

# Remittances, International Reserves, and Exchange Rate Regimes

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**Abstract:** International reserves are experiencing a significant increase, in part as a result of specific policies but also from the development of external factors, like remittances. This paper examines the role that remittances play in the accumulation of reserves, and uses a dynamic panel model for a group of 9 Latin American countries in the period 1997-2010 to uncover its influence. Our results show that international reserves are influenced positively by higher trade surpluses, exchange rate depreciations, interest rate differentials, rises in commodity prices and higher inflows of remittances. In fact, the influence that remittances exert on reserves is the strongest and most consistent amongst our determinants. Not surprisingly, we uncover a differential impact of remittances emanating from specific characteristics, like location of the receiving country, relative importance of remittances in terms of GDP, and the exchange rate regime in place, with countries operating under more rigid exchange rate regimes experience the expected magnified effect on reserves.

*Keywords:* International Reserves; Remittances; Latin America & Caribbean, Panel Data

*JEL classification:* F36, F24, O54, C23

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## **1.- Introduction**

In the last couple of decades we have observed a significant increase in international reserves around the world. This rise in reserves – mainly concentrated in the holding of U.S. dollars – has been sharp, with estimates by the International Monetary Fund (IMF) indicating that they have tripled in the last ten years, placing it at 13 percent of global GDP in 2009 (IMF (2010a)). This trend is expected to continue, as many emerging economies take into consideration that a stronger position in reserves can allow them to reduce the impact of fluctuations in capital flows, like those experienced during the recent economic crisis.

The behavior of international reserves closely reflects fluctuations in the balance of payments, and incorporates the recent restructuring of capital flows. While governments would like to claim that such increases in international reserves are the result of their policies, the influence of external factors in the determination of reserves is equally important. In particular, remittance of private resources from emigrants to their families and relatives, interest rate differentials arising from relative changes in interest rates in world markets, and fluctuations in commodity prices arising from changes in world demand lead to flows of foreign currency that can alter the reserve position of a country.

Latin American countries offer a clear example of the significant increases in international reserves. Figure 1 below shows the performance of international reserves for our sample of Latin American countries. In the case of Bolivia reserves increased from USD1 billion in the first quarter of 1999 to USD8.5 billion in the second quarter of 2010; they increased from USD33 billion in the fourth quarter of 1999 to USD120 billion in the last quarter of 2010 in the case of Mexico; and in the case of Brazil, reserves jumped from USD36 billion in the fourth quarter of 1999 to USD285 billion in the last quarter of 2010.

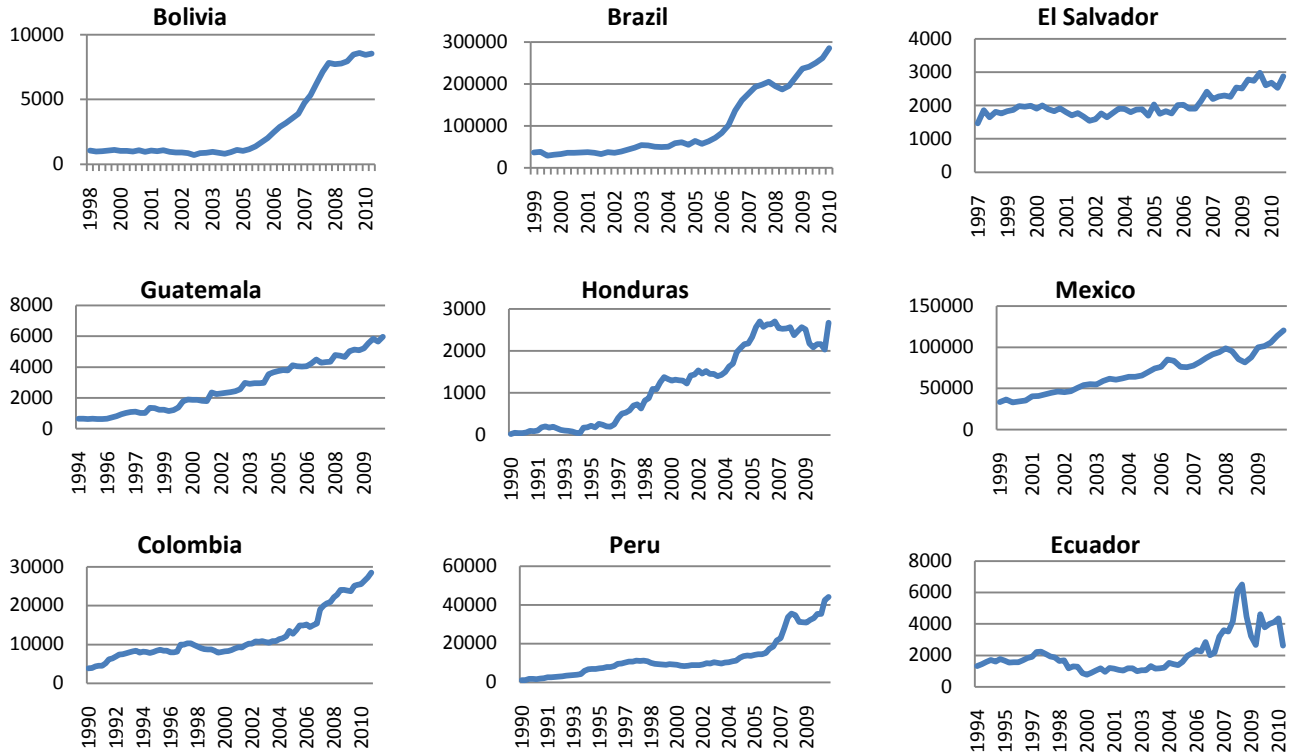


Figure 1. *Evolution of International Reserves, based on data from the Economic Commission for Latin America and the Caribbean (ECLAC) and IMF. International reserves are presented in millions of US dollars.*

While reserve accumulation in the Latin American countries of our sample was in general smooth, it is difficult to disentangle the contribution of private capital flows from reserve management performed by Central Banks, particularly under more flexible exchange rates. Some countries, if not most, intervene in the foreign exchange market to achieve certain level of exchange for their currencies (Blanchard *et al.* (2010), IMF (2010b)), complicating the analysis of reserve fluctuations. However, this traditional form of intervention has declined in recent years, giving way to the use of interest rate policy to influence capital flows and thus the exchange rate (Calvo and Reinhart (2002)).

