

Macroeconomic Determinants of Emigrants' Remittances cycles: Evidence from a panel VAR

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Abstract

This paper considers the macroeconomic determinants of emigrants' remittances cycles. By using panel VAR methods I am able to compensate for both data limitations and endogeneity among variables. The analysis considers annual data for 16 Latin and Caribbean countries. By using this data I compute variance decompositions (VDCs) and impulse response functions (IRFs). The VDCs show that the forecast error variance of remittances cycles is explained by the cycles of host country GDP, the cycles of home country GDP and the cycles of interest rate differential between home and host countries. The IRFs analysis confirms this finding. First, the IRFs show that remittances respond positively to boom in host country. Second, for altruistic motivations, a recession in home country is accompanied by an increase in remittances inflows. The last result, related to self-interested motivations, is the increase in remittances inflows following a rise in interest rate differential between home and host countries.

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1 Introduction

The recent years were marked by the increasing role of emigrants remittances in total international capital flows. Recorded remittances to developing countries are estimated to reach \$240 billion in 2007. The true size of remittances including unrecorded flows is even larger. For many developing countries, remittances represent a significant part of international capital flows, exceeding export revenues, Foreign Direct Investment (FDI) and foreign aid. In the aggregate, remittances are currently the second largest source of foreign exchange, both in absolute terms and as percentage of GDP (Figures 1 and 2). For some countries, remittances represent more than 10 percent of GDP. This is the case for small Caribbean and Pacific islands, but also for some labor-exporting countries, such as Albania, El Salvador and the Philippines (Figure 3).

Most of the literature on the determinants of emigrants remittances is based on the micro-determinants of remittances inflows to the countries of origin. Individual characteristics of emigrants such as education, age, sex, marital status, number of households at the country of origin, number of dependents accompanying emigrants in the host country, and the length of their stay are the basic determinants in such an approach. Seminal theoretical work on remittances was done by Lucas and Stark (1985), who interpreted the phenomenon of remittances in the context of the new economics of labor migration (NELM), and therefore with respect to contract theory. In this context, the decision on migration and remittances is part of the overall family/household decision making process. In general, these models argue on the base of an implicit insurance scheme between the migrant (future remitter) and the household of origin. Furthermore, these models usually explain that the household can offer uneducated labour and well educated labour; it is assumed that non-educated labour can only be offered at home. Therefore, only an “inner-group” of the household is considered as to be to earn money abroad. Nevertheless, since well-educated labor can also be offered on the domestic market, the household has to decide whether a member migrates or not. The families engage in education and sending costs, while the migrants share their income with their family left in the sending country. From a lifecycle perspective, remittances decline with the decision of migrant to settle down in the host country. According to these theoretical considerations migrants play an important role by offering income insurance and providing the sending family financial resources. Thus, Lucas and Stark look at remittances as motivated by either altruism or self-interest. In the first case, remittances are based on intrafamily obligations and depend on home economic conditions. In the second

case, remittances are explained as part of the portfolio choice of the migrant.

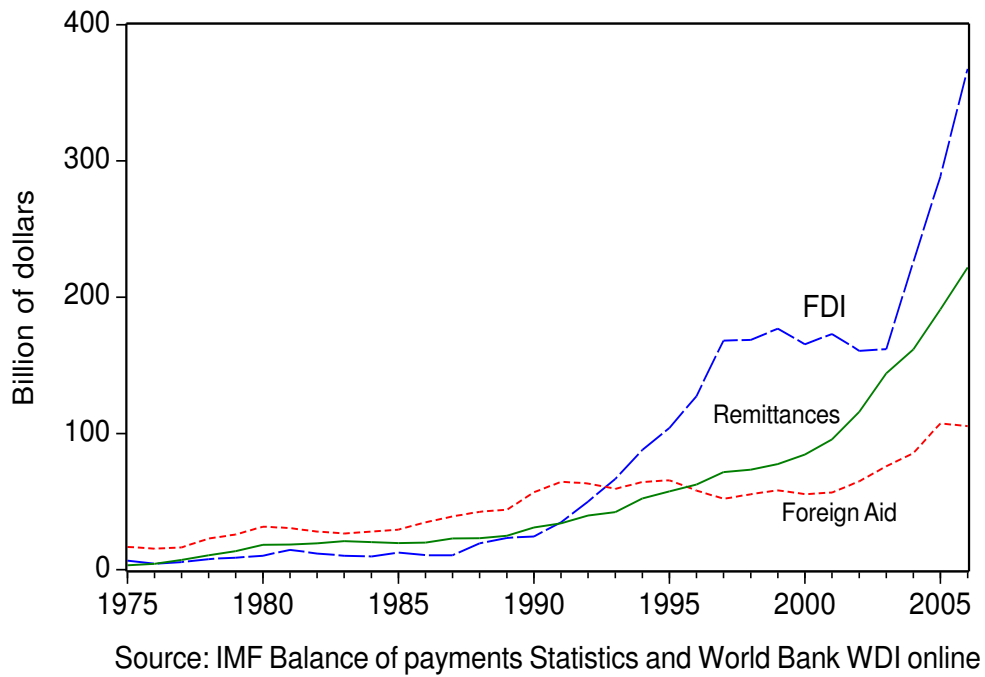


Figure 1. Remittances and Capital Flows to Developing countries (in US dollar Billions)

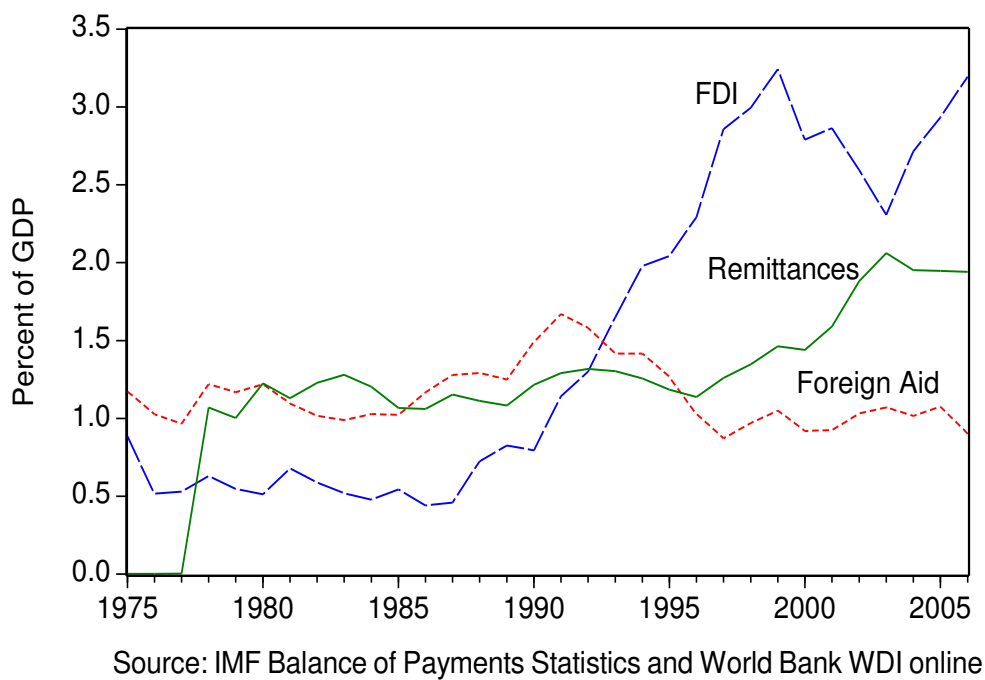


Figure 2. Remittances and Capital Flows to Developing countries (in percent of GDP)

Therefore, in this latter case, the performance of domestic financial sector seems to be an important factor concerning the size of remittances.

