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# Remittances, foreign direct investment and economic growth in Latin America and the Caribbean

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**REMITTANCES, FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH IN  
LATIN AMERICA AND THE CARIBBEAN**

A Dissertation

Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Doctor of Philosophy

in  
The Department of Agricultural Economics and Agribusiness

by  
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## **Dedication**

I dedicate this dissertation to the memory of my deceased father, whom I wish should be with me to share these wonderful moments of my life, and to my mother, my wife, my son, my sister, my brother, and to all my relatives on my father's and mother's sides.

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## Table of Contents

Dedication.....	ii
Acknowledgments.....	iii
Abstract.....	viii
Chapter 1 Introduction.....	1
1.1 References.....	10
Chapter 2 U.S. Foreign Direct Investment Outflows to Latin America and the Caribbean: Remittances and Market Size.....	13
2.1 Introduction.....	13
2.2 U.S. FDI and Remittances in Latin America and the Caribbean.....	16
2.3 Review of Literature.....	22
2.4 Methodology and Data.....	25
2.4.1 The Model.....	25
2.4.2 The Data.....	31
2.5 Empirical Results.....	32
2.6 Conclusions.....	38
2.7 References.....	40
Chapter 3 Foreign Direct Investment Inflows to Latin America and the Caribbean: Remittances and Market Size.....	46
3.1 Introduction.....	46
3.2 FDI and Remittances in Latin America and the Caribbean.....	49
3.3 Review of Literature.....	53
3.4 Methodology and Data.....	56
3.4.1 The Model.....	56
3.4.2 The Data.....	63
3.5 Empirical Results.....	63
3.6 Conclusions.....	69
3.7 References.....	71
Chapter 4 Remittances and Economic Growth in Latin America and the Caribbean: The Impact of Human Capital Development.....	76
4.1 Introduction.....	76
4.2 Overview of Remittance Inflows to Latin America and the Caribbean.....	78
4.3 Review of Literature.....	83
4.4 Methodology and Data.....	86
4.4.1 The Model.....	86
4.4.2 The Data.....	92
4.5 Empirical Results.....	93
4.6 Conclusions.....	101
4.7 Acknowledgments.....	102

4.8 References.....	102
Chapter 5 Conclusions.....	106
5.1 References.....	108
Appendix 1 Variable Definitions and Data Sources.....	110
Appendix 2 Summary Statistics, Annual Values for the Period 1983-2003.....	111
Appendix 3 Variable Definitions and Data Sources.....	112
Appendix 4 Summary Statistics, Annual Values for the Period 1983-2003.....	113
Appendix 5 Perpetual Inventory Method.....	114
Appendix 6 Variable Definitions and Data Sources.....	116
Appendix 7 Summary Statistics, Five-year Averages for the Period 1975-2000.....	117
Vita.....	118



## **Abstract**

Some of the literature about foreign direct investment (FDI) analyzes the location of FDI. It tries to identify the factors that affect FDI flows. On the association between remittances and growth, this is still an open discussion. This journal style dissertation is an attempt to investigate about the associations between remittances and FDI and growth in Latin America and the Caribbean (LAC).

The first paper investigates the effect of remittances on U.S. FDI outflows to LAC. It uses data on 14 LAC countries for the period 1983-2003. The results show that market size is one of the main determinants of FDI, which is in line with the market size hypothesis, and that remittances have a positive and significant effect on U.S. FDI, but only if the host country has a minimum threshold of per capita GDP. Thus, remittances reinforce the effect of the market size in these economies.

The second paper analyzes the effect of remittances on FDI inflows to LAC. It uses data on 14 LAC countries during the period 1983-2003. The results show that market size is one of the main determinants of FDI; this is in line with the market size hypothesis. Remittances have a positive effect on FDI inflows but it depends upon the host country having a minimum threshold of per capita GDP. Hence, remittances strengthen the market size effect in these countries.

The third paper evaluates the impact of remittances on growth through human capital in LAC. It uses panel data analysis for a sample of 14 LAC countries during the period 1975-2000. The results indicate that the level of human capital has a positive and significant effect on growth. Remittances have a positive impact on growth, but the realization of it holds only when the remittance receiving country has a minimum threshold of human capital stock.

## Chapter 1 Introduction

A large part of the literature about Foreign Direct Investment<sup>1</sup> (FDI) analyzes the associations between FDI and the factors that affect its location. Some of the motivations to explain these relationships are because FDI flows have dramatically increased, and in developing countries, are the most important source of external financing and a channel to transfer technology that contribute to economic growth. Some of the studied relationships include the effects of exchange rate on FDI (e.g., Barrell & Pain, 1996; Cushman, 1985, 1988; and Pain, 2003); the relationship between labor costs and FDI (e.g., Culem, 1988; Cushman, 1987; and Love & Lage-hidalgo, 2000); the association between political aspects and FDI (e.g., Haggard, 1989; Nigh, 1985; and Tuman & Emmert, 2004); the effect of trade issues such as openness, trade protection and trade agreements on FDI (e.g., Agosin & Machado, 2006; Barrell & Pain, 1999; and Waldkirch, 2003); and the relationship between host country market size and FDI (e.g., Barrell & Pain, 1996; and Love & Lage-hidalgo, 2000). In addition, positive associations between FDI and growth include Bengoa and Sanchez-Robles (2003), Campos and Kinoshita (2002), Hansen and Rand (2006), Li and Liu (2005), and Oliva and Rivera-Batiz (2002). The literature on the determinants of FDI reports market size as the most influential determinant of FDI. In this literature, one of the proxies used for market size is per capita GDP and represents the income level of the host country, so that it is likely that an increase in per capita GDP will increase the market size for the goods and services produced by the multinational firms' (MNF) affiliates.

Remittances<sup>2</sup> are also one of the largest capital inflows to developing countries that increase the amount of disposable money for spending on consumption, housing, education and small

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<sup>1</sup> The Internationally Monetary Fund suggests that for an investment to be considered as FDI it must represent at least 10 percent of voting stocks.

<sup>2</sup> Remittances refer to workers' remittances, compensation of employees and migrants' transfers. A complete description is provided in the data section of each paper.

business formation. Remittance inflows to developing countries increased five-fold during the period 1980-2003 and were the second most important source of external finance in 2003 (International Monetary Fund [IMF], 2005). There is a growing literature that studies the association between remittances and economic growth and development. Positive effects of remittances on economic growth include Acosta, Calderón, Fajnzylber and Lopez (2007); Catrinescu, Leon-Ledesma, Piracha and Quillin (2006); and Guiliano and Ruiz-Arranz (2006). Suggesting remittances' contributions to education are Cox Edwards and Ureta (2003), Hanson and Woodruff (2003), López-Cordova (2006), and Rapoport and Docquier (2005). Suggesting remittances' contributions to productive investments are Griffin (1976), Massey and Parrado (1998), and Woodruff and Zenteno (2001). However, there are also some findings about negative and significant effects of remittances on growth (Chami, Fullenkamp & Jahjah, 2003), or a negative but insignificant impact (IMF, 2005). However, the impact of remittances on growth is still an open discussion.

Remittances are amounts of money that increase disposable income in the remittance receiving countries, so that it is likely that remittances increase the size of the market for goods and services produced by the MNCs' affiliates. Dornbush and Fisher (1994, p.59) argue that individuals' consumption demands are related to their available income (disposable income) and not just to the output level. Culem (1988, p.888) argues that the acceleration principle implies that under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments. Glytsos (2005) incorporates the remittances' demand effect on consumption through a kind of country disposable income by adding GDP and remittances and finds a positive and significant effect of this income on consumption and imports. Taylor, Mora, Adams and Lopez-Feldman (2005) reported that remittances contributed

to 16 percent of per capita rural income in Mexico in 2002. Hence, it seems that remittances may affect FDI inflows through GDP.

Regarding the association between remittances and growth, this is an open discussion. As described above, there is some support on the positive contributions of remittances on growth as well as on the negative effect on growth. Endogenous growth theory suggests that human capital can affect total factor productivity (TFP) and, consequently, affect economic growth (Benhabib & Spiegel, 1994; Nelson & Phelps, 1966; and Romer, 1990a; among others). In the growth literature, the usual proxy for human capital is education. Interestingly, there are some suggestions on the contributions of remittances to education (Cox Edwards & Ureta, 2003; Hanson & Woodruff, 2003; López-Cordova, 2006; and Rapoport & Docquier, 2005). Therefore, it is likely that remittances may affect growth through human capital.

This dissertation is an attempt to evaluate the effects on FDI and on economic growth of remittances. It is structured as follows. Chapter 2 assesses the impact of remittances on U.S. FDI outflows to Latin America and the Caribbean (LAC). Chapter 3 analyzes the impact of remittances on FDI inflows to LAC. Chapter 4 evaluates the impact of remittances on economic growth through human capital. Lastly, chapter 5 presents the concluding remarks.

Chapter 2, “U.S. foreign direct investment outflows to Latin America and the Caribbean: Remittances and market size”, is an assessment of the impact of remittances on U.S. FDI outflows to LAC. Specifically, we test the complementary effect between remittances and per capita GDP in attracting U.S. FDI to LAC. To accomplish this task, we follow Barrell and Pain’s (1996) approach which relates the undertaking of FDI by a U.S. MNC to profit maximization. This approach considers a MNC that sells its product in both home and foreign markets and allows for deriving an equation for the optimal foreign capital stock. The optimal capital stock is

a function of the demands in the home and foreign markets as well as of the factor costs in the home and host countries. However, the desired and actual capital stocks are likely to differ in any given period due to adjustment costs because of delivery lags, delays due to searching for suitable investments overseas, or delays affecting planning permission, etc. (Barrel & Pain, 1996, p.203). Thus, a partial adjustment model is employed as the appropriate specification for FDI flows; so that, flows of FDI depend both on the determinants of the optimal capital stock and the lagged value of the U.S. capital stock in the host country. In the equation for optimal foreign capital stock, foreign market demand is proxied by per capita GDP which represents host country income. Remittances are inflows of capital to LAC countries that increase disposable income that may increase consumption of goods and services that result from FDI. Glytsos (2005) incorporates the remittances' demand effect on consumption through a kind of country disposable income by adding GDP and remittances and finds a positive and significant effect of this income on consumption and imports. Dornbush and Fisher (1994, p.59) argue that individuals' consumption demands are related to their available income (disposable income) and not just to the output level. Culem (1988) argues that the acceleration principle implies that under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments. Taylor et al. (2005) reported that remittances contributed to 16 percent of per capita rural income in Mexico in 2002. Hence, it seems that remittances may affect U.S. FDI outflows through per capita GDP.

The model for the desired foreign capital stock is extended to include remittances, exchange rate, the first lag of U.S. exports, and inflation. Then, the econometric specification for U.S. FDI outflows to LAC is given by this extended model, the first lag of the U.S. capital stock in the host country and the error term. The regressions are based on an unbalanced panel data set for a

sample of 14 LAC countries during the period 1983-2003. The total number of observations is 236, while the minimum number of observations per country is ten and the maximum is 21. The method of estimation used is panel generalized methods of moments (GMM). We use instrumental variable estimation to control for the endogeneity of remittances and use the first and second lags of remittances as well as an external instrument based on the per capita GDP of the top-eight migrant receiving countries as instruments. The panel nature of the data means that the unobserved country-fixed effects need to be considered and, based on a Hausman test, the country fixed effects are left in the error term for the estimation.

Two models are estimated. Model 2.2.1 uses the first and second lags of remittances as instruments for the instrumental variable estimation. Model 2.2.2 uses the distance weighted per capita GDP as an instrument in addition to the lagged values of remittances. The results of both models are qualitatively the same. Nevertheless, model 2.2.2's results are statistically more significant, so this is the main model. There is a positive and highly significant impact of per capita GDP (host country demand) on U.S. FDI outflows to LAC. This result is consistent with the market size hypothesis, which suggests that MNFs tend to be attracted to larger markets in order to exploit economies of scale. In addition, remittances enters significantly negative; however, the coefficient on the interaction between per capita GDP and remittances is positive and significant and suggests that remittances have a positive impact on U.S. FDI outflows, but only for certain levels of host country per capita GDP. The coefficients on remittances and on the interaction term in the model indicate that countries with a log value of per capita GDP greater than 8.6 (a per capita GDP value of \$5,431.00) will benefit from the positive effect of remittances in attracting U.S. FDI. Eight out of the 14 countries in the sample have an average log value of per capita GDP greater than 8.6, so these countries pass this threshold. Therefore,

the positive impact of remittances on U.S. FDI outflows to LAC depends upon the level of per capita GDP in the representative LAC country.

Chapter 3, “Foreign direct investment inflows to Latin America and the Caribbean: Remittances and market size”, evaluates the impact of remittances on FDI inflows to LAC. Specifically, we test the complementary effect between remittances and per capita GDP on FDI inflows to LAC. In order to do this, we follow Bajo-Rubio and Sosvilla-Rivero’s (1994) methodology which relates the undertaking of FDI by a MNF to cost minimization and allows for deriving the optimal capital input for investing abroad. This optimal capital stock is a function of the demands in the home and foreign markets and the relative factor costs between the MNF home country and the host country. Barrell and Pain (1996, p.203), however, argues that the desired and actual capital stocks are likely to differ in any given period due to adjustment costs because of delivery lags, delays due to searching for suitable investments overseas, or delays affecting planning permission, etc. This suggests that a partial adjustment model is an appropriate specification for FDI inflows to LAC; so that, flows of FDI depend both on the determinants of the optimal capital stock and the lagged value of the foreign capital stock. Per capita GDP is the proxy used for host country demand in the equation for optimal foreign capital stock and represents host country income. Other important inflows of capital to LAC countries are remittances; they increase these countries disposable income which can be used for consumption of goods and services produced by the MNFs’ affiliates. Glytsos (2005) incorporates the demand effect generated by remittances on consumption through a kind of disposable income by adding GDP and remittances and finds a positive and significant effect of this income on consumption and imports. The available money for spending (disposable income), but not just the level of output, is related to the individuals’ consumption demands

(Dornbush & Fisher, 1994, p.59). Based on the acceleration principle, under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments as Culem (1988, p.888) argues. Remittances accounted for 16 percent of rural household per capita income in Mexico in 2002 (Taylor et al., 2005). Therefore, it is likely that remittances may affect FDI inflows through per capita GDP.

The model for the optimal foreign capital stock is extended to include remittances, exchange rate, the first lag of host country imports, and inflation. Then, the econometric model for FDI inflows to LAC is given by this extended model, the first lag of the foreign capital stock and the error term. The regressions are based on an unbalanced panel data set for a sample of 14 LAC countries during the period 1983-2003. The total number of observations is 228, while the minimum number of observations per country is seven and the maximum is 21. The method of estimation used is panel generalized methods of moments (GMM). We use instrumental variable estimation to control for the endogeneity of remittances and use the first and second lags of remittances as well as an external instrument based on the per capita GDP of the top-eight migrant receiving countries as instruments. The panel nature of the data implies that the unobserved country-fixed effects must be taken into account and, based on a Hausman test, a full set of country dummy variables is included in the estimation.

We also estimate two models. Model 3.1.1 uses the first and second lags of remittances as instruments, while model 3.1.2 uses the distance weighted per capita GDP in addition to the lagged values of remittances. In both models, the results are qualitatively the same. However, based on the statistical significance, the discussion of the results comes from model 3.1.2. There is a positive and significant impact of per capita GDP on FDI inflows. This result is in line with the market size hypothesis; that is, MNFs tend to be attracted to larger markets in order to exploit



economies of scale. The results on the relationship between FDI and remittances and per capita GDP are quite interesting. Remittances have a negative and significant effect on FDI; however, the interaction between per capita GDP and remittances is positive and significant. This suggests that remittances have a positive impact on FDI inflows to LAC, but only for economies that have reached certain levels of per capita GDP. From the estimates of remittances and the interaction term, a country with a log value of per capita GDP greater than 8.46 (a per capita GDP value of \$4,722.06) will benefit from the positive effect of remittances in attracting FDI. In this study, there are nine countries with an average log value of per capita GDP greater than 8.46, so that these countries pass this threshold. Consequently, the positive impact of remittances on FDI inflows to LAC depends upon the level of per capita GDP in the representative LAC economy.

Chapter 4, “Remittances and economic growth in Latin America and the Caribbean: The impact of human capital development”, investigates the impact of remittances on economic growth through human capital. Specifically, we test the complementary effect between human capital and remittances on economic growth. We employ an endogenous growth model based on growth accounting methods that shows the relationship between the growth rate of GDP per worker and the growth rate of physical capital, human capital and TFP. Endogenous growth theory suggests that human capital affects TFP (e.g., Benhabib & Spiegel, 1994; Nelson & Phelps, 1966; and Romer, 1990a). Temple (1999, p.125) argues that the growth of TFP can be modeled as a function of some observable factors. In the growth literature, education is the usual proxy for human capital. Some studies suggest remittance contributions to education (Cox Edwards & Ureta, 2003; Hanson & Woodruff, 2003; López-Cordova, 2006; and Rapoport & Docquier, 2005; among others). Thus, we model the growth of TFP to depend upon an exogenous component, human capital and the interaction between human capital and

remittances. Then, the growth rate of output per worker in a country is affected by the level of human capital stock, the interaction between the level of human capital stock and remittances, and the growth rates of both physical and human capitals. This allows for testing as to whether remittances contribute to growth through human capital, that is testing the complementary effect of the interaction term.

The model is extended to include investment, government and inflation which are control variables. The econometric model adds an error term to this model. The regressions are based on panel data for the period 1975-2000, and the methods of estimation are pooled OLS, random effects, and random effects 2SLS. These regressions are run using a balanced panel data set from a sample of 14 Latin American and the Caribbean countries and 70 observations. We use instrumental variable estimation to control for the endogeneity of remittances. The instruments used are the first lag of investment as a share of GDP, the second lag of real per capita GDP, the first lag of the human capital index, two indices based on the economic conditions in the U.S., and an instrument based on the per capita GDP of the top-eight migrant receiving countries. The panel nature of the data implies that the unobserved country-fixed effects must be taken into account; so that the Hausman test suggests random effects estimation.

We estimate three models. However, model 4.1.3 is the main model since it controls for the endogeneity of remittances. The results lend support to the literature that suggests remittances' positive effects on growth. The coefficient on remittances is negative and significant. However, and interestingly, the coefficient on the interaction between human capital and remittances is positive and significant and suggests that remittances have a positive impact on growth, but only for certain levels of the human capital index. In addition, the coefficient on the level of human capital stock is positive and significant. The values of the coefficients on remittances and on the

interaction term indicate that countries with an index value of total human capital greater than 0.95 will benefit from the positive effect of remittances on growth. In our sample, the average value of the human capital index for eight out of the 14 countries is greater than 0.95, so these countries pass this threshold. Therefore, the positive effect of an increase in remittances on growth is dependent upon the level of the human capital stock in the economy.

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## **Chapter 2 U.S. Foreign Direct Investment Outflows to Latin America and the Caribbean: Remittances and Market Size**

### **2.1 Introduction**

The U.S., among the members of the Organization for Economic Cooperation and Development (OECD), has been the largest outward investor since the early 1950s (Filippaios, Papanastassiou and Pearce, 2003). During the last ten years, based on cumulative outflows, the U.S. has held its position as the largest supplier of foreign direct investment<sup>1</sup> (FDI) (OECD, 2007, p.23). Most of the U.S. FDI is allocated to OECD countries, between 58 percent and 87 percent of these flows have gone to these countries during the period 1987-2003; however, the cumulative U.S. FDI going to Non-OECD regions, during the same period, has a different pattern; European countries (excluding OECD members), Africa, and Near and Middle East countries attracted 1 percent each other; Asia received 8 percent; Latin America and the Caribbean (LAC) attracted 14 percent; and 1 percent is classified as unallocated (Table 2.1). LAC excludes Mexico, and when it is included LAC's cumulative share of U.S. FDI becomes 18 percent. Thus, the U.S. is an important source of FDI into LAC, and it has become not only the largest investor holding a 40 percent share of total FDI (Economic Commission for Latin America and the Caribbean [ECLAC] 2006, p.21), but also the main investor for more than a decade (ECLAC, 2008, p.13).

International investment has been an important feature of the global economy, and it is associated with technology transfers through spillovers which enhance economic growth and development in the host economies<sup>2</sup>. Positive associations between FDI and growth include Bengoa and Sanchez-Robles (2003), Campos and Kinoshita (2002), Hansen and Rand (2006), Li

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<sup>1</sup> According to the Bureau of Economic Analysis, U.S. direct investment abroad is defined as the ownership of a foreign company by an U.S. resident who holds at least 10 percent of the voting securities.

<sup>2</sup> It is a country that receives FDI.

**Table 2.1 U.S. FDI outflows in millions of dollars to the regions of the world, 1987-2003**

Year	W	O	O/W	Europe	Africa	NME	Asia	Unalloc	LAC	Mex	LacMex
1987	28977	20094	0.69		371	237	844	-237	7819	310	8129
1988	17865	13148	0.74		-507	-270	753	-540	5366	670	6036
1989	37604	29200	0.78		-596	-473	1325	669	7437	1652	9089
1990	30982	19741	0.64	2	-158	515	2583	376	8215	1926	10141
1991	32696	23830	0.73	216	103	521	3055	126	4873	2321	7194
1992	42647	24550	0.58	179	-84	845	4980	746	11431	1320	12751
1993	78164	54800	0.70	672	837	775	5439	1262	14379	2516	16895
1994	73252	46956	0.64	1484	762	709	9739	350	13252	4457	17709
1995	92074	61453	0.67	1186	352	879	4950	10197	13057	2983	16040
1996	84426	53477	0.63	1658	1678	467	9776	1637	15733	2405	18138
1997	95769	63122	0.66	1515	3436	619	10520	614	15943	5596	21539
1998	131004	104559	0.80	1662	3075	2092	3791	3719	12106	4593	16699
1999	209392	155971	0.74	2571	596	1000	12910	-151	36495	8164	44659
2000	142627	105784	0.74	542	716	1375	15205	-3	19008	4203	23211
2001	124873	90503	0.72	2640	2438	1397	17048	-618	11465	14226	25691
2002	115340	100697	0.87	258	1443	1703	10118	-136	1257	5171	6428
2003	151884	129036	0.85	768	2211	2093	10465	-194	7505	5667	13172
Total	1489576	1096921	0.74	15353	16673	14484	123501	17817	205341	68180	273521
Tot/W	1.00	0.74		0.01	0.01	0.01	0.08	0.01	0.14	0.05	0.18
Tot/O	1.36	1.00		0.01	0.02	0.01	0.11	0.02	0.19	0.06	0.25

Source: International Direct Investment Statistics Yearbook, OECD 2004, 1999.

O: OECD (Organization for Economic Cooperation and Development). W: world. O/W: OECD/World. NME: Near and Middle East. LAC: Latin America and the Caribbean. Unalloc: unallocated. Mex: Mexico. LacMex: LAC plus Mex.

and Liu (2005), and Oliva and Rivera-Batiz (2002). Consequently, for a country, attracting FDI implies receiving its benefits. Some of the host country characteristics that attract FDI include the size of the market, labor costs, trade barriers, corporate income tax, investment incentives, political stability, and macroeconomic stability. The literature refers to these factors as the determinants of FDI.

Market size is an influential determinant of FDI because it represents the level of demand for goods and services in an economy. Most of the U.S. FDI literature reports positive association between U.S. FDI and market size (e.g. Barrel & Pain, 1996; Blonigen and Davies, 2000; Cushman, 1985, 1988; Globerman and Shapiro, 2002; and Schmitz and Bieri, 1972). Therefore,

it is likely that larger markets make host countries more attractive to U.S. investors since it represents the country level of economic development, as well as characteristics such as the quality of institutions and living conditions. Fedderke and Romm's (2006) recommendations include boost market size and reduce political risks.

In the literature, the proxy used for market size is a measure of either gross domestic product (GDP) or gross national product (GNP). These proxies represent the income level of the host countries, so that an increase in, say, per capita GDP, will increase the market size for the goods and services produced as a result of FDI. In this context, remittances are important capital inflows to LAC that add to the countries' disposable incomes. Dornbush and Fisher (1994, p.59) argue that individuals' consumption demands are related to their available income (disposable income) and not just to the output level. Glytsos (2005) incorporates remittances' demand effect on consumption and imports by adding remittances to GDP, a type of country disposable income. LAC has been the largest recipient of recorded remittances. In 2007, LAC received \$53 billion in remittances, the largest amount among developing regions (World Bank, 2007, p. 54). Moreover, the U.S. has been the largest source of remittances to developing countries during the last decade (Kapur, 2004), and it remitted \$31.0 billion in 2003 to LAC (De Vasconcelos, 2004). Therefore, it may be some role of remittances in attracting FDI by increasing host country disposable income.

