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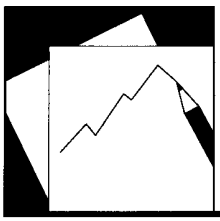

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Workers' Remittances: An Overlooked Channel of International Business Cycle Transmission?

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Workers' Remittances: An Overlooked Channel of International Business Cycle Transmission?

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Abstract

This paper shows that remittance flows significantly increase the business cycle synchronization between remittance-recipient countries and the rest of the world. Using both aggregate and bilateral remittances data in a panel data setting, the study demonstrates that this effect is robust and causal. Moreover, the econometric analysis reveals that remittance flows are more effective in channeling economic downturns than upswings from the sending countries to remittance-receiving economies. The analysis suggests that measures of openness and spillovers could be enhanced by accounting for the role of the remittances channel.

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I. INTRODUCTION

According to the recent World Bank Report (*Migration and Remittances Factbook*, 2011), worldwide remittance flows are estimated to have exceeded $440 billion in 2010, with the share of developing countries around $325 billion. The Report also highlights the fact that recorded remittances were nearly three times the amount of official development assistance (ODA) and almost on a par with foreign direct investment (FDI) flows to developing countries. For instance in Sub-Saharan Africa, remittances range from less than 1 percent of GDP to 25 percent in Lesotho, and they exceed by a large amount both FDI and aid in countries such as Mauritius, Nigeria, Egypt, Morocco, Senegal and Lesotho. Ratha (2009) summarizes all existing empirical evidence and concludes that, for a large fraction of the poorest nations, remittances surpass both ODA and FDI.

Given this increasing evidence on the important role of remittance flows relative to other flows in developing countries, it is not surprising that the last decade was marked by increasing attention by policymakers and researchers devoted to their developmental role. A growing macroeconomic literature has focused on the impact of remittances on growth, fiscal, monetary and exchange rate policies, and on economic development, more generally. The results, however, are mixed, sometimes controversial, and contingent on particular circumstances or country-specific characteristics.[2]

While the literature on the macroeconomic consequences of remittances is growing, to our best knowledge there are no studies examining the impact of remittance flows on international business cycle synchronization. This issue is important since many countries are integrated globally through labor mobility and their associated remittance flows. For example, MENA region, receives 6 percent in FDI and 4 percent of global trade, but receives 13 percent of the developing countries' remittance inflows over the period 2005–2010. Recently, Abdih et al. (2012) show that public finances of remittance-recipient countries are affected by external shocks working through private demand and ultimately affecting the tax revenue, and that this effect is quite significant. In other words, through the remittance channel, countries might be actually more integrated with the global economy than is evident when using the traditional measures of openness such as trade and capital account. In fact, accounting for remittance dependency, we show that some recipient countries appear more vulnerable to risks stemming from shocks to the global economy. This has profound policy implications for surveillance and for policymakers in these countries, which we discuss later in the paper.

[2] See, for example, Chami et al. (2003, 2008); Glytsos (2005); Giuliano and Ruiz-Arranz (2009); Catrinescu et al. (2009); Barajas et al. (2009), Bhaskara Rao and Mainul Hassan (2011); Abdih et al. (2011); Combes and Ebeke (2011); Ebeke (2012a).

This paper also contributes to the literature on the determinants of international business cycle synchronization by showing that remittance flows are another important channel of transmission of shocks to the global economy. The empirical literature on the determinants of business cycle synchronization so far has identified trade (Frankel and Rose 1997, 1998; Clark and van Wincoop 2001; Imbs 2004; Calderon et al. 2007; and Inklaar et al. 2008, Tapsoba, 2009) and financial openness (Kose et al., 2003: Kalemli-Ozcan et al., 2009, and Cerqueira and Martins, 2009) amongst the main determinants of business cycle co-movements. Recently, the emphasis has been put on the role played by specific monetary regimes such as currency unions and inflation targeting (Frankel and Rose, 1997, 1998: Rose and Engel, 2002; Flood and Rose, 2010) and country similarities in macroeconomic policies (Inklaar et al., 2008). Our results, however, suggest that the traditional concepts of openness and external vulnerability of developing countries that focus solely on the trade and capital account liberalization would need to be revisited so as to allow for the role of the remittances channel.

The paper uses both aggregate and bilateral panel data to indentify the effect of remittance flows on business cycle synchronization. The results reveal that remittance flows significantly increase business cycle synchronization between recipient countries and the rest of the world. Using a wide range of techniques, the study demonstrates that this effect is robust and causal. The remittance channel effect, however, is shown to be asymmetric, that is, remittances are more effective in channeling economic downturns than booms to the receiving countries from the sending countries.

The remainder of the paper is organized as follows. Section 2 presents the baseline specification and the data. Section 3 discusses the econometric estimates and Section 4 tests the asymmetric effect of remittances. Section 5 discusses the size of the bias due to unobservables, presents the identification strategy, and discusses the instrumental variable estimates; finally, Section 6 concludes.