Higher reserves have always raised questions about the optimality of their level as Central Banks balance safety, liquidity, and return concerns against the opportunity cost incurred in holding reserves. While this issue is important in its own right, here we concentrate on the underlying reasons giving rise to the accumulation of reserves, and explore the role that external

factors play in the determination of international reserves as a percentage of GDP, emphasizing the importance of remittances. Understanding the importance of remittances in the accumulation of international reserves is important because reserves are a measure of foreign exchange liquidity and are commonly used to gauge the creditworthiness of a particular country. To the extent that the inflow of foreign currency from remittances improves the foreign exchange position of these countries, it enhances the solvency of the country.

The existing literature has already uncovered some effects of remittances on capital flows (i.e. through appreciations of the real exchange rate), but this is the first study that explicitly incorporates remittances in a comprehensive specification of international reserves. Our results indicate that remittances have a contemporaneous positive effect on international reserves, irrespective of the scaling method, and that such influence remains important in the following quarter, although smaller in magnitude. The results also indicate that there is a differential impact of remittances on international reserves depending on regional characteristics and their relative importance in the economy. In particular, the positive effect of remittances on reserves is enhanced for South American countries, for countries where remittances are a bigger share of GDP, and for countries that operate under a more fixed exchange rate regime.

## **2.- Literature Review**

Countries choose to hold international reserves for safety or precautionary motives, and for liquidity, in support of foreign exchange interventions and international transaction. They also hold reserves for the return they provide to the Central Bank (BIS (2008)). The precautionary view in particular, emphasizes the accumulation of international reserves as self-insurance against liquidity shocks that can create costly output contractions, i.e. from sudden stops and capital flight. It is clear that countries that don't have easy access to external finance

need to hold reserves as a safety cushion, but even countries that have access to external finance usually hold reserves to avoid being subject to the stringent conditions that come with their access (IMF (2011)).

Concerns about export competitiveness motivate countries to also view reserves as a mechanism to prevent or slowdown appreciations, and thus the motive becomes a part of policy. Even if fewer countries continue to peg their currencies to the dollar, most of them still manage their currency values to a certain degree, and thus require reserves to defend their parity against the dollar (Calvo and Reinhart (2002)). Countries are further motivated to hold international reserves because the largest share of external debt is denominated in foreign currency, and strong reserves act as a signal to lower their risk premium. However, at times of greater financial integration the need to hold international reserves is diminishing, making such accumulation excessive and perhaps unnecessary.<sup>1</sup>

A trend within the literature looks at international reserves from the optimality perspective. Frenkel and Jovanovic (1981) showed that higher volatility in international reserves leads to a higher optimal level of reserves, effect that was later corroborated by Flood and Marion (2002). However, the use of their robust reserve volatility measure rendered the opportunity cost of holding reserves (interest rates) statistically insignificant. Ball and Reyes (2011) more recently reestablished the negative effect of the opportunity cost of holding reserves on the optimal reserves level using an exchange rate regime indicator.

Examining the precautionary and mercantilist motives for the accumulation of international reserves, Aizenman and Lee (2007) used a sample of 53 countries for the period 1980-2000 to find support for the precautionary motivation, clarifying that only countries in the

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<sup>1</sup> See IMF (2010a) for an extensive discussion on the appropriate level of reserves.

regions experiencing difficulties change their accumulation behavior. But measuring the true effect on international reserves can be problematic, as suggested by Calvo and Reinhart (2002), since countries frequently manage their exchange rates. They find that declared “floaters” have the highest reserve variability, with international reserves and relative interest rates fluctuating more in those countries that present the most stable exchange rates. Within low-income countries, such as Bolivia and Honduras, Dabla-Norris, *et al.* (2011) find that the shock-mitigation effect of reserves was strongest for countries with fixed exchange rate systems.

Government policies are also expected to affect international reserves through their economic stabilization channels and the growth prospects that can serve to attract capital flows. If policies are effective in generating higher levels of growth, this can act as a signal for foreign direct investment and foreign portfolio investment to enter the economy, thus increasing international reserves. In addition, changes in trade – and exchange rate – policy can affect trade patterns, and thus affect the behavior of international reserves. Since Central Banks monitor economic activity and implement monetary policy that affects the domestic interest rate, the ensuing changes in the interest rate differential with respect to other countries can generate additional flows that can affect international reserves, particularly through foreign portfolio investment. Calvo and Reinhart (2002) show that many Latin American countries are currently using interest rate policy to limit exchange rate fluctuations (i.e. Mexico, Chile, Peru and Brazil).

In a more direct manner, trade patterns also influence international reserves, as trade receipts need to be converted to the national currency to perform economic activity domestically. A particularly interesting trend in this area is the recent above-average growth of many emerging countries, like China and India, which is creating higher world demand for primary commodities. This higher demand is also exerting an upward pressure in commodity prices that is generating

renewed opportunities for exporters of primary commodities, mainly South American countries. Robles and Torero (2010) find that this higher demand is particularly important for agricultural commodity prices. Figure 2 describes the dynamics of the trade balance in the region, and it can clearly be observed that South American countries (Bolivia, Brazil and Peru) have recently enjoyed trade surpluses while Central American countries (El Salvador, Guatemala, Honduras) and Mexico have experienced continuous trade deficits.