Even though the literature on the determinants of FDI is very extensive, we are not aware of any previous empirical efforts relating remittances and market size to FDI. Assessing the role of remittances in attracting U.S. FDI is important because remittances can be identified as a signal of a larger demand, which implies profitable opportunities for U.S. investors in countries with significant amount of remittance inflows. In order to add to this strand of literature, the purpose



of the current study is to assess empirically the impact of remittances in attracting U.S. FDI through per capita GDP. To accomplish this task, we follow Barrell and Pain's (1996) approach which relates the undertaking of FDI by a U.S. multinational firm (MNF) to profit maximization in order to derive the demand for the optimal capital to invest abroad. Within this framework, we test, specifically, the complementary effect between remittances and per capita GDP in attracting U.S. FDI to LAC.

To estimate the impact of remittances on FDI, panel generalized method of moments (GMM) is used. A group of 14 countries from Latin America and the Caribbean is selected based on data availability over the period 1983-2003<sup>3</sup>. The results indicate that remittances have a positive impact on U.S. FDI outflows to LAC, but it depends upon the level of per capita GDP in the economy. This implies that a threshold of per capita GDP is needed for remittances to exert a positive effect on FDI. In addition, in line with the market size hypothesis, per capita GDP has a positive and highly significant impact on FDI.

The rest of the paper is organized as follows. Section 2.2 presents an overview of U.S. FDI and remittances in LAC. Section 2.3 provides a review of the relevant FDI literature. Section 2.4 describes the methodology and data. Section 2.5 presents a discussion of the results. Finally, section 2.6 presents conclusions and areas for further research.

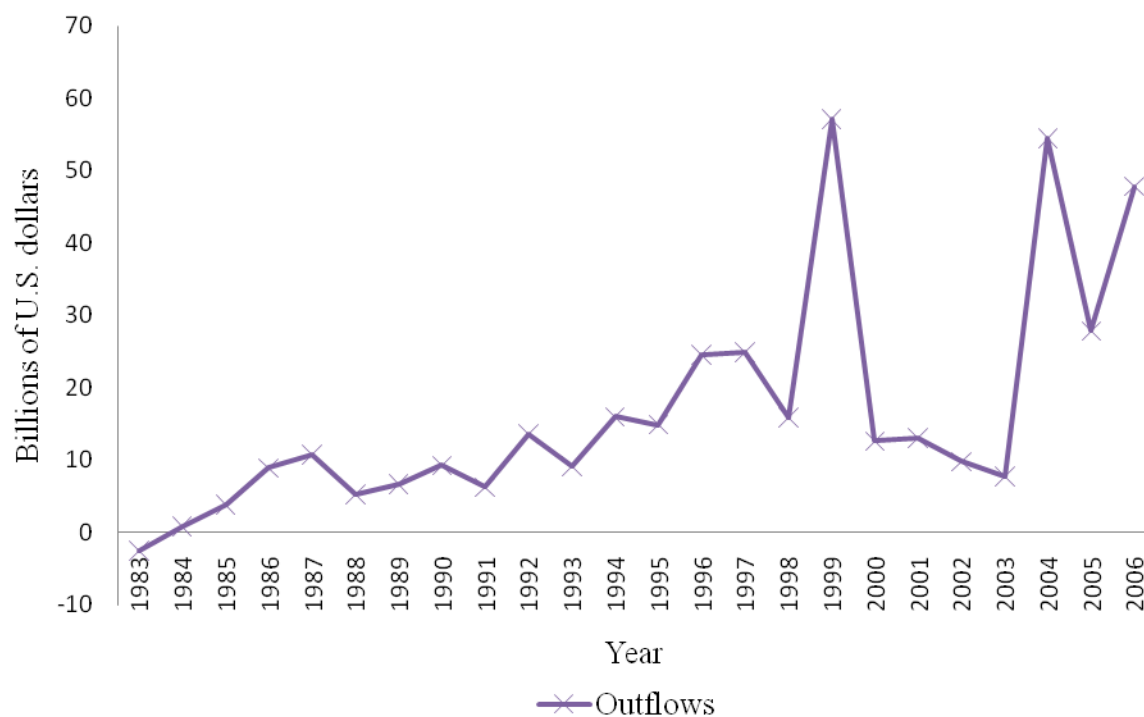
## **2.2 U.S. FDI and Remittances in Latin America and the Caribbean**

The U.S. is a very important source of FDI to LAC. It has become not only the largest investor holding a 40 percent share of total FDI (ECLAC, 2006, p.21), but also the main investor for more than a decade (ECLAC, 2008, p.13). Figure 2.1 shows the evolution of U.S. FDI outflows to LAC from 1983 through 2006; the data is in billions of U.S. dollars. The first

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<sup>3</sup> Barbados (BRB), Brazil (BRA), Colombia (COL), Costa Rica (CRI), The Dominican Republic (DOM), Ecuador (ECU), Guatemala (GTM), Honduras (HND), Jamaica (JAM), Mexico (MEX), Panama (PAN), Peru (PER), Trinidad and Tobago (TTO), and Venezuela (VEN).

increase is during the late 1980s, the 1990s show an impressive increase, and an extraordinary recovery happened in 2004 after a sharp decrease.



**Figure 2.1 U.S. Foreign Direct Investment outflows to LAC, 1983-2006**

Source: own calculations using data from U.S. direct investment abroad, U.S. direct investment position abroad on a historical cost basis, Bureau of Economic Analysis.

The first substantial increase in U.S. FDI was in 1987. This was after the debt crises during the first half of the 1980s when FDI inflows (not U.S. FDI) to Argentina, Brazil, Chile and Mexico (the major LAC FDI receivers) dropped from \$7 billion in 1981 to \$3 billion 1985 (World Bank, 1999, p.55). This increase in U.S. FDI coincided with the start of some policy reforms about trade and investment in the countries of the region. For example, the reform of Mexico’s investment laws in 1989 (Waldkirch, 2003), as well as the adoption of not only liberalization on FDI and trade controls but also privatization of state owned enterprises in the

region since 1982 (Behrman; and Pastor & Wise; as cited in Tuman & Emmert, 2004). Some dates on the starting of the trade liberalization reforms in some of the LAC countries are as follows: 1987 for Argentina, 1985 for Bolivia, 1991 for Brazil, 1976 for Chile, 1986 for Colombia, 1986 for Costa Rica, 1990 for the Dominican Republic, 1990 for Ecuador, 1989 for El Salvador, 1986 for Guatemala, 1991 for Honduras, 1986 for Mexico, 1991 for Nicaragua, 1989 for Paraguay, 1989 for Peru, 1990 for Uruguay, and 1989 for Venezuela (Pacheco-López & Thirwall). This was the start of the transition towards more open economies.

The 1990s show a new trend in U.S. FDI, following the decrease in 1988. This increase started in 1989 and ended with the largest, extraordinary inflows of \$57.2 billion in 1999. U.S. FDI to LAC as a share of total U.S. FDI rose from 13 percent in 1982 to 20 percent in 1997, and for the period 1990-1997 LAC received 43 percent of the U.S. FDI that went to developing countries, interestingly, in this period 90 percent of U.S. FDI went to just five countries (Brazil, Mexico, Chile, Argentina and Venezuela) (ECLAC, 1998). The 1990s show the U.S. multinationals' investment activities in a transformed investment environment because of the adoption of trade policy reforms that started in the late 1980s. Another key element, during the 1990s, was the signing of the North American Free Trade Agreement (NAFTA) in 1994. The sectors of attraction to U.S. investors were the motor vehicle, assembly operations (maquila), services and natural resources. In 1997, sales volumes by General Motors, Ford and Chrysler were the first, third and fifth largest ones, respectively, NAFTA and Mercosur<sup>4</sup> have also influenced investments in this sector (ECLAC, 1998). U.S. multinationals in the assembly industries have been located in Mexico and the Caribbean Basin in order to compete in the U.S. market, which investments have been motivated by the Harmonised Tariff Schedule 9882, the

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<sup>4</sup> It is the southern common market and encompasses Argentina, Brazil, Paraguay and Uruguay and was established in 1991.

Caribbean Basin Initiative and NAFTA (ECLAC, 1998). In addition, the devaluation of the Mexican peso in 1994-1995 promoted U.S. FDI in the maquila industries in Mexico (Gereffi & Bair, as cited in ECLAC, 1998). Regarding services and natural resources, FDI was influenced by acquisitions due to privatization programs and for which Argentina and Brazil were the most attractive places (ECLAC, 1998). The inflows of U.S. FDI in 1999 are the largest ones. This reflected an increase of an 11 percent in the U.S. direct investment position in LAC, and most of it went to Panama as capital gains, to Mexico as reinvested earnings of affiliates in several industries, and to Bermuda as reinvested earnings and capital contributions to existing affiliates (Bargas, 2000, p61).

The year 2000 shows a sharp decrease in U.S. FDI that lasted until 2003. During this period, the maquila sectors (a sector that have attracted substantial amounts of U.S. FDI) and sectors targeting both domestic and external markets faced a decline in total FDI in LAC, while the uncertainty of the September 11 events as well as the decrease in U.S. demand also discouraged U.S. FDI in Mexico and the Caribbean Basin (ECLAC, 2002). The U.S. direct investment position declined in LAC with the largest decreases occurring in Panama, Argentina and Brazil, which were influenced by negative valuation adjustments and negative currency translation adjustments (Borga, 2003). Another important event was the Argentinean political and economic crisis in 2002; it affected the other economies in South America among which Brazil and Chile are important receivers of U.S. FDI. This caused important trade reductions in Brazil, Uruguay and Chile; exchange rate volatility; and increased country risks and large reductions in remittances in Bolivia and Paraguay (ECLAC, 2003).

In 2004, U.S. FDI jumped to a value of \$54.5 billion, an extraordinary recovery. This reflects an increase of the U.S. direct investment position that comprised 94 percent of affiliate

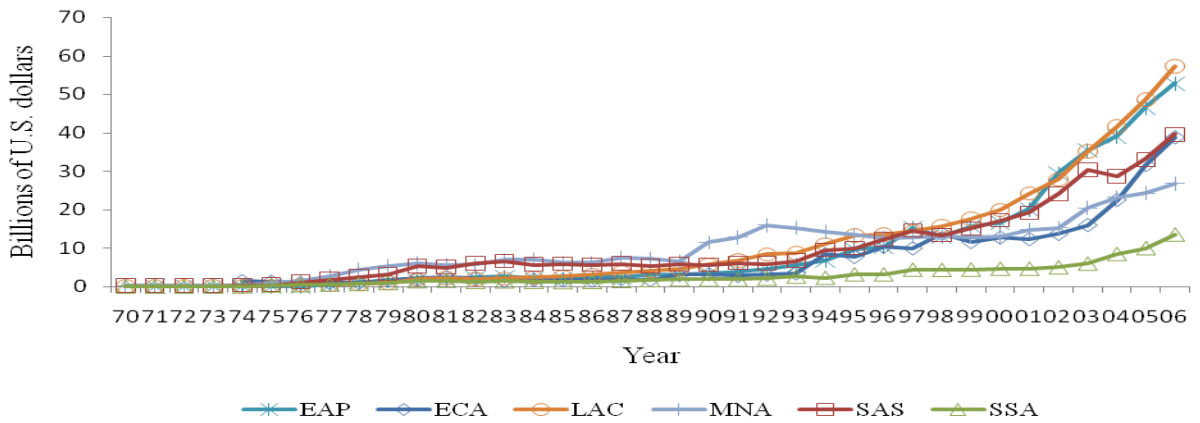
reinvested earnings, and the most influential investments happened in Mexico, the United Kingdom Islands and Bermuda, so that reinvested earnings increased 21 percentage points relative to the 2003's figure (Koncz & Yorgazon, 2005). In contrast, the year 2005 shows a considerable decline in U.S. FDI. U.S.' reinvested earnings were negative only for Europe and LAC, a value of -\$33.0 billion for global U.S. FDI which was a record since the 1950s, and were caused by the very large dividend payments to U.S. parents from their affiliates due to the American Jobs Creation Act of 2004 which allows these payments to be taxed at a lower rate (Koncz & Yorgazon, 2006). Lastly, U.S. FDI increased in 2006, which reflects an increase of \$37.4 billion in the U.S. position with the largest increases going to Bahamas, Mexico and Bermuda (Ibarra & Koncz, 2007). It is important to note that another trade agreement was signed in 2005 by the U.S. and the Central America and Caribbean countries, the Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR), which has been promoting FDI in the banking sector and in the telecommunication sector (ECLAC, 2007), as well as in the clothing sector (ECLAC, 2008).

Remittances are also a very important source of foreign exchange in LAC. In 2007, LAC received \$53 billion, the largest amount among developing regions (World Bank, 2007, p.54). Besides, the U.S. has been the largest source of remittances to developing countries during the last decade (Kapur, 2004), and it remitted \$31.0 billion in 2003 to LAC (De Vasconcelos, 2004). Figure 2.2 shows that, since the late 1990s, LAC has been the largest recipient of reported remittances. Total remittance inflows to LAC grew from \$5.7 billion in 1990 to \$57 billion in 2006 (World Development Indicators, 2007)<sup>5</sup>, a ten-fold increase. Compared to FDI and Official Development Assistance (ODA), remittance flows into LAC have become the second most important source of external finance, both in levels and as a percent of GDP (Figures 2.3 and

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<sup>5</sup> The data is from the online version.

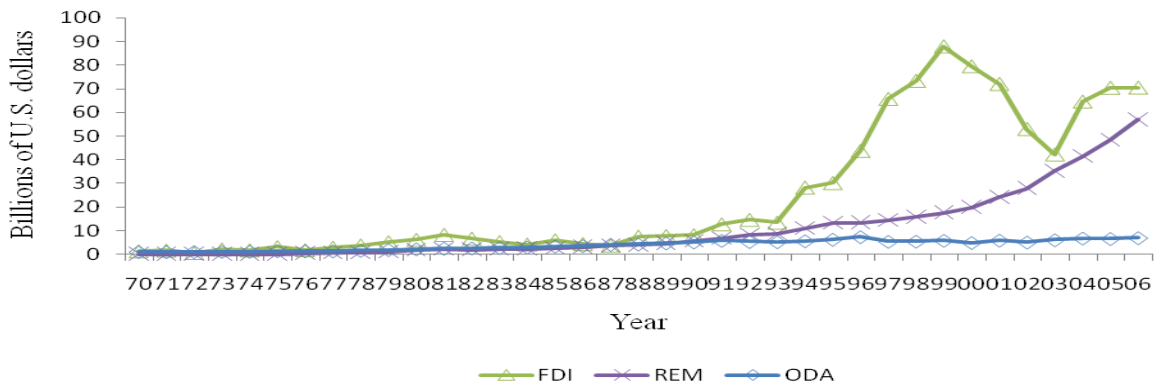
2.4). Figures 2.3 and 2.4 also show that while remittances have had a steady increase since the early 1990s, ODA in billions of U.S. dollars seems to be constant but seems to be decreasing as a percent of GDP, while FDI shows a downturn during the earlier 2000s. Therefore, remittances are less volatile than ODA and FDI as a source of foreign exchange. This shows the importance of remittances both in levels as well as a percent of GDP for the countries in the LAC region<sup>6</sup>.



**Figure 2.2 Remittance inflows to developing country regions, 1970-2006**

EAP: East Asia and the Pacific, ECA: Europe and Central Asia, LAC: Latin America and the Caribbean, MNA: Middle East and North Africa, SAS: South Asia, and SSA: Sub-Saharan Africa.

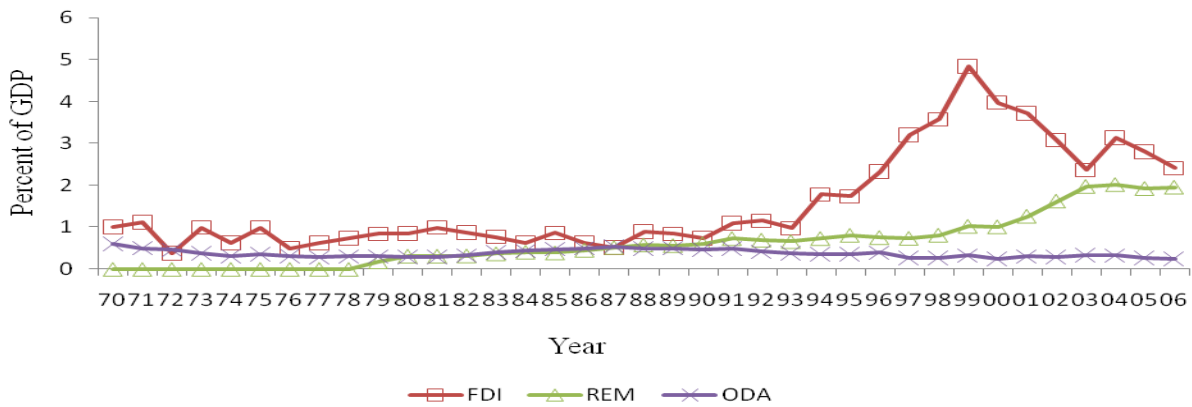
Source: own calculations using data from the World Bank. The data is available at [www.Worldbank.org/prospects/migrationandremittances](http://www.Worldbank.org/prospects/migrationandremittances).



**Figure 2.3 Remittances, FDI and ODA inflows to LAC, 1970-2006**

Source: own calculations using data from the World Development Indicators online version 2007.

<sup>6</sup> That comprises the entire group of countries in Latin America and the Caribbean as grouped by the World Bank, not just the 14 countries in this study.



**Figure 2.4 Remittances, FDI and ODA inflows to LAC, 1970-2006**

Source: own calculations using data from the World Development Indicators online version 2007.

### 2.3 Review of Literature

The literature about the determinants of FDI is very extensive. Some of the FDI determinants fit within the theories of the market size hypothesis; the location hypothesis; currency areas hypothesis; and differential rates of returns, diversification and internal financing; while there are other factors that affect FDI that may be identified under theories based on other factors (Moosa & Cadak, 2006). Market size relates to the demand for goods and services in an economy, and it is proxied by a measure of either GDP or GNP. There is a long list of studies reporting positive associations between market size and FDI (e.g., Bajo-Rubio & Sosvilla-Rivero 1994; Barrell & Pain, 1996; Brouwer, Paap & Viaene, 2008; Culem, 1988; and Fedderke & Romm, 2006). Some studies also find market size to be one of the main determinants of U.S. FDI. Bandera and White analyzed U.S. FDI in the manufacturing industry in seven European countries during the period 1958-1962 and found strong effect on the level of FDI from host country income (as cited in Chakrabarti, 2001). Schmitz and Bieri (1972) analyzed U.S. direct investment in the European Economic Community over the period 1952-1966 and found market size to have a positive and significant effect on U.S. FDI. Cushman's (1985) analysis on the association between real

exchange rate risk, expectations and U.S. direct investment to five industrialized countries for the years 1963 through 1978 reports, with one exception, a strong positive effect from foreign income on direct investment. Terpstra and Yu (1988) in their analysis of the determinants of foreign investment of the twenty largest U.S. advertising agencies during the years 1972 and 1984 find host country GDP to have a positive and significant effect on FDI. Barrell and Pain (1996) develop an econometric model and use quarterly data during the period 1971-1998 to analyze the determinants of U.S. FDI; they use the level and GNP growth to proxy for host country demand and find a significantly positive effect of GNP on U.S. FDI.

The recent FDI literature also reports positive relationships between U.S. FDI and market size. Blonigen and Davies (2000) in their assessment of the impacts of bilateral tax treaties on U.S. inbound and outbound FDI over the period 1966-1992 report significantly positive effects of host country real GDP on outbound U.S. FDI. Gopinath, Pick and Vasavada (1999) in a study of the determinants of U.S. FDI for the food processing industry in ten developed countries for the period 1982-1994 obtained a positive and significant effect on U.S. FDI from host country per capita GNP. Globerman and Shapiro's (2002) study on the effect of governance infrastructure on U.S. FDI in developed and developing countries during the period 1995-1997 find real GDP positive and highly significant on U.S. FDI for the whole sample and for the group of developing countries.

On the analysis of U.S. FDI in the LAC region, the literature also reports positive association between U.S. FDI and market size. Love and Lage-Hidalgo's (2000) study about the determinants of U.S. FDI in Mexico during the period 1967-1994 reports Mexican per capita GDP, a proxy for Mexican demand, to have a positive and highly significant effect on U.S. FDI. Lall, Norman and Featherstone (2003) conduct separate assessments of the determinants of U.S.



FDI in the Caribbean and in Latin America and for the entire sample over the period 1983-1994 and find three measures of market size (GDP, squared GDP and GDP growth) to have positive and significant effects on FDI. Tuman and Emmert (2004) study the political and economic determinants of U.S. FDI for a group of 15 countries in the LAC region during the period 1979-1996 and report that the change in real per capita GDP has a positive and significant effect on U.S. FDI.

The above literature review suggests that an increase in host country GDP will attract more U.S. FDI. The FDI literature also identifies GDP as the host country income which is used for purchasing goods and services, so that increases in host country income will increase the demand for good and services. Culem (1988, p.888) argues that the acceleration principle implies that under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments. Remittances are important flows of capital into developing countries and are a part of their disposable income. Dornbush and Fisher (1994, p.59) argue that individuals' consumption demands are related to their available income (disposable income) and not just to the level of output. Taylor, Mora, Adams and Lopez-Feldman (2005) reported that remittances contributed to 16 percent of per capita rural income in Mexico in 2002. Thus, by increasing disposable income in the host country, remittances raise the demand for good and services, which may include goods and services produced by MNF's affiliates. Glytsos (2005) incorporates the demand effect generated by remittances on consumption through a kind of country disposable income which is given by adding GDP and remittances, and finds a positive and significant effect of this income on consumption for a sample of five countries, a positive and significant effect on imports for three countries and a positive effect for the other two countries. Therefore, it seems that remittances increase aggregate demand.

## 2.4 Methodology and Data

### 2.4.1 The model

The theoretical framework used for the analysis of the outflows of U.S. FDI to LAC is based on a model of profit maximization that follows from the work of Barrell and Pain (1996). This approach has been used in many studies of FDI (Cushman, 1985, 1987, 1988; and Gopinath, et al., 1999, among others). The model allows derivation of an equation for the optimal foreign capital stock. It relates the undertaking of FDI by a MNF to profit maximization in order to derive the optimal capital input for investing. The model starts with a profit function for a MNF that sells a product in both home and foreign markets and it is defined as

$$\Pi = P_h(S_h)S_h + P_f(S_f)S_f - TC(Q) \quad (2.1)$$

where  $S_f > 0$ ; and  $S_h + S_f = Q(K, L)$ .  $P_h$  and  $S_h$  and  $P_f$  and  $S_f$  are prices and sales in the home and foreign markets, respectively. The subscripts  $h$  and  $f$  stand for home and foreign, respectively.  $Q$  is total output with  $K$  and  $L$  as capital and labor inputs, and  $TC$  is total costs.

The production function for a multinational that have decided to produce in the foreign market is given by

$$q_f = f(L_f, K_f) \quad (2.2)$$

for which, the associated costs are  $TC_f(q_f)$  and must be included in total costs. Thus, total costs are given by adding production costs at home and abroad.

Barrell and Pain (1996) define foreign market price as  $P_f(S_f, q_f)$ . They argue that sale revenues will positively affect the level of foreign investment if  $q_f$  includes consumer-oriented service facilities that increase the level of demand. This leads to define the MNF's profit maximization problem as

$$\Pi = P_h(S_h)S_h + P_f(S_f, q_f)S_f - TC_h(q_h) - TC_f(q_f) - \lambda (S_h + S_f - q_h - q_f) \quad (2.3)$$

The Lagrangean yields the following first order conditions:

$$\Pi_{Sh} = MR_h - \lambda = 0 \quad (2.4a)$$

$$\Pi_{Sf} = MR_f - \lambda = 0 \quad (2.4b)$$

$$\Pi_{qh} = -MC_h + \lambda = 0 \quad (2.4c)$$

$$\Pi_{qf} = S_f(\partial P_f / \partial q_f) - MC_f + \lambda = 0 \quad (2.4d)$$

Conditions (2.4a) and (2.4b) indicate that marginal revenue in the two markets are identical,  $MR_h = MR_f$ . However, (2.4c) and (2.4d) indicate that marginal costs are different

$$MC_h = MC_f + S_f(\partial P_f / \partial q_f) \quad (2.5)$$

Application of the implicit function theorem allows for the assumption that the first order conditions are invertible; thus,  $S_h$ ,  $S_f$ ,  $q_h$ , and  $q_f$  can be solved in terms of their exogenous factors. However, cost minimization of production in each location is an alternative for solving the problem. This yields four more endogenous variables which are the input demands,  $K_h$ ,  $K_f$ ,  $L_h$ , and  $L_f$ . Then, total costs in the home and foreign markets are given by

$$TC_h = w_h L_h + v_h K_h \quad (2.6a)$$

$$TC_f = w_f L_f + v_f K_f \quad (2.6b)$$

with  $w_h$  and  $w_f$  as the wages and  $v_h$  and  $v_f$  the cost of capital in each market. The profit maximization principle requires that marginal costs equal marginal revenues in both markets.