II. Baseline Specifications of the Effect of Remittances on Business Cycle Synchronization

This section introduces remittances into the existing empirical business cycle specifications. Two types of econometric specifications are specified according to the nature of the data used. The first econometric specification relies on aggregate remittance data, and the second uses the available cross country time-varying bilateral remittances data compiled by Lueth and Ruiz-Arranz (2008).

A. Unilateral Specification

The specification of the impact of remittance inflows on the international business cycle synchronization is as follows:

$$\rho_{i,t} = \theta_1 R_{i,t} + X'_{i,t}\beta + u_i + \eta_t + \epsilon_{i,t} \qquad [1]$$

where ρ is the coefficient of correlation between country's *i* business cycle at year *t* and the weighted sum of business cycles of country's *i* migrant host countries. $R_{i,t}$ is the value of remittance inflows received by a country *i* at the year *t* expressed as a share of country's *i* GDP. X denotes the matrix of control variables which includes trade and financial openness variables.[3] u_i and η_t represent the country and year fixed effects, respectively, and $\epsilon_{i,t}$ is the idiosyncratic error term. The hypothesis tested is that $\theta_1 > 0$, in other words, remittance inflows increase the business cycle synchronicity between the "representative" remittance-sending country and the remittance-receiving economy.[4]

Following Cerqueira and Martins (2009), ρ is computed as the yearly correlation of business cycles between country *i* and its main migrant host countries. This technique presents three distinct advantages. First, there is no need to set a specific window time span for calculating correlation. Second, the technique addresses the major shortcoming of using overlapping windows; where the resulting variables are typically heavily autocorrelated and, thus, difficult to handle in econometric analysis. Third, it can distinguish negative correlations due to episodes in single years, asynchronous behavior in turbulent times, and synchronous behavior over stable periods. The yearly coefficient of correlation is defined as follows:

$$\rho_{i,t} = 1 - \frac{1}{2}\left(\frac{\left(y^*_{i,t} - \overline{y^*_i}\right)}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(y^*_{i,t} - \overline{y^*_i}\right)^2}} - \frac{\left(y_{i,t} - \overline{y_i}\right)}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(y_{i,t} - \overline{y_i}\right)^2}} \right)^2 \qquad [2]$$

where $y_{i,t}$ and $y^*_{i,t}$ represent the business cycle in country *i* and the weighted sum of the business cycles in each migrant host country, respectively.[5] Formally, the business cycle in the remittance-sending country is as follows:

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[3] Controlling for trade and financial openness also ensures that the coefficient associated with remittance inflows captures the direct effect, which does not work through the positive impact of remittances on these variables. This point is particularly relevant given the growing literature that points to a positive impact of remittance inflows on trade and financial openness (Beine et al., 2011; Abdih et al., 2012).

[4] Henceforth, and unless otherwise noted, "sending and receiving countries" will refer to "remittance-sending and remittance-receiving countries, respectively.

[5] This paper takes advantage of the recent bilateral migration data provided by the World Bank in its World Bilateral Migration dataset. Bilateral migration stock data are available every 10 years, thus allowing us to obtain time-varying weights. Given that these weights change slowly over time, this ensures a relative exogeneity of the weighting structures in the computation of the host countries business cycles.

$$y^*_{i,t} = \sum_{j=1}^{n-1} \left(\frac{m_{ij,\tau}}{\sum_{j=1}^{n-1} m_{ij,\tau}} \right) * y_{j,t} \qquad [3]$$

where $m_{ij,\tau}$ represents the stock of country's *i* migrants living in country *j* at the decade τ and $y_{j,t}$ is the indicator of the business cycle for a country *j* at year *t*.

Following Calderon et al. (2007), business cycles are measured by taking the log deviation of the real GDP in each country with respect to its trend. The trend is computed using the methodology of Baxter and King (1999) which is particularly suitable for macroeconomic series affected by structural breaks.[6] For robustness purposes, the Hodrik-Prescott filter is also used.[7]

While the relationship linking remittance inflows and the business cycle synchronization between migrant-sending and receiving economies could be easily justified, it could appear less evident to expect a significant impact of the control variables on this migration-based definition of business cycle synchronization.[8] However, recent evidence in the empirical literature shows complementarities between migration and other dimensions of globalization. Kugler and Rapoport (2011) showed a positive and significant impact of international migration on the levels of trade and foreign direct investments (FDI). Likewise, Javorcik et al. (2011) demonstrated a positive and significant impact of migration networks on the U.S. foreign direct investment into Mexico. The main implication of this recent evidence is that net labor exporting countries tend to trade more and appear financially open. Therefore, one could expect a significant correlation between migration-based business cycle synchronicity and the other dimensions of economic globalization.