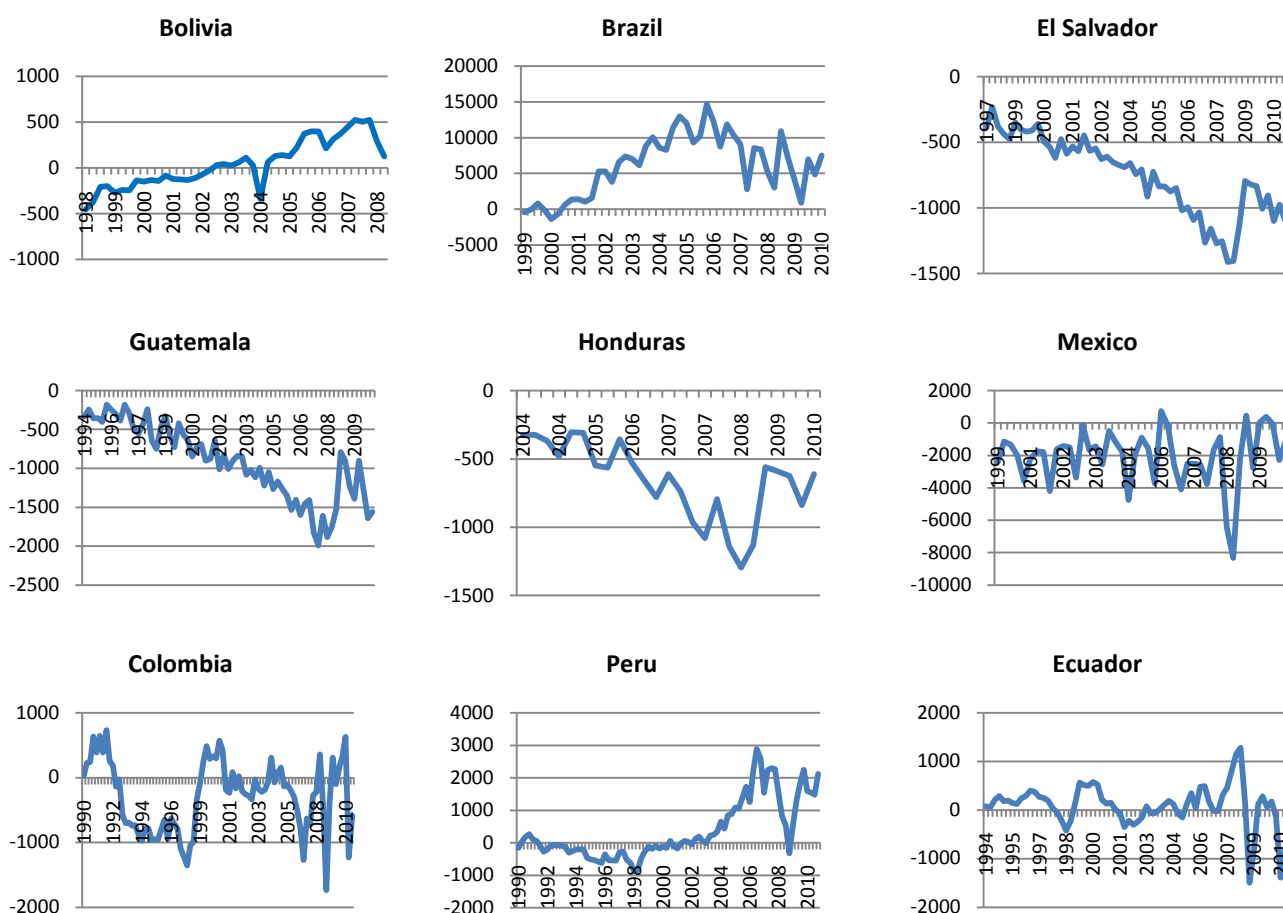


Figure 2. *Evolution of Trade Balance, based on data from the Economic Commission for Latin America and the Caribbean (ECLAC) and IMF. The trade balance is presented in millions of US dollars.*

However, a significant factor that has been neglected in the determination of reserve accumulation is remittances. While negligible until recently, most developing countries are now experiencing a significant increase in the flows of foreign currency from their migrant

population. This significant increase of officially reported remittances is mainly attributed to the lower fees charged by money transfer institutions, the improved international flows data collection by governments, and to a smaller extent to the renewed increase in migration to developed countries of the late 1990s and early 2000s. During the past ten years remittances flowing into Latin America have increased from USD5 billion to approximately USD60 billion in 2009 (Inter-American Development Bank (2011)). Figure 3 shows that all countries, with the exception of Ecuador, have experienced a significant increase in the amount of funds that their immigrants are remitting back home.

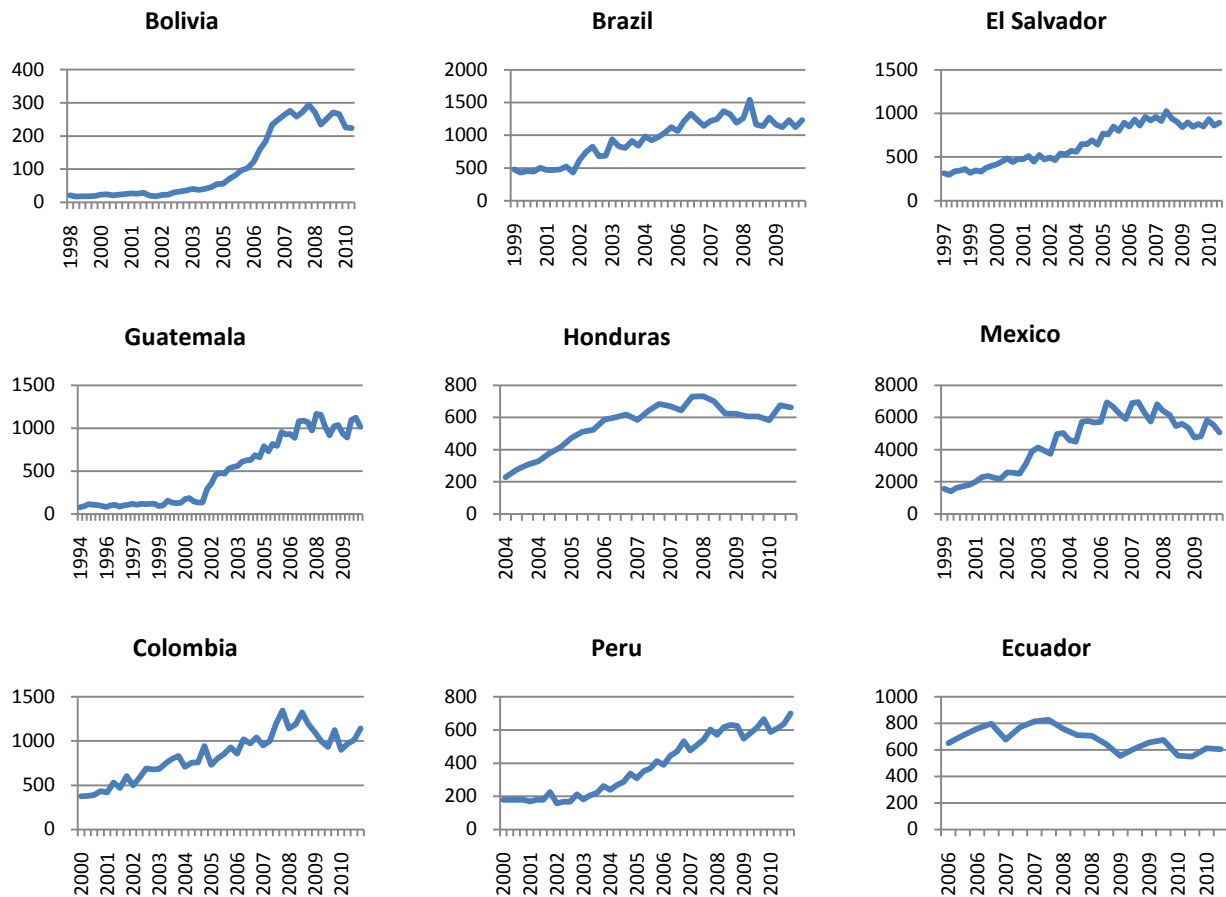


Figure 3. *Evolution of International Remittances, based on data from the Economic Commission for Latin America and the Caribbean (ECLAC) and IMF. Remittances are presented in millions of US dollars.*



While these inflows of foreign currency always result in the accumulation of international reserves, their full impact can be diminished by secondary effects, namely inflationary and “Dutch Disease” effects. A significant portion of these remittances are used to satisfy consumption needs, generating inflationary pressure – if they are not fully sterilized – through the stimulation of internal demand for imported goods (Heilmann (2006), Vacaflores (2011), Narayan *et al.* (2011), Nath and Vargas-Silva (2012)). This in turn can reduce reserves. Also, since remittances usually come in dollar form, they can induce Dutch Disease effects in the receiving economies as they appreciate the domestic currency and thus make domestic exports relatively more expensive for foreigners (Amuedo-Dorantes and Pozo (2004), Rodrik (2007), Acosta *et al.* (2009) and Narayan *et al.* (2011)). This negative effect on exports has connotations for the trade balance, indirectly affecting the accumulation of international reserves.

