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**U.S. Foreign Direct Investment in Latin America and the Caribbean: A case of
Remittances and Market Size**

Pablo A. Garcia-Fuentes

Department of Agricultural Economics and Agribusiness
207 Martin D. Woodin Hall
Louisiana State University
Baton Rouge, LA, 70803
(225) 578-2728
pgarci2@tigers.lsu.edu

P. Lynn Kennedy

Department of Agricultural Economics and Agribusiness
181 Martin D. Woodin Hall
Louisiana State University
Baton Rouge, LA, 70803
(225) 578-2726
lkennedy@agcenter.lsu.edu

Gustavo F. Ferreira

Department of Agricultural and Applied Economics
316 Hutcheson Hall
Virginia Tech
Blacksburg, VA 24061
(540) 231-4730
gferre3@vt.edu

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U.S. Foreign Direct Investment in Latin America and the Caribbean: A case of Remittances and Market Size

Abstract: *This paper investigates the effect of remittances in attracting U.S. foreign direct investment flows to Latin America and the Caribbean (LAC). It uses an unbalanced panel data set for fifteen countries covering the period 1983-2010. The results suggest a positive and significant impact of remittances on U.S. FDI flows to LAC, but it depends upon the level of per capita GDP in the host country. Thus, a threshold of per capita GDP is needed for a country to benefit from the positive effect of remittances on U.S. FDI flows. Also, host country demand positively affects U.S. FDI flows to LAC, which supports the market size hypothesis.*

JEL Classification: F21, F23, F24, O54

Keywords: *Foreign direct investment, Remittances, Market size, United States, Latin America and the Caribbean*

I. INTRODUCTION

Foreign direct investment¹ (FDI) flows to Latin America and the Caribbean (LAC) represent a very important source of external finance. FDI flows to LAC are larger than Official Development Assistance (Figs². 1 and 2). FDI flows to LAC without including financial centers were \$112.634 billion in 2010, a 40 percent increase relative to the value of 2009 and a value above the annual average for the 2000s (Economic Commission for Latin America and the Caribbean [ECLAC] 2011a). The United States (U.S.) has been a very important source of FDI to the LAC region and the main investor for more than a decade (ECLAC, 2008). Further, ECLAC (2011b) reports that the U.S. is the main investor in LAC holding a 17 percent share of

¹ According to the United States Bureau of Economic Analysis (BEA), U.S. direct investment abroad represents the ownership or control, directly or indirectly, of a least 10 percent of the voting securities of an incorporated foreign company or the equivalent interest in an incorporated foreign company by a U.S. resident. In this paper, FDI refers to FDI flows.

² Figures 1 and 2 represent the countries in LAC as grouped by BEA, not just the 15 countries of this study.

total FDI. Note that U.S. FDI flows to LAC and U.S. direct investment position³ in LAC have been trending upward (Figs⁴. 3 and 4) as it has been the case for total FDI flows (Figs. 1 and 2). ECLAC (2011b) also reports that in LAC U.S. FDI has been more stable than European Union FDI, the other more important supplier of FDI to LAC.

[Figures 1, 2, 3 and 4 about here]

FDI is important not only as a source of development finance but also as a mean for technology transfer that promote economic growth in host countries⁵. Positive relationships between FDI and growth are reported in Bengoa and Sanchez-Robles (2003), Campos and Kinoshita (2002), Hansen and Rand (2006), Li and Liu (2005), and Oliva and Rivera-Batiz (2002). This FDI's relevance has created a vast literature on the factors that determine the location of FDI.