In comparison to the microeconomic literature, the theoretical literature on the macroeconomic aspects of remittances is much less rich. Nevertheless, three types of models can be detected. First, there is a class of models arguing that remittances have a positive impact on the domestic economic development since they provide a fund for higher savings and foreign exchange. Within this framework remittances are often considered as to perform similar functions as other international flows and thus to broaden the base for economic development (Connell and Conway, 2000). A second strand of literature focuses on the adverse effects of remittances. These studies show that a high dependency on remittances might decrease the incentives for creating an efficient domestic economic policy (Martin, 1990). Furthermore, there might be a continuing trend for substituting a sufficient economic policy by higher future migration. In addition, “Dutch disease” effects might occur. A third strand of literature tries to bring together the pros and cons mentioned above. Since remittances influence investment and growth in many ways, directly and indirectly, these studies clearly show that the impact of remittances on the domestic economy highly depends on the domestic policy (Glytsos, 1997; McCormick and Wahba, 2000).

Empirically, several studies (El-Sakka and McNabb, 1999; Elbadawi and Rocha 1992) have considered the question of whether remittance flows are affected by key macroeconomic variables. In order to capture host economic conditions, GDP or GDP per capita is used explanatory variable, since this variable impacts

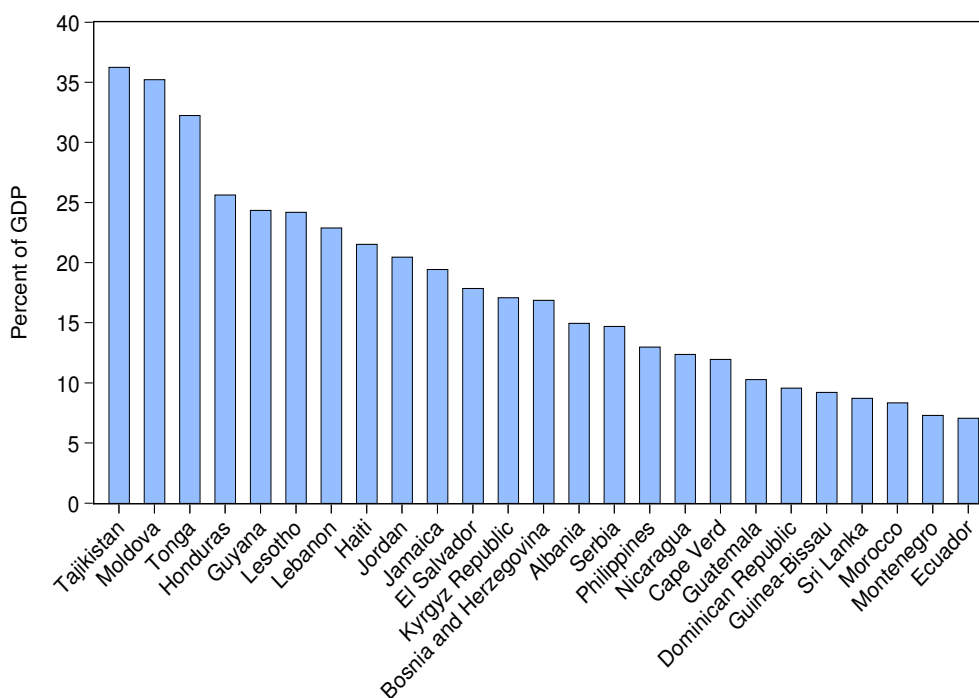


Figure 3. Top remittances -recipient countries (in percent of GDP)

on migrant' consumption and savings (El-Sakka and McNabb, 1999; Lianos 1997; Elbadawi and Rocha, 1992). Other variables are used to capture host economic activity: the hourly industrial wage of host country (Swamy, 1981), the number of migrants in the host country and the average length of stay of migrants (Elbadawi and Rocha, 1992). These variables are invariably positive and generally significant. Lianos (1997) found that the rate of unemployment in the host country had a negative impact on remittances but was not statistically significant.

To capture economic activity in home country (altruistic motivation), variables employed is per capita GDP in home country (El-Sakka and McNabb, 1999; Lianos, 1997). Here, the intuition is, for altruistic motivation, the more depressed income was in the home country, the more remittances increase. Many studies showed a negative relationship between remittances and domestic GDP, while some others indicated a positive relationship (Hysenbegasi and Pozo, 2002; Swamy, 1981). In the studies by El-Sakka and McNabb (1999) and Elbadawi and Rocha (1992), this variable was not significant. Work by Alleyne (2006) suggests that this variable might be endogenous, which accounts for the inconsistency reported in the relationship between remittances and domestic GDP per capita.

For self-interested motivations, some studies have used variables designed to capture portfolio effects due to the difference between financial returns at home and host countries. Thus, the difference between the domestic and foreign interest rate, may also be used as an explanatory variable. In the Swamy (1981) and Elbadawi and Rocha (1992) studies, this variable was not significant while El-Sakka and McNabb (1999) reported it as negative and highly significant. Lianos (1997) used the foreign and domestic interest rates separately and obtained positive and significant results for the domestic interest rate, but mixed results for the foreign rate under different formulations.

This paper completes these previous studies by analysing the determinants of remittances cycles in a panel VAR context. The analysis is about the effect on remittances cycles of host country cycles, home country cycles (altruistic motivation) and differential between home and host interest rates cycles (self-interested motivation). This study uses data for 16 Latin American and Caribbean countries. The reason of the selection of these countries is that, almost all the remittances received in these countries come from US. Then, the only host country considered is the US.

The paper is organized as follows. Section 2 examines the pattern of remittances for 16 Latin American and Caribbean countries. Section 3 presents and estimates an econometric model using panel data from 16 Latin American and Caribbean countries. This section also contains the interpretation of the results. Finally, section 4 summarizes the results and presents some conclusions. The appendix provides a detailed description of data sources and construction.

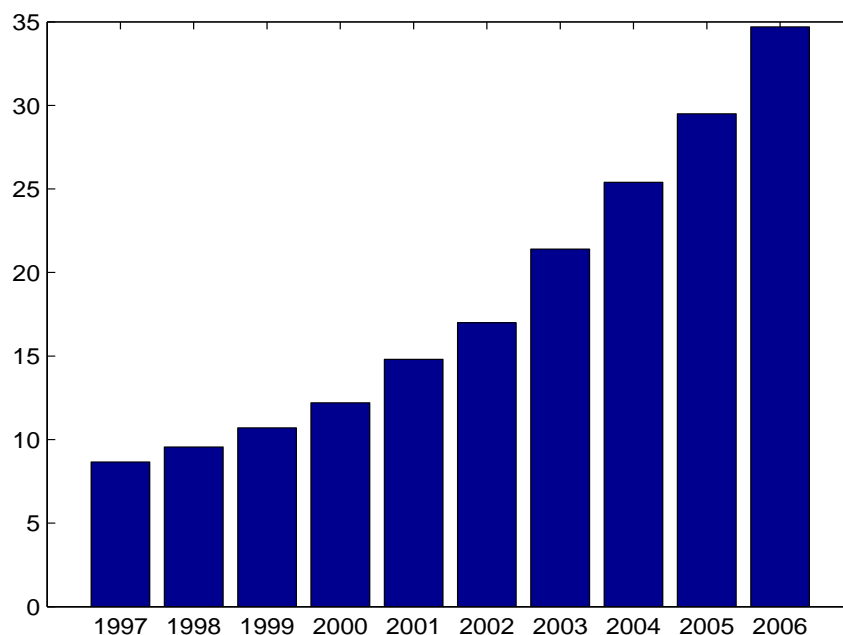
2 Some Stylized facts

In this section I explore the patterns of official remittances in 16 Latin American and Caribbean labor-exporting countries (Argentina, Belize, Bolivia, Brazil, Colombia, Dominican Republic, Ecuador and El Salvador, Guatemala, Guyana,

Haiti, Honduras, Jamaica, Mexico, Nicaragua and Peru). The reason of this selection is that most of remittances in these labor-exporting countries come from US. So, US is the only host country that is considered. The period of analysis, determined by the availability of data, starts in 1980 to 2006.