But since remittances, as any other capital inflow, provide foreign exchange liquidity, the response of the Central Bank to these capital flows becomes important in the determination of the overall effect in international reserves as a percentage of GDP. If the country is operating under a fixed exchange rate regime, then the Central Bank will intervene and buy all the foreign currency, which would lead to an increase in international reserves. But Central Banks can neutralize the inflationary pressure from such transactions by retiring some liquidity through the sale of domestic bonds, thus muting the propagation mechanism to key macroeconomic variables – trade balance, inflation, interest rate, and the exchange rate – and magnifying reserve accumulation as a percentage of GDP.

Alternatively, if the economy is operating under a flexible exchange rate regime, the monetary authority does not need to exchange this foreign capital and the linkage between remittances and reserves is attenuated or possibly eliminated. In this case the inflow of

remittances would lead to an increase in the demand for the domestic currency, and thus to its appreciation without having an effect on the balance sheet of the Central Bank. The increased demand for goods and services funded with remittances may lead to higher interest rates in response to inflationary pressures and higher demand for loanable funds, but the increased liquidity in the financial sector may ameliorate – or overturn – this rise in the interest rate. Reserve accumulation will occur when the appreciation of the currency and consequent deterioration of the trade balance forces the Central Bank to intervene in the foreign exchange market<sup>2</sup>; thus, the effect of remittances on international reserves should be weaker than in a fixed exchange regime as reserve accumulation may become more discretionary.

Depending on the route that Central Banks decide to follow, we should expect a differential effect of remittances on international reserves as a percentage of GDP: the link between remittances and international reserves depends on its effect on international reserves but also on economic activity, both affected by the exchange rate regime in place.

### **3.- Data and Methodology**

The data for this study comes from the Central Banks of each country, from ECLAC's Statistical Yearbooks, and from the Government Finance Statistics yearbooks (IMF). The sample consists of 9 Latin American countries over the period 1997-2010, with quarterly observations. The countries are: Bolivia, Brazil, Colombia, Ecuador, Peru, El Salvador, Guatemala, Honduras, and Mexico. The sample only includes countries where the Central Bank collects data on remittances at a quarterly interval and posts the information on their websites.

This study uses panel data to control for unobservable time-invariant country-specific characteristics that determine international reserves. The econometric specification is dynamic in

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<sup>2</sup> Blanchard *et al.* (2010) actually recommend that Central Banks acknowledge their foreign exchange intervention.

nature, and uses the Arellano-Bond first-differenced estimator (Arellano and Bond (1991)).<sup>3</sup> The econometric specification considers the influential variables commonly used in the literature together with remittances and commodity prices, and is given by:

$$\begin{aligned} Reserves_{i,t} = & \alpha_1 Reserves_{i,t-1} + \sum_{j=0}^1 \alpha_{2j} Trade_{i,t-j} + \sum_{j=0}^1 \alpha_{3j} Rem_{i,t-j} + \sum_{j=0}^1 \alpha_{4j} GDPgr_{i,t-j} \\ & + \sum_{j=0}^1 \alpha_{5j} irDiff_{i,t-j} + \alpha_6 ExRate_{i,t} + \alpha_7 CPrices_{i,t-1} + \varepsilon_{i,t} \end{aligned}$$

Here Reserves stands for international reserves as a percentage of GDP, where international reserves are defined as the sum of foreign exchange holdings, the reserve position at the IMF, and special drawing rights. Trade is the trade balance between the country and the rest of the world, Rem is remittances of funds from relatives and friends abroad, GDPgr is the growth rate of real GDP, ExRate is the nominal exchange rate of the specific country expressed in terms of domestic currency per dollars, irDiff is the interest rate differential between the domestic economy and the U.S., and CPrices is the specific commodity price under consideration. These measures are scaled in such a way that allows them to be compared through time – here we scale the trade balance and remittances by GDP, but also use their growth rates for robustness purposes. The explanatory variables are used contemporaneously and with a lag, with the exception of the exchange rate, since it determines the current exchange of funds, and the

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<sup>3</sup> We test for bias and precision by comparing the OLS, the fixed effects estimator, and the system estimator, and we verify that the Arellano-Bond first-differenced estimator is the appropriate estimator. Also, while the sample has small N, indicating potential problems with the Nickell bias and thus necessitating the use of Least Square Dummy Variable Corrected (LSDVC) estimator, the fact that some of the independent variables are not strictly exogenous renders the LSDVC estimation inappropriate.

commodity price index, since its effect on reserves will be delayed given the nature of trade arrangements.<sup>4</sup> The error term follows the standard one-way error specification

$$\varepsilon_{i,t} = \mu_i + \nu_{i,t}$$

where  $\mu_i$  denotes the unobservable individual specific effect and  $\nu_{i,t}$  denotes the remainder disturbance, i.i.d. over the whole sample with variance  $\sigma_v^2$ .

Since we cannot obtain data on foreign direct investment and foreign portfolio investment at quarterly frequency, which affect international reserves, we use the interest rate differential between the domestic and the U.S. interest rates to proxy for these capital flows. An increase in the domestic interest rate, or a decrease in the foreign interest rate, will enhance the return to these types of investments, and thus attract higher inflows of foreign currency into the country, increasing international reserves. Here we use the quarterly average on the short-term deposit rate as our measure of interest rate, instead of the interest on bonds, as it is the only interest rate measure that is available consistently for all the countries of our sample.