B. Specification Based on Bilateral Data

The bilateral specification takes the following form:

$$\rho_{ij,t} = \theta_2 R_{ij,t} + X'_{ij,t}\beta + u_i + u_j + \epsilon_{ij,t} \qquad [4]$$

where *i* and *j* represent the receiving and sending countries, respectively. $\rho_{ij,t}$ is the yearly correlation coefficient of the business cycles of countries *i* and country *j*. It is computed using the formula described in equation [2] for each country pair . R_{ijt} refers to the amount of

[6] The Baxter and King band-pass filter is used with arguments 2 and 8.

[7] The smoothness parameter of the Hodrik-Prescott filter is set equal to 6.25, following Ravn and Uhlig's (2002) recommendation for annual data.

[8] In the bilateral models, this problem does not arise since the dependent variable records the bilateral correlation coefficient of business cycles within each potential country-pair.

remittances received by a country *i* and sent from the country *j*, expressed as a percentage of country's *i* GDP. X' is the matrix of control variables often used in the literature focusing on the determinants of business cycle synchronization at the bilateral level, namely the degree of trade and financial openness, and the level of bilateral production asymmetry. The key hypothesis tested is that $\theta_2 > 0$, in other words, the larger the remittance inflows, the higher the business cycle synchronicity between the two countries.

Ideally, one would control for country pair fixed effects (u_{ij}), which account for time-invariant unobservable factors at the country-pair level. However, for many countries in the bilateral dataset, the number of observations within each country-pair, is relatively small and then, country-pair fixed effects absorb accordingly a sizeable share of the variance of the bilateral remittance ratio in the sample. Nonetheless, the standard errors associated with the estimated regression coefficients are clustered at the country-pair level.

C. Data

The period of analysis spans from 1980 to 2010 in the case of the aggregate approach, and from 1980 to 2005 in the bilateral specification.

Remittance data come from two main sources. For the specification using aggregate data, remittance inflows are drawn from the World Bank Development Indicators dataset which provides remittances series for many countries. We use the narrow definition of remittances which does not include compensation of employees and migrants' wealth transfers. Bilateral remittance data used to estimate equation [4] are drawn from Lueth and Ruiz-Arranz (2008).[9] These authors compiled a comprehensive panel dataset on bilateral remittance flows for 11 developing countries: Bangladesh, Croatia, Indonesia, Kazakhstan, FYR Macedonia, Moldova, Philippines, Serbia and Montenegro, Slovenia, Tajikistan, and Thailand. The numbers of source countries as well as the time period covered in the dataset vary across recipient countries. On average, each recipient country has recorded flows from about 16 source countries and over a period of nine years. This yields almost 1,650 bilateral remittance observations.

GDP is measured in purchased power parity (PPP) terms from which country specific business cycles have been computed, and is drawn from the World Bank Development Indicators (WDI). The trade openness variable is defined as the value of exports plus imports of goods and services as a percentage of GDP, also from WDI. The indicator of trade

[9] Recently, Frankel (2011) used the same dataset to analyze the countercyclical properties of remittances at the bilateral level. Beine et al. (2011) also used the same dataset in a recent study examining the role of immigration policies on the relationship between remittances and education.

intensity used in the bilateral specification is computed using bilateral data available in the IMF Direction of Trade and Statistics dataset (DOTS), and is defined as:

$$TI_{ij,t} = \left(\frac{x_{ij,t} + m_{ij,t}}{GDP_{i,t} + GDP_{j,t}} \right)$$

where $x_{ij,t}$ and $m_{ij,t}$ denote the amount of exports FOB and imports CIF in U.S. dollars between countries *i* and *j*, respectively. GDP is to the nominal Gross Domestic Product in U.S. dollars.

The financial openness variable for each country is drawn from the Chinn and Ito (2008) financial openness dataset. Higher values of the index refer to smaller capital account restrictions. In the bilateral specification, we measure financial openness at the country-pair level by summing the individual countries' openness level. The financial openness variable has been first rescaled to ensure that it is positive definite.[10]

Asymmetry in production between countries (*ASP*) is computed as the sum of the absolute differences in the shares of sectoral value added within country-pairs. For the sake of simplicity, we focus on three main sectors: agriculture, industry, and services. Sectoral value added shares were drawn from the WDI dataset. Formally, the variable is measured as follows:

$$ASP_{ij,t} = \sum_{k=1}^{3} \left| v_{ki,t} - v_{kj,t} \right|$$

where $v_{i,t}$, and $v_{j,t}$, are the value added share of each sector k in the total production of each country, respectively.

Tables in the appendix provide the descriptive statistics and the list of countries included in the sample.

III. PRELIMINARY RESULTS

Tables 1 and 2 show the results of the estimations of equation [1] and [4], respectively. They report standardized coefficients as usually done in the literature on business cycle synchronization (e.g., Frankel and Rose, 1997, 1998; Calderon et al., 2007; and Inklaar et al., 2008), and which facilitates discussing the relative importance of the impact of remittances.

[10] Given that original data in the Chinn and Ito dataset can contain negative values, the financial openness variable has been rescaled so that all the values are positive.