Workers' remittances are transfers from citizen living abroad to the home country. Therefore workers' remittances appear in the current account of the balance of payment system and are conceptually part of the gross national product. In general, the International Monetary Fund (IMF) distinguishes between three categories of migrants' transfers: (1) remittances from workers living abroad for more than one year, (2) compensation of employees, from workers living abroad less than one year and (3) migrants' transfers which reflect the migrants' claims on residents of an economy. The most important data source for workers' remittances are the Balance of Payments Statistics (BoP) published by the International Monetary Fund and the World Development Indicators (WDI) dataset available by the World Bank.

As in all developing countries, one observes an increase in remittances to the 16 Latin American and Caribbean labor-exporting countries under consideration. In these countries, official remittances increase from 12.2 billion US-dollar in 2000 to reach 34.7 billion US-dollar in 2008 (figure 4).



Source: World Bank WDI online, 2008

Figure 4. Remittances to 16 Latin American and Caribbean selected countries (in US dollar Billion)

We have to bear in mind that these figures only represent the official data. Remittances are relatively difficult to measure, since migrants send money back to their country of origin in a variety of ways. This might be due to the fact of high

transactions costs and strong regulations. Therefore, official figures would tend to under estimate the real size of remittances.

Despite these general data problems, official figures indicate that remittances are increasing over time. The magnitude of remittances differs widely among the countries under consideration (Table 1). Table 1 gives, for each country under consideration, the official remittances in nominal terms (remittances in US-dollar and per capita remittances in US-dollar). In 2006, the most important recipient of remittances was Mexico, followed by Brazil. However, remittances measured in nominal terms give only first insights concerning the importance of these cross-border transfers for a given country. More meaningful are the remittances per capita. In 2006, in per capita, the five highest recipients of remittances were: Jamaica, El Salvador, Honduras, Dominican Republic and Guyana.

Table 1: Workers' Remittances in 2006

| Remittances in million US-dollar | | Remittances per capita in US-dollar | |
|----------------------------------|-------|-------------------------------------|-----|
| Mexico | 25050 | Jamaica | 730 |
| Brazil | 4253 | El Salvador | 492 |
| Colombia | 3928 | Honduras | 340 |
| Guatemala | 3626 | Dominican Republic | 317 |
| El Salvador | 3329 | Guyana | 295 |
| Dominican Republic | 3044 | Guatemala | 278 |
| Ecuador | 2922 | Mexico | 240 |
| Honduras | 2367 | Ecuador | 221 |
| Jamaica | 1946 | Belize | 220 |
| Peru | 1837 | Nicaragua | 118 |
| Haiti | 1070 | Haiti | 113 |
| Nicaragua | 656 | Colombia | 86 |
| Bolivia | 612 | Peru | 67 |
| Argentina | 541 | Bolivia | 65 |
| Guyana | 218 | Brazil | 22 |
| Belize | 65 | Argentina | 13 |

Source: World Bank: World Development Indicators, CD ROM 2008

The dependency of a country on remittances can be measured in terms of GDP. Table 2 ranks the countries under consideration by remittances in percent of GDP, for the data in 2006. This table shows that 7 of the 16 countries under consideration have remittances-GDP ratio superior than 10 percent. This reflects the high dependency of these labor-exporting on remittances. The highest dependency on remittances, measured in percent of GDP, was reached in Honduras. Mexico, which is the most important recipient of remittances in Latin and Caribbean countries, has its dependency around 3 percent of GDP. Then, there seems to be evidence that remittances are most important for relatively small economies with a low income level.

Table 2: Economic Dependency on Remittances in 2006 (in percent of GDP)

| Remittances in percent of GDP | |
|-------------------------------|-------|
| Honduras | 25.63 |
| Guyana | 24.33 |
| Haiti | 21.50 |
| Jamaica | 19.42 |
| El Salvador | 17.84 |
| Nicaragua | 12.37 |
| Guatemala | 10.27 |
| Dominican Republic | 9.56 |
| Ecuador | 7.06 |
| Bolivia | 5.48 |
| Belize | 5.40 |
| Mexico | 2.99 |
| Colombia | 2.56 |
| Peru | 1.99 |
| Brazil | 0.40 |
| Argentina | 0.25 |

Source: Word Bank: World Development Indicators, CD ROM 2008

It is easy to illustrate the growing importance of remittances to the balance of payment accounts of these labor-exporting countries by looking table 3. Table 3 ranks countries by remittances in percent of exports and by remittances in percent of imports, for the data in 2006. For more than half of the countries under consideration, whatever remittances are expressed in terms of exports or in terms of imports, the dependency on remittances is more than 20 percent.

Table 3: Economic Dependency on Remittances in 2006 (in % of Exports and Imports)

| Remittances in percent of Exports | | Remittances in percent of Imports | |
|-----------------------------------|--------|-----------------------------------|-------|
| Haiti | 152.54 | Haiti | 49.82 |
| El Salavador | 65.66 | Honduras | 38.56 |
| Guatamala | 65.58 | El Salvador | 38.09 |
| Honduras | 62.79 | Guatamala | 33.57 |
| Jamaica | 42.42 | Jamaica | 30.80 |
| Nicaragua | 39.74 | Dominican Republic | 23.88 |
| Guyana | 29.10 | Ecuador | 21.23 |
| Dominican Republic | 28.54 | Nicaragua | 20.27 |
| Ecuador | 20.59 | Guyana | 20.01 |
| Bolivia | 13.00 | Bolivia | 16.81 |
| Colombia | 11.42 | Colombia | 10.30 |
| Mexico | 9.36 | Peru | 10.08 |
| Belize | 8.50 | Mexico | 9.00 |
| Peru | 6.92 | Belize | 8.73 |
| Brazil | 2.72 | Brazil | 3.40 |
| Argentina | 1.02 | Argentina | 1.32 |

Source: Word Bank: World Development Indicarors, CD ROM 2008

3 Econometric estimation

In this section the determinants of remittances cycles are analysed. In a preliminary analysis, I compute the correlations between remittances cycles and host country cycles, home country cycles and interest rate differential between home and host countries. After this preliminary analysis, I analyse the effect, on the remittances cycles, of host country cycles, home country cycles and interest rate differential between home and host countries.

Following Lucas (1977) and Kydland and Prescottt (1990), the business cycles is defined as the deviations from a trend. For each series, the business cycles are obtained by detrending the serie using the Hodrick and Prescott (1980) (HP) filter. For any series x , the HP filter extracts the growth component x^g and the cyclical component $x^c = x - x^g$ by minimizing the following loss function:

$$\sum_t (x_t^c)^2 + \lambda \sum_t [(x_{t+1}^g - x_t^g) - (x_t^g - x_{t-1}^g)]^2,$$

where λ is a weight that reflects the relative variance of the two components. I adopt the value of $\lambda = 100$, which is conventional for yearly data. In order to obtain the percentage deviations from trend, expected interest rate the logarithms of all the series are considered .

3.1 Preliminary Empirical Regularities

In this part, I compute the cross-correlation between remittances cycles, home output cycles, host output cycles and the cycles of interest rate differential between home and host countries. R denotes the cyclical component of the Hodrick-Prescott filtered of real remittances per capita in log. Y_{home} (respectively Y_{host}) is the cyclical component of the Hodrick-Prescott filtered of home (respectively host) real GDP per capita in log. $\Delta i = i_{\text{home}} - i_{\text{host}}$ is the differential between home and host interest rate cycles, where i_{home} (respectively) i_{host} are the cyclical component of the Hodrick-Prescott filtered of home (respectively host) country.

