of people at the end of the year that have migrated abroad from country i . We normalize the emigrant stock by measuring it as a share of the population. The emigrant stock data are only available on a decennial basis. Thus, our measure of emigrant stock as a share of the population is taken at the beginning of each decade, i.e. $Emigrant_{i,1980} = Emigrant_{i,1981} = \dots =$

³ Since remittances and FDI both tend to grow over time in levels, normalizing these variables to shares of GDP has the added benefit that they are each stationary in this form. Normalizing these variables instead as per capita measures (as in Adams, 2009) provides similar results.

⁴ We also run the model using just the log of positive values of net FDI inflows, with similar results overall.

$Emigrant_{i,1989}$. The lagged nature of this variable may mitigate concerns regarding the correlation of prior migration and FDI in the regression equation. Note that each of these key variables is an aggregate measure for country i , so that the emigrant stock may be located in any number of host countries. Similarly, the net FDI inflows and remittance flows may be coming from any country into country i .

Openness to international trade and financial flows can impact both FDI and remittances. The ability to send financial capital across borders is given by capital account openness as measured by the Chinn and Ito (2006) KAOPEN measure. Trade openness is calculated as exports plus imports relative to GDP and serves as a general measure of a country's openness. Capital account openness and trade openness are expected to be positively related to remittances as the flow of funds may be less restricted under higher openness measures. We use one-period lagged values of the openness measures.

Following the previous literature on remittances, the other control variables in X_{it} include the log of GDP per capita in the home (remittance receiving) country and the log of GDP per capita in the main destination (host) country for each remittance-recipient country's emigrants. GDP of the home country is measured on a per capita (PPP) basis each year. GDP of the main host country is the GDP per capita (PPP) of the country with the largest emigrant population at the beginning of the decade. We also consider a squared GDP per capita term to capture any nonlinearities. Remittances may follow an inverted-U pattern with respect to home country income. This is consistent with the theory of the "migration hump" (de Haas 2010). That is, extremely poor countries may lack the ability to send migrants abroad, and may lack the necessary infrastructure (postal service, banking systems, wire transfer agencies, etc.) to receive remittances. As incomes

rise, these constraints are relaxed and remittances increase. Eventually incomes become large enough that migration and remittances become less necessary, and remittances decline.

Several previous studies explore how remittances react not only to the level of economic activity, measured by GDP per capita, but also to the business cycle, measured as changes in GDP per capita, in the home country. The core question of this line of research is whether remittances are used for consumption (altruistic motive) or investment (self-interest motive). If remittances fall as GDP increases, then, it is argued, remittances are compensatory in nature. Thus, as incomes increase, fewer remittances are needed to subsidize (or cushion) consumption. If, on the other hand, remittances increase with GDP, then that is an indicator that remittances are pursuing investment opportunities. Empirical evidence on these questions is somewhat mixed. Chami et al. (2005), using a sample of 113 countries over a 28 year period, show that remittances tend to decline with economic growth, which would indicate remittances are compensatory in nature. On the other hand, Giuliano and Ruiz-Arranz (2009) and Mundaca (2009) find that remittances tend to be pro-cyclical in countries with lower levels of financial development, and are therefore likely pursuing investment opportunities. Freund and Spatafora (2008) find that after controlling for transaction costs of sending remittances, remittances tend to increase with home country income, thus providing further evidence that remittances are pro-cyclical in nature. Adenutsi (2014), using a sample of 36 Sub-Saharan African countries over 30 years, finds that rising income in the home country leads to an increase in remittances from permanent migrants but a decrease in remittances from temporary migrants. These findings seem to indicate that permanent migrants remit for self-interest (investment) purposes, while temporary migrants tend to be more altruistic. We account for business cycle activity in the home country by including the first difference of home country GDP per capita. We also include the first difference of host country GDP per capita to account for

business cycle effects on emigrant remittances in the main host country. GDP measures in the home and host countries are measured in Purchasing Power Parity (PPP) terms.

As a broad measure of domestic financial development, we also include domestic credit to the private sector by banks, measured as a percentage of GDP. The effect of domestic financial development on remittance flows is uncertain in the empirical literature. On the one hand, remittances can be used to overcome liquidity constraints in the home country, and thus remittances tend to decline with financial development (Giuliano and Ruiz-Arranz, 2009; Mundaca, 2009; Ramirez and Sharma, 2009). On the other hand, increased financial development can reduce the transaction costs of sending remittances, thereby increasing remittance flows (Freund and Spatafora, 2008; Ezeoha, 2013). Adenutsi (2014) again finds different effects for temporary and permanent migrants, with temporary migrants remitting less and permanent migrants remitting more as access to bank credit increases.

As a measure of human capital we include the share of the origin country population with a tertiary education. This measure serves as a proxy for migrants' earning potential in the host country. The expected effect is unknown, *ex ante*. While more highly educated migrants can earn more and thus send more home (Buch and Kuckulenz, 2010), migrants with higher education levels may be less likely to return home, thereby reducing the incentive to send remittances (Rapoport and Docquier, 2004; Adams, 2009).

Another contributing factor to the desire to remit home is the degree of political stability. Higgins, et al. (2004) suggest that when political risk rises, migrants that remit for investment purposes will become more uncertain in their ability to repatriate investments from their home countries, and become fearful of expropriation, thus reducing the desire to remit. To control for political instability we include an index of political violence. We use the Major Episodes of

Political Violence (MEPV) total acts of violence index, which sums magnitude scores for all episodes of civil, ethnic, and international violence and wars occurring within a country. The index ranges in value from 0 to 10. A higher value of the index indicates more intense violence, hence more instability, and is expected to reduce remittance flows.