Thus,

$$MR_h(D_h) = MC_h(w_h, v_h) \quad (2.7a)$$

$$MR_f(D_f) = MC_f(w_f, v_f) - S_f(D_f) (\partial P_f / \partial q_f) \quad (2.7b)$$

$D_h$  and  $D_f$  represent the level of demand in the home and foreign markets. This implies that the first order conditions from profit maximization and cost minimization can be solved for the eight

endogenous variables  $S_h, S_f, q_h, q_f, K_h, K_f, L_h,$  and  $L_f$  in terms of the exogenous variables.

Therefore, the optimal foreign capital stock may be given by

$$K_t^* = f(D_f, v_h, v_f, w_h, w_f) \quad (2.8)$$

where  $K_t^*$  would depend positively on host country demand ( $D_f$ ) and on the relative unit costs between home and host countries. Equation (2.8) only includes host country demand, which is proxied by per capita GDP. This is because our research interest is on the association between FDI and the market size hypothesis (e.g., Bajo-Rubio & Sosvilla-Rivero, 1994; Gopinath et al., 1999; Love & Lage-Hidalgo, 2000). In addition, the cost minimization principle implies that capital and labor costs enter equation (2.8) in ratio form, so that the rates of substitution between different types of capital and labor must be equal to their price ratios.

Equation (2.8) may be considered as a representation of the desired level of capital stock ( $K_f^*$ ) at the foreign plant. However, the MNE does not immediately adjust the level of capital based on information regarding its output demand and production costs; there are lags in the adjustment process from actual capital stock to desired capital stock. Barrell and Pain (1996, p.203) argue that the desired and actual capital stocks are likely to differ in any given period due to adjustment costs because of delivery lags, delays due to searching for suitable investments overseas, or delays affecting planning permission, etc. This indicates that a partial adjustment model will be an appropriate specification for FDI flows. Flows of FDI are defined as a lag function of the difference between desired and actual capital stock and replacement investment due to capital stock depreciation. The partial adjustment model is given by

$$FDI_t = \ell(K_t^* - K_{t-1}) + \delta K_{t-1} \quad (2.9)$$

where  $FDI_t$  is the flow of FDI in year  $t$ ,  $K_{t-1}$  is the lagged value of the actual foreign capital stock, and  $\ell$  is a distributed lagged function. Equation (2.9) can be written as

$$FDI_t = \ell K_t^* + (\delta - \ell)K_{t-1} \quad (2.10)$$

Thus, FDI flows depend both on the determinants of the optimal capital stock (equation (2.8)) and the lagged value of U.S. capital stock in the host country.

In equation (2.8),  $D_f$  represents foreign market demand. Usually, measures of GDP or GNP are the proxies for  $D_f$  in order to capture the effect of the market size of an economy on FDI. This is known as the market size hypothesis<sup>7</sup> which assumes a positive association between host country demand and the expected sales of the MNFs' subsidiaries in the host country market. Many studies of FDI find a positive and significant relationship between FDI and GDP (e.g., Bajo-Rubio & Sosvilla-Rivero, 1994; Filippaios et al., 2003; Lall et al., 2003; Love & Lage-Hidalgo, 2003; and Marchant, Cornell & Koo, 2002) and between FDI and GNP (e.g., Barrel & Pain, 1996; Culem, 1988; and Cushman, 1985, 1987, 1985). This implies that either GNP or GDP represents the effect of the host country income in attracting FDI, and that an increase in host country GDP or GNP will attract more FDI. Additionally, countries with a larger GDP will attract more FDI.

Glytsos (2005) develops a Keynesian type macroeconometric model to estimate the demand generated by remittances on consumption, investment and imports. The model contains three behavioral equations and one identity; that is, consumption,  $C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 C_{t-1}$ ; investment,  $I_t = \beta_0 + \beta_1 Y_t + \beta_2 K_{t-1}$ ; imports,  $M_t = \gamma_0 + \gamma_1 Y_t + \gamma_2 Y_{t-1} + \gamma_3 M_{t-1}$ ; and income,  $Y_t = C_t + I_t + G_t + X_t - M_t + R_t$ . The income identity is given by GDP plus remittances,  $R_t$ ; thus, remittances are part of the disposable income. He finds positive and significant effects of income,  $Y_t$ , on consumption for the five countries; a positive and significant effect of  $Y_t$ , a proxy for profits, on investment for four countries; and a positive and significant

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<sup>7</sup> Moosa's (2002) chapter 2 gives a description of the theories of FDI.

effect of income,  $Y_t$ , on imports for three countries and a positive effect for two countries. Thus, Glytsos (2005) incorporates the demand effect generated by remittances on consumption through a kind of country disposable income. Dornbush and Fisher (1994, p.59) argue that individuals' consumption demands are related to their available income (disposable income) and not just to output level. Culem (1988) argues that the acceleration principle implies that under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments. Remittances increase the income of the recipients. Taylor et al. (2005) reported that remittances contributed to 16 percent of per capita rural income in Mexico in 2002. Consequently, it seems that remittances increase aggregate demand in an economy.

It is likely that remittances affect the desired capital stock in equation (2.8) through foreign market demand,  $D_f$ . Therefore, the model for the desired capital stock is extended to include the effects of remittances, exchange rate, U.S. exports and inflation. The extended model for the desired capital is given as

$$K_f^* = f(D_f, v_h/v_f, w_h/w_f, REM, ER, EX, INF) \quad (2.11)$$

where  $REM$  is remittances as share of GDP,  $ER$  is real exchange rate,  $EX$  is U.S. exports, and  $INF$  is inflation.

The majority of studies on the determinants of FDI control for the effect of exchange rate. The argument is that foreign currency depreciation against the MNF home country currency encourages outflows of FDI. Aliber argues that depreciation of the host country currency allows the MNFs to capitalize returns to a higher rate relative to the host country's firms (as cited in Bajo-Rubio & Sosvilla-Rivero, 1994). The possible depreciation of host country currency means that domestic firms face a risk premium in the interest rate applied to their borrowing. Froot and Stein (1991) suggest that host country currency depreciation can stimulate foreign investment.

Some studies find strong and negative effects of exchange rate on FDI (Cushman, 1985; Blonigen & Feenstra, 1996; and Froot & Stein, 1991). Nonetheless, there are contradictory findings; a positive association between exchange rate and FDI is in Waldkirch (2003), while suggesting positive or negative association is Stevens (1998). In this study, exchange rate is expected to have a negative effect on U.S. FDI outflows.

Following Barrell and Pain (1996), the model includes U.S. exports lagged one period. The reasoning is that exports can promote FDI in downstream services. These are consumer service facilities such as dealer networks as well as after sale repairs and maintenance outlets. They define MNF's exports as given by the difference between the MNF's foreign sales and its foreign production, which implies that exports are jointly endogenous, so that its lagged value is included in the estimated model. In addition, inclusion of exports allows for examining whether exports and FDI are complements or substitutes. In this study, exports are expected to have either a positive or a negative effect on U.S. FDI outflows.

Inflation can be a proxy for macroeconomic stability (Barro & Sala-i-Martin, 2004, p.520). Romer (2006, p.550) argues that one of the potential additional costs of inflation is that high variability of inflation can depress long term investment since this can be regarded as a signal of government malfunctioning that can result in government policies that hurt capital holders. Temple (1999, p.144) states that the presence of high inflation is accompanied by the presence of exchange rate volatility, political instability and other undesirable factors. Bruno and Easterly (1998); Cukierman, Kalaitzidakis, Summers and Webb (1993); and Fischer (1993) find negative relationships between inflation and investment, and between inflation and growth. Thus, lack of macroeconomics stability might affect U.S. investors' expectations about profits. In this study, inflation is expected to have a negative impact on U.S. FDI outflows.

In order to test empirically the hypothesis concerning the theoretical model, equation (2.10) is estimated in the following form:

$$FDI_t = \beta_0 + \beta_1 LnGDPP_t + \beta_2 LnREM_t + \beta_3 LnGDPP_t * LnREM_t + \beta_4 ER_t + \beta_5 EX_{t-1} + \beta_6 LnINF_t + \beta_7 (W^h/W^f)_t + \beta_8 K_{t-1} + a_i + \mu_t + \varepsilon_t \quad (2.12)$$

where  $a_i$  denotes the unobservable country effect;  $\mu_t$  denotes the unobservable time effects; and  $\varepsilon_{it}$  is the idiosyncratic error which is assumed to be independently and identically distributed with zero mean and variance  $\sigma_\varepsilon^2$ .  $Ln$  is the natural logarithm operator.

#### 2.4.2 The Data

The data set used covers 14 Latin American countries over the period 1983-2003<sup>8</sup>. The dependent variable is the annual U.S. FDI outflows as a share of host country GDP, and it is constructed using data on the U.S. direct investment position abroad from the Bureau of Economic Analysis (BEA). The data on per capita GDP is obtained from the Penn World Tables version 6.2. Real exchange rate is constructed using data from the International Financial Statistics CD-ROM (2007). The data on U.S. exports is obtained from OECD Statistics. Inflation is obtained from the International Financial Statistics CD-ROM (2007). The proxy for wages was constructed using data from the U.S. Bureau of Labor Statistics and from BEA. The data on U.S. FDI stocks is from BEA.

The remittance variable refers to workers' remittances, compensation of employees, and migrants' transfers, and is obtained from the World Development Indicators CD-ROM (2006). Workers' remittances are private transfers from migrant workers who reside in the host country for more than a year to people in their home country; compensation of employees is the income of migrants who have lived in the host country for less than a year; and migrant transfers are

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<sup>8</sup> See footnote 2.



transfers from one country to another at the time of migration of the net worth of migrants who live in the host country for more than a year. Remittances are expressed as a share of GDP. Complete variable definitions and data sources and descriptive statistics are provided in appendices 1 and 2 respectively.

## **2.5 Empirical Results**

This section presents the estimation results of the empirical model given by equation (2.12). The regressions are based on an unbalanced panel data set for a sample of 14 LAC countries during the period 1983-2003. These countries were selected based on the availability of data, particularly, data on remittances and wages. The econometric analysis uses a total of 236 annual observations. The minimum number of observations on a country is 10 while the maximum is 21. The method of estimation used is panel generalized methods of moments (GMM).

The data set is composed of long panels. It is possible that the errors are heteroskedastic and autocorrelated over time for each cross section, so that the errors may not be independent and identically distributed (iid). In this situation, panel GMM is more appropriate to use than pooled OLS since it allows for panel-robust standard error estimation; that is, it controls for intra-cluster correlation and heteroskedasticity. Besides, panel GMM allows controlling for endogeneity in the remittance variable; that is, remittances can be contemporaneously correlated with the errors because of reverse causality, measurement error or omitted variable issues. Reverse causality implies that increases in FDI outflows due to attractive investment conditions may increase remittance inflows. Measurement error in remittances may arise because official recorded remittances are smaller than the true size of remittances. The World Bank (2006, p.85) states that because of unrecorded remittance flows through both formal and informal channels the true size of remittances may be at least 50 percent greater than recorded remittances. Omitted factors may

affect both remittances and U.S. FDI outflows, which also yields biased estimates. The assumption of weak exogeneity allows past values of remittances to be uncorrelated with the errors and to be used as remittance own instruments. In addition, an exogenous instrument<sup>9</sup> based on per capita GDP of the top-eight migrant receiving countries is used as an instrumental variable. The panel nature of the data means that the unobserved country-fixed effects need to be considered, and for this, a Hausman test applied to an OLS version of equation (2.12) indicates that random effects are appropriate<sup>10</sup>, so the country fixed effects are left in the error term for the panel GMM estimation. The validity of the instruments is a key issue for the consistency of the instrumental variable estimator, for that purpose we report the J-statistic for overidentifying restrictions in Table 2.2; we fail to reject the null hypothesis that the instruments are uncorrelated with the error process. In order to control for the time effects, as in the pooled long panel case, a linear time trend is included (Cameron & Trivedi, 2009, p.267).

The results of the panel GMM for instrumental variable estimation are presented in Table 2.2. The aim is to explain U.S. FDI outflows to LAC by a model that includes as explanatory variables per capita GDP (a proxy for demand in the host country), remittances, an interaction term between remittances and per capita GDP, real exchange rate, the first lag of U.S. exports, inflation, the ratio of U.S. wages and host country wages, the first lag of the U.S. capital stock in the host country, and year (time effects). The main interest is in the effect of the interaction between remittances and per capita GDP on U.S. FDI. The R-squared statistics in each model are approximately 5 percent. However, goodness of fit is not relevant in instrumental variable estimation because it seeks to provide better estimates of the ceteris paribus effect of remittances

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<sup>9</sup> The instrument is based on the economic conditions of the top-eight migrant receiving countries and is adopted from Acosta et al. (2007). The per capita GDP of each of these countries is weighted by the inverse of the distance of each of these countries to each LAC country.

<sup>10</sup> P-value of Hausman test is 0.2231.

on U.S. FDI since remittances are endogenous. Thus, it is not necessary to report these R-squared results (see Wooldridge 2003, p.494).

**Table 2.2 Remittances, per capita GDP and U.S. FDI Outflows to Latin America and the Caribbean, Panel GMM estimation, 1983-2003**

Explanatory variables	Model 2.2.1	Model 2.2.2
constant	-0.8948 (0.35)	-0.4614 (0.22)
per capita GDP	0.7513** (2.64)	0.6946*** (3.33)
remittances	-3.0186** (2.43)	-2.7705*** (3.05)
remittances * per capita GDP	0.3510** (2.50)	0.3227*** (3.17)
exchange rate	0.1521*** (3.39)	0.1409*** (5.87)
lag U.S. exports	0.3260** (2.20)	0.3007** (2.49)
inflation	-0.0465*** (3.83)	-0.0439*** (5.30)
U.S. wage/host wage	0.0046 (0.95)	0.0051 (1.10)
lag U.S. capital stock	-0.1160*** (4.44)	-0.1103*** (6.30)
year	-0.0028** (2.82)	-0.0028** (2.81)
R-squared	0.0478	0.0492
Observations	236	236
Countries	14	14
J-statistic	0.64	0.73
P-value for J-statistic	0.7250	0.8657

Asterisks indicate significance at the 10 percent (\*), 5 percent (\*\*) and 1 percent (\*\*\*) levels respectively. Model 2.2.1 uses the first and second lag of remittances as instruments. Model 2.2.2 uses a distance weighted per capita GDP in addition to the lag values of remittances. Values in parenthesis are t-values.

Two models are estimated. Model 2.2.1 uses the first and second lags of remittances as instruments for the instrumental variable estimation. Model 2.2.2 uses the distance weighted per capita GDP as an instrument in addition to the lagged values of remittances. The results of both models are qualitatively the same. Nevertheless, model 2.2.2's results are statistically more

significant, so these are the ones discussed. There is a positive and highly significant impact of per capita GDP<sup>11</sup> (host country demand) on U.S. FDI. This result is consistent with the market size hypothesis, which suggests that MNCs tend to be attracted to larger markets in order to exploit economies of scale. Many studies find host country market size as an important determinant of U.S. FDI (Barrel & Pain, 1996; Cushman, 1985; Scaperlanda & Balough, 1983; 1969; among others). Some other studies find Positive associations between U.S. FDI and market size in LAC economies (Lall et al., 2003; Love & Lage-Hidalgo, 2000; and Tuman & Emmert, 2004). Thus, this result is in line with the literature.

The results about the association between U.S. FDI outflows and remittances and per capita GDP are very interesting. Model 2.2.2 includes per capita GDP and remittances individually, so the significance of the interaction term can not be the result of the omission of any of these two factors. Remittances enters significantly negative; however, interestingly, the coefficient on the interaction between per capita GDP and remittances is positive and significant<sup>12</sup> and suggests that remittances have a positive impact on U.S. FDI outflows, but only for certain levels of the host country per capita GDP. The coefficients on remittances and on the interaction term in the model indicate that countries with a log value of per capita GDP greater than 8.6 (a per capita GDP value of \$5,431.00) will benefit from the positive effect of remittances in attracting U.S. FDI. Eight out of the 14 countries in the sample have an average log value of per capita GDP greater than 8.6, so these countries pass this threshold<sup>13</sup>. On the other hand, remittances have a negative predicted effect on U.S. FDI outflows to six of the 14 LAC countries<sup>14</sup>.

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<sup>11</sup> P-value is 0.001.

<sup>12</sup> P-value is 0.002

<sup>13</sup> Barbados, Brazil, Colombia, Costa Rica, Mexico, Panama, Trinidad and Tobago, and Venezuela pass the threshold.

<sup>14</sup> The Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica and Peru do not pass the threshold.

The positive effect of an increase in remittances on U.S. FDI depends upon the level of per capita GDP in the economy. An increase in remittances as a share of GDP of 0.03 (one standard deviation) which is an increase of 132 percent relative to the sample mean in an economy with a per capita GDP log value of 8.67 (the sample average and equivalent to \$5,825.5) increases U.S. FDI to a LAC country by 0.04 percentage points per year. If the same increase in remittances happens in an economy that has a per capita GDP log value of 9.82 (as in the case of Trinidad and Tobago, and equivalent to \$18,398.05), the maximum value in the sample, then U.S. FDI rises by 0.53 percentage points a year. Taking the average value of per capita GDP for the year 1995 as a reference, coincidentally, the same eight countries pass the threshold of 8.6 as the log value of per capita GDP. The average value of per capita GDP for this year is \$6,454.34 which corresponds to a log value of 8.77. In this case, an 132 percent increase in remittances in a country with this log value (8.77) increases U.S. FDI by 0.08 percentage points a year. Therefore, on average, an increase in remittances as share of GDP has a positive impact on U.S. FDI outflows to the LAC countries.

The main point of interest of these findings is the positive and significant impact of the interaction between market size and remittances on U.S. FDI. There is a significant complementary effect between per capita GDP and remittances on U.S. FDI. That is, remittances are reinforcing the impact of market size in attracting U.S. FDI to LAC countries, but it depends upon the level of per capita GDP in the economy. Dornbush and Fisher (1994, p.59) argue that individuals' consumption demands are related to their available income (disposable income) and not just to output level. Culem (1988) argues that the acceleration principle implies that under a growing aggregate demand new investments are required, which promotes FDI and new and expansion investments. Glytsos (2005) incorporates the demand effect generated by remittances

on consumption by adding GDP and remittances, a kind of disposable income, and finds positive associations between this income and consumption and imports. Taylor et al. (2005) reported that remittances contributed to 16 percent of per capita rural income in Mexico in 2002. Thus, by increasing disposable income, remittances raise aggregate demand in the LAC economies and increase U.S. FDI outflows to LAC. If FDI contributes to growth and development in the LAC economies, this is a very good contribution of remittances.

The real exchange rate has a significantly positive effect on U.S. FDI. This was not expected. The argument is that foreign currency depreciation against the MNC home country currency encourages FDI. However, the literature on FDI reports mixed results, some studies find negative associations between host country exchange rate and FDI (e.g., Cushman, 1985; Blonigen & Feenstra, 1996; and Froot & Stein, 1991). On the other hand, there are contradictory findings; a positive association between exchange rate and FDI is in Waldkirch (2003), while suggesting positive or negative association is Stevens (1998). Waldkirch (2003) analyzed FDI in Mexico and argues that the positive association between FDI and exchange rate is consistent with Mexican currency appreciation in real terms if increased Mexican productivity is caused by capital inflows.

There is a positive and highly significant effect of exports on U.S. FDI. This suggests a complementary association between U.S. FDI and U.S. exports to LAC. Barrell and Pain (1996) argue that exports can promote FDI in down stream services, and that these services can raise the level of demand if they are included in the MNC's foreign operations. On this issue, Mundell (1957) is one of the earlier theoretical studies suggesting that trade of goods and factor flows are substitutes because trade constraints influence factors flows while factor flow restrictions influence trade. In contrast, Markusen (1983) present several models which suggest that factor

mobility promotes trade. In addition, some empirical research finds positive associations between FDI and trade, including Brenton, Di Mauro and Lücke (1999); and Brouwer et al. (2008). Regarding the association between U.S. FDI and exports to developing countries, Marchant et al. (2002) find a complementary relationship for the U.S. processed food industry.

Inflation is negatively and significantly affecting U.S. FDI, as expected. In this study, inflation is a proxy for macroeconomic instability and uncertainty and is depressing U.S. FDI in LAC. As Romer (2006) argues, high variability of inflation can decrease long term investment because it signals government policies that hurt capital holders. Fischer and Modigliani (1978) also point up to firms' investment reduction due to inflation uncertainty. Temple (1999, p.144) states that high inflation is accompanied by exchange rate volatility, political instability and other undesirable factors. Negative association between FDI and inflation includes Bajo-Rubio and Sosvilla-Rivero (1994), Bengoa and Sanchez-Robles (2003), Schneider and Frey (1985), and Yang, Groenewold, and Tcha (2000).

The ratio of U.S. wages to host country wages is positive but is not significant. It shows the expected relationship; that is, increase in U.S. wages raise U.S. FDI outflows to LAC. The lagged U.S. capital stock negatively and significantly affects U.S. FDI as suggested by the theoretical model.

## **2.6 Conclusions**

This study examines the relationship between U.S. FDI outflows to and remittances in a group of 14 Latin American and Caribbean countries during the period 1983-2003. The analysis is based on a model of profit maximization that follows from the work of Barrel and Pain (1996). Panel GMM is used for the estimation because it allows for obtaining panel-robust standard errors, and it controls for intra-cluster correlation and heteroskedasticity.

The results indicate that host country market size, as measured by per capita GDP, is one of the main factors driving U.S. FDI outflows to the countries in the LAC region. This is in line with the theory of the market size hypothesis and with empirical studies that find positive associations between U.S. FDI outflows and developing countries' market size (e.g., Lall et al., 2003; and Love & Lage-Hidalgo, 2000; Tuman & Emmert, 2004).

An important finding of this study is the significant and complementary effect between remittances and per capita GDP on U.S. FDI outflows. That is, the positive impact of remittances on U.S. FDI outflows is dependent upon the level of per capita GDP in the host economy. On average, an increase in remittances as a share of GDP of 132 percent which is one standard deviation relative to the sample mean in a LAC economy with a per capita GDP log value of 8.67 (the sample average and equivalent to \$5,825.5) would lead to an increase in U.S. FDI outflows to this economy of 0.04 percentage points per year. This result is in line with the findings of Glytsos (2005); he adds remittances to GDP in order to capture the remittances' demand effects on consumption, imports and investment. He finds a positive and significant impact of remittances on consumption and imports. Consequently, in this study, since remittances increase disposable income, remittances contribute to attract U.S. FDI outflows to the representative country in the LAC region through per capita GDP.

Regarding further research, it would be of interest to add data on FDI from other developing countries in order to have a larger sample. It would also be interesting to assess the association between remittances and sectoral FDI such as that in services and manufacturing that seeks to serve hosts' country markets. This may be the case of Mexico and Brazil in LAC, as well as for China and India which also receive large inflows of both FDI and remittances. In the case of Mexico, it has been considerable FDI increases through acquisitions of existing enterprises in the



food, beverages and tobacco industries, while FDI in the services sector (financial services, telecommunications, and commerce and other services) was 37 percent of total FDI during the period 1994 and 1998 (ECLAC, 2000). In Brazil, the market seeking FDI has not only been reflected in the services sector (telecommunications, finance, commerce, and electricity and gas) which increased as a share of total FDI from 31 percent in 1995 to 64 percent in 2000, but also in that Brazil hosts affiliates of about 400 of the top 500 transnational corporations (ECLAC, 2005). In addition, the primary objective of U.S. multinational affiliate sales is to serve host country markets (Mataloni & Fahin-Nader, 1996; and Mataloni & Yorgason, 2006).

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## **Chapter 3 Foreign Direct Investment Inflows to Latin America and the Caribbean: Remittances and Market Size**

### **3.1 Introduction**

Global Foreign Direct Investment<sup>1</sup> (FDI), as part of the world economic integration, has increased dramatically since the late 1980s. In developing countries, FDI has not only increased but also become one of the most important sources of development finance. In addition, FDI is positively associated with economic growth, so that it is not surprising the adoption of policies aimed at attracting it in host countries<sup>2</sup>. Positive associations between FDI and growth include Bengoa and Sanchez-Robles (2003), Campos and Kinoshita (2002), Hansen and Rand (2006), Li and Liu (2005), and Oliva and Rivera-Batiz (2002), among many others. Latin America and the Caribbean (LAC), among developing regions, has received remarkable increases in inward FDI since the late 1990s. FDI inflows to LAC were \$27.5 billion for the period of 1992-1996, \$76.9 billion for the period of 1997-2001, \$61.0 billion for the period 2002-2006 (Economic Commission for Latin America and the Caribbean [ECLAC], 2007), and \$105.9 billion in 2007 (ECLAC, 2008). The impressive increase in FDI flows and the benefits it drives in has motivated the study of the factors that affect its locations.