Tables 4-6 contain the contemporaneous cross correlation, as well as asynchronous correlations, between remittances cycles and home cycles, host cycles and the differential interest rate, respectively. The correlation coefficients that are statistically significant at 90 percent level are marked by asterisk.

Figures 5 and 6 give a comparison of the cycles of remittances to the cycles of home GDP and host GDP, for each country under consideration. Figures 7 and 8 compares the cycles of remittances to those of interest rate differential.

Table 4 shows that remittances flows into some the countries within the group are positive correlated to US cycles, whereas into the others countries remittances are not significant correlated to US cycles. The countries where one observes the

positive and significant correlation between remittances cycles and US cycles are: Belize, Bolivia, Colombia, Dominican Republic, Ecuador, Guatemala and Mexico. In the others countries the correlation is non significant positive or significant negative.

The positive correlation between remittances cycles and US cycles mean that when a boom occurs in US, migrants in US send more remittances to their home countries. This can be explain by two reasons. On the one hand, a boom in host country can directly affect the demand for migrant labor. Labor importing countries often set quotas which limit the number of immigrants who can enter the country and how long they can remain. On the other hand, the level of economic activity in the host country can impact upon the wages faced by migrants. The level of migrants' earnings will determine thier own consumption and saving behavior and thus the potential amount that can be remitted.

The non significant correlation between remittances cycles and host country cycles can be explain by the integration of the economy of US and home country. If the two economies are integrated, a boom in US can lead to a increase in the output of home country. This can cause a decrease in remittances from US to home country, by a altruistic motivations. In fact, for altruistic motivations, migrants send more remittances if home economic conditions are bad.

Table 5 shows that remittances flows into some the countries within the group are countercyclical whereas others they are procyclical or acyclical. The countries where strong countercyclicity is found are Belize, Bolivia, Colombia and Guatemala. The procyclicity is observed in El Salvador, Mexico, Peru and Jamaica. In the others countries remittances are acyclical. These results mean that, in some countries (Belize, Bolivia, Colombia and Guatemala), migrants increase their transfers during times of economic hardship at home (implying a strong consumption smoothing motives). On the contrary, migrants from El Salvador, Mexico, Peru, and Jamaica increase their transfers during good times at home (implying a stronger investment motivations or higher risk aversion). In terms of response time, migrants from Colombia (though in the opposite direction) and Jamaica (though in the same direction) respond with respond with a time lag.

Among the countries where remittances are acyclical, there are some countries (Argentina, Brazil, Colombia, Ecuador, Nicaragua) where remittances appear to be countercyclical but the degree of cyclicity is not strong enough to state this with confidence based on statistical significance of correlations estimated using annual data. Likewise, the seemingly procyclicity relationship between remittances sent to the remaining countries (Dominican Republic, Guyana, Haiti and Honduras) and respective outputs fails to pass statistical significance tests requiring that remittances received by these countries be classified as acyclical.

The procyclicity (or the acyclicity) can be explained by the fact that home economic activity can be endogenous. In fact, an increase in remittances leads to an increase in global demand, then leads to an increase in home economic activity

through the keynesian effect. In this case remittances can be acyclical (if the keynesian effect compasentes the altruistic effect) or procyclicalacyclical (the keynesian effect dominates the altruistic effect).

Table 6 shows that in the countries (El Salvador, Mexico, Peru, and Jamaica) where remittances are procyclical the correlation between remittances cycles and interest rates differential between home and host countries is positive and significant. This result confirm the finding that, in these countries, remittances are driven by investment motivations (or seff-interested motivations). In some countries where remittances are acyclical there a positive and significant correlation between remittances and differential interest rate. Dominican Republic is the only country where remittances are countercyclical and where the correlation between remittances and differential interest rate is positive and significant.

The differents results mentioned above show the difficulty to establish a relationship between remittances cycles and its potential determinants. Even if there is the correct expected signe of the correlation, one can not know the effect on remittances cycles. So, an appropriate econometric analysis is necessary.

Table 5: Correlation between Remittances Cycles and Host (US) GDP Cycles

| Countries | Cross Correlation between Remittances (R) and GDP of Host country (Y_{host}) | | | Nature of Co-movement |
|----------------|---|-------------------|-----------------------|-----------------------|
| | $Y_{\text{host}}(-1)$ | Y_{host} | $Y_{\text{host}}(+1)$ | |
| Argentina | -0.0029 | -0.0206 | -0.1120 | 0 |
| Belize | 0.2319 | 0.4222* | 0.4103* | + |
| Bolivia | 0.0169 | 0.3805* | 0.4641* | + |
| Brazil | -0.0399 | -0.0051 | -0.0811 | 0 |
| Colombia | 0.5696* | 0.4051* | 0.0885 | + |
| Dominican Rep. | 0.2589 | 0.4443* | 0.3698* | + |
| Ecuador | 0.1193 | 0.3528* | 0.3126* | + |
| El Salavador | 0.0534 | 0.1062 | 0.0264 | 0 |
| Guatemala | 0.3211* | 0.0249 | 0.0118 | + |
| Guyana | 0.2582 | 0.0662 | 0.1157 | 0 |
| Haiti | 0.1980 | 0.2069 | 0.1588 | 0 |
| Honduras | 0.3815* | 0.1555 | -0.0407 | 0 |
| Jamaica | 0.0642 | -0.0012 | -0.2275 | 0 |
| Nicaragua | -0.1996 | -0.1396 | 0.0737 | 0 |
| Mexico | 0.3461 | 0.5240* | 0.7088* | + |
| Peru | -0.0348 | -0.0560 | 0.0650 | 0 |

Table 4: Correlation between Remittances Cycles and Home GDP Cycles

| Countries | Cross Correlation between Remittances (R) and GDP of Home country(Y_{home}) | | | Nature of Co-movement |
|----------------|--|-------------------|-----------------------|-----------------------|
| | $Y_{\text{home}}(-1)$ | Y_{home} | $Y_{\text{home}}(+1)$ | |
| Argentina | 0.1147 | -0.0150 | -0.0948 | Acyclical |
| Belize | -0.5023* | -0.3394* | -0.1478 | Countercyclical |
| Bolivia | -0.1982 | -0.3820* | -0.2033 | Countercyclical |
| Brazil | -0.2270 | -0.2653 | -0.2236 | Acyclical |
| Colombia | -0.3103* | -0.0942 | 0.1282 | Countercyclical |
| Dominican Rep. | 0.1074 | 0.0820 | 0.0759 | Acyclical |
| Ecuador | 0.0328 | -0.0266 | 0.0600 | Acyclical |
| El Salvador | 0.3011* | 0.5420* | 0.4111* | Procyclical |
| Guatemala | -0.3270* | -0.5472* | -0.5489* | Countercyclical |
| Guyana | 0.1870 | 0.2261 | 0.1261 | Acyclical |
| Haiti | 0.2605 | 0.3567 | 0.3247 | Acyclical |
| Honduras | 0.1170 | 0.1981 | 0.3006 | acyclical |
| Jamaica | 0.3777* | 0.0849 | 0.0119 | Procyclical |
| Nicaragua | 0.1720 | -0.1643 | -0.2048 | Acyclical |
| Mexico | 0.3243 | 0.4636* | 0.7139* | Procyclical |
| Peru | 0.1307 | 0.5255* | 0.7149* | Procyclical |