To control for the altruistic motivation to remit we include the age dependency ratio, defined as the share of the population ages 0-14 and 65 and over relative to the working aged (ages 15-64) population, of the home country (similar to measures in Buch and Kuckulenz, 2010; Adams, 2009). If migrants are altruistic, then we would expect a higher age dependency ratio to lead to an increase in remittances.

Finally, we include two time dummies to control for periods of financial crises that may affect global remittance flows. The first is for the Asian financial crisis during 1997-1998. The second is for the Great Recession from 2008-2010.

Our data set comprises an unbalanced panel of 118 countries over 1980-2010, with an average of 22.1 observations for each country. We first present the full sample of countries to examine the overall implications of FDI inflows for remittance inflows. We then consider the possibility that the relationship between remittance flows and FDI may differ across broad income classifications. In particular, migrant characteristics may vary systematically across income groups, which could, in turn, affect the motivations to remit, thus altering the relationship between the two flows. To explore this possibility we separate the countries in our sample into four income groups (low, lower-middle, upper-middle, and high income) along income classifications as defined by the World Bank. Since both incomes and definitions of income groups can vary from year to year, in order to maintain a stable grouping we define a country's income group as the

income group to which they were assigned in the year 2000.⁵ Appendix Table A1 provides a list of countries by income group.

Summary statistics for the 3 key variables of interest (remittances, FDI flows, and emigrant stock) are reported in Table 1 as averages over countries and years, with full summary statistics in Appendix Table A2. Table 2 provides correlations between these 3 variables, along with the two openness measures. We show these summary statistics and correlations for the full sample of countries along with countries grouped by income. Remittances as a percentage of GDP range from nearly zero (0.00003% for Uruguay in 1983) to as much as 106% (Lesotho in 1982). However, 90 percent of the observations on remittances range from 0.03% to 13.1% of GDP. Similarly, net inflows of FDI range from -1.9% to 51.9% of GDP with 90 percent of the observations between -0.002% and 9.6% of GDP. There is a great deal of variation across income groups with higher remittance shares in the low income and lower-middle income countries. These countries tend to receive less FDI flows as a share of GDP than the upper-middle income countries. We also see variation in the raw correlations between FDI and remittances, with a positive correlation in all country groups (except the high income group which shows a small negative correlation) and the highest correlation for the upper-middle income countries. We explore these correlations further by conditioning our results for the relationship between FDI and remittances on the other standard determinants of remittances.

4. Results

4.1 Causality

⁵ Grouping countries by income groups based on 1990 or 2010 income provides similar results regarding the relationship between FDI flows and remittances. Results available upon request.

Before we can estimate the model in equation (1) we first need to establish that causality runs in the direction from FDI to remittances. Table 3 reports results of the causality test outlined by equations (2)-(5) for various lag lengths.⁶ Column 2 presents the Wald statistics for the test that FDI causes remittances. Choosing the overall model with the highest R-squared to determine optimal lag length indicates three lags is the preferred specification. We can reject the non-causality null hypothesis at the 5% level. We also note that the non-causality hypothesis is rejected for all lag lengths. Column 4 indicates that causality also runs in the direction from remittances to FDI. Thus, while these results demonstrate that remittances can be placed as the dependent variable in equation (1), the results also show that it is necessary to control for the potential for reverse causality in our model. We utilize a number of specifications below to address concerns regarding reverse causality.

4.2 Baseline Results

The main results of our estimation are presented in Table 4a, where we focus on the relationship between FDI inflows and remittance inflows to country i . Column 1 reports the naïve results of the random effects estimation. The coefficient for FDI is positive and significant. Furthermore, the Breusch-Pagan LM test indicates that we can reject the null that $u_i = 0$, confirming the presence of idiosyncratic effects at the country level. However, as mentioned above, the coefficient estimates of FDI are biased due to an endogenous relationship between remittances and FDI stemming from reverse causality. Columns 2 and 3 present estimates of the IV model, which controls for the endogeneity of FDI, and is thus our preferred specification. We show the first-stage results for these two regressions in Table 4b (with corresponding column

⁶ This test also requires that the variables being tested are stationary. We perform a Fisher-type ADF test and reject non-stationarity at the 1% level based on Choi (2001) modified z-statistics of 7.48 and 36.37 for remittances and FDI, respectively.

numbers), where the instruments are the lagged values of FDI flows relative to GDP. We use up to 3 lags of FDI as IV variables, using the Sargan-Hansen test to examine the validity of the instruments. In column 2 of Table 4a, the p-value corresponding to the Sargan-Hansen test statistic is 0.4624, indicating that we cannot reject the null hypothesis that the model is over-identified, confirming the validity of our instruments. We also perform a test for weak instruments following Stock and Yogo (2005). The Cragg-Donald Wald statistic of 41.68 rejects the null hypothesis of weak instruments. Additionally, results of the Hausman test for fixed versus random effects in column 2 fail to reject, indicating the random effects model is the appropriate specification. Using the random effects model we are able to add time-invariant regional dummies to the model, with the results of this specification presented in column 3.

The coefficient estimate on FDI in column 2 is significant and positive, and substantially larger than the coefficient in column 1, indicating that failing to control for endogeneity leads to results that are biased downward. Column 3 of Table 4a introduces a set of regional controls into the IV regression. The results are robust to the inclusion of the regional dummies, with a somewhat higher coefficient on the FDI measure in column 3 than in column 2. While the dummies for EAP (East Asia and the Pacific), LAC (Latin America and the Caribbean), and SSA (Sub-Saharan Africa) are all negative, only SSA is significant. The fourth regional dummy (MENA for the Middle East and North Africa) is positive, but not significant. Taken together, Table 4a shows that remittances and FDI tend to complement each other, suggesting that diasporas seek to capitalize on investment opportunities in their home countries.