A. Results Using Aggregate Data

Columns [1] and [2] of Table 1 show the results of the models in which business cycle measures have been derived from the Hodrik-Prescott (HP) and the Baxter and King (BK) filters, respectively. The results highlight a positive and statistically significant effect of remittances on business cycle synchronization. Consistent with prior findings, estimates for other traditional determinants of business cycle synchronicity—trade and financial openness—are statistically significant with the expected signs. The magnitude of the impact of remittances is similar to the contribution of financial openness although less than that of trade openness.

Table 1. Impact of Remittance Inflows on International Business Cycle Synchronization (Standardized Coefficients and Yearly Data)

	Cycles (HP)	Cycles (BK)
	(1)	(2)
Trade openness	0.161**	0.184**
	(2.345)	(2.611)
Financial openness	0.0978***	0.0759**
	(2.883)	(2.213)
Remittance ratio	0.101***	0.0879**
	(3.006)	(2.412)
Observations	1,853	1,754
Number of countries	70	70

Robust t-statistics in parentheses. Country and time dummies are included in all the specifications. Standardized coefficients are reported.
*** p<0.01, ** p<0.05, * p<0.1.

B. Results Using Bilateral Data

The estimation results are presented in Table 2. Despite the lower country coverage, estimates confirm the role of remittances in enhancing the co-movement of recipient countries to the economic cycles in the sending countries. The size of the impact is relatively close to the assessment from aggregate data. Similar to the findings from the aggregate analysis, other traditional factors of business cycle synchronicity are found to be statistically significant with the expected sign.

Table 2. Bilateral Determinants of Business Cycle Synchronization (Standardized Coefficients and Yearly Data)

	Cycles (HP)	Cycles (BK)
	(1)	(2)
Bilateral trade intensity	0.105**	0.0711*
	(2.549)	(1.961)
[Financial openness in *i*] + [Financial openness in *j*]	0.267***	0.218***
	(4.136)	(3.361)
Asymmetries in production between *i* and *j*	-0.196***	-0.255***
	(-3.148)	(-3.377)
Bilateral remittance inflows-to-GDP in *i* sent from *j*	0.0659**	0.0627***
	(2.571)	(3.817)
Observations	1,541	1,116
Country pairs	154	111

Robust t-statistics in parentheses. Standard errors are clustered at the country-pair level. The model includes a full set of receiving and sending country fixed effects. Standardized coefficients are reported.
*** p<0.01, ** p<0.05, * p<0.1.

Baseline analyses point that remittances, overlooked until now, constitute an additional channel connecting recipient countries to the global economy. The remittance channel does not work in isolation; it remains robust when other determinants are accounted for.

IV. Is the Effect of Remittance Inflows Asymmetric?

This section investigates whether there is any asymmetry in the effect of remittance flows on business cycle synchronization depending on what phase of the business cycle the sending country is in.[11] Before providing a number of possible explanations, however, it is worth noting here that the literature on the determinants of remittances has clearly identified the output of the sending country as a main (positive) determinant of remittance outflows to receiving countries. Several explanations can be evoked to explain why remittances might be more effective in channeling economic downturns in the sending countries into remittance-receiving countries. First, remittance outflows from sending countries may contract more sharply in bad times compared to their recovery during good times. For example, migrant workers are particularly vulnerable to economic downturns in the host countries given that they have temporary employment contracts and are easily fired during downturns. Moreover, in some countries migrant workers suffer from discrimination in the labor market when the economic situation deteriorates, and are often victims of political battles which intensify during recessions.[12] Second, the positive effects of large remittance inflows on domestic

[11] Chami et al. (2006, 2012), among others, show that remittances effect on macroeconomic variables is non-linear.

[12] Unless remittances are sent for investment purposes in the country of origin, there is no established result suggesting that remittance outflows from migrant host countries during booms rise more than proportionally. These issues are discussed in Ebeke (2012b).

activity might be partially offset by the negative effects that remittances exert on the recipient country (see for example, among others, Chami and Fullenkamp (2012). on external competitiveness Amuedo-Dorantes and Pozo, 2004; Barajas et al., 2009, 2011 and on domestic inflation Chami et. al. 2006).
To test the asymmetric effect of remittance dependency, the following specification is proposed:

$$\rho_{i,t} = u_i + \eta_t + \theta_3 R_{i,t-1} \cdot \left(\theta_4 {y_{i,t}}^{*-} + \theta_5 {y_{i,t}}^{*+}\right) + \sigma_1 {y_{i,t}}^{*-} + X'_{i,t}\beta + \epsilon_{i,t} \qquad [5]$$

with,

${y_{i,t}}^{*-} = {y_{i,t}}^{*} \cdot d_{i,t}$ and $d_{i,t} = \mathbf{1}\left[{y_{i,t}}^{*} < 0\right]$, and

${y_{i,t}}^{*+} = {y_{i,t}}^{*} \cdot \left(1 - d_{i,t}\right)$

The additive term of remittances is also not included linearly due to perfect colinearity issue. The asymmetric specification using bilateral data takes the following form:

$$\rho_{ij,t} = u_i + u_j + \theta_6 R_{ij,t} + \theta_7 R_{ij,t-1} \cdot \left(\theta_8 {y_{j,t}}^{-} + \theta_9 {y_{j,t}}^{+}\right) + \sigma_2 {y_{j,t}}^{-} + X'_{ij,t}\beta + \epsilon_{ij,t} \qquad [6]$$

We test the following hypotheses. In case of symmetric behavior, one would observe:

$\theta_4 = \theta_5$, and $\theta_8 = \theta_9$.