Table 6: Cross Correlation between Remittances and differential interest rate

| Countries | Cross Correlation between Remittances (R) and differential interest rate ($\Delta i = i_{\text{home}} - i_{\text{host}}$) | | | Nature of Co-movement |
|----------------|---|------------|----------------|-----------------------|
| | $\Delta i(-1)$ | Δi | $\Delta i(+1)$ | |
| Argentina | -0.1522 | 0.0045 | 0.0709 | 0 |
| Belize | -0.1479 | 0.0632 | 0.1628 | 0 |
| Bolivia | 0.1739 | 0.1071 | 0.0812 | 0 |
| Brazil | 0.5442* | 0.1993 | -0.2048 | + |
| Colombia | 0.0331 | 0.1001 | 0.0011 | 0 |
| Dominican Rep. | 0.0079 | 0.3613* | 0.2755 | + |
| Ecuador | 0.2860 | 0.1107 | 0.0185 | 0 |
| El Salvador | 0.2818 | 0.3343* | 0.1949 | + |
| Guatemala | 0.3608* | 0.2271 | 0.1445 | 0 |
| Guyana | 0.0680 | 0.0366 | -0.2372 | 0 |
| Haiti | 0.1808 | 0.7573* | 0.6263* | + |
| Honduras | 0.0126 | 0.0042 | 0.0145 | 0 |
| Jamaica | 0.1659 | 0.3794* | 0.0552 | + |
| Nicaragua | 0.3096 | 0.4273* | 0.3341* | + |
| Mexico | 0.3831 | 0.4029* | 0.0453 | + |
| Peru | 0.5294* | 0.5028* | 0.5526* | + |

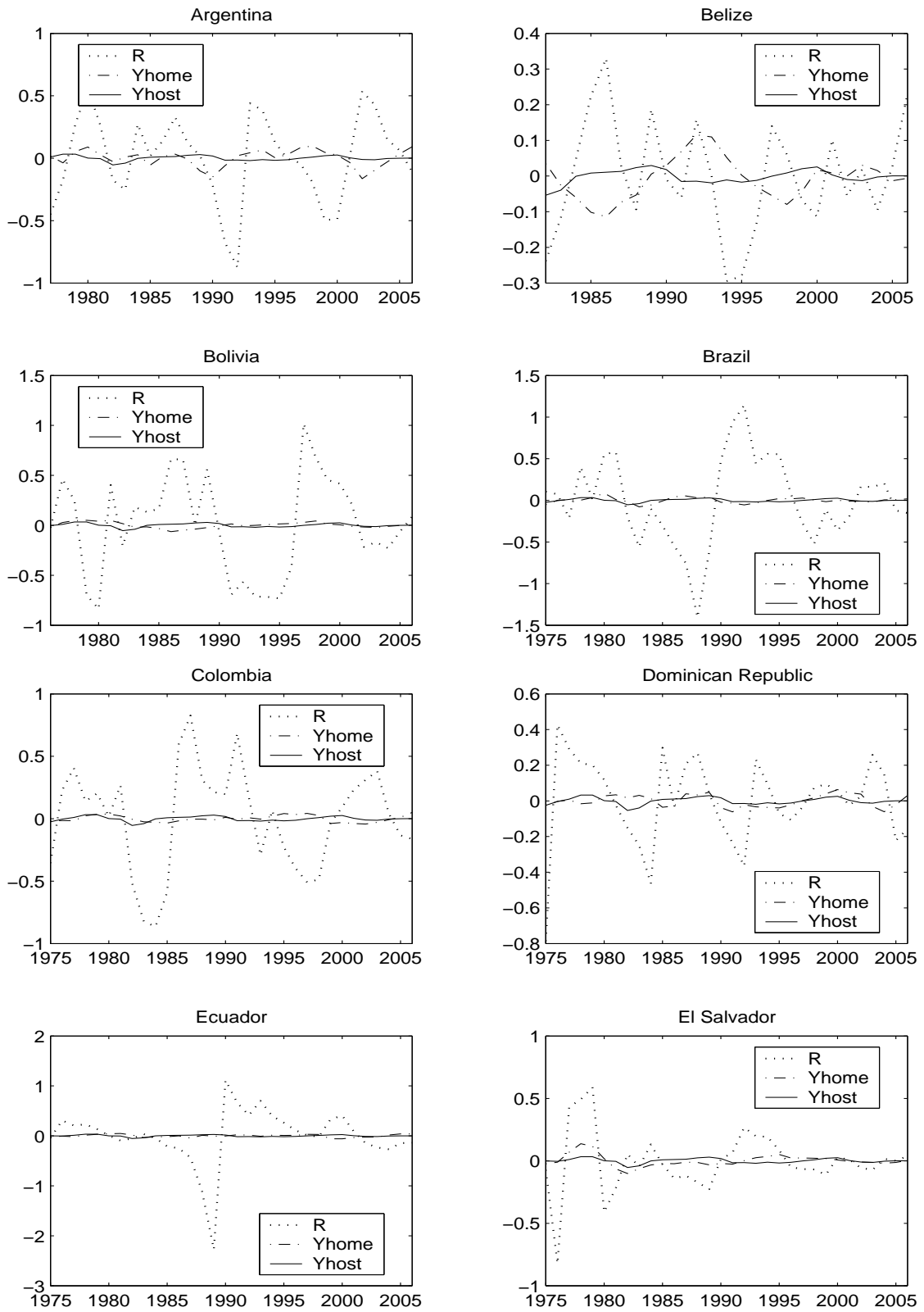


Figure 5. Cycles of Remittances, Home GDP and Host GDP (Argentina, Belize, Bolivia, Brazil, Colombia, Dominican Republic, Ecuador and El Salvador)