Based on previous literature on the determinants of remittance flows across countries, the coefficients on the other control variables generally show the expected signs. Countries that are more open to trade and capital have higher remittances relative to GDP. Countries with larger

emigrant stocks have higher remittances as expected. The domestic financial development variable, domestic credit to the private sector by banks, is insignificant, which is consistent with mixed results in prior literature. An increase in political violence is associated with lower remittances, and a more educated labor force is associated with higher remittances. One unexpected result is that remittances appear to be negatively associated with the age dependency ratio. This finding is similar to that in Buch and Kuckulenz (2010) who argue that a higher number of dependents may limit migration and thus remittance flows. Remittance flows appear to have been largely unaffected by the Asian financial crisis, but we see a significant increase in remittances as a share of GDP during the Great Recession. This result, however, is more likely a result of GDP declines, rather than increases in remittances. In fact, global remittances fell slightly in 2009 (World Bank, 2011).

For the income control variables in X_{it} , we find that remittances are positively related to the level of GDP per capita and negatively related to squared GDP per capita, indicating that remittances follow an inverted U pattern with respect to home country income. However, the coefficients are only significant for the squared terms. We also find that remittances are positively related to the change in GDP per capita in columns 1-3. That is, remittance flows increase when the economy is growing, perhaps indicative of remittances flowing toward investment opportunities. However, results from the first stage, presented in Table 4b, indicate that the change in GDP per capita is also a significant predictor of FDI flows, along with prior FDI flows and openness. Thus, the pro-cyclical behavior of remittances found in previous literature (as in Freund and Spatafora, 2008) may emanate from the relationship between remittances and FDI. The international community appears to respond to increases in home country GDP by increasing FDI, with migrants then following suit to increase remittance flows.

We have explored different combinations of these control variables (in particular leaving out the squared GDP per capita term and the first-differenced GDP per capita term).⁷ The results for the FDI variables are robust to these different combinations of these control variables, indicating that the relationship between remittances and FDI flows are not sensitive to these inclusions. However, since FDI and GDP are closely related, we explore this relationship further by also controlling for potential endogeneity between these two variables.

Column 4 of Table 4a presents results of an IV model in which we instrument for both FDI and GDP variables in the first stage, adding lagged values of GDP and GDP² as instruments (Wooldridge, 2002). Our results are robust to this change, with our coefficient for FDI changing only slightly from 0.335 to 0.337.⁸

Taken together, the coefficient estimates in Table 4a indicate that the relationship between FDI and remittance flows is positive and in the range of 0.32 to 0.34. Given the log-log nature of the regressions, these estimates are interpreted as elasticities. Consequently, a 10% rise in FDI flows relative to GDP to country *i* is associated with a 3.2% to 3.4% increase in remittances relative to GDP. To put this in context, the median per capita income in our sample is \$5,603 PPP. If we assume that this country has average shares of remittances (3.4%) and FDI (2.9%), then per capita remittances and FDI would be approximately \$191 and \$162, respectively. For this median country, our results indicate that a 10% increase in FDI corresponds to approximately a \$20 increase in FDI per capita, which translates into a \$5.52 increase in remittances per capita.

⁷ These benchmark results are also robust to a larger sample (up to 157 countries) obtained by leaving out the controls on education, political violence, and age dependency. The results are also robust to the inclusion of time fixed effects in place of the two global shock variables.

⁸ Including a domestic interest rate (relative to LIBOR) as an instrument for FDI provides similar results to those presented in Table 4a, with a coefficient on FDI of 0.387. We do not include this variable in the results presented due to a substantial loss of observations.

4.3 Income Groups

The baseline evidence presented above indicates that remittances are positively related to FDI, perhaps indicating that remittances are being used for investment purposes. The degree to which migrants may alter their remitting patterns with respect to investment opportunities, as measured by FDI flows, is likely to vary with the level of economic development in their home countries. Thus, we consider four income groups based on World Bank classifications: low income, lower-middle income, upper-middle income, and high income countries. As noted above, we use the year 2000 classifications to group countries as shown in Appendix Table A1. Alternative years provide similar results.

Results of the IV Random Effects model, instrumenting for both FDI and GDP, by income groups are reported in Table 5.⁹ Low income countries show the largest remittance response to FDI inflows, with a 10% increase in FDI relative to GDP leading to a 7.19% increase in remittance flows relative to GDP. For lower-middle income countries, this response is smaller but still significantly positive, with a 10% increase in FDI inflows relative to GDP leading to a 2.65% increase in remittances relative to GDP. In upper-middle income countries the relationship between FDI and remittances is not significantly different from zero. The relationship is again significant in high income countries, and relatively high, with a 10% increase in FDI as a share of GDP leading to a 4% increase in remittances as a share of GDP.

⁹ We do not report the first-stage regression results for the estimation in Table 5 to conserve on space. The first-stage regressions use lagged FDI flows and lagged GDP and GDP² as instruments for FDI, GDP, and GDP². The reported Wald statistic rejects weak instruments at the 5% level with a maximal relative bias of 20% for low income countries, 10% for high income countries, and 5% for middle income countries. When we use only lagged FDI as an instrument in the first stage, then the Stock and Yogo (2005) critical values for rejecting weak instruments at the 5% level indicate a maximal relative bias of 10% for low income countries and 5% for the other country groups. In all cases, the coefficient values remain the same with either set of instrumental variables.

At first glance, the coefficient estimates in Table 4a appear to indicate a U-shaped pattern in the relationship between FDI and remittances across income groups (i.e., that FDI and remittances are complements in the lower income and high income countries but not in the middle income countries). However, since these coefficients measure relative percentage changes, much of this pattern arises due to variation in the base levels and relative importance of remittances and FDI across income groups. For example, in low income countries the average remittance-to-GDP ratio is much higher than that of high income countries (5.97% compared to 0.76%). Consider a country with the median income within each income group. Suppose that median country has the average remittance-to-GDP ratio and the average FDI-to-GDP ratio for that income group. The level of remittances then translates into per capita remittances of \$77 in the low income group and \$193 in the high income group. Similarly, the level of FDI translates into per capita FDI of \$34 in the low income group and \$718 in the high income group.