The literature on the determinants of FDI is very extensive. Among the issues studied, for example, are the effects of exchange rate on FDI (e.g., Barrell & Pain, 1996; Cushman, 1985, 1988; and Pain, 2003); the relationship between labor costs and FDI (e.g., Culem, 1988; Cushman, 1987; and Love & Lage-hidalgo, 2000); the association between political aspects and FDI (e.g., Haggard, 1989; Nigh, 1985; and Tuman & Emmert, 2004); the effect of trade issues such as openness, trade protection and trade agreements on FDI (e.g., Agosin & Machado, 2006;

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<sup>1</sup> The Internationally Monetary Funds suggests that for an investment to be considered as FDI it must represent at least 10 percent of voting stocks.

<sup>2</sup> It is a country that receives FDI.

Barrel & Pain, 1999; and Waldkirch, 2003); and the relationship between host country market size and FDI (e.g., Barrel & Pain, 1996; and Love & Lage-hidalgo, 2000). Interestingly, many of these determinants are host country characteristics, of which market size has been one of the most influential on FDI location.

Host country market size represents the level of demand for goods and services in an economy. In the literature, the association between market size and FDI is usually identified as positive (Bajo-Rubio and Sosvilla-Rivero, 1994; Barrel & Pain, 1996; Billington, 1999; Culem, 1988; Cushman, 1985, 1988; and Gopinath, Pick & Vasavada, 1999; among others). Hence, it is likely that economies with a larger market can be more attractive to foreign investors since it represents the country level of economic development, as well as characteristics such as the quality of institutions and living conditions. Thus, enhancing market size and reducing political risk are some of the recommendations (Fedderke and Romm, 2006).

Measures of either gross domestic product (GDP) or gross national product (GNP) are used as the proxies for market size. These proxies capture the effect of the host country's income, so that an increase in, for example, per capita GDP will increase the market size for the goods and services produced by the multinational firms' (MNF) subsidiaries. Remittances are others important capital inflows to LAC that add to disposable income. The available money for spending (disposable income), but not just the level of output, is related to the individuals' consumption demands (Dornbush & Fisher, 1994, p.59). Glytsos (2005) adds remittances and GDP, in a type of country disposable income, to capture remittances' demand effect on consumption and imports. LAC has been the largest recipient of recorded remittances, and it attracted \$53 billion in 2007, the largest amount among developing regions (World Bank, 2007, p. 54). Hence, it is likely that remittances may affect FDI inflows to LAC.



There is a vast number of studies about the determinants of FDI, however, to our knowledge, there is no previous empirical research dealing with the effect of the association between remittances and market size on FDI. Investigating the relation between remittances and FDI is important because remittances may be identified as a signal of a larger demand as well as profitable opportunities for foreign investors in countries with significant amount of remittances inflows. In this study, the objective is to investigate empirically the impact of remittances in attracting FDI through per capita GDP. In order to do this, we follow Bajo-Rubio and Sosvilla-Rivero's (1994) methodology which relates the undertaking of FDI by a MNF to cost minimization in order to derive the demand for the optimal capital to invest abroad. Specifically, we assess the complementary effect between remittances and per capita GDP in attracting FDI to LAC.

The estimation method is based on panel generalized method of moments (PGMM). Constrained by data availability, the research uses an unbalanced panel data set on 14 countries from LAC over the period 1983-2003<sup>3</sup>. The result is a positive and significant impact of remittances on FDI inflows to LAC, but it depends upon the level of per capita GDP in the economy. That is, a threshold of per capita GDP is needed for a LAC economy to benefit from the positive effect of remittances on FDI. In addition, per capita GDP is positive and significant, which is in line with the market size hypothesis.

The structure of the rest of the paper is as follows. Section 3.2 presents an overview of FDI and remittances in LAC. Section 3.3 provides a review of the relevant FDI literature. Section 3.4 describes the methodology and data. Section 3.5 presents a discussion of the results. Finally, section 3.6 presents conclusions and suggestions for further research.

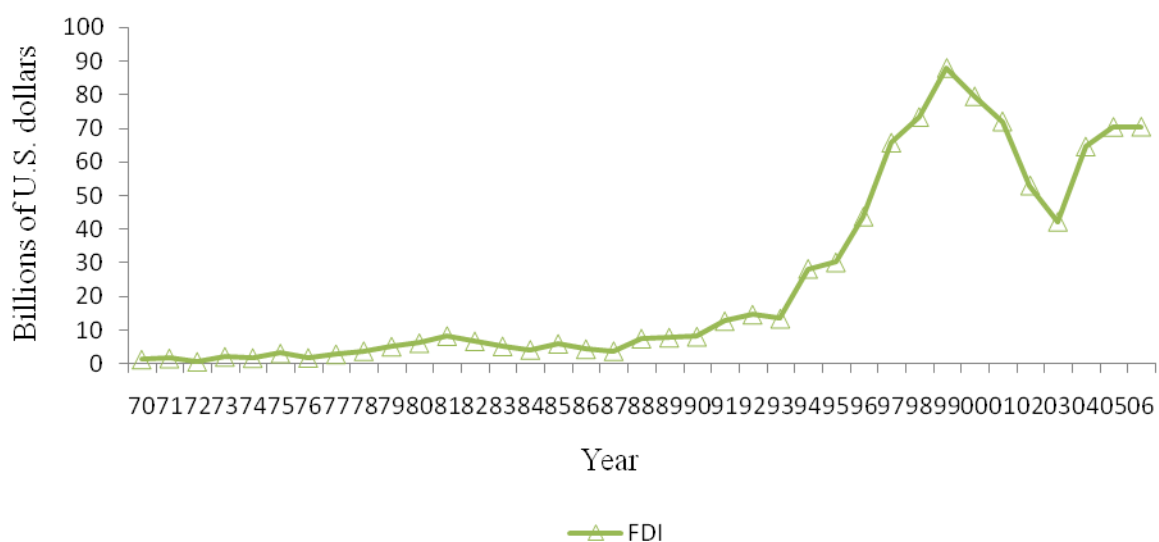
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<sup>3</sup> Barbados (BRB), Brazil (BRA), Colombia (COL), Costa Rica (CRI), The Dominican Republic (DOM), Ecuador (ECU), Guatemala (GTM), Honduras (HND), Jamaica (JAM), Mexico (MEX), Panama (PAN), Peru (PER), Trinidad and Tobago (TTO), and Venezuela (VEN).

### 3.2 FDI and Remittances in Latin America and the Caribbean

In this section, some interesting facts about FDI and remittances in LAC are described.

Figure 3.1 shows the evolution of inward FDI in LAC from 1970 through 2006; the data is in billions of U.S. dollars. It has been three increases in FDI, a small one in the early 1980s, an extraordinary increase in the late 1990's, a sharp decline from 2000 to 2003, and a recovery since 2004.



**Figure 3.1. FDI inflows to Latin America and the Caribbean, 1970-2006**

Source: own calculations using data from the World Development Indicators online version 2007.

The first increase in FDI inflows to LAC occurred during the period 1977-1983 when LAC attracted 12 percent of global FDI (ECLAC, 2005, p.30). The second half of the 1990s shows a big surge of FDI in LAC (\$87.91 billion), it was the first extraordinary increase in FDI. Brazil's service sector attracted large amounts of FDI influenced by privatizations of state-owned enterprises and deregulation of some important sectors of the economy; Spain invested in two large South American companies, one in Argentina and the other in Chile; at the same time, privatization and deregulation of state controlled sectors promoted FDI in the service sector in

Central America and the Caribbean (ECLAC, 2000). In Mexico, the policy changes undertaken during the 1990s that brought about liberalization of FDI regulations and the signing of the North American Free Trade Agreement (NAFTA), as well as the geographical proximity to the U.S. market were fundamental to the increase in FDI (ECLAC, 2001). During the period 1995 and earlier 2000s, FDI inflows to Mexico's manufacturing sector were more than 60 percent of which 65 percent was from the U.S. ([www.secofi.gob.mx](http://www.secofi.gob.mx) as cited in ECLAC, 2001). ECLAC (2002) suggests that, the increase in FDI during the 1990s was the result of a better economic and political environment which allowed for trade liberalization, liberalization of the mining and the hydrocarbon sectors, liberalization of the banking sector, privatization of public sector enterprises, and revitalization of the regional integration processes.

The decline of inward FDI started in the year 2000 and lasted until 2003. From 1996 to 2002, FDI was allocated as follows: the service sector attracted 57 percent, manufacturing 28 percent and the primary sector 15 percent; however, since 2001 FDI in services has declined (ECLAC, 2004). This decline was influenced by the slowdown of the world economy, the U.S. recession, the end of the privatization process, and the political and economic instability in Argentina, Venezuela, Bolivia, Ecuador, Colombia and Peru (ECLAC, 2002). Argentina's political and economic crisis in 2002 had negative effects on the other South American countries; consequently, there were important trade reductions in Brazil, Uruguay and Chile; exchange rate volatility; and increased country risks and large drops in remittances in Bolivia and Paraguay; while in Mexico and Central America and the Caribbean, the reduction of the U.S. demand and the revaluation of the Mexican peso hindered FDI (ECLAC, 2003).

The recovery of FDI inflows to the LAC region started in 2004. Among the factors contributing to this were improved economic conditions and large corporate acquisitions,

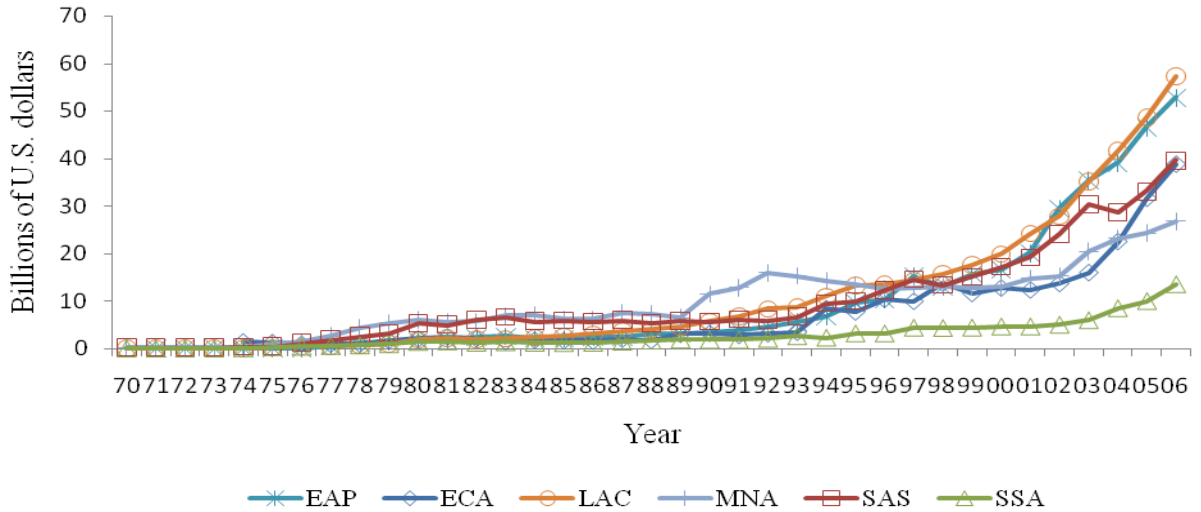
increased Mexico's maquila activity due to a recovery in U.S. demand, and larger inflows to Brazil (Brazil received \$18.2 billion out of the \$34.1 billion FDI inflows to South America in 2004) which was followed by Chile, Colombia and Argentina (ECLAC, 2005). The increase of FDI inflows to Brazil was promoted by the rise in Brazil's domestic demand and the achievement of some fiscal targets (ECLAC, 2004). Furthermore, economic growth in the U.S. and in LAC, increased demand for the LAC region's natural resources, and the increase in merger and acquisition transactions contributed to the FDI recovery in the LAC region (ECLAC, 2006, p. 21). The Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR) signed in 2005 has also encouraged FDI in the banking and communication sectors (ECLAC, 2007), as well as in the clothing sector (ECLAC, 2008). Lastly, FDI inflows to the LAC region for the year 2007 was \$105.9 billion, a record level (not on the figures), and most of it went to Brazil, followed by Mexico, Chile and Colombia, and shows the region recovery in attracting FDI (ECLAC, 2008).

Another important source of external financing in the LAC countries is remittances. LAC has been the largest recipient of recorded remittances among developing regions, and it attracted \$53 billion in 2007 (World Bank, 2007, p. 54). Since the late 1990s, LAC has been the largest recipient of reported remittances (Figure 3.2). Total remittance inflows to LAC grew from \$5.7 billion in 1990 to \$57 billion in 2006 (World Development Indicators, 2007)<sup>4</sup>, a ten-fold increase. Figures 3.3 and 3.4 show that relative to FDI and Official Development Assistance (ODA), remittances have become the second most important source of external finance in LAC, both in levels and as a percent of GDP. Remittances have had a steady increase since the early 1990s, ODA in billions of U.S. dollars seems to be constant but also seems to be decreasing as a percent of GDP, while FDI shows a sharp drop during the earlier 2000s (Figures 3.3 and 3.4).

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<sup>4</sup> The data is from the online version.

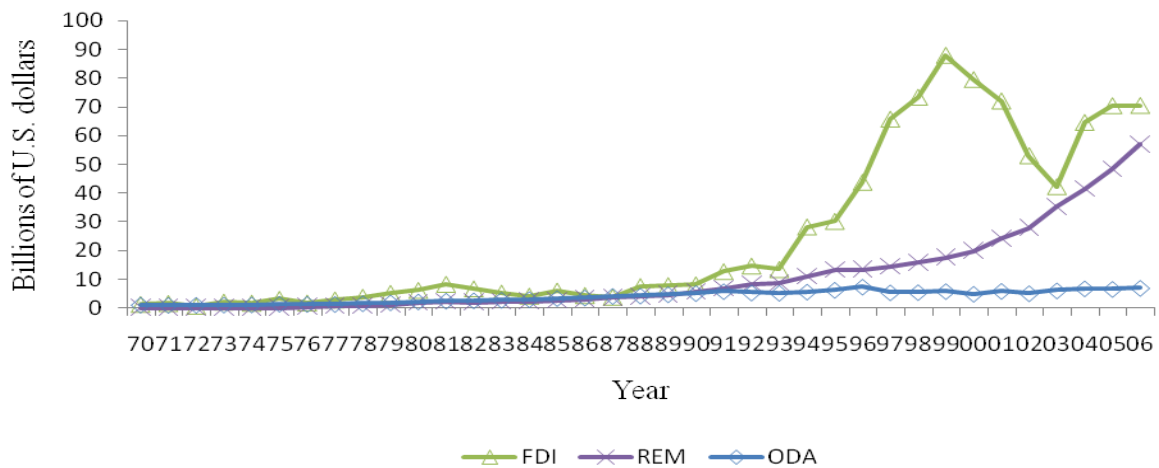
This shows that remittances are less volatile than ODA and FDI, and the importance of remittances for the countries in the LAC region<sup>5</sup>.



**Figure 3.2 Remittance inflows to developing country regions, 1970-2006**

EAP: East Asia and the Pacific, ECA: Europe and Central Asia, LAC: Latin America and the Caribbean, MNA: Middle East and North Africa, SAS: South Asia, and SSA: Sub-Saharan Africa.

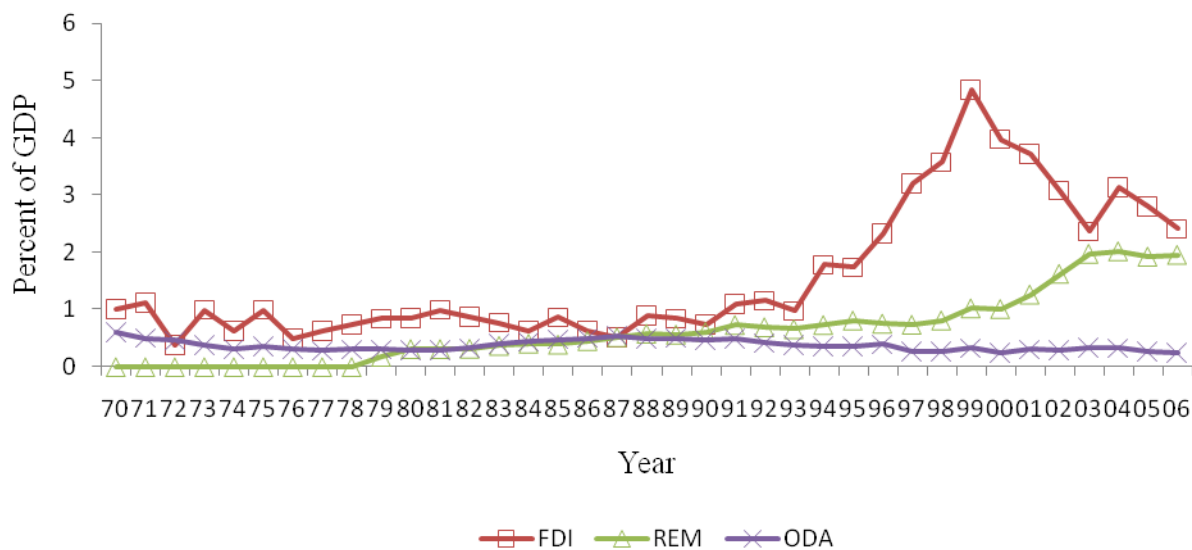
Source: own calculations using data from the World Bank. The data is available at [www.Worldbank.org/prospects/migrationandremittances](http://www.Worldbank.org/prospects/migrationandremittances).



**Figure 3.3 Remittances, FDI and ODA inflows to LAC, 1970-2006**

Source: own calculations using data from the World Development Indicators online version 2007.

<sup>5</sup> That comprises the entire group of countries in Latin America and the Caribbean as grouped by the World Bank, not just the 14 countries in this study.



**Figure 3.4 Remittances, FDI and ODA inflows to LAC, 1970-2006**

Source: own calculations using data from the World Development Indicators online version 2007.

### 3.3 Review of Literature

This section is a review of some previous studies that focus on the association between FDI and market size. In this literature, market size represents the level of demand for goods and services in an economy and it is proxied by a measure of either GDP or GNP. This literature is very extensive and most of it reports market size to be an important determinant of FDI. Cushman (1985) assess the association between real exchange rate risk, expectations and U.S. direct investment to five industrialized countries for the years 1963 through 1978 and finds, with one exception, a strong positive effect from foreign income on direct investment. Terpstra and Yu's (1988) analysis of the determinants of foreign investment of the twenty largest U.S. advertising agencies during the years 1972 and 1984 finds host county GDP to have a positive and significant effect on FDI. Bajo-Rubio and Sosvilla-Rivero (1994) examined the determinants of FDI in Spain over the period 1964-1989. The results, based on cointegration analysis, indicated the existence of a long-run relationship between real GDP and manufacturing and non-

manufacturing FDI as well as for total FDI. Barrell and Pain (1996) use quarterly data during the period 1971-1998 to study the determinants of U.S. FDI. They use GNP level and GNP growth to proxy for host country demand and find a significantly positive effect of GNP on U.S. FDI. Billington (1999) analyzes the location of FDI at the country level for seven industrialized countries and at the regional level for 11 regions of the United Kingdom. He reports that, at the country level, income and growth (proxies for market size) are among the significant determinants of FDI.

Some of the recent research has also found positive influence of market size on FDI inflows. Blonigen and Davies (2000) assessed the impacts of bilateral tax treaties on U.S. inbound and outbound FDI over the period 1966-1992 and found positive and significant effects of host country real GDP on outbound U.S. FDI. Gopinath et al., (1999) examine the determinants of U.S. FDI for the food processing industry in ten developed countries for the period 1982-1994 and obtain a positive and significant effect on U.S. FDI from host country per capita GNP. Globerman and Shapiro (2002) investigate the effect of governance infrastructure on U.S. FDI in developed and developing countries during the period 1995-1997 and find real GDP to have a positive and highly significant effect on U.S. FDI for the whole sample as well as for the group of developing countries. Li and Liu (2005) examine the relationship between economic growth and FDI on a panel of 84 countries over the period 1970-1999. They use GDP to proxy market size in the FDI equation and estimate single equations of growth and FDI as well as a simultaneous equation system. Their results indicate, with one exception, positive and significant effects of GDP on FDI.

The literature on FDI about the LAC region also finds significant effects of market size on FDI. Love and Lage-Hidalgo (2000) study the determinants of U.S. FDI in Mexico for the period

1967-1994. They find Mexican per capita GDP, the proxy for Mexican demand, to have a positive and highly significant effect on U.S. FDI. Lall, Norman and Featherstone (2003) carry out separate assessments of the determinants of U.S. FDI in Latin America and the Caribbean as well as for the entire sample over the period 1983-1994; they find three measures of market size (GDP, squared GDP and GDP growth) to have positive and significant effects on FDI. Tuman and Emmert (2004) examine the political and economic determinants of U.S. FDI on a sample of 15 LAC countries over the period 1979-1996. They show that the change in real per capita GDP has a positive and significant effect on U.S. FDI. Bengoa and Sanchez-Robles' (2003) study on the relationship between FDI, economic freedom and growth on a panel of 18 LAC countries during the period 1970-1999, using both random and fixed effects estimations, finds GDP to be positive and significant in all regressions. Daude, Mazza and Morrison (2003) analyze the effects of core labor standards on bilateral FDI flows to 12 LAC countries from the U.S. and Japan during the period 1989-2000. They use OLS and random effects to estimate a gravity model of FDI for total, manufacturing and nonmanufacturing FDI and find host country GDP positive and significant in ten out of the 12 regressions.

Based on this review of literature, an increase in host country GDP will attract more FDI. In the literature, GDP is also identified as host country income which is used for acquiring goods and services, thus, an increase in host country income will raise the demand for good and services. Based on the acceleration principle, under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments as Culem (1988, p.888) argues. Remittances are not only important flows of capital into developing countries but are a part of their disposable income. The available money for spending (disposable income), but not just the level of output, is related to the individuals' consumption demands



(Dornbush & Fisher, 1994, p.59). Remittances accounted for 16 percent of rural household per capita income in Mexico in 2002 (Taylor, Mora & Adams, 2005). Therefore, remittances raise the demand for good and services in an economy through increasing disposable income. Glytsos (2005) adds remittances and GDP, in a type of country disposable income, to capture remittances' demand effect on consumption and imports. He finds a positive and significant effect of this income on consumption for a sample of five countries, a positive and significant effect on imports for three countries and only a positive effect for the other two countries. Thus, it seems that remittances raise aggregate demand in an economy.

### **3.4 Methodology and Data**

#### **3.4.1 The model**

The theoretical methods used for the analysis of the inflows of FDI to LAC are based on a model of cost minimization that follows from the work of Bajo-Rubio and Sosvilla-Rivero (1994). This approach is used in many studies of FDI (e.g., Love & Lage-Hidalgo, 2000; Marchant, Cornell, & Koo, 2002; Pain, 1993). The approach relates the undertaking of FDI by a multinational firm (MNF) to cost minimization which allows deriving the optimal capital input for investing abroad. The model assumes that the MNF decides first on whether or not to undertake FDI which requires a decision on the output level in the foreign country. Once the firm's decision on FDI is positive, total costs of production are defined as a function of costs of production in both the MNF-home and MNF-foreign plants. Total costs are given by

$$TC = c_h(q_h)q_h + c_f(q_f)q_f \quad (3.1)$$

where  $TC$  is total costs,  $c_h$  and  $q_h$  are unit costs and output level in the home plant,  $c_f$  and  $q_f$  are unit costs and output level in the foreign plant, subscripts  $h$  and  $f$  are for home and foreign. The constraint for total cost minimization is given by total output demand as

$$TD = q_h + q_f \quad (3.2)$$

Then the Lagrangean function is defined as

$$L = c_h(q_h)q_h + c_f(q_f)q_f + \lambda (TD - q_h - q_f) \quad (3.3)$$

The first order conditions for the cost minimization problem are given by

$$\partial L / \partial q_h = c'_h(q_h)q_h + c_h(q_h) - \lambda = 0 \quad (3.4)$$

$$\partial L / \partial q_f = c'_f(q_f)q_f + c_f(q_f) - \lambda = 0 \quad (3.5)$$

$$\partial L / \partial \lambda = TD - q_h - q_f = 0 \quad (3.6)$$

where  $c'_h = \partial c_h / \partial q_h$  and  $c'_f = \partial c_f / \partial q_f$ . Equations (3.4) and (3.5) are marginal costs in the home and foreign plants respectively. Equating (3.4) and (3.5) and solving for home output ( $q_h$ ) and then substitutes this result into equation (3.6) yields equilibrium output in the foreign plant.