If, as suggested above, the transmission of downturns is stronger than that of upswings, then we should observe $\theta_4 > \theta_5$ and $\theta_8 > \theta_9$. In other words, the coefficient associated with the interaction of the lagged remittance ratio crossed with the negative host country business cycle $\Phi_1 = (\theta_3 \cdot \theta_4\ ,\ \theta_7 \cdot \theta_8)$ would be larger than the coefficient associated with the interaction of remittances crossed with the positive business cycle in the migrant host country $\Phi_2 = (\theta_3 \cdot \theta_5\ ,\ \theta_7 \cdot \theta_9)$.

The results of the estimation of equations [5] and [6] above are presented in Tables 3 and 4, respectively. As shown in Table 3, the hypothesis that the spillover effect of remittances is statistically stronger during economic slowdowns is not rejected. In fact, the results indicate that there is little transmission of *upswings* from sending to recipient countries. In Table 4, the asymmetric effect of remittances on the business cycle synchronization is further analyzed at the bilateral level. Although these results now show that upswings as well as downturns are effectively transmitted, they also show that the dependency upon remittance flows is more effective in channeling downturns.

Table 3. Asymmetric Impact of Remittances

	Cycles (HP)	Cycles (BK)
	(1)	(2)
Trade openness	0.164**	0.195**
	(2.233)	(2.606)
Financial openness	0.105***	0.0919**
	(3.081)	(2.503)
Lagged remittance ratio * **1**[y* < 0]	0.0668***	0.0610**
	(2.663)	(2.291)
Lagged remittance ratio * **1**[y* > 0]	0.0511	0.0100
	(1.140)	(0.243)
Observations	1,773	1,674
Number of countries	70	70

Robust t-statistics in parentheses. The model includes a full set of country fixed effects and the dummy identifying the negative business cycle in the remittance-sending country. Standardized coefficients are reported.
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Asymmetric Impact of Remittances: Bilateral Data

	Cycles (HP)	Cycles (BK)
	(1)	(2)
Bilateral trade intensity	0.101**	0.0740*
	(2.334)	(1.859)
[Financial openness in *i*] + [Financial openness in *j*]	0.256***	0.207***
	(4.022)	(3.275)
Asymmetries in production between *i* and *j*	-0.230***	-0.306***
	(-2.893)	(-3.530)
Lagged bilateral remittance ratio * **1**[y* < 0]	0.0429***	0.0413***
	(2.940)	(4.047)
Lagged bilateral remittance ratio * **1**[y* > 0]	0.0392**	0.0234**
	(2.170)	(2.561)
Observations	1,452	1,072
Country pairs	154	111

Robust t-statistics in parentheses. Standard errors are clustered at the country-pair level. The model includes a full set of receiving and sending country fixed effects, and the dummy identifying the negative business cycle in the remittance-sending country. Standardized coefficients are reported.
*** p<0.01, ** p<0.05, * p<0.1

V. Identifying a Causal Relationship Between Remittances and the International Business Cycle Synchronization

This section addresses the issue of whether the relationship between remittances and the business cycle synchronization can be considered *causal*. The paper takes two approaches aimed at achieving this objective.

A. Using the Selection Based on Observables to Assess the Bias from Unobservables

We begin first by using the selection on observables to assess the bias from unobservables following the methodology first implemented by Altonji et al. (2005), and discussed by Bellows and Miguel (2009), and Nunn and Wantchekon (2011). It provides a measure to gauge the strength of the likely bias arising from unobservables: i.e. how much stronger the selection based on unobservables relative to that on observables must be to explain away the full estimated effect. To see how this measure is calculated, consider two regressions: one with a restricted set of control variables, and one with a full set of controls. Denote the estimated coefficient for the variable of interest from the first regression θ^R (where R stands for restricted) and the estimated coefficient from the second regression θ^F (where F stands for full). Then, the ratio can be calculated as: $\theta^F / (\theta^R - \theta^F)$.

Following the discussion in Nunn and Watchekon (2011), the intuition behind the formula is straightforward. The smaller the difference between θ^R and θ^F, the less the estimate is affected by selection on observables, and the stronger the selection on unobservables needs to be (relative to observables) to explain away the entire effect. In addition, the larger θ^F, the greater is the effect that needs to be explained away by selection on unobservables, and therefore the higher is the ratio.