#### **4.- Results**

To be clear, this article does not examine the measures that determine the optimal or efficient level of international reserves, but analyze the determinants of actual international reserve accumulation, providing evidence of their influence. Since the recent improvement of commodity prices exerts a direct effect on the main exports of commodity-based economies, the case of most Latin American countries, we incorporate the potential effect of 4 measures of commodity prices with the main determinants (other commodity prices retain the same influence and do not affect the main results). The column CP1 includes the broader measure of commodity

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<sup>4</sup> We have also estimated our specification of international reserves with all determinants having 2 lags, and the results are consistent in general, with a small number of estimates changing their statistical significance but not their sign. Results are available from the authors upon request.

price index, column CP2 includes the non-fuel commodity price index, column CP3 includes agricultural raw materials commodity price index, and column CP4 includes the energy commodity price index.

The specification controls for the main determinants of international reserves, and our measure for international reserves is scaled by GDP – together with net exports and remittances. Neither the Hansen’s over-identification test nor the tests for second-order serial correlation detect any problems with the validity of the instruments or with the serial correlation assumptions. Table 1 below shows the high degree of persistence in international reserves as a percentage of GDP, and also indicates that our explanatory measures have a consistent and statistically significant effect on the behavior of international reserves, with the exception of contemporaneous net exports as a percentage of GDP and the growth rate of GDP, which are not statistically significant at any conceivable level.

The influence of government policies on international reserves is mixed. Governments can influence the performance of the economy, the exchange rate, the interest rate differential, and their trade pattern. The results show that exchange rate depreciations have a small positive and statistically significant effect on international reserves, which can arise from the fact that depreciations improve net exports or because the outflows of returns from existing portfolio investment gets reduced by higher exchange rates, both improving the reserve position. In terms of the interest rate differential, we find evidence that increases in the interest rate differential in the current period leads to improvements in the reserve position of a country. This shows that the interest rate policy is in fact effective at attracting higher level of foreign currency into the country, i.e. foreign portfolio investment. However, while the result indicate that increases in the interest rate differential in the previous quarter leads to a statistically significant decline in

international reserves, this decline is small and statistically insignificant when tested together with the contemporaneous effect – the contemporaneous effect increases reserves by approximately 0.007 percentages points, so the lagged effect reduces reserves from this higher level causing an overall decline of approximately 0.002.

Table 1. Effect on International Reserves as percentage of GDP (L.A. countries)

	CP1	CP2	CP3	CP4
Lag 1	.9348*** (.0285)	.9335*** (.0309)	.9431*** (.0234)	.9360*** (.0274)
Net Exports	.1935 (.1300)	.1888 (.1288)	.2156 (.1339)	.1930 (.1297)
Lag Net Exports	.2874*** (.0951)	.2924*** (.0972)	.2615*** (.0952)	.2870*** (.0947)
Remittances	.9365** (.3685)	.9298** (.3641)	.9251*** (.3255)	.9389** (.3694)
Lag Remittances	-.8027*** (.2732)	-.7884*** (.2661)	-.7760*** (.2881)	-.7964*** (.2797)
GDP growth rate	-.0012 (.0011)	-.0012 (.0011)	-.0013 (.0011)	-.0012 (.0011)
Lag GDP growth rate	.0002 (.0007)	.0002 (.0007)	.0001 (.0007)	.0002 (.0007)
i.r. differential	.0071** (.0029)	.0073** (.0028)	.0062** (.0028)	.0071** (.0029)
Lag i.r. differential	-.0073*** (.0025)	-.0074*** (.0025)	-.0060** (.0023)	-.0074*** (.0026)
Exchange rate	.00003*** (8e-06)	.00003*** (.00001)	.00002*** (6e-06)	.00003*** (7e-06)
Lag All Commodities	.00023*** (.00007)			
Lag Non-Fuel Commodities		.0003** (.0001)		
Lag Agricultural Raw Mat.			.0010*** (.0003)	
Lag Energy Commodities				.0001*** (.00005)
AR(1) Test	0.0576	0.0578	0.0585	0.0576
AR(2) Test	0.1887	0.1898	0.1899	0.1888

*Note: Statistical significance given by \*\*\* for 1% confidence level, \*\* for 5% confidence level, and \* for 10% confidence level. Robust Standard Errors in parentheses.*

Perhaps the strongest influence on international reserves arising from government policy comes from the effect of the trade balance. When we consider the influence that governments can have on the trade balance, i.e. by changing tariffs, quotas or other trade barriers, the results

show that while net exports as a percentage of GDP has a positive effect on international reserves, only the lagged measure has a statistically significant effect. The results show that a 1 percentage point increase in net exports as a percentage of GDP in the previous period leads to an average 0.28 percentage point increase in international reserves as a percentage of GDP, with marginal changes in the estimate when commodity prices are controlled by the different commodity price indexes. This lagged result perhaps is indicative of the delayed payments from exports, typical in international trade.

With regards to the measure of interest in this study, our results indicate that the determinant that has the largest impact on international reserves as a percentage of GDP is remittances. Current remittances have a positive and significant impact on international reserves, implying that a 1 percentage point increase in remittances as a percentage of GDP results in an average 0.93 percentage point increase in international reserves. Remittances constitute inflows of foreign currency that need to be exchanged for domestic currency to perform economic activity in the domestic economy, and thus has a direct impact on reserves. The greatest impact of remittances on international reserves is when commodity prices are controlled by the energy commodity price index, and the smaller effect of remittances on international reserves is when commodity prices are controlled by the agricultural raw materials commodity price index.

However, while the results suggest that lagged remittances have a negative and statistically significant effect on reserves, the overall effect is also positive and statistically significant. Since the contemporaneous effect of remittances raises reserves by approximately 0.93 percentage points, the negative lagged effect reduces reserves from this higher level by approximately 0.79 percentage points, resulting in reserves still being above the initial level by approximately 0.14 percentage points. This overall effect is statistically significant. While a large

portion of remittances is used to satisfy current consumption, the results indicate that a given portion is actually exchanged in the following quarter and thus having a smaller and delayed effect on international reserves.

While the inclusion of commodity prices helps control for external influences on trade, it also shows that lagged commodity prices exert a positive effect on international reserves as a percentage of GDP, with all measures being statistically significant. Out of these, the largest effect is that of agricultural raw materials, indicating that a 1 percentage point increase in this commodity prices leads to a 0.001 percentage point increase in international reserves. These results suggest that increases in commodity prices enhance trade receipts of the following period and thus contributes in the accumulation of international reserves of that period.

These results hold for the alternative scaling of the variables prone to have unit root, growth rates. The behavior of the measures that affect international reserves indirectly – through its effect on foreign direct investment and foreign portfolio investment – present coefficients of similar magnitude, sign, and statistical significance than in our initial scaling. The only difference comes from the effect of growth rates of net exports losing statistical significance for its lagged effect, and the effect of the growth rate of remittances on international reserves remaining positive and statistically significant only for the contemporaneous case.<sup>5</sup>

Given that the countries in our sample have different characteristics, we also estimate the same set of specifications according to the two smaller regions. An important difference between South American (S.A.) countries and Central American (C.A.) countries arises from their trade patterns. S.A. countries are to great extent exporters of primary commodities, like corn, soya beans, tin, cooper, etc., while C.A. countries are mainly exporters of light manufactures, like textiles, medical supply, etc., products that compete with fast growing countries like China.