To further explore these differences we calculate the effect of a 10% increase in FDI on remittances in dollar terms for the median country in each income group assuming mean shares of remittances and FDI. We then normalize that to a \$1 increase in per capita FDI. We find that for the median low income country a \$1 increase in FDI per capita corresponds to a \$1.62 increase in remittances per capita. As investment opportunities arise and FDI flows increase into the country, the diaspora also seize on these opportunities by increasing their remittances at a rate of roughly one and a half times that of other international investors. Given that prior research has found that remittances are often invested in microenterprise (Woodruff and Zenteno, 2007) and that remittances can serve as substitutes for bank finance in the absence of formal credit markets (Coon, 2014) it is not surprising that the complementarity between remittances and FDI is strongest among low income countries. In addition to further highlighting the importance of remittances for

investment in low income countries, this result also shows that policies aimed at attracting FDI can also spur investment by the diaspora community.

The migrant response to changes in FDI is much smaller for the other groups. For the median lower-middle income country a \$1 increase in FDI per capita corresponds to a \$0.38 increase in remittances per capita. There is no significant change for upper-middle income countries, and the median high income country sees remittances per capita increase by \$0.11 for each \$1 increase in FDI. While we cannot identify directly what is driving this variation using the current data, it is possible that much of the response is due to variation in the types of investments being undertaken by migrants and the availability of alternative sources of capital. For example, an investor in a lower-middle income country may be able to secure a bank loan to start a small business by using remittance income as a down payment. In such a case the change in remittances need not be as large as if the entire enterprise were being financed through remittances. Similarly, migrants from high income countries may prefer to invest their savings in portfolio capital, rather than starting businesses in their home countries. If this is the case, then these purchases would not necessarily be recorded as remittance flows. While we leave the testing of these subtle sources of variation to further research, it is important to note that although the relationship between remittances and FDI does change across income groups, at no point do we find evidence that the two capital flows serve as substitutes. Thus, the variation provides evidence of the strength of the complementarity between the two flows.

There is also interesting variation in the results for the control variables across income groups. First, capital account openness appears to be significant only for middle income countries. Trade openness is positive and significant for all income groups except the high income group where it is insignificant. Remittances are positively associated with GDP for low income countries

and negatively associated with GDP for high income countries, consistent with the theory of the migration hump. The age dependency ratio has a positive impact on remittances to lower-middle income countries, but a negative impact on upper-middle income countries. Low income countries with a larger share of labor with tertiary education receive fewer remittances, while more education increases remittances in upper-middle and high income countries.

4.4 Official Development Assistance

Recent literature has examined how remittances may relate to other capital flows, such as Official Development Assistant (ODA). Broad correlations, as examined by Buch and Kuckulenz (2009), show that remittances and official capital flows are positively related. Kpodar and Le Goff (2011) show that remittances may increase aid dependency in general unless remittances are used for human or physical capital accumulation. We include in the benchmark regression a measure of Official Development Assistance capital flows, which are gifts of aid or assistance to the governments of country i , and often include strict guidelines on their use or disbursement. Our focus is not directly on how ODA may impact remittances since remittances are flowing directly to households, but in how they may impact the relationship between FDI and remittances. We might imagine, however, that ODA flows would affect remittances if both are predominantly flowing to poorer countries. Table 6 provides results for the low income, lower-middle income, and upper-middle income country groups.¹⁰ The high income group is excluded since these countries are not generally the recipients of ODA capital flows. Table 6 shows that ODA flows (as a share of GDP) are negatively associated with remittance flows (as a share of GDP) in low income countries, but are not a significant determinant of remittances in middle income

¹⁰ We do not report the first-stage regression results for the estimation in Table 6 to conserve on space. The first-stage regressions use lagged FDI flows, lagged GDP and GDP² measures, and lagged ODA flows as instruments for FDI, GDP, GDP², and ODA.

countries.¹¹ The relationship between FDI flows and remittances remains the same as before, with low income and lower-middle income countries showing a positive and significant relationship between FDI flows and remittances, with similar size coefficients to those reported in Table 5. Overall, the inclusion of ODA does not change our main conclusion that FDI inflows positively impact remittance inflows.

5. Conclusion

The results presented above indicate a positive relationship between FDI and remittance flows. We interpret this relationship as suggestive of the desire among migrants to invest in their home countries. While there is a clear positive relationship between these two flows, the estimated coefficients show that remittance flows are inelastic with respect to FDI flows. Overall, we find that a 10% increase in FDI inflows corresponds to a 3.6% increase in remittances. We find the effect (measured in terms of either elasticity or levels) to be much larger among low income countries, where remittance flows typically exceed FDI flows as a share of GDP on average. The effects are smaller for lower-middle income countries and high income countries, and insignificant for upper-middle income countries. Although the measured elasticity is larger in high income countries than lower-middle income countries, the level changes in remittances are larger for a given increase in FDI in the lower-middle income countries than in high income countries. This is consistent with the fact that remittances make up a larger share of GDP relative to FDI in the low and lower-middle income countries.