We consider as our set of restricted covariates the controls included in our baseline specifications (equation [1] and equation [4]): remittances, trade openness, financial openness, and the asymmetry in production. The set of 'full' covariates adds to the baseline controls the following covariates: some measures of economic shocks (banking crisis dummies, natural disasters), a variable characterizing oil producing countries (oil rents-to-GDP), domestic policy shocks (inflation rates, differences in government consumption growth rate, reserve money growth rate).[13]

[13] The banking crisis dummy comes from Laeven and Valencia (2010) dataset. The Natural disasters variable is defined as the ratio of people affected by a natural disasters normalized by the lagged value of the total population (data are drawn from the EM-DAT dataset). All the remaining additional control variables are drawn from the World Development Indicators dataset.

The computed ratios are reported in Table 5. Of the four ratios reported, none is less than one. The ratios range from 3 to 28. Therefore, to attribute the entire OLS estimate to selection effects, the selection on unobservables would have to be at least three times greater than selection on observables. In our view, these results make it less likely that the estimated effect of remittance flows on international business cycle synchronization is fully caused by unobservables.

Table 5. Additional Controls and Assessing the Bias due to Selection Based On Unobservables

		Coefficient of remittances		Altonji et al.
		Baseline	Additional controls	(2005) ratio
		(1)	(2)	(3)
Cycles: HP	Aggregate data	0.101***	0.097*	28.7
		(3.006)	(1.77)	
Cycles: BK	Aggregate data	0.0879**	0.075*	6.1
		(2.412)	(1.78)	
Cycles: HP	Bilateral data	0.0659**	0.059*	8.3
		(2.571)	(1.66)	
Cycles: BK	Bilateral data	0.0627***	0.049***	3.8
		(3.817)	(3.80)	

Robust t-statistics in parentheses. The set of additional controls in the model using aggregate data includes the following variables: [reserve money growth rate, dummy variable for banking crisis, natural disaster indicator, an indicator of economic structure (oil rents as percentage of GDP), and inflation rate]. The set of additional control variables using the bilateral data includes the following: Asymmetry in fiscal and monetary policies, dummies for banking crises in both countries, natural disaster variables in both countries. Standardized coefficients are reported.
*** p<0.01, ** p<0.05, * p<0.1.

B. Addressing the Potential Reverse Causality Between Remittances and the Components of the Dependent Variable

The second strategy to assess the causal impact of remittances on the synchronization of business cycles uses a two-stage approach, which addresses the possible reverse causality bias that arises because of cyclical behavior driving remittance flows. As mentioned earlier, several papers have documented that remittances to developing countries are highly procyclical vis-à-vis the economic conditions in the sending countries (Lueth and Ruiz-Arranz, 2008; Frankel, 2011; Abdih et al., 2012) and countercyclical with respect to recipient economies' business cycle (Frankel, 2011), or procyclical (Lueth and Ruiz-Arranz (2008) and Neagu and Schiff (2009)). Others have shown that remittances tend to be more procyclical with the recipients' business cycle when markets in these countries are less financially developed (Giuliano and Ruiz-Arranz, 2009). Recently, Ebeke (2011) shows that these flows have become more countercyclical in recent decades as more developing economies appear to have integrated into the world economy, and are therefore more vulnerable to various types of external shocks.

To correct for this reverse causality bias, the paper uses the insights in Brückner (2011), which applied this two-stage approach to uncover a causal relationship between foreign aid and economic growth. The approach has the main advantage of being simple, and does not require finding exogenous external instruments for remittances. This is particularly worth noting since the main exogenous instrument used to instrument for remittances in the macro literature is the rate of growth of GDP in the remittance sending countries, which is already a component of our dependent variable and cannot be therefore used.

The procedure is as follows. In the first stage, an estimation is undertaken of the response of remittance inflows to the business cycles in both the sending and the receiving economies using the terms of trade variable as an instrumental variable for real GDP growth in the remittance receiving country.[14] In the second stage, after the causal response of remittance inflows to real GDP growth in remittance sending and receiving countries has been quantified by the IV estimates, the paper uses the residual variation in remittances—the portion of fluctuations in remittances that is not driven by the two cycles—as an instrument to estimate the effect of remittance inflows on correlation of the business cycles. This two-step estimation strategy enables one to: (i) obtain an understanding of how remittances respond to economic conditions in both the sending and the receiving economies; and (ii) compute an estimate of the effect that remittance inflows have on business cycle synchronization that is adjusted for the reverse causal effect that each component of the dependent variable has on remittance flows.[15]

More formally, the procedure is written as follows. An estimation of the first stage is performed using both the aggregate and the bilateral specifications:

$$R_{ij,t} = \theta_{10}\Delta log\left(GDP_{i,t}\right) + \theta_{11}\Delta log\left(GDP_{j,t}\right) + X_{ij,t}{}'\beta + \omega_{ij,t} \qquad [7]$$

where in equation [7] $\Delta log\left(GDP_{i,t}\right)$ is instrumented by the log of the terms of trade.