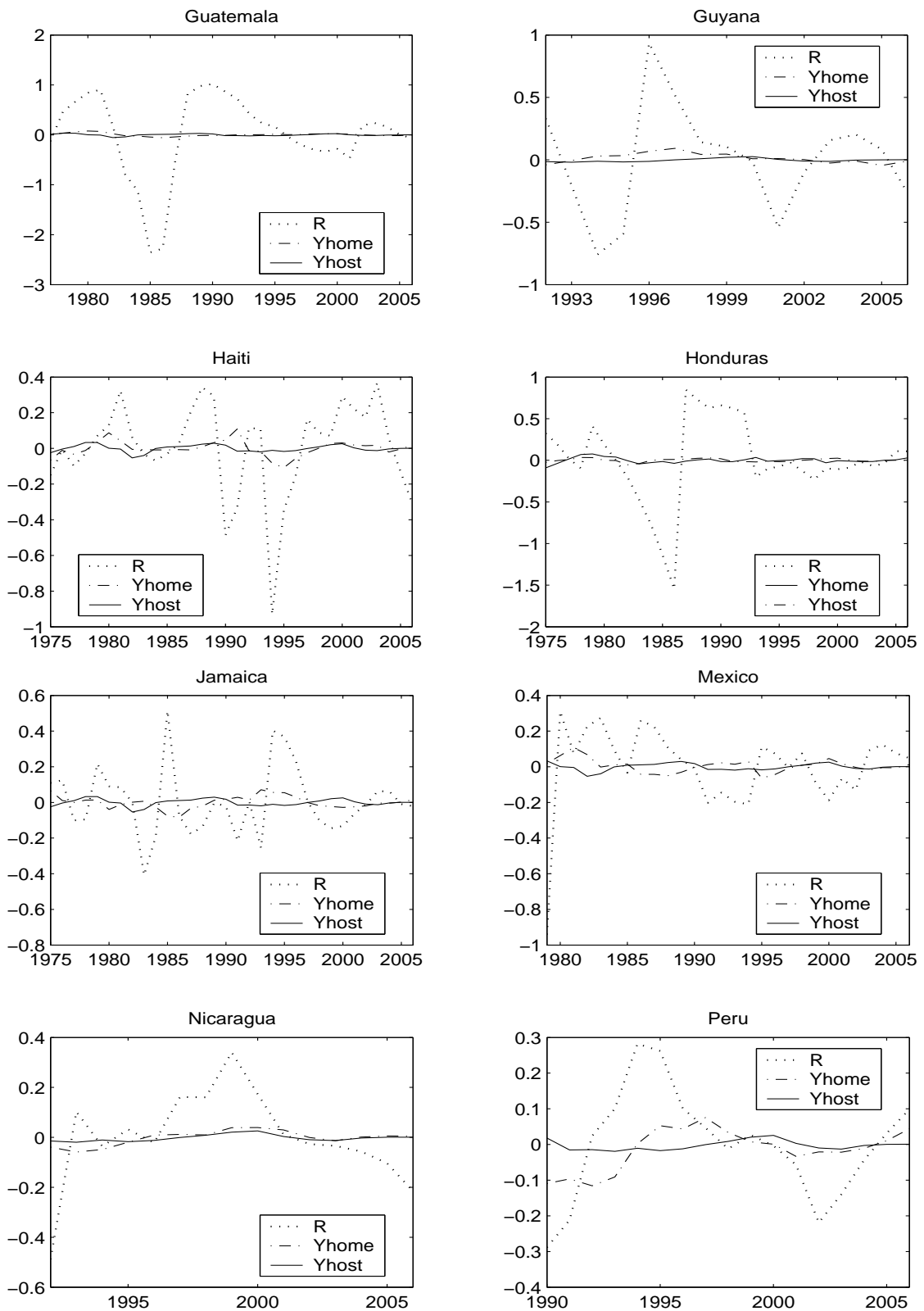


Figure 6. Cycles of Remittances, Home GDP and Host GDP, (Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua and Peru)

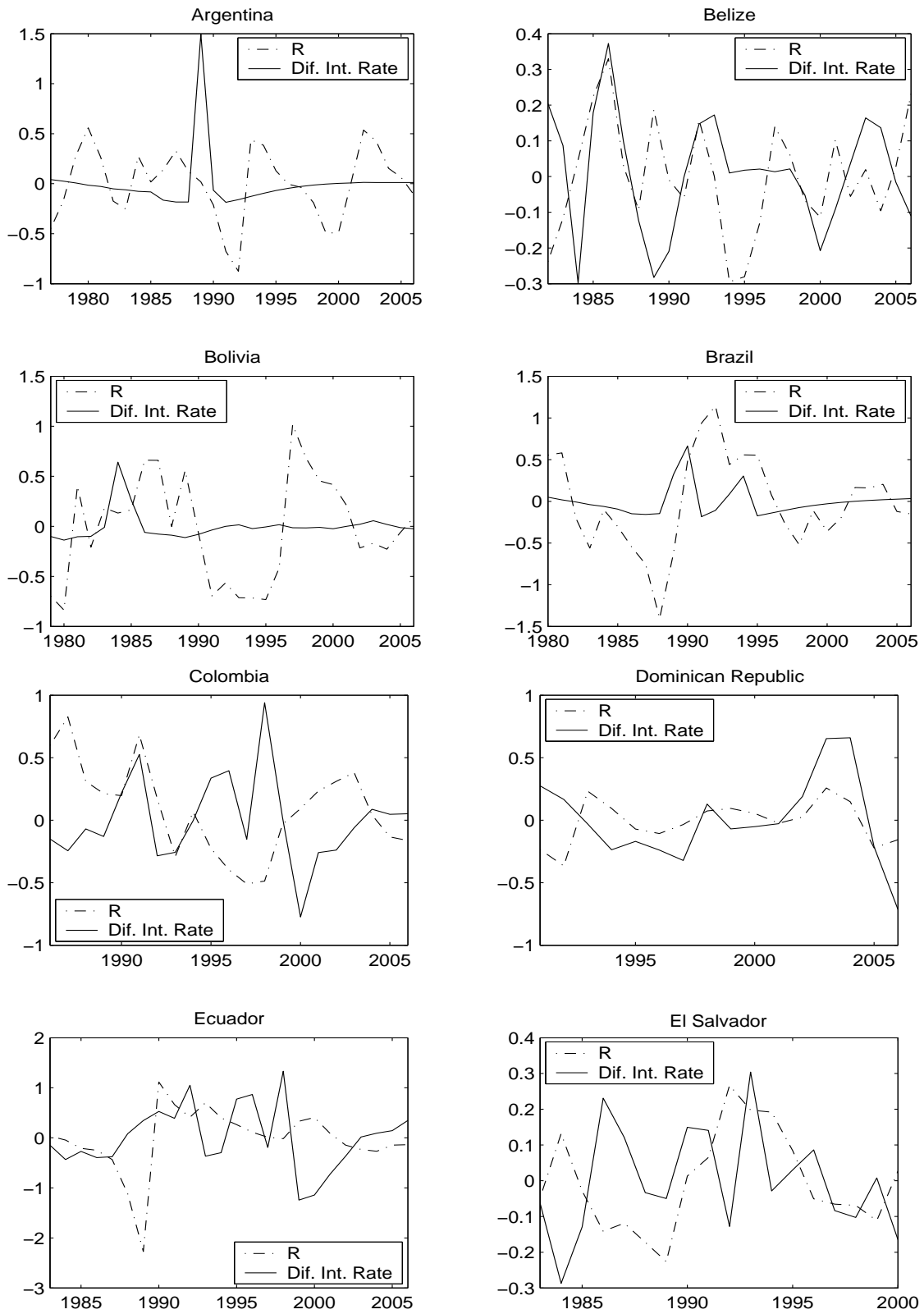


Figure 7. Cycles of Remittances and Differential between Home and Host interest rates (Argentina, Belize, Bolivia, Brazil, Colombia, Dominican Republic, Ecuador and El Salvador).