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<sup>5</sup> Complete results are presented in the Appendix and will be made available in the author's web page.



Another important difference is the market that they are serving, with S.A. countries having a more diversified international market while C.A. countries being more heavily concentrated on the U.S. market. In terms of remittances, C.A. countries receive the bulk of these funds, both in overall size (Mexico) and in share of GDP (Honduras 17%, El Salvador 16%, and Guatemala 11%).

These potentially different dynamics can have an impact in economic activity, and thus on the behavior of reserves, so we account for this by introducing a dummy variable SA that takes the value of 1 for South American countries and 0 for Central American countries. We interact this dummy only with the variables that have a direct impact on international reserves, the trade balance as a percentage of GDP and the ratio of remittances with respect to GDP. The estimates from the specification that accounts for these potentially different effects are presented below in Table 2.<sup>6</sup>

Examination of the coefficients of the measures that have an indirect effect on international reserves show a similar picture than in our base specification, both in terms of magnitudes and signs. In this case we still find that the current interest rate differential exerts a positive and statistically significant effect on international reserves, with the effect of the lagged interest rate differential still exerting a negative but smaller statistically significant effect on international reserves. However, the effect of the nominal exchange rate on international reserves loses its significance when we control for potential differences according to the two regions.

In addition, in all of our four specifications the positive effect of commodity prices on international reserves remain statistically significant. The largest effect of commodity prices occurs when we control for the effect of commodity prices by the use of agricultural raw materials. In this case we find that a 1 percentage point increase in the price of agricultural raw

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<sup>6</sup> Alternatively, we could estimate the same specification for each region. The results are similar.

materials leads to approximately 0.0009 percentage point increase in international reserves as a percentage of GDP. The smaller effect comes when we control for commodity prices with the energy commodity price index (0.0002).

Table 2. Effect on International Reserves as percentage of GDP, by regions

	CP1	CP2	CP3	CP4
Lag 1	.8897*** (.0245)	.8877*** (.0270)	.9155*** (.0202)	.8925*** (.0232)
Net Exports	.3586*** (.1048)	.3612*** (.1054)	.4143*** (.1011)	.3583*** (.1046)
Net Exports in S.A.	-.0732 (.2418)	-.0821 (.2308)	-.0386 (.2478)	-.0713 (.2432)
Lag Net Exports	-.1524 (.1193)	-.1848 (.1235)	-.1833 (.1183)	-.1464 (.1161)
Lag Net Exports in S.A.	.3116*** (.0745)	.3283*** (.0683)	.3257*** (.0676)	.3114*** (.0770)
Remittances	.6346*** (.1470)	.6287*** (.1649)	.7138*** (.1801)	.6415*** (.1435)
Remittances in S.A.	3.626*** (1.090)	3.663*** (1.098)	3.558*** (1.153)	3.622*** (1.099)
Lag Remittances	-1.053*** (.2085)	-1.072*** (.2084)	-.9389*** (.1610)	-1.033*** (.2067)
Lag Remittances in S.A.	-1.678*** (.5025)	-1.736*** (.5063)	-1.992*** (.4452)	-1.691*** (.4889)
GDP growth rate	-.0011 (.0012)	-.0012 (.0012)	-.0011 (.0012)	-.0011 (.0012)
Lag GDP growth rate	.0001 (.0006)	.0001 (.0006)	.0001 (.0006)	.0001 (.0006)
i.r. differential	.0063** (.0027)	.0065** (.0027)	.0059** (.0029)	.0063** (.0028)
Lag i.r. differential	-.0059** (.0023)	-.0058*** (.0022)	-.0056** (.0022)	-.0060** (.0023)
Exchange rate	.00001 (.00001)	.00001 (.00001)	3e-06 (.00001)	.00001 (.00001)
Lag All Commodities	.0003** (.0001)			
Lag Non-Fuel Commodities		.0004** (.0001)		
Lag Agricultural Raw Mat.			.0009*** (.0003)	
Lag Energy Commodities				.0002** (.00009)
AR(1) Test	0.0559	0.0563	0.0588	0.0561
AR(2) Test	0.1958	0.1950	0.1950	0.1964

Note: Statistical significance given by \*\*\* for 1% confidence level, \*\* for 5% confidence level, and \* for 10% confidence level. Robust Standard Errors in parentheses. Overall effect for South American countries is presented instead of the marginal effect.

When we turn our attention to the effect of the two measures that have a direct effect on international reserves, important differences arise. With respect to the trade balance as a percentage of GDP, the results indicate that there is a positive and statistically significant effect of the current trade balance on reserves in C.A. countries, and none for S.A. countries. We also find that the lagged effect of trade balances on international reserves disappears for C.A. countries but remains positive and statistically significant for S.A. countries. As it can be observed, both effects are similar in magnitude. Trade balances having a contemporaneous effect in C.A. countries and a lagged effect in S.A. countries can be indicative of trade patterns, with C.A. countries experiencing a quicker inflow of foreign currency because of their greater trade with countries geographically closer (i.e. the U.S.).

Turning to the main measure of interest in this study, here we also uncover significant differences on the impact of remittances on international reserves in the countries of these regions. As it can be observed in the results, the contemporaneous remittances' effect on international reserves is positive and statistically significant for both sets of countries, but this effect is much larger for S.A. countries. While a 1 percentage point increase in remittances as a percentage of GDP results in approximately 0.63 percentage point increase in international reserves as a percentage of GDP in C.A. countries, a similar 1 percentage point increase in remittances in a S.A. country will lead to an average 3.6 percentage point increase in reserves. This effect is the largest in C.A. countries when commodity prices are controlled by agricultural raw materials, while such effect is the largest in S.A. countries when commodity prices are controlled by the non-fuels commodity price index. Since C.A. countries receive the bulk of remittances, it has to be the case that its current contribution to economic activity, and growth,

has to be much larger in countries of this region than in S.A. countries to produce this smaller effect on reserves as a percentage of GDP.