Further research could focus on the individual uses of remittances and how these choices are affected by not only the access to domestic credit but also to international capital flows, such

¹¹ The negative relationship between ODA and remittances is similar to that in Mallye and Yogo (2011) who only examine low income countries.

as FDI. Our aggregate data cannot show the individual choices of emigrants but are suggestive that the different types of capital flows are related. In particular, the remittance flows here are positively related to FDI flows and to measures of openness in both trade and financial flows. We do not find any evidence that FDI flows substitute directly for remittance flows, but instead show that these two types of capital are complements as remittances increase with greater FDI inflows even after controlling for such factors as openness. Thus, from a policy prescription standpoint, increases in remittance flows may accompany continued openness and policies that attract FDI. Given prior evidence that remittance flows tend to be less volatile than other capital flows (Ratha, 2003), they may provide a more stable form of capital that may remain in a country when other types of capital are withdrawn. Consequently, policies to help direct both remittances and FDI flows into domestic investment may prove fruitful from a development perspective.

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Tables

Table 1: Main Summary Statistics 1980-2010 (averages over countries and years)

Variable	Obs	Mean	Std. Dev.	Min	Max
All Countries					
Remittances (% of GDP)	2607	3.39	7.91	0.00003	106.48
FDI (% of GDP)	2607	2.91	4.23	-16.06	51.90
Emigrant Stock (% of population)	2607	6.34	6.51	0.09	47.71
Low Income					
Remittances (% of GDP)	763	5.97	13.00	0.00	106.48
FDI (% of GDP)	763	2.63	4.45	-4.03	35.23
Emigrant Stock (% of population)	763	5.04	5.00	0.09	27.76
Lower-Middle Income					
Remittances (% of GDP)	759	4.46	5.11	0.001	25.10
FDI (% of GDP)	759	3.08	3.59	-3.28	39.81
Emigrant Stock (% of population)	759	7.20	8.01	0.28	47.71
Upper-Middle Income					
Remittances (% of GDP)	491	0.90	1.02	0.00003	6.94
FDI (% of GDP)	491	3.20	4.67	-16.06	51.90
Emigrant Stock (% of population)	491	5.55	5.00	0.25	24.23
High Income					
Remittances (% of GDP)	594	0.76	1.17	0.0001	9.12
FDI (% of GDP)	594	2.83	4.30	-6.71	36.43
Emigrant Stock (% of population)	594	7.56	6.81	0.52	29.53

Table 2: Correlations (over countries and years)

	All Countries	Low Income	Lower-Middle Income	Upper-Middle Income	High Income
Corr(Remittances, FDI)	0.11	0.19	0.09	0.04	0.01
Corr(Remittances, emigrant stock)	0.30	0.52	0.48	0.31	0.43
Corr(Remittances, KAOPEN)	-0.06	0.06	0.26	0.22	-0.42
Corr(Remittances, Trade Openness)	0.28	0.54	0.24	0.23	0.09
Corr(FDI, emigrant stock)	0.29	0.28	0.37	0.31	0.25
Corr(FDI, KAOPEN)	0.21	0.18	0.24	0.39	0.20
Corr(FDI, Trade Openness)	0.44	0.47	0.46	0.34	0.53

FDI is FDI inflows as a share of GDP, Remittances are remittance inflows as a share of GDP, and emigrant stock is the number of immigrants (relative to population) at the beginning of the decade.

Table 3: Granger causality test Wald statistics

Lags (k)	H _a : FDI causes Remittances	R ²	H _a : Remittances cause FDI	R ²
1	7.33***	0.916	21.23***	0.148
2	4.35**	0.927	8.08***	0.210
3	2.71**	0.933	3.34**	0.267
4	2.85**	0.933	2.69**	0.258

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4a: Random Effects Panel Estimates; Dependent Variable: Ln[Remittances (% of GDP)]

	Random Effects GLS		2SGLS Random Effects IV	
	(1)	(2) ^a	(3) ^a	(4) ^b
Ln[FDI (% of GDP)]	0.021 [*] (0.013)	0.323 ^{***} (0.065)	0.335 ^{***} (0.066)	0.337 ^{***} (0.067)
KAOPEN _{t-1}	0.120 ^{***} (0.023)	0.108 ^{***} (0.027)	0.113 ^{***} (0.027)	0.117 ^{***} (0.027)
Trade Openness _{t-1}	0.010 ^{***} (0.001)	0.006 ^{***} (0.002)	0.007 ^{***} (0.002)	0.007 ^{***} (0.002)
Domestic Credit	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)
Emigrant Stock	0.076 ^{***} (0.009)	0.074 ^{***} (0.009)	0.071 ^{***} (0.010)	0.071 ^{***} (0.010)
Ln[GDP per capita]	1.155 (0.780)	0.901 (0.865)	0.715 (0.905)	0.708 (0.929)
Ln[(GDP per capita) ²]	-0.129 ^{***} (0.047)	-0.112 ^{**} (0.052)	-0.105 [*] (0.054)	-0.108 [*] (0.055)
Δ(GDP per capita)	2.556 ^{***} (0.505)	1.373 ^{**} (0.600)	1.362 ^{**} (0.605)	^c
Ln[Main Host GDP per capita]	0.083 (0.051)	0.076 (0.056)	0.065 (0.058)	0.066 (0.058)
Δ(Main Host GDP per capita)	-0.033 (0.083)	-0.036 (0.091)	-0.028 (0.092)	-0.017 (0.092)
Asian Financial Crisis	-0.055 (0.067)	-0.097 (0.075)	-0.103 (0.076)	-0.112 (0.076)
Great Recession	0.300 ^{***} (0.064)	0.276 ^{***} (0.070)	0.292 ^{***} (0.071)	0.265 ^{***} (0.071)
Age Dependency Ratio	-0.022 ^{***} (0.003)	-0.014 ^{***} (0.004)	-0.013 ^{***} (0.004)	-0.015 ^{***} (0.005)
Political Violence Index	-0.057 ^{***} (0.019)	-0.059 ^{***} (0.022)	-0.062 ^{***} (0.022)	-0.065 ^{***} (0.022)
Share of Labor with Tertiary Education	0.050 ^{***} (0.013)	0.027 [*] (0.014)	0.026 [*] (0.015)	0.028 [*] (0.015)
East Asia and Pacific (EAP)			-0.445 (0.413)	-0.461 (0.410)