The second stage specification takes the following form:

$$\rho_{ij,t} = \theta_{12}R_{ij,t} + X'_{ij,t}\beta + \vartheta_{ij,t} \qquad [8]$$

[14] The real GDP growth in the remittance sending country is taken as exogenous conditional on the presence of the globalization variables (trade and financial openness).

[15] See Brückner (2011) for the proof of the robustness of this two-step approach and the efficiency of the technique.

In equation [8], the endogeneity of remittances inflows is addressed by instrumenting for remittances with the residuals of the first stage (using equation [7]), i.e.

$$R_{ij,t}{}^{*} = \omega_{ij,t} \qquad [9]$$

The results of the two-stage approach are presented in Tables 6 and 7. In each case, the first two columns show the instrumental variable estimations (IV) of for remittances.[16] The remaining columns contain the results of the second stage, the IV estimates of the effects of remittance flows on the business cycle synchronization.

As expected, the terms of trade are positively correlated with the real GDP in receiving economies (columns [1] of Tables 6 and 7). Results also point out a positive and significant growth's spillover effect from the sending into the receiving economies (the elasticity of domestic income with respect to sending countries is positive and significant). In column [2] of Tables 6 and 7, the results highlight a positive and significant correlation between remittances and income in the sending countries and a negative correlation between remittances and recipient country income, supporting the hypothesis of countercyclical remittance flows.

The IV results of the impact of remittances on business cycle synchronization are presented in columns [4] and [6] of Tables 6 and 7. The instrumentation of the remittance ratio does not affect the qualitative results already found in the baseline estimates: remittance flows significantly determine the synchronization of business cycle across countries and this result is robust to the two alternative filtering techniques and the type of data used (aggregate or bilateral). Compared to the OLS results presented in Tables 1 and 2, the IV estimates appear higher. This can be explained by the fact that the IV procedure helps account for the negative reverse causality from domestic income to remittance inflows. In other words, in the presence of countercyclical remittances, OLS estimates of the effect of remittances on the business cycle synchronization are biased downwards.

[16] Column [1] in each Table presents the first-stage results of the instrumentation of the log of real GDP of the remittance-receiving economy.

Table 6. Instrumental Variable Estimates: Aggregate Data

	Determinants of remittances: 2SLS		*Determinants of business cycle sync.: 2SLS*		*Determinants of business cycle sync.: 2SLS*	
Dependent variable:	log (Real GDP)	Remittance-to-GDP	Remittance-to-GDP	Sync (HP)	Remittance-to-GDP	Sync (BK)
	(1)	(2)	(3)	(4)	(5)	(6)
Remittance-to-GDP				0.157**		0.137**
				(2.410)		(2.125)
Remittance instrument			0.409***		0.418***	
			(9.127)		(8.561)	
Trade openness	0.306***	0.0582***	0.403***	0.115	0.419***	0.145*
	(9.164)	(3.697)	(6.822)	(1.551)	(6.651)	(1.880)
Financial openness	0.0355***	0.00905***	0.245***	0.0957***	0.255***	0.0754**
	(6.582)	(4.884)	(5.341)	(2.656)	(5.585)	(2.106)
log (Real GDP)		-0.0819*				
		(-1.802)				
log (*Real GDP in sending countries*)	0.492***	0.0493**				
	(29.62)	(2.204)				
log (Terms of trade)	0.0497***					
	(2.982)					
Observations	1,793	1,793	1,793	1,793	1,706	1,706
First-stage F-stat., p-value	0.0	..	0.0	..	0.0	..
Number of countries	69	69	69	69	69	69

Robust t-statistics in parentheses. Country and time dummies are included in all the specifications. Standardized coefficients are reported.
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Instrumental Variable Estimates: Bilateral Data

	Determinants of remittances: 2SLS		*Determinants of business cycle sync.: 2SLS*		*Determinants of business cycle sync.: 2SLS*	
Dependent variable:	log (Real GDP)	Remittance-to-GDP	Remittance-to-GDP	Sync (HP)	Remittance-to-GDP	Sync (BK)
	(1)	(2)	(3)	(4)	(5)	(6)
Bilateral remittance-to-GDP				0.139***		0.0622***
				(4.641)		(4.016)
Remittance instrument			0.561***		1.020***	
			(1,055)		(1,335)	
Bilateral trade intensity	37.78***	0.0411*	0.0351***	0.114**	0.0606***	0.0720*
	(10.47)	(1.648)	(18.95)	(2.000)	(18.22)	(1.652)
[Fin. openness in i] + [Fin. openness in j]	0.168***	0.000208**	0.0361***	0.330***	0.0578***	0.256***
	(10.65)	(2.105)	(18.42)	(3.865)	(19.91)	(3.518)
Asymmetries in production between i and j	0.0312***	0.000229***	0.140***	-0.266***	0.245***	-0.310***
	(6.535)	(6.525)	(57.86)	(-3.062)	(52.00)	(-3.108)
log (Real GDP)		-0.000883				
		(-1.243)				
log (*Real GDP in sending country*)	0.0247*	0.00108***				
	(1.793)	(4.793)				
log (Terms of trade)	1.844***					
	(11.29)					
Observations	1,088	1,088	1,088	1,088	923	923
First-stage F-stat., p-value	0.0	..	0.0	..	0.0	..
Number of country pairs	116	116	116	116	106	106