Some of the literature related to the determinants of FDI include the effects of exchange rate on FDI (Barrel and Pain 1996; Cushman 1985, 1988; Pain 2003); the relationship between labor costs and FDI (Culem 1988; Cushman 1987; Love and Lage-Hidalgo 2000); the relationship between political factors and FDI (Haggard 1989; Nigh 1985; Tuman and Emmert 2004); the effect of trade factors such as openness, trade protection and trade agreements on FDI (Agosin and Machado 2006; Barrel and Pain 1999; Waldkirch 2003); and the relationship between host country market size and FDI (Barrel and Pain 1996; Love and Lage-Hidalgo 2000). Host country's market size is one of the most influential determinants of FDI. Market size represents the level of demand for goods and services in the host country. The literature reports positive

³ BEA defines it as the book value of U.S. direct investors' equity in their foreign affiliates and the net outstanding loans of U.S. direct investors' to their foreign affiliates.

⁴ Figures 3 and 4 represent net FDI (not just U.S. FDI flows), remittances, and ODA flows received by the countries in LAC as grouped by UNCTAD for FDI flows and by the World Bank for ODA and remittances, not just the 15 countries of this study.

⁵ A host country is a receiver of FDI, and a home country is a supplier of FDI.

associations between market size and U.S. FDI (Barrel and Pain 1996; Blonigen and Davies 2000; Cushman 1985, 1988; Globerman and Shapiro 2002; and Schmitz and Bieri 1972).

Therefore, it is likely that countries with a larger market will be more attractive to U.S. direct investors.

In the literature, gross domestic product (GDP) or gross national product (GNP) are the usual proxies for market size. These variables capture the effect of the host country's income on FDI. Therefore, an increase in per capita GDP will increase the market size for the goods and services produced by multinational firms' (MNF) subsidiaries. However, Dornbush and Fisher (1994, p.59) argue that it is not just the level of output (GDP) that is related to consumption demand, but the money available for spending.

Another important source of external finance to LAC is remittances⁶. Remittances in LAC are second to FDI and larger than ODA (Figs. 2 and 3). Note that remittances have been upward trending and more stable than FDI. According to the United Nations Conference on Trade and Development [UNCTAD] (2012), remittances to LAC increased from \$1.94 billion in 1980 to \$58.74 billion in 2010. Additionally, remittances affect households' consumption in the host country because of increasing disposable incomes of the recipient individuals. Hence, it is likely that remittances may affect U.S. FDI flows to LAC through increasing disposable income.

To our best knowledge, no previous study has assessed the effect of remittances and market size on U.S. FDI flows to LAC. By investigating about this relationship, this paper contributes to the literature on U.S. FDI and market size. Our purpose is to empirically assess the effect of remittances through per capita GDP on U.S. FDI flows to LAC. To do this, we follow Barrel and

⁶ Remittances comprise workers' remittances, compensation of employees and migrants' transfers received by individuals in a LAC country. In this study, the remittance measure represents the sum of these three items as a share of host country GDP.

Pain's (1996) profit maximization method to derive a U.S. multinational firm's (MNF) optimal level of capital at the foreign plant.

We assess the effect of remittances on U.S. FDI flows to LAC using an unbalanced panel data set for 15 LAC countries⁷ that covers the period from 1983 to 2010. The econometric method used is panel generalized method of moments with instrumental variables (GMM-IV). Our results suggest that remittances have a positive effect on U.S. FDI flows to LAC, but only for countries in which per capita GDP is above a certain threshold. This also suggests a complementary effect of remittances and per capita GDP on U.S. FDI flows to LAC. Additionally, in support of the market size hypothesis, per capita GDP has a positive and significant effect on U.S. FDI flows to LAC.

The rest of the paper is organized as follows. Section 2 provides a review of the relevant FDI literature, followed by a description of the methodology and data. The next section presents a discussion of the results. Finally, conclusions and suggestions for further research are presented.