Latin America and Caribbean (LAC)			-0.493 (0.370)	-0.519 (0.367)
Sub-Saharan Africa (SSA)			-0.658* (0.391)	-0.698* (0.388)
Middle East and North Africa (MENA)			0.733 (0.457)	0.726 (0.454)
Constant	-1.369 (3.330)	-0.707 (3.678)	0.681 (3.890)	1.041 (3.984)
N	2607	2453	2453	2453
χ^2	501.908	434.377	436.880	430.393
$p(x > \chi^2)$	0.000	0.000	0.000	0.000
Breusch-Pagan LM Statistic $p(x > \chi^2)$	0.000			
Hausman Test FE vs. RE $p(x > \chi^2)$		0.5994		
Sargan-Hansen Statistic $p(x > \chi^2)$		0.4624	0.4558	0.4017
Cragg-Donald Wald Statistic		41.68	40.23	24.10

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; ^aInstrumented Variables: Ln[FDI (% of GDP)];
^bInstrumented Variables: Ln[FDI (% of GDP)], Ln[GDP per capita], Ln[(GDP per capita)²]; ^c Δ (GDP per capita) dropped due to collinearity in first stage.

Table 4b: First-Stage Results, Random Effects Panel Estimates

Dependent Variable	(2)	(3)	Ln[FDI (% of GDP)]	(4)	Ln[(GDP per capita) ²]
	Ln[FDI (% of GDP)]	Ln[FDI (% of GDP)]		Ln[GDP per capita]	
KAOPEN _{t-1}	0.043 (0.036)	0.037 (0.036)	0.044 (0.036)	0.002** (0.001)	0.044*** (0.015)
Trade Openness _{t-1}	0.008*** (0.002)	0.007*** (0.002)	0.008*** (0.002)	0.0003*** (0.00005)	0.005*** (0.001)
Domestic Credit	-0.001 (0.001)	-0.0004 (0.001)	-0.001 (0.001)	-0.0002 (0.0003)	-0.003*** (0.001)
Emigrant Stock	-0.001 (0.013)	0.002 (0.013)	0.002 (0.013)	0.0001 (0.0003)	0.004 (0.006)
Ln[GDP per capita]	1.175 (1.183)	1.462 (1.224)			
Ln[(GDP per capita) ²]	-0.075 (0.071)	-0.087 (0.073)			
Δ(GDP per capita)	2.972*** (0.787)	2.957*** (0.787)			
Ln[Main Host GDP per capita]	-0.017 (0.077)	0.008 (0.079)	0.009 (0.079)	0.000 (0.002)	0.001 (0.034)
Δ(Main Host GDP per capita)	0.016 (0.126)	-0.002 (0.126)	0.022 (0.127)	0.009*** (0.003)	0.151*** (0.054)
Asian Financial Crisis	0.234** (0.102)	0.238** (0.102)	0.222** (0.103)	-0.006** (0.003)	-0.098** (0.044)
Great Recession	-0.114 (0.098)	-0.145 (0.099)	-0.198** (0.097)	-0.020*** (0.002)	-0.382*** (0.042)
Age Dependency Ratio	-0.025** (0.005)	-0.026** (0.005)	-0.030*** (0.005)	-0.001*** (0.000)	-0.021*** (0.002)
Political Violence Index	0.002 (0.031)	0.008 (0.031)	0.003 (0.031)	-0.002** (0.001)	-0.024* (0.013)
Share of Labor with Tertiary Education	0.037* (0.019)	0.039** (0.019)	0.044** (0.019)	0.002*** (0.000)	0.033*** (0.008)
East Asia and Pacific (EAP)		0.047 (0.565)	0.001 (0.561)	-0.012 (0.014)	-0.204 (0.239)

Latin America and Caribbean (LAC)		0.499 (0.503)	0.430 (0.499)	-0.020 (0.013)	-0.356* (0.213)
Sub-Saharan Africa (SSA)		1.120** (0.518)	1.030** (0.514)	-0.026** (0.013)	-0.341 (0.219)
Middle East and North Africa (MENA)		0.103 (0.626)	0.077 (0.622)	-0.006 (0.016)	-0.120 (0.265)
Ln[FDI (% of GDP)] _{t-1}	0.114*** (0.020)	0.113*** (0.020)	0.110*** (0.020)	-0.001* (0.001)	-0.007 (0.008)
Ln[FDI (% of GDP)] _{t-2}	0.072*** (0.020)	0.070*** (0.020)	0.074*** (0.020)	0.001 (0.001)	0.013 (0.008)
Ln[FDI (% of GDP)] _{t-3}	0.141*** (0.019)	0.139*** (0.019)	0.139*** (0.019)	0.000009 (0.0005)	-0.002 (0.008)
Ln[GDP per capita] _{t-1}			1.611 (1.204)	1.028*** (0.031)	1.143** (0.513)
Ln[(GDP per capita) ²] _{t-1}			-0.102 (0.072)	-0.004** (0.002)	0.902*** (0.031)
Constant	-3.086 (5.050)	-5.125 (5.273)	-4.971 (5.176)	0.133 (0.131)	-0.863 (2.207)

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Column numbers correspond to those in Table 4a.