Therefore, foreign production is given as

$$q_f = \Phi_1 TD + \Phi_2 (c_h - c_f) \quad (3.7)$$

where  $\Phi_1 = c'_h / (c'_h + c'_f)$  and  $\Phi_2 = 1 / (c'_h + c'_f)$  and are assumed to be positive. Equation (3.7) shows that foreign plant's output is positively related to both total demand and unit cost differential between home and foreign inputs.

The next decision faced by the MNF is the choice of inputs for foreign plant production.

Foreign production is assumed to be given by a Cobb-Douglas production function, that is

$$q_f = L_f^\alpha K_f^\beta \quad (3.8)$$

The associated costs with foreign production are then given by

$$C_f = w_f L_f + r_f K_f \quad (3.9)$$

where  $w$  and  $r$  are real wage and real user cost of capital respectively. Foreign plant costs are minimized, so that the Lagrangean function is defined as

$$L = w_f L_f + r_f K_f + \lambda (q_f - L_f^\alpha K_f^\beta) \quad (3.10)$$

The first order conditions for the cost minimization problem are given by:

$$\partial L / \partial L_f = w_f - \lambda \alpha (q_f / L_f) = 0 \quad (3.11)$$

$$\partial L / \partial K_f = r_f - \lambda \beta (q_f / K_f) = 0 \quad (3.12)$$

$$\partial L / \partial \lambda = q_f - L_f^\alpha K_f^\beta = 0 \quad (3.13)$$

Dividing equation (3.11) by equation (3.12) and then rearranging yields

$$w_f L_f / \alpha q_f = r_f K_f / \beta q_f \quad (3.14)$$

Taking  $L_f$  from equation (3.13) and substituting it into (3.14) yields  $K_f$  as

$$K_f = [(\beta / \alpha) (w_f / q_f)]^{\alpha / (\alpha + \beta)} q_f^{1 / (\alpha + \beta)} \quad (3.15)$$

Plugging equation (3.7) into (3.15) yields the final expression for the desired capital stock at the foreign plant

$$K_f^* = [(\beta / \alpha) (w_f / q_f)]^{\alpha / (\alpha + \beta)} [\Phi_1 TD + \Phi_2 (c_h - c_f)]^{1 / (\alpha + \beta)} \quad (3.16)$$

Specifically, the desired capital stock at the foreign plant may be given by

$$K_t^* = f(q_f, RUC) \quad (3.17)$$

where the desired capital stock,  $K_t^*$ , would depend positively on host country demand ( $q_f$ ) and on the relative unit costs ( $RUC$ ) between home and host countries. Equation (3.17) only includes host country demand, which in this study is proxied by per capita GDP. This is because our research interest is on the association between FDI and the market size hypothesis (e.g., Bajo-Rubio & and Sosvilla-Rivero, 1994; Gopinath et al., 1999; Love & Lage-Hidalgo, 2000). In addition, cost minimization implies that capital and labor costs enter equation (3.17) in ratio form, so that the rates of substitution between different types of capital and labor must be equal to their price ratios.

In equation (3.17),  $K_t^*$  may be considered as the desired capital stock. However, adjustments in the level of capital stock do not occur immediately, there are some lags in the adjustment process. The desired and actual capital stocks differ in each period of time because of adjustment costs due to delivery lags, delays due to searching for suitable investments overseas, and/or delays affecting planning permission (Barrel & Pain, 1996). Based on these constraints, a partial adjustment model will be an appropriate specification for FDI flows, which can be specified as a lag function of the difference between desired and actual capital stock, and replacement investment due to capital stock depreciation. This adjustment model is given as

$$FDI_t = \gamma(K_t^* - K_{t-1}) + \delta K_{t-1} \quad (3.18)$$

where  $FDI_t$  is FDI inflows in year  $t$  and  $\gamma$  is a distributed lag function. Equation (3.18) can also be written as

$$FDI_t = \gamma K_t^* + (\delta - \gamma) K_{t-1} \quad (3.19)$$

This equation indicates that FDI is a function of the factors determining the desired capital stock (equation, (3.17)) and the lagged value of foreign capital stock.

Foreign market demand, in equation (3.17), is given by  $q_f$ . In the literature, the proxies used for  $q_f$  are measures of either GDP or GNP which capture the effect of the market size of an economy on FDI. This is called the market size hypothesis<sup>6</sup>. It assumes a positive relationship between host country demand and the expected sales of the MNCs' subsidiaries. Examples of positive and significant effect of GDP on FDI include Bajo-Rubio and Sosvilla-Rivero (1994); Filippaios, Papanastassiou and Pearce (2003); Lall et al. (2003); Love and Lage-Hidalgo (2000); and Marchant et al. (2002); among others; while between FDI and GNP include Barrel and Pain (1996); Culem (1988); Cushman (1985, 1987, 1988). Hence, either GNP or GDP captures the

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<sup>6</sup> Moosa's (2002) chapter 2 gives a description of the theories of FDI.

effect of the host country income in attracting FDI, and an increase in this income will attract more FDI. Moreover, countries with a larger GDP will attract more FDI.

Glytsos (2005) estimates the demand generated by remittances on consumption, investment and imports. He develops a Keynesian type macro-econometric model. The model is a system given by three behavioral equations and one identity: consumption,  $C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 C_{t-1}$ ; investment,  $I_t = \beta_0 + \beta_1 Y_t + \beta_2 K_{t-1}$ ; imports,  $M_t = \gamma_0 + \gamma_1 Y_t + \gamma_2 Y_{t-1} + \gamma_3 M_{t-1}$ ; and income,  $Y_t = C_t + I_t + G_t + X_t - M_t + R_t$ . The income identity is the addition of GDP and remittances,  $R_t$ , so that remittances are part of the disposable income. The results show positive and significant effects of income,  $Y_t$ , on consumption for the five countries; a positive and significant effect of  $Y_t$ , a proxy for profits, on investment for four countries; and a positive and significant effect of income,  $Y_t$ , on imports for three countries and a positive effect for the other two countries. Therefore, Glytsos (2005) incorporates the remittances' demand effect on consumption through a type of country disposable income. The available money for spending (disposable income), but not just the level of output, is related to the individuals' consumption demands (Dornbush & Fisher, 1994, p.59). Based on the acceleration principle, under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments as Culem (1988, p.888) argues. Remittances accounted for 16 percent of rural household per capita income in Mexico in 2002 (Taylor et al., 2005). Therefore, it seems that remittances increase aggregate demand in an economy.

It is likely that remittances affect the desired capital stock in equation (3.17) through foreign market demand,  $q_f$ . Then, the model for the desired capital stock is extended to include the effects of remittances, exchange rate, imports and inflation. The extended model is given by

$$K_f^* = f(q_f, w_h/w_f, REM, ER, IM, INF) \quad (3.20)$$

where *REM* is remittances as share of GDP, *ER* is real exchange rate, *IM* is host country imports, and *INF* is inflation.

This study control for the effect of exchange rate, as it is usual in the literature, because foreign currency depreciation against the MNF's home country currency can influence FDI inflows. Host country currency depreciation gives the MNF an opportunity to capitalize its returns to a higher rate relative to the host country's firms (Aliber, as cited in Bajo-Rubio & Sosvilla-Rivero, 1994). That is, domestic firms face a risk premium in the interest rate applied to their borrowing. However, host country currency depreciation can stimulate foreign investment (Froot & Stein, 1991). A number of studies find strong and negative effects from exchange rate on FDI (Cushman, 1985; Blonigen & Feenstra, 1996; and Froot & Stein, 1991). In contrast, a positive association between exchange rate and FDI is Waldkirch (2003), while suggesting ambiguous effects of exchange rate on FDI is (Stevens, 1998). In this study, exchange rate is expected to have a negative effect on FDI inflows.

The association between FDI and trade is not unambiguous. Under trade restriction scenarios, it is likely that FDI and trade behave as substitutes; however, in open market economies with relatively less trade restrictions, FDI and trade are more likely to be complements. An earlier theoretical study that examined the relationship between international movements of goods and factors is Mundell (1957); he suggests that goods and factors behave as substitutes. On the contrary, Markusen (1983) presents several models which suggest that factor mobility promotes trade. In addition, the literature report complementary associations between international flows of goods and factors (Billington, 1999; Brenton, Di Mauro & Lücke, 1999; Globerman & Shapiro, 1999). Barrel and Pain (1996) argue that MNF's exports (host country imports) can promote FDI in downstream services which are consumer service facilities such as dealer

networks as well as after sale repairs and maintenance outlets. They define MNF's exports as given by the difference between the MNF's foreign sales and its foreign production, which implies that exports are jointly endogenous, so that the lagged value of exports is included in the estimated model. This study controls for host country imports lagged one period, and it is expected that imports are either complements or substitutes to FDI, that is, imports can have either a positive or a negative effect on FDI inflows.

One possible proxy for macroeconomic stability is inflation (Barro & Sala-i-Martin, 2004, p.520). One of the possible negative effects of inflation is its high variability, which can discourage long term investment because it can be perceived as government malfunctioning that can result in government policies that hurt capital holders (Romer, 2006, p.550). It is also argued that high inflation is tied to exchange rate volatility, political instability and other undesirable factors (Temple, 1999, p.144). Negative association between inflation and investment, and between inflation and growth include the findings of Bruno and Easterly (1998); Cukierman, Kalaitzidakis, Summers and Webb (1993); and Fischer (1993). Therefore, macroeconomic instability may affect international investors' expectations about their foreign investment profits. In this study, we expect inflation to have a negative impact on FDI inflows to the countries of the LAC region.

The empirical specification of equation (3.19) is, then, given by

$$FDI_t = \beta_0 + \beta_1 LnGDPP_t + \beta_2 LnREM_t + \beta_3 LnGDPP_t * LnREM_t + \beta_4 LnER_t + \beta_5 IM_{t-1} + \beta_6 LnINF_t + \beta_7 Ln(\frac{W_h}{W_f})_t + \beta_8 LnK_{t-1} + a_i + \mu_t + \varepsilon_t \quad (3.21)$$

where  $a_i$  denotes the unobservable country fixed effects;  $\mu_t$  denotes the unobservable time effects; and  $\varepsilon_{it}$  is the idiosyncratic error which is assumed to be independently and identically distributed with zero mean and variance  $\sigma_\varepsilon^2$ .  $Ln$  is the natural logarithm operator.

### **3.4.2 The Data**

The study comprises the period 1983 to 2003 for a sample of 14 LAC countries<sup>7</sup>. The dependent variable is annual FDI inflows as share of host country GDP, and it is obtained from the World Development Indicators CD-ROM (2006). Per capita GDP is obtained from the Penn World Tables version 6.2. Real exchange rate is constructed using data from International Financial Statistics CD-ROM (2007). The data on host country imports is obtained from the World Development Indicators CD-ROM (2006). The data on inflation is obtained from the International Financial Statistics CD-ROM (2007). The data to construct the proxy for wages is obtained from the Bureau of Economic Analysis (BEA) and from the U.S. Bureau of Labor Statistics. The data on FDI stocks is from the World Investment Report Annex Tables.

Remittances comprise workers' remittances, compensation of employees and migrants' transfers, and they are obtained from the World Development Indicators CD-ROM (2006). Workers' remittances are private transfers from migrant workers who reside in the host country for more than a year to people in their home country. Compensation of employees is the income of migrants who have lived in the host country for less than a year. Migrant transfers are transfers from one country to another at the time of migration of the net worth of migrants who lived in the host country for more than a year. Remittances are expressed as a share of GDP. Complete variable definitions and data sources and descriptive statistics are provided in appendices 3 and 4 respectively.

### **3.5 Empirical Results**

This section shows the results of the regressions based on the specification given by equation (3.21). The data set is an unbalanced panel and covers a sample of 14 LAC countries during the period 1983-2003. The selection of these countries was determined by the availability of data on

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<sup>7</sup> See footnote 2.



remittances and wages. The econometric analysis uses a total of 228 annual observations, while the number of observations per country ranges between seven and 21. The econometric technique used is panel generalized methods of moments (GMM).

The long panel nature of the data set makes it possible that the errors are no longer independent and identically distributed (iid); that is, the errors may be heteroskedastic and autocorrelated over time for each cross section in the sample of countries. In this situation, an appropriate estimation technique is panel GMM since it allows for a robust estimation that controls for intra-cluster correlation and heteroskedasticity. In addition, panel GMM allows for instrumental variable estimation since remittances are endogenous. That is, remittances can be contemporaneously correlated with the errors because of reverse causality, measurement error or omitted variable issues. Because of reverse causality, increases in FDI inflows may increase remittance inflows to the LAC countries. Measurement error problems can arise because of remittance flows through informal channels. It is argued that because of unrecorded remittance flows through both formal and informal channels the true size of remittances may be at least 50 percent greater than recorded remittances (World Bank, 2006, p.85). Regarding omitted variables issues, these can affect both remittances and FDI inflows to LAC countries, which also yield biased estimates. We assume weak exogeneity, so that past values of remittances would be uncorrelated with the errors and be used as instruments for remittances. In addition to the past values of remittances, an exogenous instrument<sup>8</sup> based on the per capita GDP of the top-eight migrant receiving countries is used. In order to control for the country fixed effects in the panel data set, a Hausman test<sup>9</sup>, was applied to an OLS version of equation (3.21) and suggested that

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<sup>8</sup> The instrument is based on the economic conditions of the top-eight migrant receiving countries and is adopted from Acosta et al. (2007). The per capita GDP of each of these countries is weighted by the inverse of the distance of each of these countries to each LAC country.

<sup>9</sup> P-value of Hausman test is 0.0001.

fixed effects are appropriate so a full set of country dummy variables is included in the estimated model. The validity of the instruments affects the consistency of the instrumental variable estimator, for that purpose the J-statistic for overidentifying restrictions is reported in Table 3.1. The J-statistic's test suggests a failure for rejecting the null hypothesis that the instruments are uncorrelated with the error process, so it is appropriate to use our instruments. A linear time trend is included to control for the time effects (Cameron & Trivedi, 2009, p.267).

**Table 3.1 Remittances, per capita GDP and FDI inflows to Latin America and the Caribbean, Panel GMM estimation, 1983-2003**

Explanatory variables	Model 3.1.1	Model 3.1.2
constant	-11.0807*** (3.73)	-11.0396*** (3.77)
per capita GDP	0.6298* (1.96)	0.6170** (1.97)
remittances	-2.6958** (2.21)	-2.6575** (2.22)
remittances * per capita GDP	0.3188** (2.17)	0.3140** (2.18)
exchange rate	0.0033 (0.29)	0.0030 (0.28)
lag imports	0.1403*** (3.08)	0.1404*** (3.14)
inflation	0.0042 (0.67)	-0.0045 (0.83)
U.S. wage/host wage	-0.0014* (1.94)	-0.0014* (1.96)
lag foreign capital stock	-0.0107* (1.66)	-0.0107* (1.67)
year	0.0028** (2.36)	0.0028** (2.46)
R-squared	0.1181	0.1138
Observations	228	228
Countries	14	14
J-statistic	4.727	4.752
P-value for J-statistic	0.0941	0.1909

Asterisks indicate significance at the 10 percent (\*), 5 percent (\*\*) and 1 percent (\*\*\*) levels respectively. Model 3.1.1 uses the first and second lag of remittances as instruments. Model 3.1.2 uses a distance weighted per capita GDP in addition to the lag values of remittances. Values in parenthesis are t-values. Country fixed effects are not reported to save space.

Table 3.1 shows the results for the panel GMM estimation. FDI inflows to LAC are explained by a set of explanatory variables that include per capita GDP, remittances, an interaction term between remittances and per capita GDP, real exchange rate, host country imports lagged one period, inflation, the ratio of U.S. wages and host country wages, foreign capital stock lagged one period, and year (time effects). The specific objective is to assess the effect of the interaction between remittances and per capita GDP on FDI inflows. The R-squared statistics in each model are approximately 11 percent. However, goodness of fit is not relevant in instrumental variable estimation because it seeks to provide better estimates of the ceteris paribus effect of remittances on FDI flows since remittances are endogenous. Thus, it is not necessary to report these R-squared results (see Wooldridge, 2003, p.494).

In Table 3.1, two models are shown. Model 3.1.1 uses the first and second lags of the remittance variable as instruments, while model 3.1.2 uses the distance weighted per capita GDP in addition to the lagged values of remittances. In both models, the results are qualitatively the same. However, based on the statistical significance, the discussion of the results develops from model 3.1.2. There is a positive and significant impact of per capita GDP<sup>10</sup> on FDI inflows to LAC. This result suggests support for the market size hypothesis; that is, MNFs tend to be attracted to larger markets in order to exploit economies of scale. Many studies report positive associations between market size and FDI (e.g., Bajo-Rubio & Sosvilla-Rivero 1994; Barrell & Pain, 1996; Brouwer, Paap & Viaene, 2008; Culem, 1988; and Fedderke & Romm, 2006, among others). Regarding the FDI literature that focuses on LAC region, some studies also find positive associations between FDI and market size (Lall et al. 2003; and Love & Lage-Hidalgo, 2000; and Tuman & Emmert, 2004, among others). Consequently, our result lends support to this literature.

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<sup>10</sup> P-value is 0.048.

The results on the relationship between FDI and remittances and per capita GDP are quite interesting. In model 3.1.2, per capita GDP and remittances are included individually, so that the significance of the interaction term can not be the result of the omission of any of these two factors. Remittances have a negative and significant effect on FDI; however, the interaction between per capita GDP and remittances is positive and significant<sup>11</sup>. This suggests that remittances have a positive impact on FDI inflows to LAC, but only for economies that have reached certain levels of per capita GDP. From the estimates of remittances and the interaction term, a country with a log value of per capita GDP greater than 8.46 (a per capita GDP value of \$4,722.06) will benefit from the positive effect of remittances in attracting FDI. In this study, there are nine countries with an average log value of per capita GDP greater than 8.46, so that these countries pass this threshold<sup>12</sup>; conversely, remittances have a negative predicted effect on five LAC countries<sup>13</sup>.

Remittances' positive impact on FDI depends upon the level of per capita GDP in the economy. In a country with a per capita GDP log value of 8.67 (the sample average and equivalent to \$5,825.5), an increase in remittances of 0.03 as a share of GDP (one standard deviation) which is an increase of 132 percent relative to the sample mean will raise FDI inflows to the country by 0.09 percentage points per year. Based on the same increase in remittances, but in a country with a per capita GDP log value of 9.82 (as in the case of Trinidad and Tobago, and equivalent to \$18,398.05), the maximum value in the sample, FDI inflows rise by 0.56 percentage points a year. Based on the average value of per capita GDP for the year 1995, coincidentally, the same nine countries pass the threshold of 8.46. The log value of the average

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<sup>11</sup> P-value is 0.029.

<sup>12</sup> Barbados, Brazil, Colombia, Costa Rica, Mexico, Panama, The Dominican Republic, Trinidad and Tobago, and Venezuela pass the threshold.

<sup>13</sup> Ecuador, Guatemala, Honduras, Jamaica and Peru do not pass the threshold.

per capita GDP (\$6,454.34) for the year 1995 is 8.77. In this case, the same increase in remittances raises FDI inflows by 0.13 percentage points a year. As a result, on average, increasing remittances has a positive impact on FDI inflows to the LAC countries.

The most important finding is the positive and significant impact of the interaction between host country's per capita GDP and remittances on FDI inflows. There is a significant complementary effect on FDI inflows from per capita GDP and remittances. This suggests that remittances strengthen the impact of market size in attracting FDI to the LAC economies, but it depends upon the level of per capita GDP. The available money for spending (disposable income), but not just the level of output, is related to the individuals' consumption demands (Dornbush & Fisher, 1994, p.59). Based on the acceleration principle, under a growing aggregate demand new investments are required, which promotes FDI as well as new and expansion investments as Culem (1988, p.888) argues. Glytsos (2005) adds remittances and GDP, in a type of country disposable income, to capture remittances' demand effect on consumption and imports and finds positive associations between them. Remittances accounted for 16 percent of rural household per capita income in Mexico in 2002 (Taylor et al., 2005). Consequently, by increasing disposable income, remittances not only raise aggregate demand in the LAC economies but also increase FDI inflows to LAC. If FDI contributes to growth and development in the LAC economies, this is a very good contribution from remittances.

The real exchange rate is positive but is not significant. This is not the expected sign. However, the literature on FDI reports mixed results, some studies find negative associations between host country exchange rate and FDI (Blonigen & Feenstra, 1996; Cushman, 1985; Froot & Stein, 1991). On the other hand, suggesting positive associations between exchange rate and FDI include Stevens (1998) and Waldkirch (2003).

There is a positive and highly significant effect of imports on FDI. This suggests a complementary association between FDI inflows and host country imports. Barrell and Pain (1996) argue that MNF's exports (host country imports) can promote FDI in down stream services, and that these services can raise the level of demand if they are included in the MNF's foreign operations. They find a complementary relationship between lagged exports and FDI. There are also other studies that find positive associations between FDI and trade; these include Brenton et al. (1999) and Brouwer et al. (2008). On the complementary association between host country imports and FDI, the FDI literature includes the studies of Billington (1999) and Globerman and Shapiro (1999).

The ratio of U.S. wages (a proxy for MNF home country wages) to host country wages is negative and significant. This is not the expected sign, and it implies that an increase in host country wages raises FDI inflows. Chakrabarti (2001) argues that, among all the potential FDI determinants, wages have been the most controversial because the literature reports host country wages negatively affecting FDI, having no effect or positively affecting it. In addition, low wages by itself are not a main factor influencing FDI (UNCTAD, 2002). Positive and significant associations between host country wages and FDI include Filippaios et al., (2003); Marchant et al., (2002); Swedenborg (2001); and Wheeler and Moody (1992). Inflation has an unexpected sign but is not significant. Daude et al., (2003) and Tuman and Emmert (2004) find positive and insignificant effect of inflation on FDI in LAC. Lastly, the lagged foreign capital stock negatively and significantly affects FDI inflows as suggested by the theoretical model.

### **3.6 Conclusions**

This research assesses the association between FDI inflows and remittances for a group of 14 Latin American and Caribbean countries during the period 1983-2003. The methods used for the

analysis are based on a model of cost minimization that follows from the work of Bajo-Rubio and Sosvilla-Rivero (1994). The approach relates the undertaking of FDI by a MNF to cost minimization in order to derive the optimal capital input for investing abroad. Panel GMM is used for the estimation because it allows for robust estimation by controlling for intra-cluster correlation and heteroskedasticity.

The results show that per capita GDP, a proxy for host country market size, is one of the main factors in attracting FDI inflows to the countries in the LAC region. This is in line with the theory of market size and with the research that find positive associations between FDI and developing countries' market size (e.g., Bengoa & Sanchez-Robles, 2003; Daude et al. 2003; Jaumotte, 2004; Lall et al. 2003; Love & Lage-Hidalgo, 2000; and Tuman & Emmert, 2004, among others).

The significant and complementary effect between remittances and per capita GDP on FDI inflows to LAC is a very important finding of this study. This suggests a positive impact of remittances on FDI inflows to the countries in the LAC region; however, it depends upon the level of per capita GDP in the host economy. On average, in a country with a per capita GDP log value of 8.67 (the sample average and equivalent to \$5825.5), an increase in remittances of 0.03 as a share of GDP (one standard deviation) which is an increase of 132 percent relative to the sample mean will raise FDI inflows to this economy by 0.09 percentage points per year. This result is in line with the findings of Glytsos (2005); he adds remittances to GDP in order to capture remittances' demand effects on consumption, imports and investment. He finds a positive and significant impact of remittances on consumption and imports. Therefore, in this study, by increasing disposable income, remittances contribute to attract FDI inflows to the representative country of the LAC region through per capita GDP.

With respect to future research, it would be of interest to increase the sample size by including other developing countries which can serve to do draw comparisons among developing regions. In addition, there are large FDI flows going to the services and manufacturing sectors, which seek to serve host country markets, so that studying the relationship between this type of FDI and remittances would be very interesting. Mexico may be a case where acquisitions in existing enterprises in the food, beverages and tobacco industries has attracted considerable amounts of FDI, while the services sector received 37 percent of total FDI during the period 1994 and 1998 (ECLAC, 2000). Another case may be Brazil where FDI in the services sector increased as a share of total FDI from 31 percent in 1995 to 64 percent in 2000, and Brazil has hosted affiliates of about 400 of the top 500 transnational corporations (ECLAC, 2005). Other interesting cases may be China and India which have been attracting large inflows of FDI as well as receiving large inflows of remittances.