II. REVIEW OF LITERATURE

Market size represents the level of demand for goods and services in the host country, and it is usually proxied by a measure of either GDP or GNP. Most of this literature identifies market size as an important determinant of FDI. Bandera and White analyze U.S. FDI in the manufacturing industry in seven European countries for the period from 1958 to 1962 and find a strong relationship between the level of FDI and host country income (as cited in Chakrabarti 2001). Schmitz and Bieri (1972) analyze U.S. direct investment in the European Economic Community for the period from 1952 to 1966 and find market size to have a positive and significant effect on U.S. FDI. Cushman (1985) assesses the relationship between real exchange

⁷ Countries examined include Argentina (ARG), Barbados (BRB), Brazil (BRA), Chile (CHL), Colombia (COL), Costa Rica (CRI), The Dominican Republic (DOM), Ecuador (ECU), Guatemala (GTM), Honduras (HND), Jamaica (JAM), Mexico (MEX), Peru (PER), Trinidad and Tobago (TTO), and Venezuela (VEN).

rate risk, expectations, and U.S. direct investment flows to five industrialized countries for the years 1963 through 1978 and finds, with one exception, a strong positive effect between foreign income and 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 find host country GDP to have a significant positive effect on FDI. Barrell and Pain (1996) study the determinants of U.S. FDI over the period from 1971 to 1998. They use GNP level and GNP growth to proxy for host country's demand and find a significant and positive effect of host country's GNP on U.S. FDI.

Some recent research also finds market size having a positive influence on U.S. FDI. Blonigen and Davies (2000) assess the impact of bilateral tax treaties on both U.S. inbound and outbound FDI over the period from 1966 to 1992 and find positive and significant effects of host country's real GDP on outbound U.S. FDI. Gopinath, Pick and Vasavada (1999) examine the determinants of U.S. FDI for the food processing industry in ten developed countries for the period 1982-1994 and find a significant positive effect of host country per capita GNP on U.S. FDI. Globerman and Shapiro (2002) investigate the effect of governance infrastructure on U.S. FDI in both developed and developing countries during the period 1995-1997. They find real GDP to have a positive and highly significant effect on U.S. FDI.

Some of the literature about U.S. FDI in LAC also finds positive and significant effects of market size on U.S. FDI. Love and Lage-Hidalgo (2000) examine the determinants of U.S. FDI in Mexico for the period from 1967 to 1994 and find per capita GDP to have a significant positive effect on U.S. FDI. Lall, Norman and Featherstone (2003) study the determinants of U.S. FDI for a group of LAC countries over the period from 1983 to 1994. They find GDP, squared GDP and GDP growth to have significant and positive effects on FDI. Tuman and

Emmert (2004) examine the political and economic determinants of U.S. FDI for a sample of 15 LAC countries over the period from 1979 to 1996. They show that the change in real per capita GDP has a positive and significant effect on U.S. FDI.

Based on this literature review, it is likely that an increase in host country's GDP will increase U.S. FDI in the host country. The literature also identifies GDP as host country's income which is used for acquiring goods and services; thus, an increase in host country income will raise the demand for goods and services. Moreover, under a growing aggregate demand new investments are required which promotes FDI by creating new investments and expanding existing ones as Culem (1988, p. 888) argues.

Remittances are also an important source of external financing for developing countries and part of the recipient individuals' disposable income. Glytsos (2005) adds up remittances and GDP to construct a type of host country disposable income to capture the demand effect of remittances on consumption, investment and imports. He finds a significant positive effect of this country income on consumption. As such, it is likely that remittances raise the demand for goods and services in an economy through increasing disposable income. Therefore, it seems that remittances may raise host country's aggregate demand.

IV. METHODOLOGY AND DATA

A. The model

The theoretical method used for the analysis of U.S. FDI flows to LAC follows Barrell and Pain's (1996) profit maximization approach. It has been used in many studies of FDI (Cushman 1985, 1987, 1988; Gopinath, Pick and Vasavada 1999, among others). The approach relates the undertaking of FDI by a U.S. MNC to profit maximization and allows for deriving the optimal

capital input for investing abroad. The method begins with a profit function of a U.S. MNF that sells a product in both the home and foreign markets. So, profits are given by

$$\Pi = P_h(S_h)S_h + P_f(S_f)S_f - TC(Q) \quad (1)$$

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 of a MNF that decides to produce in the foreign market is given by

$$q_f = f(L_f, K_f) \quad (2)$$

with associated costs $TC_f(q_f)$ which are included in total costs. Then, total costs are given by the sum of production costs at home and abroad.