With respect to the effect of lagged remittances on current international reserves, the results also show a clear differentiation between these two regions. While the effect is negative and statistically significant for C.A. countries (approximately -0.4 percentage points from initial level), the estimate for S.A. countries indicates a lagged positive and statistically significant effect on reserves (approximately 1.85 percentage points from the initial level). This lagged effect on international reserves as a percentage of GDP can also be rationalized by the reasoning used for the whole sample. Some remittances can be exchanged and used in the following quarter, thus leading to an improvement in reserves, but the use of those funds – together with the activity generated from the use of remittances from the previous quarter – seems to generate greater economic activity in C.A. countries, enough to raise GDP at a higher rate than the improvement in international reserves, thus lowering reserves as a percentage of GDP. This indicates that the positive effect in S.A. countries arises from a smaller contribution of lagged remittances on current GDP – for similar accumulation of reserves – in S.A. countries.

Remittances in S.A. countries do not only have a larger contemporaneous effect on international reserves as a percentage of GDP, but increases in remittances continues to exert a positive influence in reserves in the subsequent quarter – although its effect on GDP is larger and thus exerts a downward pressure on reserves as a percentage of GDP. This finding can be corroborated by the results found in Vacaflores (2011), where it is shown that a 10 percentage point increase in the growth rate of remittances leads to almost a 1.1 percentage point increase in the domestic money growth rate. Since remittances in foreign currency have to be exchanged for

domestic currency to allow for transactions, this increase in money supply reflects the increase in foreign currency accumulation, or international reserves.

In order to further check the robustness of these results we explore an alternative differentiation of the receiving countries: by the relative importance of remittances as a percentage of GDP. It can be argued that countries with large inflows of remittances, as a percentage of GDP, will make more adjustments in order to adequately control these inflows and sustain a given policy. Over the sample period Bolivia, El Salvador, Guatemala, and Ecuador received in average remittances worth more than 3 percent of GDP, so we created a dummy variable that takes the value of 1 for this set of countries, and zero for the rest of the countries. This breakdown provides some interesting insight in the functioning of this set of countries.

As it can be observed in Table 3 below, the influence of the measures that affect international reserves only indirectly remains similar than in the baseline specification, except in the case of the coefficient of the exchange rate. When we control for the relative importance of remittances as a percentage of GDP we find that the positive effect of depreciations on international reserves becomes twice as large while remaining statistically significant. This suggests that part of the effect that exchange rates bring to the movement of capital across countries was being thwarted by the specific policy characteristics of countries with different shares of remittances.

More interesting is the behavior of the coefficient that measures the influence of the trade balance on international reserves. The results show that a contemporaneous increase in net exports in countries with relative small shares of remittances as a percentage of GDP leads to a marginal decline in international reserves as a percentage of GDP, which is statistically significant at least at the 5 percent confidence level. However, the effect of net exports on

Table 3 – Effect on International Reserves as percentage of GDP, by relative importance of remittances (as % of GDP)

	CP1	CP2	CP3	CP4
Lag 1	.9312*** (.0312)	.9288*** (.0345)	.9405*** (.0247)	.9329*** (.0296)
Net Exports	-.2569*** (.0851)	-.2806*** (.0897)	-.2530** (.1019)	-.2556*** (.0851)
Net Exports in MREM	.2518* (.1529)	.2506* (.1517)	.2735* (.1610)	.2501* (.1521)
Lag Net Exports	.5684*** (.1677)	.5821*** (.1641)	.5643*** (.1707)	.5712*** (.1703)
Lag Net Exports in MREM	.2675*** (.0929)	.2721*** (.0974)	.2387** (.0964)	.2666*** (.0916)
Remittances	2.813** (1.159)	2.909** (1.210)	2.695** (1.092)	2.817** (1.143)
Remittances in MREM	.8496*** (.2791)	.8360*** (.2700)	.8542*** (.2378)	.8540*** (.2810)
Lag Remittances	-3.649*** (.8826)	-3.795*** (.9182)	-3.282*** (.9291)	-3.588*** (.8795)
Lag Remittances in MREM	-.7080*** (.2015)	-.6946*** (.1941)	-.6834*** (.2182)	-.6999*** (.2087)
GDP growth rate	-.0012 (.0010)	-.0012 (.0011)	-.0012 (.0010)	-.0011 (.0010)
Lag GDP growth rate	.0002 (.0007)	.0002 (.0007)	.0001 (.0007)	.0002 (.0007)
i.r. differential	.0064** (.0027)	.0065** (.0027)	.0055** (.0028)	.0064** (.0028)
Lag i.r. differential	-.0066** (.0028)	-.0065** (.0028)	-.0054** (.0027)	-.0067** (.0028)
Exchange rate	.00004*** (.00001)	.00004*** (.00001)	.00003*** (6e-06)	.00004*** (.00001)
Lag All Commodities	.0002*** (.00008)			
Lag Non-Fuel Commodities		.0003** (.0001)		
Lag Agricultural Raw Mat.			.0010*** (.0003)	
Lag Energy Commodities				.0001*** (.00006)
AR(1) Test	0.0600	0.0600	0.0610	0.0601
AR(2) Test	0.1902	0.1905	0.1915	0.1906

*Note: Statistical significance given by \*\*\* for 1% confidence level, \*\* for 5% confidence level, and \* for 10% confidence level. Robust Standard Errors in parentheses. Overall effect for countries with higher shares of remittances is presented instead of the marginal effect.*

international reserves for countries that experience relatively large inflows of remittances as a percentage of GDP becomes positive and is statistically significant also. When one allows for the relative importance of remittances we find net exports exerting a statistically significant but

opposite influence on international reserves according to the level of remittances coming into the country. More in accord with previous results, we find that the lagged effect of net exports on international reserves is always positive and statistically significant irrespective of the relative importance of remittances, with the only peculiarity that such effect it's almost twice as large in countries with relatively low shares of remittances as a percentage of GDP.

With regards to the effect of remittances on international reserves for these two types of countries also indicate a differential impact. While the contemporaneous effect of remittances on international reserves is positive and statistically significant irrespective of the importance of remittances relative to GDP, the effect in countries where remittances are relatively smaller is almost 300 percent larger. Here we also find that remittances has a negative lagged marginal effect on international reserves, but we observe a larger drop in international reserves resulting from an increase in remittances in the previous period for the countries where the inflow of remittances are a smaller fraction of GDP. The overall effect is negative for countries where remittances are a smaller fraction of GDP (-0.7) but positive for countries with higher proportions of remittances as a percentage of GDP (0.14).

But it is just the regional differences or the relative importance of remittances in the receiving countries which is driving this differential effect? What is the tractable channel for such differential effect? Since remittances provide foreign exchange liquidity, the response to these capital flows from the Central Bank is important in the determination of the overall effect in the rest of the economy, and on international reserves in particular. If the country is operating under a fixed exchange rate regime, then the Central Bank will intervene and buy the foreign currency, which would lead to a direct relationship between remittances and international reserves. However, if the receiving country is operating under a flexible exchange rate regime

then the Central Bank is not required to buy the foreign currency to preserve the exchange rate, so we should expect a smaller relationship between remittances and international reserves. To this end, we construct a dummy variable (MFERR) that takes the value of 1 for countries that operate under a more rigid exchange rate regime, and zero otherwise.