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## **Chapter 4 Remittances and Economic Growth in Latin America and the Caribbean: The Impact of Human Capital Development**

### **4.1 Introduction**

Remittances are one source of external financing for developing countries that have been increasing in both size and importance as of late. During 2006 inflows to developing countries of Foreign Direct Investment (FDI), remittances and Official Development Assistance (ODA) in billions of U.S. dollars were \$324.7, \$206.0 and \$103.9, respectively (World Bank, 2007). Remittances are second to FDI, but greater than ODA inflows. Among developing countries, Latin America and the Caribbean (LAC) have been the largest recipient of recorded remittances. Remittance inflows to developing regions in 2006 were \$47.0 billion for East Asia and the Pacific (EAP), \$32.0 billion for Europe and Central Asia (ECA), \$53.0 billion for LAC, \$25.0 billion for Middle East and North Africa (MNA), \$41.0 billion for South Asia (SAS), and \$9.0 billion for Sub-Saharan Africa (SSA) (World Bank, 2007, p.54). The remarkable increase in remittances' size has awakened the interest of researchers in the development economics area as well as of policy makers to study the relationship between remittances and economic growth. However, the impact on economic growth from remittances is still an open discussion.

Some studies find negative and significant impacts of remittances on economic growth (Chami, Fullenkamp & Jahjah, 2003), or a negative but insignificant impact (International Monetary Fund [IMF], 2005). On the other hand, the positive impact of remittances on economic growth is associated with remittance's potential for financing education and health (human capital development) and/or productive investments. Some of the studies that find remittances' positive effect on growth are Acosta, Calderón, Fajnzylber and Lopez (2007); Catrinescu, Leon-Ledesma, Piracha and Quillin (2006); and Guiliano and Ruiz-Arranz (2006). Suggesting remittances' contributions to education are Cox Edwards and Ureta (2003), Hanson and

Woodruff (2003), López-Cordova (2006), and Rapoport and Docquier (2005). Suggesting remittances' contributions to productive investments are Griffin (1976), Massey and Parrado (1998), and Woodruff and Zenteno (2001).

Even though the research on remittances has been growing, the interesting question about remittances' impact on economic growth in developing economies is still opened for discussions. In order to add to this discussion, the purpose of the current study is to assess empirically the impact of remittances on economic growth through human capital. The empirical work is based on a model of endogenous growth in which the growth rate of total factor productivity (TFP) is modeled as being dependent on human capital and an interaction between human capital and remittances. Remittances' potential to affect economic growth may be associated with remittances' use for investment in education which can affect TFP. However, the impact of remittances on growth may be affected by the requirement of an adequate level of human capital in the remittance receiving economy, so that the level of human capital is conditioning the utilization of remittances. It may be that human capital has a role similar to that in Nelson and Phelps (1966) and Benhabib and Spiegel (1994) who suggest that human capital limits the adoption and implementation of new technologies; or that the level of human capital limits the absorptive capacity of an economy as in Borensztein, De Gregorio and Lee (1998). Therefore, in this study we test the complementarity between human capital and remittances on growth.

To estimate the effect of remittances on growth, we use cross-country growth accounting methods. A group of 14 countries from Latin America and the Caribbean is selected based on data availability over the period 1975-2000<sup>1</sup>. We model the growth of TFP as a function of human capital and its interaction with remittances. The results indicate that remittances have a

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<sup>1</sup> Barbados (BRB), Bolivia (BOL), Brazil (BRA), Colombia (COL), Costa Rica (CRI), Dominican Republic (DOM), El Salvador (SLV), Guatemala (GTM), Honduras (HND), Jamaica (JAM), Mexico (MEX), Panama (PAN), Paraguay (PRY), and Trinidad and Tobago (TTO).

positive impact on economic growth, though the realization of this impact depends upon the level of human capital stock in the economy. This implies that a threshold of human capital stock is needed for remittances to exert a positive effect on growth. In addition, the level of human capital stock has a positive and significant effect on growth.

To accomplish this, this paper will proceed as follows. Section 4.2 will present an overview of remittances in LAC. Section 4.3 provides a review of the literature on remittances and growth. Section 4.4 describes the methodology and data. Section 4.5 presents a discussion of the results. Finally, section 4.6 presents conclusions and areas for further research.

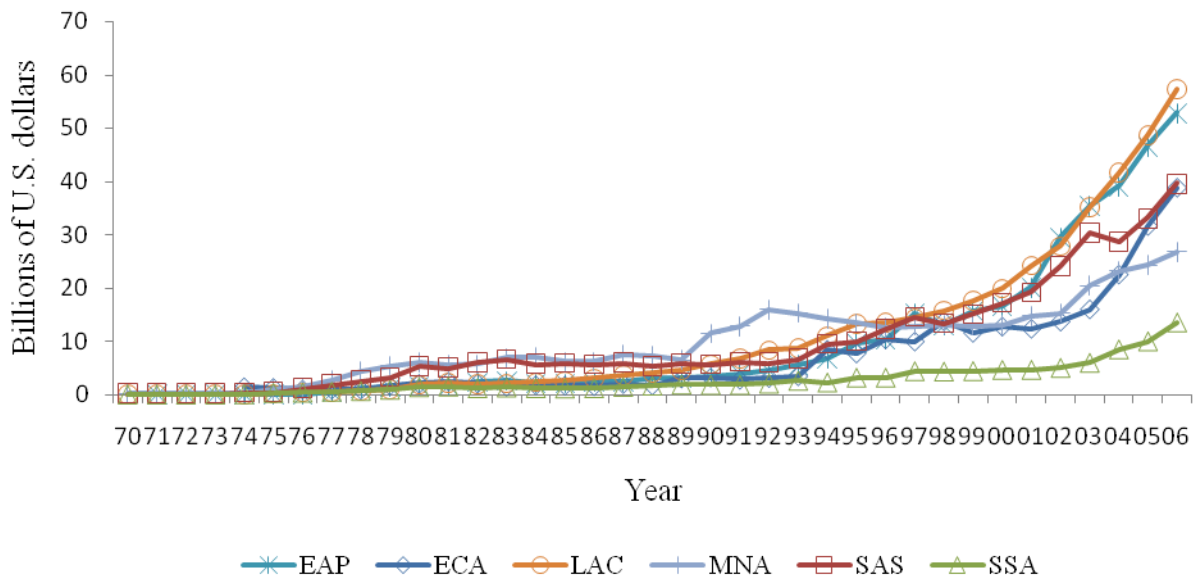
## **4.2 Overview of Remittance Inflows to Latin America and the Caribbean**

Remittance inflows to developing countries have been increasing and becoming an important source of foreign exchange. In 2006 these inflows were estimated to be \$206 billion, which is composed of: \$47 billion to East Asia and Pacific; \$32 billion to Europe and Central Asia; \$53 billion to Latin America and the Caribbean; \$25 billion to the Middle East and North Africa; \$41 billion to South Asia; and \$9 billion to Sub-Saharan Africa (World Bank, 2007, p. 54). Figure 4.1 shows that, since the late 1990s, LAC has been the largest recipient of reported remittances followed by East Asia and Pacific.

Remittances are one of the largest sources of external finance for the countries in the LAC region. Total remittance inflows to LAC grew from \$5.7 billion in 1990 to \$57 billion in 2006 (World Development Indicators, 2007)<sup>2</sup>, a ten-fold increase. IMF (2005, p. 72) reports that five countries (Mexico, Brazil, Colombia, El Salvador, and the Dominican Republic) from the LAC region belong to the group of the top 20 largest recipients of remittances during the period 1990-2003, of which Mexico is second. Compared to FDI and ODA, remittance flows into LAC have become the second most important source of external finance, both in levels and as a percent of

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<sup>2</sup> The data is from the online version.



**Figure 4.1 Remittance inflows to developing country regions, 1970-2006**

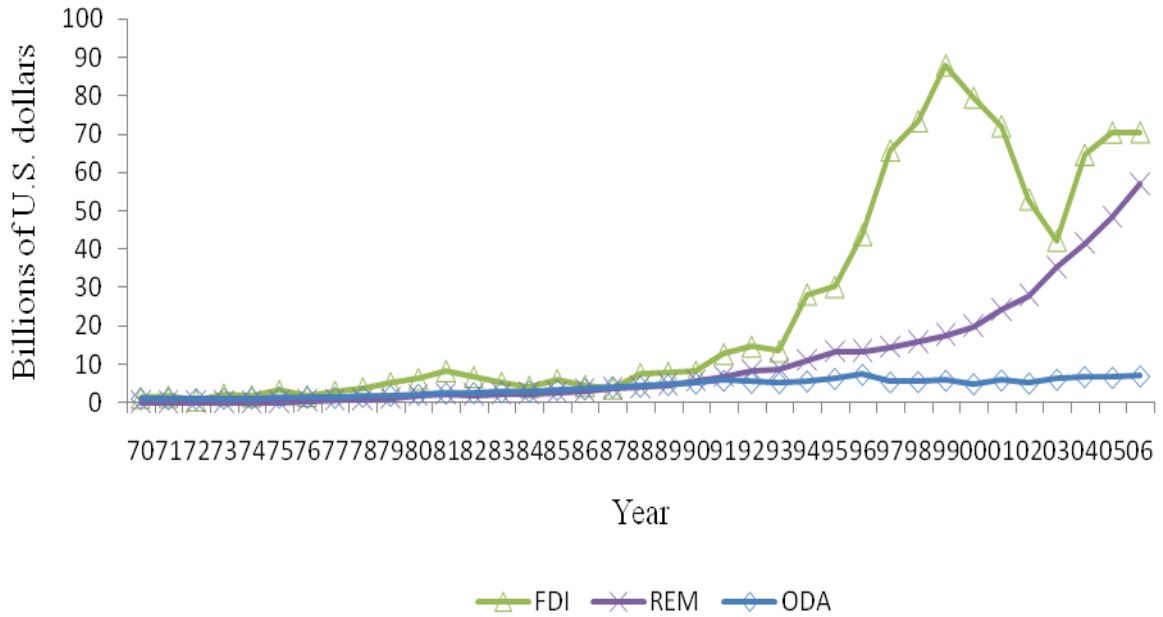
Source: own calculations using data from the World Bank. The data is available at [www.Worldbank.org/prospects/migrationandremittances](http://www.Worldbank.org/prospects/migrationandremittances).

GDP (Figures 4.2 and 4.3). Figures 4.2 and 4.3 also show that while remittances have had a steady increase since the early 1990s, ODA in billions of U.S. dollars seems to be constant but seems to be decreasing as a percent of GDP, while FDI shows a downturn during the late 1990s and earlier 2000s. Therefore, remittances are less volatile than ODA and FDI as a source of foreign exchange. This shows the importance of remittances both in levels as well as a percent of GDP for the countries in the LAC region<sup>3</sup>.

Figures 4.4 and 4.5 show remittance inflows to the countries in our sample for the period 1979-2000 both in levels and in percent of GDP. Most of the countries show an increase in remittances over the period, with the exception of Panama. For Panama, Figures 4.4 and 4.5 show that remittances both as a share of GDP and in levels have decreased during the period of the study.

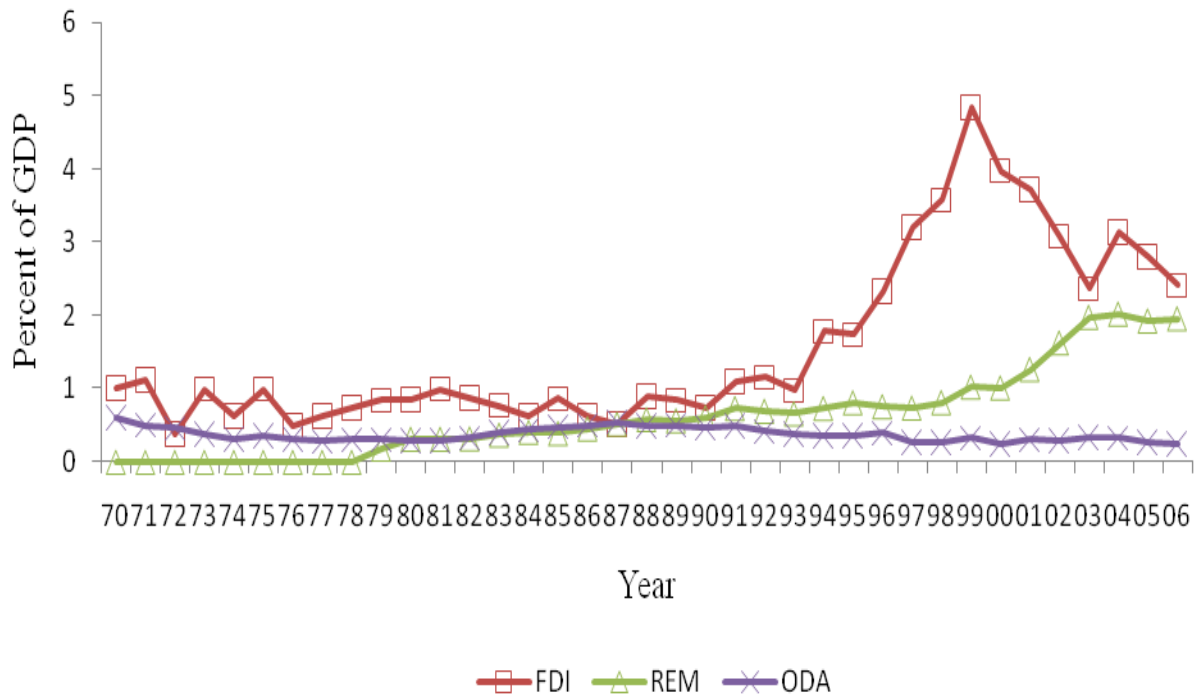
<sup>3</sup> That comprises the entire group of countries in Latin America and the Caribbean as grouped by the World Bank, not just the 14 countries in this study.





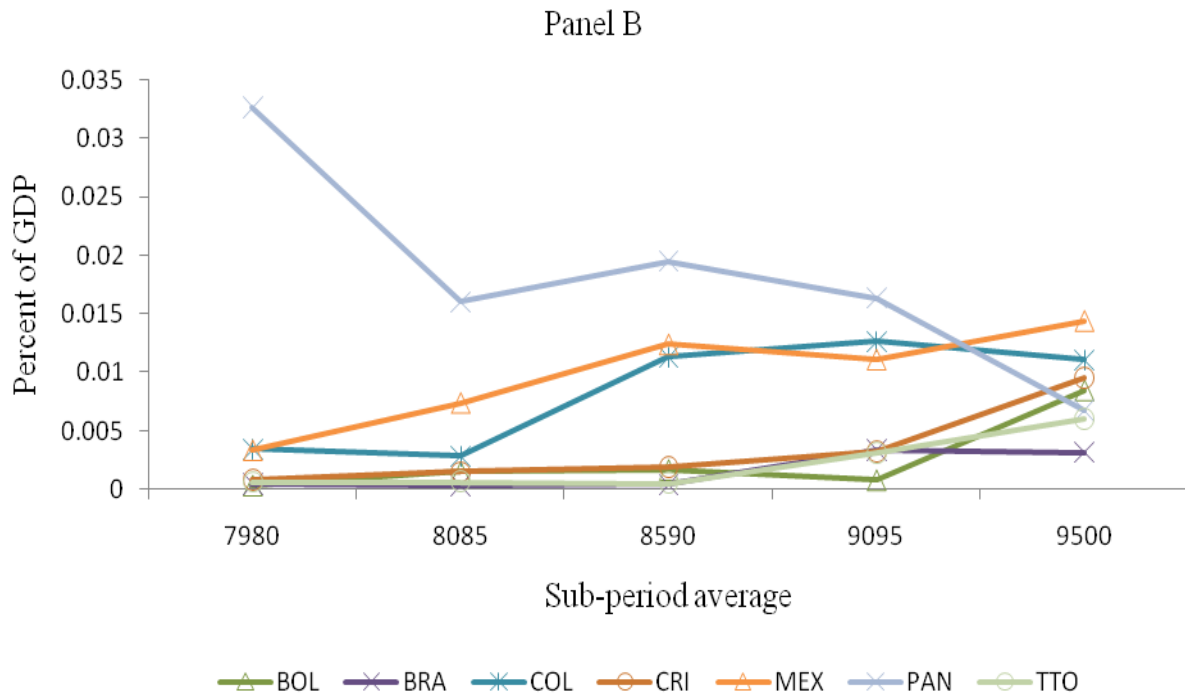
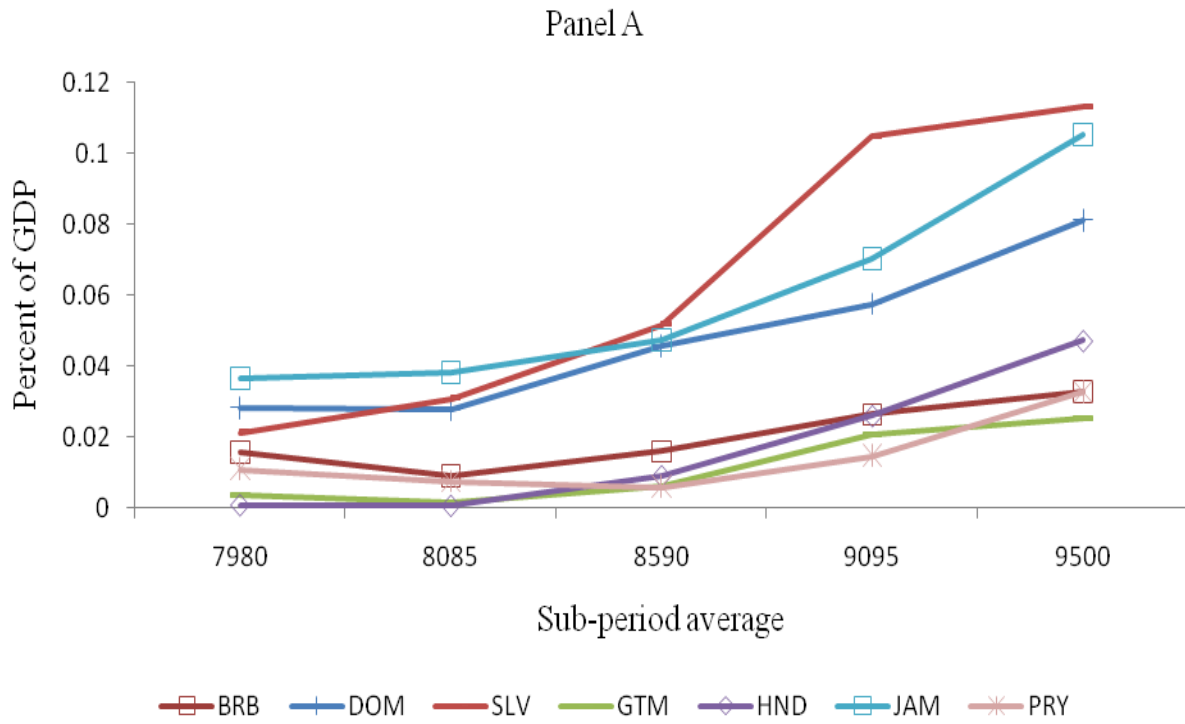
**Figure 4.2 Remittances, FDI and ODA inflows to LAC, 1970-2006**

Source: own calculations using data from the World Development Indicators online version 2007.



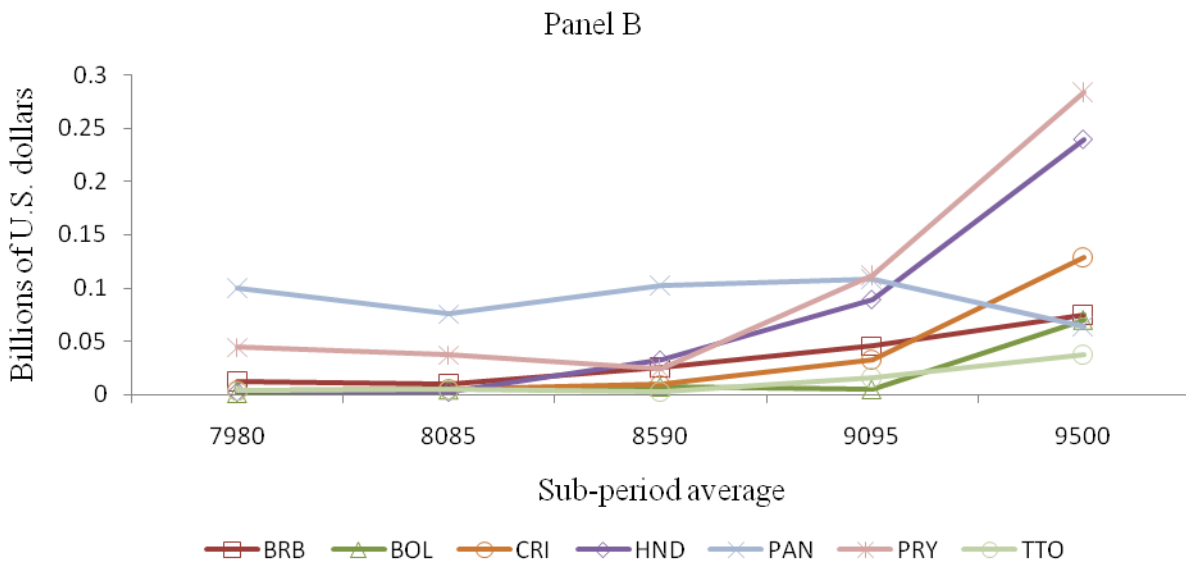
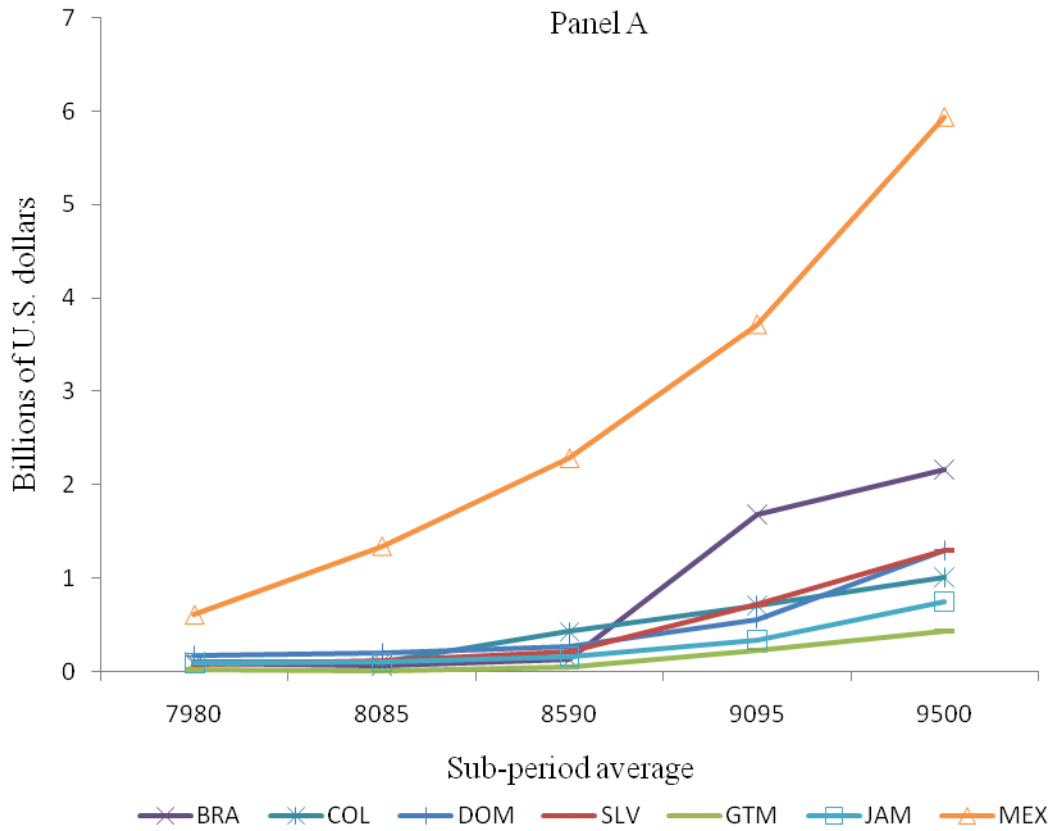
**Figure 4.3 Remittances, FDI and ODA inflows to LAC, 1970-2006**

Source: own calculations using data from the World Development Indicators online version 2007.



**Figure 4.4 Remittances, FDI and ODA inflows to LAC, 1979-2000**

Source: own calculations using data from the World Development Indicators CD-ROM version 2005.



**Figure 4.5 Remittances, FDI and ODA inflows to LAC, 1979-2000**

Source: own calculations using data from the World Development Indicators CD-ROM version 2005.

### 4.3 Review of Literature

The impact of remittances on economic growth is still an open discussion. Remittances are used either for consumption, investment, or both uses. Some strands of literature on remittances suggest that using remittances for consumption does not make any good contribution to economic growth. Another strand of literature argues that by easing liquidity constraints remittances can contribute to investment in physical and human capital and, thus, affect growth.