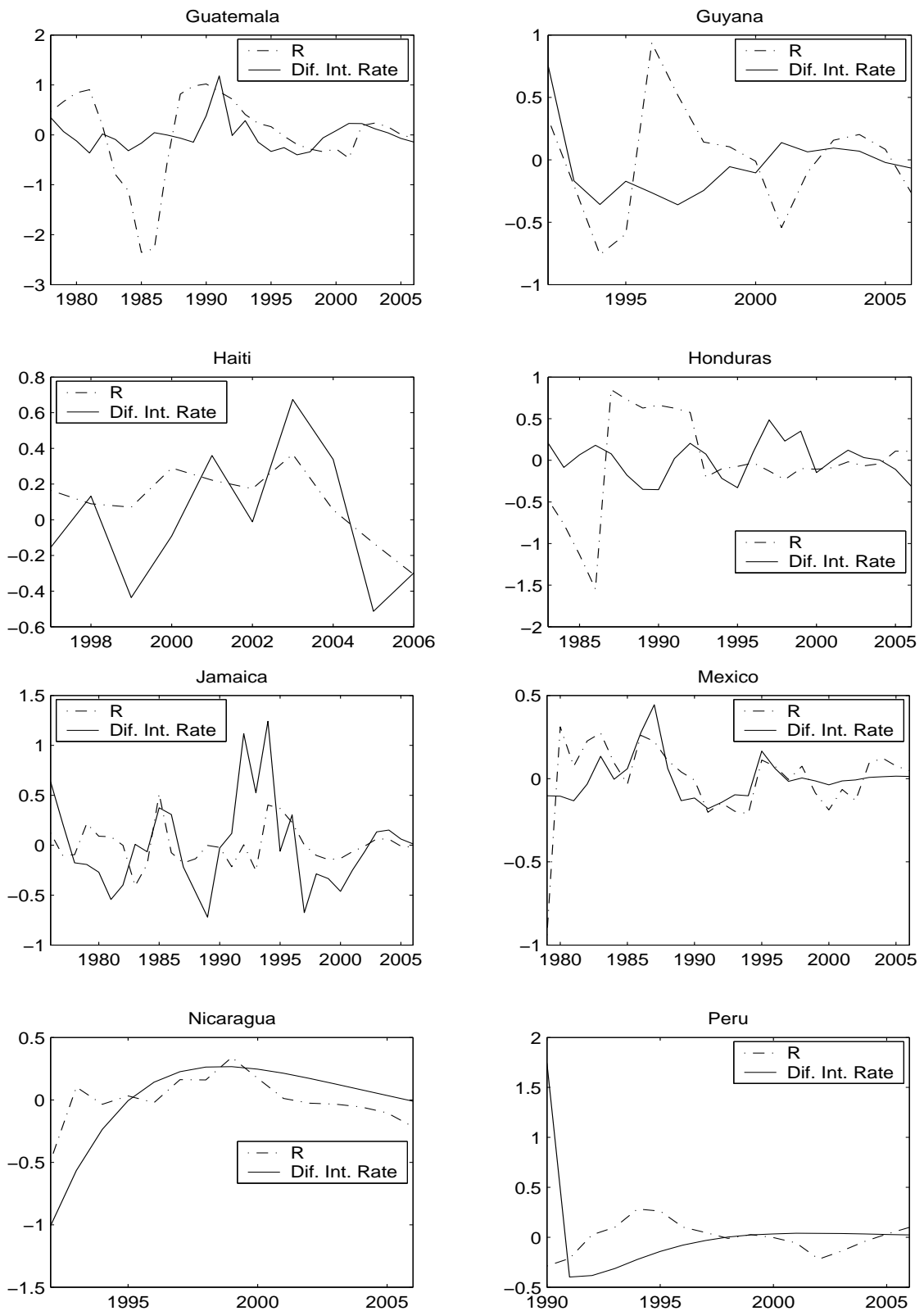


Figure 8. Cycles of Remittances and Differential between Home and Host interest rates (Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua and Peru).

3.2 Econometric Issues and Modelling

Two problems arrive when conducting the empirical analysis. First, as mentioned above, it is difficult to establish the effect of the some determinants of remittances, because these variables can be jointly determined with remittances. The second problem is the scarcity of macroeconomic data. There are non long macroeconomic time series for these countries and the data are typically reported at relatively low frequencies (i.e. annually). To tackle these two issues, I use a panel vector autoregressive (panel VAR) model.

The use of a VAR address the endogeneity problem by treating all the variables in the system as endogenous. Moreover, the panel VAR also overcomes a data limitation problem by using the data from various countries. Then, the use of panel VAR seems appropriate for this empirical analysis. Some authors even argue that the asymptotic results are easier to derive for panel data than for time series data (Gilchrist and Himmelberg 1998).

The initial econometric model takes the following reduced form:

$$Y_{it} = \Gamma(L)Y_{it} + u_{it} \quad (1)$$

where Y_{it} is the 4x1 vector of variables with $Y_{it} = [R_{it}, (Y_{home})_{it}, (Y_{host})_{it}, \Delta i_{it}]'$. As above, R , Y_{home} , Y_{host} and Δi are the cyclical components of real remittances per capita in log, home real GDP per capita in log, host real GDP per capita in log, and differential deposit interest rate between home and host countries, respectively. $\Gamma(L)$ is matrix polynomial in the lag operator, with $\Gamma(L) = \Gamma_1 L + \Gamma_2 L^2 + \dots + \Gamma_p L^p$. u_{it} is the model error term.

This panel VAR is estimated by using the package provided in Love (2001) and used in Love and Zicchino (2006). The estimation procedure in this package requires that time and country fixed effects must removed. There is no need to remove the time and country fixed effects in this model, since all variables are cyclical components given by Hodrick-Prescott filter. By construction, the Hodrick-Prescott filter removes the time and country fixed effects. Then, in this model the error term u_{it} is idiosyncratic error.

Once all coefficients of the panel VAR are estimated, I compute variance decompositions (VDCs) and impulse response functions (IRFs). The VDCs inform us on the portion of the forecast error variance for one variable that is attributable to its own innovations and to innovations from the others variables in the system. On the contrary, the IRFs inform us on the sign and time trajectory of the impact of one standard deviation shock to one considered variable in the system.

The order of the variables in the VAR is important. In fact, in order to compute the VDCs and the IRFs, the residuals must be orthogonalized. A recursive ordering is used in the orthogonalization of the residuals. The assumption behind such ordering is that series listed earlier in the ordering impact the others variables contemporaneously, while series listed later in the ordering impact those listed earlier only with lag. Consequently, variables listed earlier in the ordering are considered to be more exogenous. Since the US interest rate (i_{host}) depends on the reaction of Federal Reserve to the US business cycles (Y_{host}), it is natural to list the cycles of host country (US) at the beginning of the ordering. The ordering between home cycles (Y_{home}) and differential of interest rates (Δi) is problematic. In fact, the US interest rate is exogenous to home cycles, but the home interest rate also depends on the reaction of home monetary authority to the home cycles. Since, the goal of this model is to analyse the determinants of remittances, remittances cycles (R) is placed last in the ordering. Then, the two resulting ordering are considered:

Model 1: $[(Y_{host})_{it}, \Delta i_{it}, (Y_{home})_{it}, R_{it}]$

Model 2: $[(Y_{host})_{it}, (Y_{home})_{it}, \Delta i_{it}, R_{it}]$

In order to analyse the IRFs one needs to estimate their confidence intervals. Since the matrix of impulse responses functions is constructed from the estimated VAR coefficients, their standard errors must be taken into account. The IRFs and their confidence intervals are generated with Monte Carlo simulations. In practice the coefficients Γ are generated by using the estimated coefficients and their variance-covariance matrix, and the impulse-responses are re-calculated. This procedure are repeated 1000 times. The 5th and 95th percentiles of this distribution are used as a confidence interval for the IRF.

3.3 Econometric results and Interpretation

The general dataset covers the years 1980 to 2006 for the 16 Latin and Caribbean countries under consideration. The lag length is selected so that there is no serial correlation remaining in the residuals. In this model, one lag suffices so that residuals have no serial correlation. Table 7 reports the results of the estimation for this 4-variable VAR model. Figure 9 reports graphs of impulse responses for the two models (Model 1 and Model 2), (where errors are 5% on each side are computed via Monte Carlo simulation with 1,000 draws and shock corresponds to one standard deviation)

The estimation in Table 7 shows that US business cycles depend only on its own lags. This confirms that host (US) cycles is the most exogenous variable among the variables under consideration. The estimation also shows that remittances depend on the lags of all other variables.

Table 7: Estimation of the 4-variable VAR model

| Response of | Response to | | | |
|----------------|--------------------|--------------------------------|--------------------|------------------|
| | $(Y_{host})_{t-1}$ | Δi_{t-1} | $(Y_{home})_{t-1}$ | R_{t-1} |
| $(Y_{host})_t$ | 0.6294 (15.52)*** | 0.0000 (-1.44) | -0.3494 (-1.03) | -0.0043 (-0.82) |
| Δi_t | 7.51740 (1.93)** | 0.3400 (2.24)** | 2.32077 (2.02)** | 1.0141 (0.01) |
| $(Y_{home})_t$ | 0.0309 (2.35)** | $-5.05 \cdot 10^{-6}(-4.85)**$ | 0.6631 (15.74)*** | 0.0029 (2.14)** |
| R_t | 1.5169 (2.22)** | 0.0020 (2.23)** | -1.1012 (2.23)** | 0.5447 (4.62)*** |

Four variable VAR model is estimated by GMM. Reported numbers show the coefficients of regressing the row variables on lags of the column variables. Heteroskedasticity adjusted t-statistics are in parentheses. ***, ** and * indicates significance at 1%, 5% and 10%, respectively.