Table 5: 2SGLS Random Effects IV Panel Estimates, by Income Group

Dependent Variable: Ln[Remittances (% of GDP)];

Instrumented Variables: Ln[FDI(% of GDP)], Ln[GDP per capita], Ln[(GDP per capita)²]

	(1)	(2)	(3)	(4)
	Low Income	Lower-Middle Income	Upper-Middle Income	High Income
Ln[FDI (% of GDP)]	0.719*** (0.193)	0.265*** (0.090)	-0.070 (0.108)	0.404*** (0.085)
Ln[GDP per capita]	9.779*** (3.690)	3.840 (2.429)	-0.127 (8.090)	-45.896*** (8.058)
Ln[(GDP per capita) ²]	-0.758*** (0.259)	-0.245 (0.150)	-0.068 (0.436)	2.187*** (0.396)
KAOPEN _{t-1}	0.110 (0.084)	0.341*** (0.041)	0.166*** (0.053)	-0.057 (0.040)
Trade Openness _{t-1}	0.006* (0.004)	0.004* (0.003)	0.013*** (0.003)	0.002 (0.003)
Domestic Credit	0.004 (0.003)	0.002 (0.002)	-0.001 (0.002)	-0.002 (0.001)
Emigrant Stock	0.062*** (0.024)	0.042*** (0.012)	0.119*** (0.032)	0.000 (0.019)
Ln[Main Host GDP per capita]	0.219*** (0.079)	0.797*** (0.207)	-0.160* (0.085)	0.188 (0.155)
Δ(Main Host GDP per capita)	-0.151 (0.276)	-0.873*** (0.299)	0.057 (0.128)	-0.276 (0.274)
Asian Financial Crisis	-0.333 (0.292)	-0.163 (0.124)	0.049 (0.163)	0.008 (0.097)
Great Recession	0.589** (0.263)	-0.054 (0.132)	0.122 (0.166)	0.179* (0.105)
Age Dependency Ratio	-0.001 (0.010)	0.014* (0.008)	-0.031*** (0.011)	-0.012 (0.013)
Political Violence Index	0.017 (0.041)	-0.089** (0.040)	0.064 (0.088)	0.147*** (0.057)
Share of Labor with Tertiary Education	-0.089** (0.041)	0.023 (0.024)	0.068** (0.029)	0.041** (0.018)
East Asia and Pacific (EAP)	-2.642*** (0.414)	-0.488 (0.622)	0.113 (1.273)	-0.238 (0.523)
Latin America and Caribbean (LAC)	-0.572 (0.499)	-0.398 (0.502)	-0.743 (0.805)	

Sub-Saharan Africa (SSA)	-2.372*** (0.388)	1.210 (1.026)	0.531 (1.003)	
Middle East and North Africa (MENA)	0.139 (0.761)	0.731 (0.549)	-1.280 (1.306)	-0.215 (0.868)
Constant	-31.323** (13.254)	-23.996** (10.283)	7.283 (37.928)	237.616*** (41.222)
<i>N</i>	740	716	465	555
χ^2	302.001	280.684	129.327	137.907
$p(x > \chi^2)$	0.000	0.000	0.000	0.000
Sargan-Hansen Statistic $p(x > \chi^2)$	0.716	0.520	0.499	0.307
Cragg-Donald Wald Statistic	6.56 ^c	20.35 ^a	17.99 ^a	9.10 ^b

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Rejects weak instruments based on Stock and Yogo (2005) critical values for maximal relative bias of ^a 5%, ^b 10%, and ^c 20%.

Table 6: 2SGLS Random Effects IV Panel Estimates, by Income Group
 Dependent Variable: Ln[Remittances (% of GDP)]; Instrumented Variables: Ln[FDI (% of GDP)], Ln[ODA (% of GDP)], Ln[GDP per capita], Ln[(GDP per capita)²]

	(1)	(2)	(3)
	Low Income	Lower-Middle Income	Upper-Middle Income
Ln[FDI (% of GDP)]	0.752*** (0.196)	0.257*** (0.092)	-0.146 (0.160)
Ln[GDP per capita]	9.636*** (3.731)	10.338*** (2.741)	12.776 (10.232)
Ln[(GDP per capita) ²]	-0.793*** (0.262)	-0.647*** (0.171)	-0.789 (0.557)
Ln[ODA (% of GDP)]	-0.509*** (0.140)	0.144 (0.104)	0.056 (0.132)
KAOPEN _{t-1}	0.128 (0.085)	0.304*** (0.042)	0.130** (0.060)
Trade Openness _{t-1}	0.009** (0.004)	0.001 (0.003)	0.013*** (0.004)
Domestic Credit	0.003 (0.003)	0.000 (0.002)	-0.004 (0.003)
Emigrant Stock	0.082*** (0.024)	0.052*** (0.012)	0.111*** (0.041)
Ln[Main Host GDP per capita]	0.236*** (0.080)	0.646*** (0.206)	-0.129 (0.089)
Δ(Main Host GDP per capita)	-0.143 (0.279)	-0.574* (0.303)	0.054 (0.133)
Asian Financial Crisis	-0.393 (0.296)	-0.132 (0.123)	0.126 (0.169)
Great Recession	0.618** (0.265)	-0.083 (0.140)	0.109 (0.219)
Age Dependency Ratio	0.011 (0.010)	-0.000 (0.010)	-0.040*** (0.015)
Political Violence Index	-0.033 (0.044)	-0.115*** (0.040)	0.091 (0.102)
Share of Labor with Tertiary Education	-0.056 (0.043)	0.012 (0.025)	0.095** (0.038)
East Asia and Pacific (EAP)	-2.307*** (0.427)	-0.041 (0.635)	0.575 (1.314)
Latin America and Caribbean (LAC)	0.023 (0.530)	0.005 (0.513)	-0.286 (0.826)

Sub-Saharan Africa (SSA)	-2.115*** (0.396)	1.768* (1.047)	1.103 (1.021)
Middle East and North Africa (MENA)	-0.016 (0.770)	1.175** (0.556)	-0.636 (1.367)
Constant	-29.206** (13.416)	-47.787*** (11.254)	-50.330 (47.125)
<i>N</i>	740	686	420
χ^2	306.626	274.470	107.341
$p(x > \chi^2)$	0.000	0.000	0.000
Sargan-Hansen Statistic $p(x > \chi^2)$	0.704	0.541	0.331
Cragg-Donald Wald Statistic ^a	5.17	14.74	2.21

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; ^a Stock and Yogo (2005) only provide critical values for up to three endogenous variables. Extrapolating from their Table 5.1, the test statistics reported here appear to be sufficient to reject weak instruments at the 5% level for a maximal relative bias level of 20% and 5% for low and lower-middle income countries, respectively.