Remittances are associated with consumption, which relates to the economics of the family and to the existence of an altruistic relationship between the migrant and his/her family, so that remittances behave as compensatory transfers that ease bad economic conditions (Chami et al. 2003). On the relationship between remittances and investment, Rapoport & Docquier (2005) suggest that remittances have distributive effects that are associated with its effects on growth and present two models in which remittances promote investment in physical and human capitals. The first model, “Liquidity Constraint 1: Entrepreneurship”, considers that emigration does not have a direct effect on the labor market of the immigrant home country but has an indirect effect on the economy because of the migrants’ intergenerational transfers (remittances). The model presents three cases with two of them resulting in promoting entrepreneurship in the immigrant home economy. The second model, “Liquidity constraint 2: Human Capital”, considers an economy with individuals having a two period life, so that in the first period the individual earns a minimum wage, receives a transfer from the previous generation and has the possibility to engage in an educational program. In the second period, the model assumes that migration occurs and at the end of the period migrants return to their home country and transfer their accumulated savings to the next generation. This model divides the home country population in four groups (A, B, C, and D) and distinguishes three cases, and under case number

three groups B, C and D emigrate whose transfers (remittances) allow their next generation to invest in education. Thus, in these two models remittances are promoting both productive investment projects and education.

Arguments against remittances' contributions to development include Böhning (1975) and Rempel and Lodbell (1978). In these studies, remittances are primarily used for consumption and housing expenditures. Chami et al. (2003) find a significant and negative growth effect of remittances. However, it is argued that the estimate in this study is biased because of the instrumental variables estimator used for remittances (Catrinescu, et al., 2006, p.11; IMF, 2005); and as Lucas argues that the lack of significance of the interest rate gap differential in the first stage regression reduces the effectiveness in eliminating the bias of the estimate (as cited in Catrinescu et al., 2006, p.3). Rapoport & Docquier, (2005, p. 66) also argue that Chami et al. (2003) ignored the possibility that remittances could affect investment and human capital formation due to the existence of liquidity constraints, so that human capital, an important factor that affects growth, was absent in their analysis. On the importance of the association between remittances and growth, Glytsos (2005) finds that remittance spending differs across countries and that the negative effect of a decrease in remittances on growth is greater than the positive effect of an increase in remittances on growth. Guiliano and Ruiz-Arranz (2006) find that remittances promote growth in countries with less developed financial systems since remittances finance investment and help to alleviate liquidity constraints. Catrinescu et al. (2006) find that remittances have a positive impact on growth, although weakly, and suggest that the existence of good institutions could allow for remittances to be invested in greater amount and more efficiently. Thus, it seems that there are some country conditions that affect the means by which remittances can affect growth. Investment and education are two of the possible channels.

The above discussion suggests that remittances may affect growth via human capital and investment. Endogenous growth theory supports modeling the growth of TFP as being affected by human capital. Romer (1990a) models the growth of total factor productivity as being affected by human capital employed in the research sector, and finds that the stock of human capital in an economy is a determinant of the rate of growth. Nelson and Phelps (1966) argue that including education (human capital) as an additional input in an aggregate production function to represent the relationship between education and aggregate output may be a gross misspecification; they argue that education promotes adoption and implementation of new technologies and model the growth of technology as being affected by an interaction of human capital in a catching up setting. Benhabib and Spiegel (1994) followed Nelson and Phelps (1966) and Romer (1990a) and model TFP growth as a function of human capital itself and its interaction in a catch-up setting. They suggest that the growth rates may differ among countries because of differences in human capital stock levels. Thus, human capital enhances economic growth by affecting the growth of TFP both directly and through its interactions.

The literature on FDI and growth include interesting findings about the effects on growth of interactions of human capital and FDI. In this strand of literature, human capital affects the absorptive capacity of the economy and conditions the positive effects of FDI on economic growth (Borensztein et al., 1998). Borensztein et al. (1998) highlight the introduction of more advanced technologies through FDI and test the effect of the interaction between human capital and FDI on growth. They find a strong complementary effect between human capital and FDI on growth and that a minimum threshold of human capital is needed for FDI to exert a positive effect on growth. Xu (2000) finds that technology transfers from U.S. multinationals contributes to productivity growth in developed countries but not in developing countries, and that a

threshold of human capital is required in the host country in order to benefit from the technology transfer spillover. Other studies that find positive and significant effects of the interaction between human capital and FDI on growth are Eller, Haiss and Steiner (2006) and Li & Liu (2005). Balasubramanyam, Salisu and Sapsford (1999) and Makki and Somwaru (2004) find a positive interaction though insignificant. Thus, the FDI literature shows how the level of human capital stock affects the absorptive capacity of an economy and, consequently, the positive effects of capital inflows such as FDI on economic growth.

This literature review suggests that the impact of remittances on economic growth depends on whether remittances are used for consumption or investment. However, it is important to note that one of the uses of remittances is for investment in education, which contributes to the development of human capital in the remittance receiving countries. In addition, the endogenous growth literature points out the role of human capital in affecting the growth rate of TFP, in which not only human capital itself but also its interactions have a role. This study aims to test the hypothesis regarding the impact of remittances through human capital on economic growth in the remittance receiving economy. It uses cross-country growth accounting methodology and tests the effect of the interaction between human capital and remittances on growth. This study covers a specific region of the world which is Latin America and the Caribbean and has also been receiving large amounts of remittances.

## **4.4 Methodology and Data**

### **4.4.1 The model**

In this section, we present an endogenous growth model based on growth accounting methods that shows the relationship between the growth rate of GDP per worker and the growth rate of physical capital, human capital and TFP. This is cross-country growth accounting. In the

model, human capital affects growth as an additional input and through TFP. It is through the interaction between human capital and remittances that remittances affect growth. The model is in line with endogenous growth theory in which the growth rate of TFP is a function of human capital. The model demonstrates a channel by which remittances affect economic growth.

We model TFP as a function of human capital. This approach is in Benhabib and Spiegel (1994), Nelson and Phelps (1966) and Romer (1990a), among others. Benhabib and Spiegel (1994, p.155) model the growth of TFP as a function of an exogenous technological progress, an endogenous technological progress which involves a human capital direct effect and is adopted from Romer (1990a), and a technology catch-up factor that depends on human capital and is adapted from Nelson and Phelps (1966). Temple (1999, p.125) argues that cross country growth accounting allows for modeling the growth rate of TFP as a function of some observable variables. Additionally, Romer (1990b, p. 270) argues that the human capital level may affect the growth of technology directly and through the catching-up process. We model the growth rate of TFP as a function of human capital and the interaction between human capital and remittances.

The model starts with an augmented Cobb-Douglas production function in which output per worker is dependent upon physical capital, human capital, and labor. We assume constant returns to scale which allows specifying the production function in its intensive form to analyze the growth of output per worker. The production function is given by

$$Y = AK^\alpha H^\beta L^{1-\alpha-\beta} \quad (4.1)$$

where  $Y$  is output,  $A$  represents total factor productivity,  $K$  is physical capital,  $H$  is human capital, and  $L$  is labor force. The intensive form of the production function is given by

$$y = A k^\alpha h^\beta \quad (4.2)$$



where  $y$  is the ratio of output to labor ( $Y/L$ ),  $k$  is the ratio of physical capital to labor ( $K/L$ ), and  $h$  is the ratio of human capital to labor ( $H/L$ ). Taking log differences of equation (4.2) and expanding it to the cross-section and time dimension gives

$$\Delta \ln(y_{it}) = \Delta \ln(A_{it}) + \alpha \Delta \ln(k_{it}) + \beta \Delta \ln(h_{it}) \quad (4.3)$$

where  $i = 1, \dots, N$  and represents the number of cross sections/countries, and  $t = 1, \dots, T$  and represents the time dimension.

In Equation (4.3), the growth of TFP,  $\Delta \ln(A_{it})$ , can be replaced by a function of some observable factors (Temple, 1999, p. 125). One of the earlier studies that specify the growth of TFP as a function of human capital is Nelson and Phelps (1966); they argue that education, a proxy for human capital, contributes to the adoption and implementation of new technologies. In

Nelson and Phelps' (1966) specification,  $\frac{\dot{A}}{A} = c(H) \left[ \frac{T(t) - A(t)}{A(t)} \right]$ , the rate for closing the gap between a theoretical and actual level of knowledge depends on the level of human capital, which is given by the function  $c(H)$ . Romer (1990a, p. S83) models the growth of TFP as  $\dot{A} = \delta H_A A$ , where  $H_A$  is total human capital employed in research and affects the growth of TFP. Benhabib and Spiegel (1994, p.161) model the growth of TFP as  $[\log A_T(H_t) - \log A_0(H_t)]_i = c + gH_i + mH_i[(Y_{max} - Y_i)/Y_i]$ , which includes a term for exogenous technological progress ( $c$ ), a term for endogenous technological progress which represents domestic innovation ability of a country and is the human capital direct effect ( $gH_i$ ), and a term for the technology catch-up effect in which  $H_i$  is human capital ( $mH_i[(Y_{max} - Y_i)/Y_i]$ ). In this study we are not interested in any catching-up effect, but on the effect of remittances on TFP through human capital.

The literature about the effect of remittances on economic growth is still an open discussion. Chami et al. (2003) find a negative effect of remittances on growth. However, this study has

been criticized for not addressing the problem of autocorrelated errors in panel regressions and for not having appropriate instruments for the remittance variable which yields biased estimates (Catrinescu et al., 2006, p.10 & 11). Catrinescu et al. (2006, p.13) also find that remittances affect growth positively when they are endogeneized and are tested in conjunction with institutional variables. Other studies have found positive association between remittances and education. Cox-Edwards and Ureta's (2003) study of remittances and schooling in El Salvador find that remittances have a large and significant contribution to school retention. Hanson and Woodruff (2003) find that children at Mexican households having migrants completed more years of schooling and argue that this is related to migrant remittances which relax credit constraints and increase the educational attainment of children. Lopez-Cordova (2006) finds that an increase in the fraction of Mexican households receiving remittances has a significant effect in reducing illiteracy of children six to 14 years of age and in improving school attendance of children five-years of age. These studies suggest that remittances contribute to human capital development which may be one channel for remittances to affect TFP. We model the growth of TFP to depend upon an exogenous component, the individual effect of human capital, and an interaction between human capital and remittances. That is

$$\Delta \ln(A_{it}) = \gamma_{A0} + \gamma_{A1} \ln(h_{it}) + \gamma_{A2} (\ln h_{it}) * (\ln RE_{it}) \quad (4.4)$$

where  $h_{it}$  is the ratio of human capital to labor in country  $i$  and directly affects the growth of  $A_{it}$ , and  $RE_{it}$  is remittances as share of GDP in country  $i$  and indirectly affects the growth of  $A_{it}$ .

Then, inserting (4.4) into (4.3) yields

$$\Delta \ln(y_{it}) = \gamma_{A0} + \gamma_{A1} \ln(h_{it}) + \gamma_{A2} (\ln h_{it}) * (\ln RE_{it}) + \alpha \Delta \ln(k_{it}) + \beta \Delta \ln(h_{it}) \quad (4.5)$$

Equation (4.5) states that the growth rate of output per worker in country  $i$  is affected by the level of human capital stock, the interaction between the level of human capital stock and

remittances, and the growth rates of both physical and human capital. Equation (4.5) allows for testing as to whether remittances contribute to growth through human capital. In addition, some control variables are added to equation (4.5) as well as the individual remittance variable. This yields the following econometric model

$$\Delta \ln(y_{it}) = \gamma_{A0} + \gamma_{A1} \ln(h_{it}) + \gamma_{A2} (\ln h_{it}) * (\ln RE_{it}) + \phi_1 (\ln RE_{it}) + \phi_2 \ln(I_{it}) + \phi_3 \ln(G_{it}) + \phi_4 \pi_{it} + \alpha \Delta \ln(k_{it}) + \beta \Delta \ln(h_{it}) + a_i + \mu_t + \varepsilon_{it} \quad (4.6)$$

where  $a_i$  denotes the unobservable country effect;  $\mu_t$  denotes the unobservable time effects which are represented by time dummies in (4.6); and  $\varepsilon_{it}$  is the idiosyncratic error which is assumed to be independently and identically distributed with zero mean and variance  $\sigma_\varepsilon^2$ .

Investment  $I_{it}$ , government  $G_{it}$  and inflation  $\pi_{it}$  are added as control variables; these variables have been found to affect economic growth in earlier studies. Barro and Sala-i-Martin (2004, p.518) present a set of control and environmental variables that are frequently included as determinants of the growth rate in cross-countries studies. The control variables added to equation (4.6) belong to these control and environmental variable group. Investment in the neoclassical growth model is a proxy for the effect of the saving rate (Barro & Sala-i-Martin, 2004, p.519). In the augmented Solow model, investment, in addition to population growth rate and human capital level, affects income per capita (Mankiw, Romer & Weil, 1992, p.418). Temple (1999, p.137) defines investment in physical capital as one of the proximate sources of growth in addition to investment in human capital and research and development. He also argues that the correlation between investment rates and growth is robust. Positive impacts of investment on economic growth are observed in Barro (1995, p.6), Barro & Sala-i-Martin (2004, p.532), and Mankiw, Romer and Weil (1992, p.420) among others. In this study investment is expected to have a positive effect on growth.

Government consumption proxies for government expenses that, although they do not have a direct effect on productivity, distort private decisions, thus an increase in government consumption will negatively affect the growth rate of output per worker (Barro & Sala-i-Martin, 2004, p.519). Barro and Sala-i-Martin (1995, p.434) also argue that government consumption proxies for political corruption and other undesirable government aspects, as well as for direct effects of nonproductive public expenditures and taxation. An important issue regarding the use of government consumption as a control variable involves controlling for the effect of taxes on growth. Barro and Sala-i-Martin (2004, p.519) discuss about directly controlling for the effect of taxes and blame inadequate data on public finance. Bassanini and Scarpetta (2001) argue that government consumption represents the size of government whenever taxes are not controlled for. Barro and Sala-i-Martin (1995, p.434; 1996, p. 526) find negative and significant relationships between government consumption and economic growth. In this study government proxies for the size of government and is expected to have a negative effect on growth.

Inflation can be used to proxy for macroeconomic stability (Barro & Sala-i-Martin, 2004, p.520). Romer (2006, p.550) argues that one of the potential additional costs of inflation is that high variability of inflation can depress long term investment since this can be regarded as a signal of government malfunctioning that can result in government policies that hurt capital holders. Temple (1999, p.144) states that the presence of high inflation is accompanied by the presence of exchange rate volatility, political instability and other undesirable factors. Bruno and Easterly (1998); Cukierman, Kalaitzidakis, Summers and Webb (1993); and Fischer (1993) find negative relationships between inflation and investment, and between inflation and growth. Even though these studies give evidence of a negative relation between inflation and growth, there is little evidence on a causal relationship (Romer, 2006, p.250). Additionally, Temple

(1999, p.144) states that the association between inflation and growth is controversial. In this study inflation is expected to have a negative impact on growth.

#### **4.4.2 The Data**

The data set used covers 14 Latin American countries over the period 1975-2000 which is subdivided into five overlapping five-year periods<sup>4</sup>. The dependent variable is the growth rate of real GDP per worker during a five-year period, and is calculated by running a least squares regression of the log of the real GDP series on a constant and a time trend. The rate of growth is computed as  $r = e^b - 1$ , where  $b$  is the estimate on the time trend. The data for this variable is obtained from The Penn World Tables version 6.2.

The series for capital stock per worker is constructed using the perpetual inventory method<sup>5</sup>. The growth rate of this variable over a five-year period is also computed using the least squares method. The remittance variable refers to workers' remittances, compensation of employees, and migrants' transfers, and is obtained from the World Development Indicators CD-ROM (2005). Workers' remittances are private transfers from migrant workers who reside in the host country for more than a year to people in their home country; compensation of employees is the income of migrants who have lived in the host country for less than a year; and migrant transfers are transfers from one country to another at the time of migration of the net worth of migrants who live in the host country for more than a year. This is the definition frequently used in the literature (Acosta et al., 2006; Catrinescu et al., 2006; among others) and adopted by the IMF (2005, p.97) and the World Bank (2006, p. 85). Remittances are expressed as a share of GDP.

The level of the human capital stock is represented by an index as in Collins and Bosworth (1996, p.151). The index is constructed based on data on educational attainment of the total

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<sup>4</sup> The first period for the remittance variable is represented by observations on the years 1979 and 1980 because of data limitations.

<sup>5</sup> It is described in appendix 5.

population aged 15 and over from the Barro and Lee (2000) data set and the social returns to schooling for each educational level. For country  $i$ , the index is given by

$$H_i = \sum R_j P_j.$$

The index weights the share of the population  $P_j$  with education level  $j$  by  $R_j$  which is the social return to education estimate. The education levels are as follows: no schooling; incomplete primary education; complete primary education; incomplete secondary education; complete secondary education; incomplete tertiary education; and complete tertiary education. The social return to education estimates are those of Psacharopoulos (1994) and are obtained from Loayza, Fajnzylber and Calderón (2004, appendix A), these estimates are for no education = 1, incomplete primary education = 1.68, complete primary education = 2.69, incomplete secondary education = 3.91, complete secondary education = 5.53, incomplete college education = 5.87, and complete college education = 8.80. The growth rate of the human capital index is the exponential growth rate given by  $r = \ln (P_n/P_1)/n$ , where  $P_n$  and  $P_1$  are the last and initial observation in each five-year overlapping period,  $n$  is the number of periods, and  $\ln$  is the natural logarithm operator.

The data on government consumption and investment both as a share of GDP is obtained from The Penn World Tables version 6.2. The data on inflation is from the International Financial Statistics CD-ROM (2007). Complete variable definitions and data sources and descriptive statistics are provided in appendices 6 and 7 respectively.

#### **4.5 Empirical Results**

The purpose of the empirical analysis is to estimate the impact of remittances through human capital on growth. Specifically, we examine the effect of the interaction between human capital and remittances on growth rates of output per worker through the growth rate of TFP.

The results indicate that remittances have a positive impact on economic growth, though the realization of this impact depends upon the level of human capital stock in the economy. This means that for countries with low levels of human capital stock, remittances have a negative impact on growth. In addition, the coefficient on the level of human capital stock is positive and significant. The regressions are based on a panel data for the period 1975-2000, and the methods of estimation are pooled OLS, random effects, and random effects 2SLS. These regressions are run using data from a sample of 14 Latin American and the Caribbean countries and 70 observations.

Table 4.1 reports the results on the association between economic growth and remittances, human capital and the control variables. The standard growth determinants behave as follows. The growth rate of the physical capital stock per worker is positively and significantly related to economic growth. The growth rate of total human capital in the labor force is positive though not significant. Government consumption as a share of GDP has the expected negative sign, but it is insignificant. Inflation is negative and insignificant. Investment as share of GDP, surprisingly, is negatively related to economic growth though not at a significant level. The results regarding the association between human capital and remittances and economic growth are quite interesting. The pooled OLS results indicate that the coefficient on remittances is negative but insignificant, while the coefficient on the interaction between remittances and human capital is positive though insignificant. The usual random effects estimation reports the same qualitative results as those obtained with the pooled OLS; however, and interestingly, the interaction between remittances and human capital is positive and significant at the 10 percent level<sup>6</sup>.

A potential problem with the estimates of model 4.1.2 is that they may be biased because of reverse causality, measurement error and omitted variable issues. Reverse causality implies that

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<sup>6</sup> P-value is 0.087.

**Table 4.1 Remittances, human capital and GDP per worker growth (Cross-country growth accounting, panel data of five-year overlapping periods (1975-2000))**

Dep. variable: Growth rate of GDP per worker			
Explanatory variables	Model 4.1.1	Model 4.1.2	Model 4.1.3
constant	-0.0400 (1.13)	-0.0400 (1.13)	-0.1819* (1.70)
physical capital growth	0.3354** (2.19)	0.3354** (2.19)	0.3693*** (2.63)
human capital growth	0.2225 (1.12)	0.2225 (1.12)	0.1800 (0.86)
remittances	-0.0098 (1.57) [0.141]	-0.0098 (1.57) [0.117]	-0.0395* (1.79) [0.074]
human capital stock	0.0619* (1.95) [0.073]	0.0619* (1.95) [0.051]	0.2112* (1.93) [0.054]
human capital stock * remittances	0.0102 (1.71) [0.111]	0.0102* (1.71) [0.087]	0.0415* (1.83) [0.067]
investment	-0.0810 (1.45)	-0.0810 (1.45)	-0.0803 (1.16)
government	-0.0087 (0.16)	-0.0087 (0.16)	-0.0334 (0.43)
inflation	-0.0002 (0.12)	-0.0002 (0.12)	-0.0011 (0.23)
d8085	-0.0311** (2.66)	-0.0311*** (2.66)	-0.0283*** (3.16)
d8590	-0.0106 (0.81)	-0.0106 (0.81)	-0.0054 (0.51)
d9095	-0.0047 (0.47)	-0.0047 (0.47)	-0.0006 (0.06)
d9500	-0.0051 (0.73)	-0.0051 (0.73)	-0.0029 (0.30)
R-squared	0.4526	0.4526	0.3791
Observations	70	70	70
Countries	14	14	14
Hausman test for random effects		6.06	3.56
P-value for Hausman test		0.9131	0.9902
Sargan test for overidentifying restrictions			2.747
P-value for Sargan test			0.6010

Asterisks indicate significance at the 10 percent (\*), 5 percent (\*\*) and 1 percent (\*\*\*) levels respectively. Model 4.1.1 is pooled OLS with fully robust standard errors. Model 4.1.2 is the usual random effects model with fully robust standard errors. Values in parenthesis are t-values, while values in brackets are p-values for the variables of interest.



improved economic conditions due to increases in economic growth may increase remittance inflows. Measurement error in remittances may arise because official recorded remittances are smaller than the true size of remittances. The World Bank (2006, p. 85) states that because of unrecorded remittance flows through both formal and informal channels the true size of remittances may be 50 percent greater than recorded remittances. Omitted factors may affect both remittances and economic growth, which leads to biased estimates on remittances and the interaction between human capital and remittances. Therefore, to address this problem, use of the instrumental variable technique is required. Catrinescu et al. (2006) argue that contradictory results on the relationship between remittances and economic growth have been found because of lack of correct control of endogeneity of remittances. To manage the endogeneity problem of remittances a random effects 2SLS (EC2SLS) model is estimated following Baltagi (2005, chapter 7).

Model 4.1.3 in Table 4.1 is based on EC2SLS estimation. The instruments used are the first lag of investment as a share of GDP, the second lag of real per capita GDP, the first lag of the human capital index, two indices based on the economic conditions in the U.S., and an instrument based on the per capita GDP of the top-eight migrant receiving countries. Rapoport and Docquier (2005, p.10) argue that empirical models that explain remittances include income of both the sender and the receiver countries as explanatory variables. Lueth and Ruiz-Arranz (2006) find a significant effect of per capita GDP of the receiver country on remittances, while Ziesemer (2006) finds a significant effect of the second lag of per capita GDP of the receiver country on remittances. Following Ziesemer (2006) we include the second lag of per capita GDP of the receiver country as an instrument which proxies for economic conditions in the remittance receiving country. Vargas-Silva and Huang's (2006) study on the effects of both host and home

country economic conditions on remittances includes two indices of the economic conditions in the rest of the world (ROW)<sup>7</sup> in the set of explanatory variables that explain U.S. net aggregate remittances. Their results suggest that host country (U.S.) economic conditions are significant in explaining remittances. To construct the indices, they weight the CPI and exchange rate from each of the five countries in ROW by the share of remittances of each country in the total amount of remittances of the group (see Vargas-Silva and Huang, 2006, p. 89-90). We do the opposite of Vargas-Silva and Huang (2006); we construct two indexes based on the economic conditions of the U.S., one based on the U.S. CPI and the other based on the U.S. unemployment rate<sup>8</sup>. We weight each five-year overlapping average of the U.S. CPI and the U.S. unemployment rate by the share of remittances of each LAC country in the total amount of remittances received by the group of 14 LAC countries during the period of the study. The other instrument which is based on the economic conditions of the top-eight migrant receiving countries<sup>9</sup> is adopted from Acosta et al. (2007). The per capita GDP of each of these migrant receiving countries is weighted by the inverse of the distance of each of these countries to each LAC country. The validity of the instruments is a key issue for the consistency of the instrumental variable estimator, for that purpose we report the Sargan test of overidentifying restrictions in Table 4.1; we fail to reject the null hypothesis that the instruments are uncorrelated with the error process. The Hausman test for random effects appropriateness of models 4.1.2 and 4.1.3 is also reported in Table 4.1; it justifies the use of random effects estimation.