Robust t-statistics in parentheses. Standard errors are clustered at the country-pair level. The model includes a full set of receiving and sending country fixed effects. Standardized coefficients are reported.
*** p<0.01, ** p<0.05, * p<0.1

VI. Concluding Remarks

This paper identifies remittances as another important determinant of the international business cycle synchronization for sending and receiving countries. The empirical literature, for the most part, has focused on the standard globalization variables such as trade and financial openness as the main determinants, and concluded that more open economies exhibit higher synchronization of business cycles with the rest of the world. This analysis, however, misses the fact that countries which experience external labor mobility and its concomitant remittance flows are also globally integrated, and that these remittance flows play an important role in propagating global shocks to countries that receive them. As we show in this paper, the impact of this remittances channel, however, is asymmetric, with correlations increasing during downturn episodes of the global economy than during upswings in remittance-sending countries.

To determine whether the relationship detected between remittances and the international business cycle synchronization is robust and causal, the paper pursued two strategies. First, the paper uses techniques developed by Altonji et al. (2005) to show that, on average, selection based on unobservables would have to be at least three times greater than selection based on observables in order for the positive effect of remittance flows on business cycle synchronization to be completely spurious. Second, the paper proposes and implements an identification strategy allowing the instrumentation of remittance flows. The result of the instrumental variable approach also confirmed a positive and significant effect of remittance flows. Finally, the paper demonstrates that the main conclusion of the study is robust to different filtering techniques used to measure business cycles.

This paper has clear policy implications. Developing countries that receive sizable remittance inflows tend to be more connected and vulnerable to external shocks than what traditional measures would suggest. Remittance flows represent an important and distinct channel of spillover effects from the global economy into emerging and developing countries. Countries with less trade and limited capital account liberalization could still be vulnerable to risks stemming from the global economy through their dependency on remittance inflows. These findings imply that the concept of external openness needs to be modified to account for the role of the remittances channel. Measures of openness and integration into the global economy which allow for the role of remittance flows would provide governments and policymakers a more accurate measure of the degree of exposure of their countries to remittance fluctuations and their impact on the domestic economy. This, in turn, would allow policymakers to develop more efficient tools to manage external spillovers.

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APPENDIX I. DESCRIPTIVE STATISTICS AND LIST OF COUNTRIES

A. Aggregate Data

Table A1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Synchronization coefficient (HP)	2100	0.21	1.37	-13.99	1
Synchronization coefficient (BK)	1958	0.18	1.42	-14.28	1
Trade-to-GDP ratio	2058	0.71	0.40	0.06	2.80
Financial openness	2075	1.62	1.31	0.16	4.48
Remittance-to-GDP ratio	1907	0.02	0.04	0.00	0.24
Terms of trade (in log)	1999	4.65	0.35	2.36	6.01

Table A2. List of Countries, 70

Algeria	Fiji	Mexico	Thailand
Argentina	Gabon	Morocco	Togo
Bangladesh	Gambia	Nepal	Tunisia
Belize	Ghana	Nicaragua	Turkey
Benin	Guatemala	Niger	Uruguay
Bolivia	Guinea-Bissau	Nigeria	Venezuela, RB
Botswana	Guyana	Pakistan	Zambia
Brazil	Honduras	Panama	
Burkina Faso	India	Papua New Guinea	
Burundi	Indonesia	Paraguay	
Cameroon	Iran	Peru	
Chile	Jamaica	Philippines	
China	Jordan	Rwanda	
Colombia	Kenya	Senegal	
Congo, Rep.	Lesotho	Seychelles	
Costa Rica	Madagascar	Sierra Leone	
Cote d'Ivoire	Malawi	Sri Lanka	
Dominican Republic	Malaysia	St. Vincent and the Grenadines	
Ecuador	Mali	Sudan	
Egypt	Mauritania	Suriname	
El Salvador	Mauritius	Syrian Arab Rep.	

B. Bilateral Data

Table B1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Synchronization coefficient (HP)	1569	0.29	1.36	-13.75	1
Synchronization coefficient (HP)	1140	0.20	1.45	-12.01	1
Bilateral trade intensity	1569	0.00	0.01	0.00	0.05
Financial openness in i and j	1569	5.44	1.52	1.01	8.16
Asymmetry of production	1569	11.50	6.00	0.74	47.83
Bilateral remittance ratio	1569	0.00	0.01	0.00	0.20
Terms of trade (in log)	1088	4.74	0.12	4.45	4.96

Table B2. List of Countries, 10

Bangladesh
Croatia
Indonesia
Kazakhstan
Macedonia
Moldova
Philippines
Slovenia
Tajikistan
Thailand