The results are presented below in Table 5, and we can observe that the effect of most of the control variables is similar to the results presented in our baseline specification. Once we control for the exchange rate regime, the effect of the nominal exchange rate on reserves remains larger than in the baseline specification. Also, while the contemporaneous effect of net exports on reserves remains statistically insignificant for both set of countries, the lagged effects suggests that only countries with a more fixed exchange rate regime benefit from improvements in the trade balance, in terms of increases in international reserves as a percentage of GDP – improved net exports in countries with more flexible exchange rate regimes could deteriorate subsequent terms of trade, diminishing its impact on reserves, but since more fixed exchange rate regimes preserve previous terms of trade, this higher net exports result in a positive and statistically significant effect on reserves for this set of countries.

It is also observed that the effect of remittances in countries with a more flexible exchange rate regime is positive and statistically significant, but the overall effect of remittances on international reserves for countries operating under a more fixed exchange rate regime is almost twice as large. This should not surprising, since the exchange rate regime dictates intervention in the foreign currency market for the more fixed exchange rate regime, but our result bring to light the foreign currency intervention that happens even in countries operating under more flexible exchange rate regimes. It is an open secret that most countries do intervene



to a certain extent to protect their preferred exchange rate, intervention that in unveiled in these results.

Table 4 – Effect on International Reserves as percentage of GDP, by exchange rate regime

	CP1	CP2	CP3	CP4
Lag 1	.9244*** (.0286)	.9211*** (.0319)	.9360*** (.0210)	.9264*** (.0271)
Net Exports	.1326 (.2688)	.1261 (.2774)	.2034 (.2645)	.1353 (.2688)
Net Exports in MFERR	.1912 (.1954)	.1875 (.1938)	.1992 (.1965)	.1893 (.1935)
Lag Net Exports	.1710 (.2932)	.1567 (.2950)	.1621 (.2839)	.1786 (.2955)
Lag Net Exports in MFERR	.3254*** (.0875)	.3355*** (.0834)	.2952*** (.1048)	.3231*** (.0878)
Remittances	.5559** (.2640)	.5264** (.2661)	.4890** (.2353)	.5634** (.2675)
Remittances in MFER	.9063** (.4398)	.8966** (.4333)	.9298** (.4159)	.9099** (.4410)
Lag Remittances	-1.036*** (.3234)	-1.036*** (.3223)	-.9221*** (.2894)	-1.023*** (.3247)
Lag Remittances in MFERR	-.5724** (.2654)	-.5587** (.2663)	-.5637** (.3040)	-.5640** (.2659)
GDP growth rate	-.0013 (.0012)	-.0014 (.0012)	-.0014 (.0012)	-.0013 (.0012)
Lag GDP growth rate	.00004 (.0007)	.00002 (.0007)	-.00002 (.0007)	.00005 (.0007)
i.r. differential	.0068*** (.0026)	.0070*** (.0026)	.0060** (.0026)	.0068** (.0027)
Lag i.r. differential	-.0074*** (.0026)	-.0074*** (.0025)	-.0062** (.0024)	-.0076*** (.0026)
Exchange rate	.00004*** (.00001)	.00004*** (.00001)	.00003*** (6e-06)	.00004*** (8e-06)
Lag All Commodities	.0002*** (.00009)			
Lag Non-Fuel Commodities		.0003** (.0001)		
Lag Agricultural Raw Mat.			.0010*** (.0003)	
Lag Energy Commodities				.0001*** (.00006)
AR(1) Test	0.0588	0.0590	0.0600	0.0589
AR(2) Test	0.1909	0.1915	0.1939	0.1912

*Note: Statistical significance given by \*\*\* for 1% confidence level, \*\* for 5% confidence level, and \* for 10% confidence level. Robust Standard Errors in parentheses. Overall effect for countries with a more fixed exchange rate regime is presented instead of the marginal effect.*

In terms of the lagged effect of remittances on international reserves, we find again a differential effect emanating from the two types of exchange rate regimes classification: the lagged effect of remittances is negative and statistically significant for both sets of countries, but such effect is almost twice as large in countries operating with a more flexible exchange rate regime. This is completely in accord with the results of our baseline specification. To the extent that the contemporaneous positive effect in countries operating in more flexible exchange rates is smaller than in those with a more fixed exchange rate regime, the subsequent negative effect of remittances will be large enough to produce a negative effect in the case of countries with flexible exchange rate regimes (-0.46) but it will remain positive in countries with a more fixed exchange rate regime (0.33).

This study confirms the intuitive notion that inflows of remittances in countries with different characteristics should have a differential effect on international reserves. As expected, regional characteristics, the share of remittances, and the exchange rate regime influence the degree in which remittances affect reserve accumulation. What is novel about our explicit incorporation of remittances in the study of reserves accumulation is that our results confirm the dominant role that capital inflows – remittances – play in reserve accumulation and highlight the enhanced importance of remittances in countries with more fixed exchange rate regimes.

## **5.- Conclusions**

This article is the first to show that the accumulation of international reserves in Latin American countries is also being determined by the behavior of remittances and commodity prices, after controlling for the traditional contributions of trade balances, interest rate differentials, growth, and fluctuations of the exchange rate. These results diminish the claims that sound economic policies implemented by Latin America governments are the main drivers of the

observed improvements in international reserves, and suggest that external conditions play a significant role in the recent accumulation of reserves in the region.

In fact, our results show that remittances exert the largest contemporaneous impact on international reserves accumulation, relative to the other determinants. Furthermore, these results also show that there exist significant differences in this impact according to the regional differences between Central American and South American countries (and in the relative importance that remittances can have in the receiving economy), with the effect in South American countries being magnified. This could be suggestive of a stronger effort to sterilize these flows in economies with different characteristics. In particular, the expected impact of remittances on international reserves is highly dependent on the way in which countries treat capital inflows and manage their exchange rate. Specific differentiation of the exchange rate regime that countries implement shows that the effect of remittances of international reserves is stronger in economies that operate under a more fixed exchange rate regime, as theory suggests.

Furthermore, our results indicate that the current improvement in international reserves in the region, and in the whole world for that matter, should be taken with some caution. The results show that the economic performance of Latin American countries, in this case international reserves, is still dependent on external factors, and the current accumulation of international reserves is to a high degree a result of favorable international conditions. Current forecasts suggest that this trend will continue, as high commodity prices, immigrant remittances and strong capital flows continue to affect the region, so governments of the region should take this into consideration while managing their holdings of international reserves.

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