Model 4.1.3 is the main model in this study. Note that this model includes remittances and the level of human capital stock individually, so the significance of the interaction term can not

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<sup>7</sup> ROW represents Brazil, Colombia, Dominican Republic, El Salvador and Mexico.

<sup>8</sup> Adams and Page (2005) consider the US as one of the two main labor receiving countries.

<sup>9</sup> Canada, France, Germany, India, Saudi Arabia, Spain, United Kingdom, and United States are the top migrant receiving countries for our sample of LAC countries. Acosta et al. (2007) have ten countries as the top migrant receiving countries.

be the result of the omission of any of these two factors. In model 4.1.3 the coefficient on remittances is negative and significant. However, and interestingly, the coefficient on the interaction between human capital and remittances is positive and significant<sup>10</sup> and suggests that remittances have a positive impact on growth, but only for certain levels of the human capital index. In addition, the coefficient on the level of human capital stock is positive and significant. The values of the coefficients on remittances and on the interaction term in model 4.1.3 indicate that countries with an index value of total human capital greater than 0.95 will benefit from the positive effect of remittances on growth. In our sample, the average value of the human capital index for eight out of the 14 countries is greater than 0.95, so these countries pass this threshold<sup>11</sup>; conversely, remittances have a negative predicted effect on six out of the 14 LAC countries<sup>12</sup>.

The positive effect of an increase in remittances on growth is dependent upon the level of the human capital stock in the economy. An increase in remittances as a share of GDP of 0.026 (one standard deviation) which is an increase of 130 percent relative to the sample mean in an economy with a index of human capital stock of 0.98 (the sample average) increases the growth rate of output per worker by 0.15 percent. If the same increase in remittances happens in an economy that has a value for the human capital index of 1.39 (as in the case of Panama), the maximum value in the sample, then the rate of growth increases by 2.36 percent. An example gives a better picture of the effect of remittances on growth. The average of the human capital index in Guatemala during the period 1975 to 2000 is 0.63, well below the threshold of 0.95. If remittances increase by one standard deviation, the growth rate decreases by -1.7 percent.

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<sup>10</sup> P-value is 0.067.

<sup>11</sup> Barbados, Colombia, Costa Rica, Jamaica, Mexico, Panama, Paraguay, and Trinidad and Tobago pass the threshold.

<sup>12</sup> Bolivia, Brazil, Dominican Republic, El Salvador, Guatemala, and Honduras do not pass the threshold.

However, if Guatemala's human capital stock increases to the sample mean value, 0.98, growth increases by 0.15 percent, and if the increase is to the level of the human capital stock of Panama, 1.23, the maximum average value during the period of the study, Guatemala's growth increases by 1.5 percent. Looking at the values of the human capital index for the year 1995, ten out of the 14 countries in the sample pass the threshold of 0.95<sup>13</sup>; the average value of the index for this year is 1.04. This means that an increase in remittances of one standard deviation, a 130 percent increase, in a country with an index value of 1.04 for human capital stock increases growth in the remittance receiving country by 0.48 percent. This result is close to the lower value of the range of 0.5 percent and 1.3 percent increase in the growth rate due to a 100 percent increase in remittances as a share of GDP found by Acosta et al. (2007, p.94). They argue that the increase in the growth rate due to increases in remittances hold for the representative country in the world as well as for the representative country in the LAC region. Thus, our result is in line with that of Acosta et al. (2007). If we allow for a 100 percent increase in remittances and take the 1.04 value of the human capital index in 1995, the increase in the growth rate is 0.37 percent which is very close to the lower value of Acosta et al. (2007). On the whole, taking the average value for the human capital index, an increase in remittances has a positive impact on growth in the countries of the LAC region.

The interesting point about the results from Table 4.1 is the significant complementary effect between human capital and remittances on the growth rate of output per worker. Remittances seem to promote economic growth depending upon the level of the human capital stock in the economy. This implies that human capital is an important factor in determining the utilization of remittances and their effect on economic growth. Koechlin and León (2006, p.25) find that the

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<sup>13</sup> Barbados, Bolivia, Colombia, Costa Rica, Dominican Republic, Jamaica, Mexico, Panama, Paraguay and Trinidad and Tobago.

interaction between education and remittances (a negative coefficient) significantly contributes to decrease income inequality. They suggest that it is likely that families with a relatively high educational level use remittances for productive investments which increase long-term income.

A strong complementary effect between human capital and FDI on growth is found in Borensztein et al. (1998). They interpret their result in that the advanced technology embedded in FDI can promote economic growth only through the interaction with the countries' absorptive capacity which is dependent upon human capital. They find a threshold for the stock of human capital from which FDI starts having a positive effect on economic growth. In our study, it seems that the level of the human capital stock in the economy (the absorptive capacity as in Borensztein et al., 1998) is also conditioning the positive effect of remittances on economic growth. Thus, it may be that countries with relatively higher human capital levels use remittances for investment in education which fosters human capital development and in productive economic projects that promote investment and, consequently, promotes long-term growth. Benhabib and Spiegel (1994, p. 165) find that human capital has a positive and significant effect in attracting physical capital. Giuliano and Ruiz-Arranz (2006) suggest positive effect of remittances on economic growth because remittances finance investment in countries with less developed financial systems. Aggarwal, Demirgüç-Kunt and Martinez Peria (2006) find a positive impact of remittances on the financial sector and argue that that is a channel for remittances to promote development. On the other hand, the negative coefficient on remittances implies that remittances make a negative contribution to growth in countries with low level of human capital. This may be the case as in Chami et al. (2003) who argue that remittances are compensatory transfers between the migrant and her/his family, so remittances are a source of money that helps the family to overcome economic problems.

## 4.6 Conclusions

This paper contributes to the body of literature regarding the impact of remittances on economic growth by investigating on the impact of remittances through human capital on growth in a group of countries from Latin America and the Caribbean for the period 1975-2000. An endogenous model of growth based on cross-country growth accounting methods is estimated using pooled OLS, random effects and random effects 2SLS techniques. The main results come from the random effects 2SLS estimation because it is the econometric method that allows for controlling endogeneity of remittances in the panel data setting.

The empirical results of this study are in line with Rapoport and Docquier's (2005) models that examine the contributions of remittances to investment in both physical and human capitals, as well as with the other studies that find contributions of remittances to economic growth. The results show a significant and complementary effect between human capital and remittances on the growth rate of output per worker. In addition, the level of human capital stock positively and significantly affects the growth rate of TFP which is in line with endogenous growth theory as in Romer (1990b, p. 270) who argues that the human capital level may affect the growth of technology directly and through the catching up process (a human capital interaction term), and as in Benhabib and Spiegel (1994) who find positive effects of human capital on growth while modeling TFP as dependent on human capital.

An important finding of this study is the significant and complementary effect between human capital and remittances on economic growth. That is, the effect of remittances on growth is dependent upon the level of human capital stock in the remittance receiving economy. After instrumenting for the possible endogeneity of remittances, an increase in remittances as a share of GDP of 130 percent (one standard deviation) relative to the sample mean in a LAC economy

with an index of human capital stock of 0.98 (the sample average) would lead, on average, to a 0.15 percent increase in the growth rate of output per worker. It is likely that countries with higher educational levels use remittances for investment in education which foster human capital development and for investment in productive projects such as small businesses which contributes to long term growth. Therefore, remittances promote growth in the representative country of the LAC region through human capital. It would be interesting to assess the impact of remittances on growth through human capital using a larger sample of countries as well as for other developing regions of the world. In addition, the effects of remittances on the level of human capital could be explored.

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## **Chapter 5 Conclusions**

This journal style dissertation investigates about the associations between remittances and FDI and economic growth in LAC. Three topics are addressed. The impact of remittances on U.S. FDI outflows to LAC, on FDI inflows to LAC, and on economic growth in LAC. Chapter 2 focuses on the impact of remittances on U.S. FDI outflows to LAC. It analyzes the complementary effect between remittances and per capita GDP in attracting U.S. FDI to LAC. The theoretical foundation relates the undertaking of FDI by a MNF to profit maximization in order to derive the optimal capital stock for investment abroad and follows from the work of Barrell and Pain (1996). The empirical estimation is based on an unbalanced panel data set for a sample of 14 LAC countries during the period 1983-2003. The results lend support to the market size hypothesis; that is, per capita GDP, the proxy for market size, is positive and highly significant on U.S. FDI. In addition, an interesting finding of this estimation is the complementary and significant effect of the interaction between remittances and per capita GDP, which implies positive effect of remittances on U.S. FDI for the countries that have reached certain levels of per capita GDP. This suggests that remittances increase the host country market size for the goods and services produced by the U.S. MNFs' affiliates and that remittances reinforce the effect of the market size hypothesis in attracting U.S. FDI. In addition, remittances may be identified as profitable opportunities for U.S. investors in the LAC countries with significant amounts of remittances inflows.

Chapter 3 focuses on the impact of remittances on FDI inflows to LAC. It evaluates the complementary effect between remittances and per capita GDP in attracting FDI to LAC. The theoretical framework relates the undertaking of FDI by a MNF to cost minimization in order to derive the optimal capital stock for investment abroad and follows from the work of Bajo-Rubio

and Sosvilla-Rivero (1994). The empirical estimation is based on an unbalanced panel data set for a sample of 14 LAC countries during the period 1983-2003. The results also lend support to the market size hypothesis; that is, per capita GDP, the proxy for market size, have a positive and significant effect on FDI inflows to LAC. In this estimation, interestingly, there is a complementary and significant effect of the interaction between remittances and per capita GDP, which suggests positive effect of remittances on FDI for the countries that have reached certain levels of per capita GDP. This suggests that remittances increase the host country market size for the goods and services produced by the MNCs' affiliates and that remittances strengthen the effect of the market size hypothesis. Therefore, remittances may be identified as profitable opportunities for foreign investors in the LAC countries with significant amounts of remittances inflows.

Chapter 4 focuses on the impact of remittances on economic growth in LAC. It evaluates the complementary effect between remittances and per capita GDP on growth in LAC. We employ an endogenous growth model based on growth accounting methods and model the growth of TFP to depend upon an exogenous component, human capital and the interaction between human capital and remittances. The regressions are based on balanced panel data for the period 1975-2000, and the methods of estimation are pooled OLS, random effects, and random effects 2SLS. These regressions are run using data from a sample of 14 LAC countries and 70 observations. The results are in line with the endogenous growth theory since the level of human capital has a positive and significant effect on growth and lend support to the literature that suggests remittances' positive effects on growth. The main finding of this estimation is that the coefficient on the interaction between human capital and remittances is positive and significant and suggests that remittances have a positive impact on growth, but only for countries that have reached

certain levels of the human capital index. Therefore, remittances contribute to economic growth in the LAC countries through human capital.

Overall, this dissertation research lends support to the literature that suggests remittances' contributions to economic growth and development. FDI is considered a main channel for developing countries to get access to advanced technologies. Borensztein, de Gregorio and Lee (1998) find that, in developing countries, FDI is a very important channel for technology transfer and that its contributions are higher than that of domestic investment, but this effect is conditioned by the requirement of a minimum level of human capital. Balasubramanyam, Salisu and Sapsford (1999) find that the interaction between FDI and human capital has an important influence on growth. Thus, by contributing to attracting U.S. FDI as well as total FDI to the LAC region, remittances indirectly contribute to economic growth. In addition, endogenous growth theory suggests that human capital affects TFP (e.g., Benhabib & Spiegel, 1994; Nelson & Phelps, 1966; and Romer, 1990a). Koechlin and León (2006, p.25) find that the interaction between education and remittances (a negative coefficient) significantly contributes to decrease income inequality and suggest that it is likely that families with a relatively high educational level use remittances for productive investments which increase long-term income. Thus, the significant and complementary effect of remittances and human capital on growth found in the analysis of chapter 4 may suggest that LAC countries with relatively higher human capital levels use remittances for investment in education, which fosters human capital development, and in productive economic projects that promote investment; hence, it influences economic growth.

## **5.1 References**

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## Appendix 1 Variable Definitions and Data Sources

Variable name	Variable definition	Source
U.S. FDI outflows	First difference of the U.S. direct investment position in each LAC country divided by its total nominal GDP.	Own calculations.
Per capita GDP	Real per capita GDP.	Penn World Tables version 6.2, 2006.
Remittances	Natural log of the annual values of remittances as a share of GDP.	World Development Indicators CD-ROM, World Bank 2006.
Remittances * per capita GDP	Interaction of the log of remittances and log of per capita GDP.	Own calculations.
Exchange rate	Real exchange rate. Dollars per unit of foreign currency. It is defined as in Waldkirch (2003). It is computed by multiplying the nominal exchange rate by the ratio of the host country CPI to the U.S. CPI.	Own calculations.
Lag U.S. exports	First lag of U.S. exports to each LAC country.	SourceOECD ITCS international trade by commodities statistics.
Inflation	Natural log of 1 plus the annual change of GDP deflator.	GDP deflator is from the International Financial Statistics CD-ROM, IMF 2007.
U.S. wage/Host wage	The ratio of U.S. wages to host country wages.	Own calculations.
Lag U.S. capital stock	First lag of the annual values of the U.S. direct investment position in each LAC country.	U.S. direct investment abroad, U.S. direct investment position abroad on a historical cost basis, Bureau of Economic Analysis.
U.S. CPI	U.S. consumer price index.	International Financial Statistics CD-ROM, IMF 2007.
Host country CPI	Consumer price index for each LAC country.	International Financial Statistics CD-ROM, IMF 2007.
U.S. wage	Real U.S. wages. Average weekly hours times average hourly earnings times 48. The result is divided by the U.S. GDP deflator.	Own calculation.
Weekly hours	Average hours worked per week in a year.	U.S. Bureau of Labor Statistics.
Earnings/hour	Average earnings per hour in a year.	U.S. Bureau of Labor Statistics.
Host wage	Real host country wage. Compensation of employees divided by total employees. The result is divided by the GDP deflator.	Own calculation.
GDP deflator	GDP deflator	International Financial Statistics CD-ROM, IMF 2007.
Compensation of employees	U.S. dollars paid to all employees per year.	U.S. direct investment abroad, operations of U.S. parent companies and their foreign affiliates, data on majority owned nonbank foreign affiliates of nonbank parents, Bureau of Economic Analysis.
Total employees	Total number of employees in a year.	U.S. direct investment abroad, operations of U.S. parent companies and their foreign affiliates, data on majority owned nonbank foreign affiliates of nonbank parents, Bureau of Economic Analysis.
Nominal GDP	Total nominal GDP for each LAC country.	World Development Indicators CD-ROM, World Bank 2006.

## Appendix 2 Summary Statistics, Annual Values for the Period 1983-2003

Variable	obs	mean	std. dev.	min	max
U.S. FDI/GDP	279	0.00851	0.16252	-2.16955	0.85116
Per capita GDP	294	8.67268	0.46027	7.67961	9.81958
Remittances	285	-2.12045	0.20666	-2.30259	-1.31026
Real exchange rate	294	0.24013	0.37519	0.00004	2.63830
Lag U.S. exports	294	0.11375	0.08024	0.01002	0.44138
Inflation	294	0.25371	0.53250	-0.37864	4.00035
U.S. wage/host wage	249	1.18468	0.92479	0.00000	3.65211
Lag U.S. capital stock	279	0.18836	0.43802	0.01101	2.92354
Rem/GDP	285	0.02286	0.03017	0.00000	0.16975

Note: Rem/GDP is remittances as a share of GDP, while remittances are the log of Rem/GDP. U.S. FDI/GDP is U.S. FDI flows as a share of host country GDP. Lag means the first lag of the variable.



### Appendix 3 Variable Definitions and Data Sources

Variable name	Variable definition	Source
FDI inflows	Net inflows as a share of total GDP.	World Development Indicators CD-ROM, World Bank 2006.
Per capita GDP	Real per capita GDP.	Penn World Tables version 6.2, 2006.
Remittances	Natural log of the annual values of remittances as a share of GDP.	World Development Indicators CD-ROM, World Bank 2006.
Remittances * per capita GDP	Interaction of the log of remittances and log of per capita GDP.	Own calculations.
Exchange rate	Real exchange rate. Dollars per unit of foreign currency. It is defined as in Waldkirch (2003). It is computed by multiplying the nominal exchange rate by the ratio of the host country CPI to the U.S. CPI.	Own calculations.
Lag imports	First lag of host country imports as share of GDP.	World Development Indicators CD-ROM, World Bank 2006.
Inflation	Natural log of 1 plus the annual change of GDP deflator.	GDP deflator is from the International Financial Statistics CD-ROM, IMF 2007.
U.S. wage/Host wage	The ratio of U.S. wages to host country wages.	Own calculations.
Lag foreign capital stock	First lag of the foreign capital stock in the host country.	Key Data from WIR (World Investment Report) Annex Tables, UNCTAD (United Nations Conference on Trade and Development), <a href="http://www.unctad.org/fdistatistics">www.unctad.org/fdistatistics</a> .
U.S. CPI	U.S. consumer price index.	International Financial Statistics CD-ROM, IMF 2007.
Host country CPI	Consumer price index for each LAC country.	International Financial Statistics CD-ROM, IMF 2007.
U.S. wage	Real U.S. wages. Average weekly hours times average hourly earnings times 48. The result is divided by the U.S. GDP deflator.	Own calculation.
Weekly hours	Average hours worked per week in a year.	U.S. Bureau of Labor Statistics.
Earnings/hour	Average earnings per hour in a year.	U.S. Bureau of Labor Statistics.
Host wage	Real host country wage. Compensation of employees divided by total employees. The result is divided by the GDP deflator.	Own calculation.
GDP deflator	GDP deflator	International Financial Statistics CD-ROM, IMF 2007.
Compensation of employees	U.S. dollars paid to all employees per year.	U.S. direct investment abroad, operations of U.S. parent companies and their foreign affiliates, data on majority owned nonbank foreign affiliates of nonbank parents, Bureau of Economic Analysis.
Total employees	Total number of employees in a year.	U.S. direct investment abroad, operations of U.S. parent companies and their foreign affiliates, data on majority owned nonbank foreign affiliates of nonbank parents, Bureau of Economic Analysis.
Nominal GDP	Total nominal GDP for each LAC country.	World Development Indicators CD-ROM, World Bank 2006.

#### Appendix 4 Summary Statistics, Annual Values for the Period 1983-2003

Variable	obs	mean	std. dev.	min	max
FDI/GDP	294	0.01869	0.04130	-0.44750	0.17421
Per capita GDP	294	8.67268	0.46027	7.67961	9.81958
Remittances	285	-2.12045	0.20666	-2.30259	-1.31026
Log real exchange rate	294	-3.39563	2.87099	-10.12663	0.97013
Lag host imports	294	0.34327	0.18967	0.05026	0.98070
Inflation	294	0.25371	0.53250	-0.37864	4.00035
Log U.S. wage/host wage	249	-1.17566	3.93236	-22.715600	1.29531
Log lag foreign capital stock	286	-1.90728	0.87495	-5.20108	0.00513
Rem/GDP	285	0.02286	0.03017	0.00000	0.16975

Note: Rem/GDP is remittances as a share of GDP, while remittances are the log of Rem/GDP. U.S. FDI/GDP is U.S. FDI flows as a share of host country GDP. Lag means the first lag of the variable.

## Appendix 5 Perpetual Inventory Method

The perpetual inventory method (PIM) is used to compute the capital stock series. In order to compute the initial capital stock values, we follow the procedure outlined in Easterly and Levine (2001, p. 55-56). The data used is in constant 2000 prices and obtained from the Penn World Tables (PWT) version 6.2. This data is available since 1950 for most of the countries. The PIM is based on the capital accumulation equation  $K_t = K_{t-1}(1 - \delta) + I_t$ , where  $K_t$  is real capital stock in period  $t$ ,  $I_t$  is gross investment in period  $t$ , and  $\delta$  is the depreciation rate assumed to be 0.07. In order to use the capital accumulation equation we need to estimate the initial capital stock  $K$ . To estimate the initial capital stock, we assume that the country is at the steady state capital output ratio  $K/Y$ , where  $K$  and  $Y$  are initial capital and output respectively. At the steady state  $k = K/Y$ ,  $g$  is the growth rate of real output, and  $i = I/Y$ . From the capital accumulation equation and the steady state assumption, define the capital output ratio as  $k = i/(g + \delta)$ . The next step is to compute values for  $i$ ,  $g$  and  $\delta$ . Thus,  $i$  is the average of the investment rate during the first ten years of available data for each country. The investment rate which is the ratio of Investment to real GDP is taken from the PWT version 6.2. The growth rate of output  $g$  is computed by applying the least squares growth rate method during the first ten years of data on the log of real GDP per capita chain. Real GDP per capita chain is taken from the PWT version 6.2. Now that we have the values for  $i$ ,  $g$  and  $\delta$  we can compute  $k = i/(g + \delta)$  for each country, and since  $k = K/Y$  we also need to compute initial output  $Y$ . Initial  $Y$  is given by the average of real GDP chain for the years 1950-1952. Real GDP chain is from the PWT version 6.2. Now we are able to estimate the initial capital stock for the year 1950, which is given as  $K_{initial} = Y_{initial} * k$ . Once we have estimated the initial capital stock, we input it into the capital accumulation equation to

get the next year (1951) capital stock value, and next values are generated in a similar way. To compute capital stocks per worker, we divide each year's capital stock value by the number of workers. We compute workers by dividing real GDP chain by real GDP per worker; this data is also from the PWT version 6.2.

## Appendix 6 Variable Definitions and Data Sources

Variable name	Variable definitions	Source
Growth	Five-year average growth rate of real GDP per worker.	Own calculations.
Capital growth	Five-year average growth rate of real capital per worker.	Own calculations.
Human capital growth	Five-year growth rate of the human capital index.	Own calculations.
Remittances	Log of five-year average of remittances as a share of GDP.	World Development Indicators CD-ROM, World Bank 2005.
Human capital	Log of human capital index.	Own calculations.
Human capital * remittances	Interaction of the log of human capital index and log of remittances.	Own calculations.
Investment	Investment as a share of GDP in 2000 constant prices.	Penn World Tables version 6.2 (2006).
Government	Government as a share of GDP in 2000 constant prices.	Penn World Tables version 6.2 (2006).
Inflation	Log of 1 plus the five-year average of the proportionate change of GDP deflator.	GDP deflator is from the International Financial Statistics CD-ROM, IMF 2007.
U.S. CPI index	Five-year average of the U.S. CPI weighted by each LAC country remittance share. $w_i$ * U.S. CPI, $w_i$ = remittance total value over the period 1979-2000 for each LAC country divided by the remittance total that results from adding the total of each LAC country over the period 1979-2000.	U.S. CPI is from the International Financial Statistics CD-ROM, IMF 2007.
U.S. unemployment index	Five-year average of the U.S. unemployment rate weighted by each LAC country remittance share. $w_i$ * U.S. unemployment rate, $w_i$ is the same as in the U.S. CPI index.	U.S. unemployment rate is from the International Financial Statistics CD-ROM, IMF 2007.
Education	Educational attainment of the population aged 15 and over.	Barro and Lee (2000) data set downloaded at <a href="http://www.cid.harvard.edu/ciddata/ciddata.html">www.cid.harvard.edu/ciddata/ciddata.html</a> .
Return to schooling	Social returns to schooling for each educational level.	Loayza, Fajnzylber and Calderón (2004, appendix A).
GDP per worker	Real GDP chain per worker in 2000 constant prices.	Penn World Tables version 6.2 (2006).

## Appendix 7 Summary Statistics, Five-year Averages for the Period 1975-2000

Variable	Obs	Mean	Std. dev.	Min	Max
GDP growth	70	0.00384	0.02343	-0.05590	0.07475
Physical capital growth	70	0.00996	0.02830	-0.03669	0.09546
Human capital growth	70	0.00999	0.01279	-0.05245	0.04633
Investment	70	0.12510	0.05240	0.03638	0.28150
Remittances	70	-4.84298	1.59854	-8.17641	-2.17830
Human capital stock	70	0.98334	0.18392	0.59580	1.38871
Government	70	0.17807	0.04470	0.10403	0.28408
Inflation	70	0.31816	0.65444	0.01225	3.30528
Rem/GDP	70	0.02002	0.02573	0.00028	0.11323

Note: Rem/GDP is remittances as a share of GDP, while remittances are the log of Rem/GDP.

## **Vita**

Pablo Antonio García-Fuentes was born in May 1968, in La Trinidad, Nicaragua. He got his bachelor in science in agronomy from the Universidad Nacional Agraria, Managua, Nicaragua, in December, 1990. In 1995, he was awarded a USAID scholarship to pursue master studies and received the degree of master in science in agricultural economics from North Carolina Agricultural and Technical State University in May, 1997. In 2004, he was admitted to the doctoral program in the department of Agricultural Economics and Agribusiness at Louisiana State University. Currently, he is a candidate for the degree of Doctor of Philosophy.