Appendix

Table A1: List of Countries by Income Classification

Low Income		Lower-Middle Income		Upper-Middle Income	High Income
Armenia	Mauritania	Albania	Kazakhstan	Argentina	Australia
Bangladesh	Moldova	Algeria	Latvia	Botswana	Austria
Benin	Mongolia	Bolivia	Lithuania	Brazil	Belgium
Burundi	Mozambique	Bulgaria	Morocco	Chile	Cyprus
Cameroon	Nepal	Cambodia	Namibia	Costa Rica	Denmark
Central African Republic	Nicaragua	China	Papua New Guinea	Croatia	Finland
Congo	Niger	Colombia	Paraguay	Czech Republic	France
Cote d'Ivoire	Pakistan	Dominican Republic	Peru	Estonia	Germany
Gambia	Rwanda	Ecuador	Philippines	Gabon	Greece
Ghana	Senegal	Egypt	Romania	Hungary	Ireland
Haiti	Sierra Leone	El Salvador	Russia	Korea	Israel
India	Sudan	Fiji	Sri Lanka	Libya	Italy
Indonesia	Tajikistan	Guatemala	Swaziland	Malaysia	Japan
Kenya	Tanzania	Guyana	Syria	Mauritius	Netherlands
Kyrgyz Republic	Togo	Honduras	Thailand	Mexico	New Zealand
Lao	Uganda	Iran	Tunisia	Panama	Norway
Lesotho	Ukraine	Jordan		Poland	Portugal
Liberia	Vietnam			Saudi Arabia	Slovenia
Mali	Yemen			Slovak Republic	Spain
				South Africa	Sweden
				Trinidad and Tobago	Switzerland
				Turkey	United Kingdom
				Uruguay	United States
				Venezuela	

Table A2: Additional Summary Statistics 1980-2010 (averages over countries and years)

Variable	Obs	Mean	Std. Dev.	Min	Max
All Countries					
KAOPEN	2605	0.23	1.55	-1.86	2.46
Trade Openness [(EX+IM)/GDP]	2603	73.98	38.68	6.32	280.36
Domestic Credit to Private Sector (% of GDP)	2607	61.48	52.79	-72.99	328.99
GDP per capita (PPP)	2607	9934	10251	325	48403
Main Host GDP per capita (PPP)	2607	21745	13843	501	52170
Age Dependency Ratio	2607	67.46	18.92	34.52	113.71
Political Violence Index	2607	0.71	1.68	0	10
Share of Labor with Tertiary Education	2607	5.52	5.38	0	30.04
Low Income					
KAOPEN	761	-0.47	1.27	-1.86	2.46
Trade Openness [(EX+IM)/GDP]	762	65.80	36.38	6.32	209.87
Domestic Credit to Private Sector (% of GDP)	763	29.18	25.66	-20.87	248.90
GDP per capita (PPP)	763	1524	920	325	6734
Main Host GDP per capita (PPP)	763	9337	12001	510	43636
Age Dependency Ratio	763	84.34	16.31	36.36	113.71
Political Violence Index	763	1.08	2.16	0	10
Share of Labor with Tertiary Education	763	2.26	3.67	0.07	24.55
Official Development Assistance (% of GDP)	763	10.66	11.34	0.05	147.17
Lower-Middle Income					
KAOPEN	759	-0.19	1.38	-1.86	2.46
Trade Openness [(EX+IM)/GDP]	756	79.38	37.74	22.48	280.36
Domestic Credit to Private Sector (% of GDP)	759	51.46	35.58	-12.62	269.58
GDP per capita (PPP)	759	4853	2662	814	17600
Main Host GDP per capita (PPP)	759	25146	12292	823	49952
Age Dependency Ratio	759	68.71	16.66	34.52	107.75
Political Violence Index	759	0.98	1.86	0	9
Share of Labor with Tertiary Education	759	4.63	4.34	0	24.74
Official Development Assistance (% of GDP)	729	3.26	4.08	-0.07	35.32
Upper-Middle Income					
KAOPEN	491	0.28	1.48	-1.86	2.46
Trade Openness [(EX+IM)/GDP]	491	84.57	46.10	12.35	220.41
Domestic Credit to Private Sector (% of GDP)	491	55.52	43.63	-72.99	212.92
GDP per capita (PPP)	491	11198	4263	3611	26774
Main Host GDP per capita (PPP)	491	27354	12294	501	52170
Age Dependency Ratio	491	59.46	13.52	37.61	96.22
Political Violence Index	491	0.26	0.83	0	5
Share of Labor with Tertiary Education	491	5.64	4.44	0.16	30.04
Official Development Assistance (% of GDP)	445	0.63	1.37	-0.07	9.97

High Income					
KAOPEN	594	1.63	1.22	-1.86	2.46
Trade Openness [(EX+IM)/GDP]	594	68.86	32.48	15.92	183.62
Domestic Credit to Private Sector (% of GDP)	594	120.70	56.53	22.90	328.99
GDP per capita (PPP)	594	26182	6844	11350	48403
Main Host GDP per capita (PPP)	594	28700	7187	7902	46906
Age Dependency Ratio	594	50.76	4.86	41.52	71.61
Political Violence Index	594	0.24	0.92	0	7
Share of Labor with Tertiary Education	594	10.77	5.22	1.36	26.80