Before discussing the response of remittances to different variables under consideration, I check the ability of these variables to explain remittances by computing variance decomposition (VDCs). Table 8 contains the VDCs for the two models. The results of VDCs in two models are nearly identical. Host GDP explains 9.12 percent of the forecast error variance of remittances. About 7 percent of the forecast error of remittances is explained by innovations to interest rate differential between home and host countries. Home GDP explains up to 9.5 percent of the forecast error variance of remittances. These findings suggest that remittances are explained both by host and home economic conditions. The results also show that remittances explain 6.14 percent of the home GDP and only 1.12 percent of interest rate differential between home and host countries. To identify the response of remittances to the other variables, I compute the IRFs from the two VAR models.

Table 8: Variance Decompositions after 10 periods

| Models | Variables | Percentage of the Variance explained by | | | |
|---------|------------|---|------------|------------|-------|
| | | Y_{host} | Δi | Y_{home} | R |
| Model 1 | Y_{host} | 87.75 | 6.76 | 4.92 | 0.57 |
| | Δi | 16.90 | 81.00 | 0.98 | 1.12 |
| | Y_{home} | 3.91 | 0.58 | 89.36 | 6.14 |
| | R | 9.12 | 6.81 | 9.68 | 74.37 |
| Model 2 | Y_{host} | 87.75 | 7.13 | 4.54 | 0.57 |
| | Δi | 16.90 | 81.00 | 0.99 | 1.12 |
| | Y_{home} | 3.91 | 0.34 | 84.61 | 11.4 |
| | R | 9.12 | 6.63 | 9.86 | 74.38 |

Figure 4 displays (for the two models) the IRFs of remittances to the other variables. The response of remittances to shocks on different variables is the same in the two models. The IRFs show that an increase in host GDP has contemporaneous and positive impact on remittances that lasts two periods. The response of remittances to home GDP is negative and remains significant for two periods after the shock occurred. After a positive shock on interest rate differential between home and host countries, remittances response positively in the first period and negatively in the second period.

The different responses of remittances flows are relevant for understanding:

- First, the positive response of remittances to host GDP means that a boom in host country leads emigrants to send more money to home country.
- Second, the negative response of remittances to home GDP is line with the altruistic motivation of emigrants. In fact, for altruistic motivation, emigrants send more (less) money to home country if home economic activity is bad (good).
- The last result, related to self-interest motivation, is the increase in remittances inflows following a rise in interest rate differential between home and host countries. This result shows that some part of remittances behaves like any other portfolio investment. In this case, emigrants send money to exploit investment opportunities in home country, and more money are sent if assets prices are relatively higher in home country.

These different results, obtained by an appropriate methodology which takes account of the variables endogeneity, are in line with some previous results mentioned above.

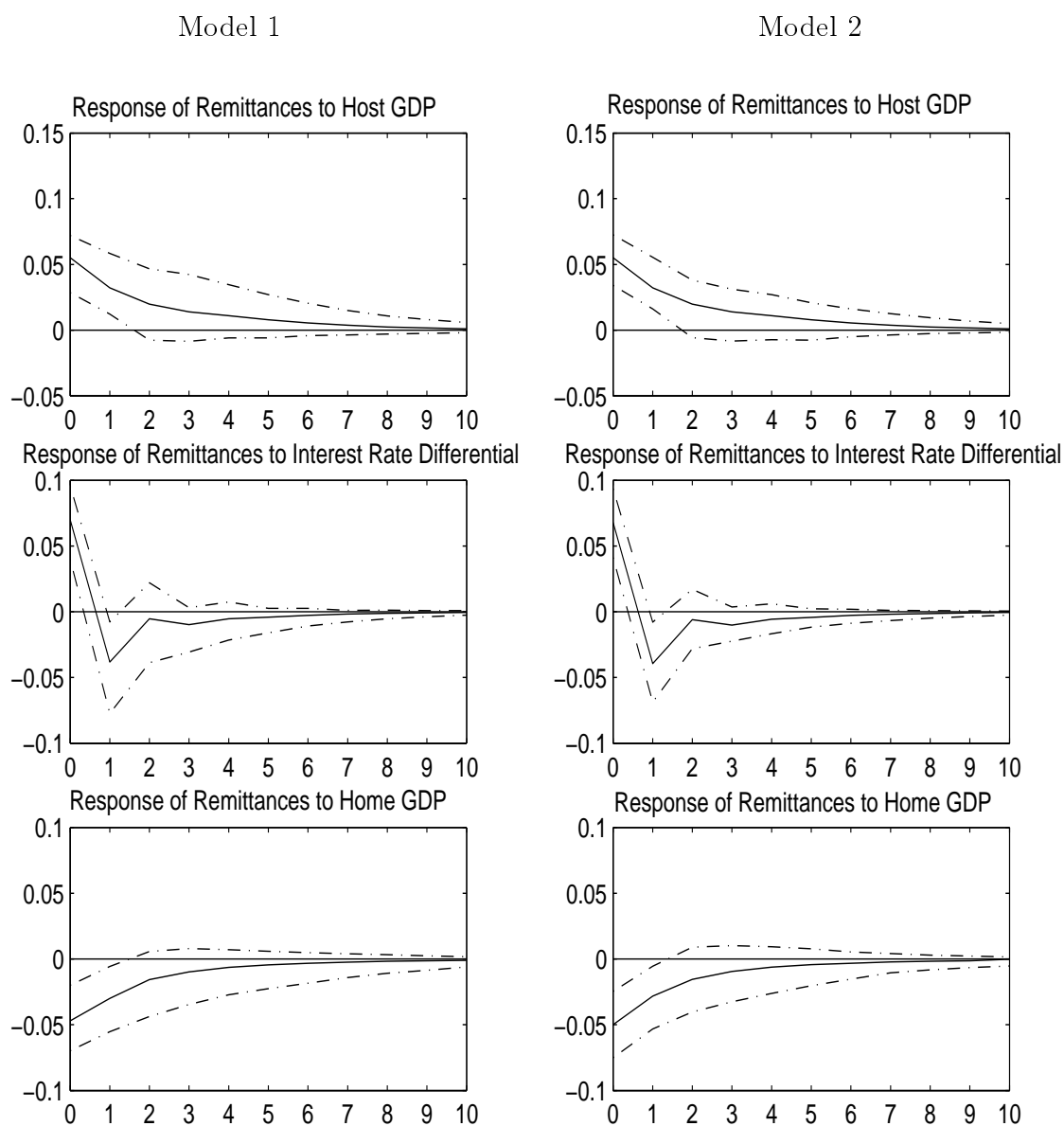


Figure 9. Impulses Responses of Remittances. (Solid lines indicate Impulses Responses, Dash-dotted lines indicate the error bands).

Note: Errors are 5% on each side computed via Monte Carlo simulation with 1,000 draws. The shock corresponds to one standard deviation

4 Conclusion

Remittances flows to emerging markets have been increasing in recent years. For many countries, they exceed foreign aid and foreign direct investment. Empirically, some studies have considered the question of whether remittance flows are affected by key macroeconomic variables. Due to the endogeneity among vari-

ables, these previous studies give contradictory findings. This paper employs a panel vector autoregressive approach, that controls for endogeneity problem, to explain the determinants of remittances cycles.

Using annual data from 16 Latin and Caribbean countries, I explore impulse response functions of remittances cycles to shocks on host (US) GDP, home GDP and differential interest rate between home and host countries. First, the results show that remittances respond positively to boom in host country. Second, for altruistic motivation, a recession in home country is accompanied by an increase in remittances inflows. The last result, related to self-interest motivation, is the increase in remittances inflows following a rise in interest rates differential between home and host countries. These findings point the need for continued research into understanding the economic relationships that exist between remittances and other macroeconomic variables, like exchange rate, inflation...

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