Barrel 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 the definition of the MNF's profit maximization problem as:

$$\Pi = P_h(S_h)S_h + P_f(S_f, q_f)S_f - TC_h(q_h) - TC_f(q_f) - \lambda (S_h + S_f - q_h - q_f) \quad (3)$$

Then, the Lagrangean function yields the following first order conditions:

$$\Pi_{S_h} = MR_h - \lambda = 0, \quad (4a)$$

$$\Pi_{S_f} = MR_f - \lambda = 0, \quad (4b)$$

$$\Pi_{q_h} = -MC_h + \lambda = 0, \text{ and} \quad (4c)$$

$$\Pi_{q_f} = S_f(\partial P_f / \partial q_f) - MC_f + \lambda = 0. \quad (4d)$$

Conditions (4a) and (4b) indicate that marginal revenues in the two markets are identical,

$MR_h = MR_f$. However, (4c) and (4d) indicate that marginal costs are different

$$MC_h = MC_f + S_f(\partial P_f / \partial q_f) \quad (5)$$

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. Yet, cost minimization in each location is an alternative for solving the problem. This yields four additional endogenous variables which are the input demands, K_h, K_f, L_h , and L_f . Therefore, total costs in the home and foreign markets are given by

$$TC_h = w_h L_h + v_h K_h, \text{ and} \quad (6a)$$

$$TC_f = w_f L_f + v_f K_f \quad (6b)$$

with w_h and w_f representing wages and v_h and v_f representing costs of capital in each market.

Profit maximization requires that marginal cost equals marginal revenue in both markets. So,

$$MR_h(D_h) = MC_h(w_h, v_h) \text{ and} \quad (7a)$$

$$MR_f(D_f) = MC_f(w_f, v_f) - S_f(D_f) (\partial P_f / \partial q_f) \quad (7b)$$

where 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. Consequently, the optimal capital stock at the foreign plant can be defined as

$$K_t^* = f(D_f, v_h, v_f, w_h, w_f) \quad (8)$$

where K_t^* would depend positively on host country demand (D_f) and on the relative unit costs between home and host countries.

Equation (8) only includes host country demand, which is proxied by per capita GDP. This is because our research interest is on the relationship between FDI and host country's market size (Bajo-Rubio and Sosvilla-Rivero 1994; Gopinath, Pick and Vasavada 1999; Love and Lage-Hidalgo 2000). In addition, cost minimization implies that capital and labor costs enter equation

(8) in ratio form, so the rates of substitution between different types of capital and labor must equal their respective price ratios.

Even though K_t^* in equation (8) represents the MNF's desired capital stock at the foreign plant, desired and actual capital stocks at the foreign plant are likely to differ in each time period because of adjustment costs due to delivery lags, delays due to searching for suitable investments overseas, and/or delays affecting planning permission (Barrel and Pain, 1996). Given these constraints, a partial adjustment model is an appropriate specification for U.S. FDI flows as a share of host country GDP, which can be specified as a lag function of the difference between desired and actual capital stocks and replacement investment due to capital stock depreciation. The partial adjustment model is defined as in Bajo-Rubio and Sosvilla-Rivero (1994), Barrel and Pain (1996) and Love and Lage-hidalgo (2000) and is given as

$$FDI_t = \ell (K_t^* - K_{t-1}) + \delta K_{t-1} \quad (9)$$

where FDI_t is U.S. FDI flows as a share of host country GDP in year t , ℓ is a distributed lagged function and δ is the depreciation rate of capital.

Equation (9) shows that U.S. FDI flows at the beginning of period t are determined by the difference between the desired capital stock in period t and the actual capital stock in period $t - 1$ plus replacement capital at the foreign plant. Furthermore, equation (9) can be rewritten as

$$FDI_t = \ell K_t^* + (\delta - \ell)K_{t-1} \quad (10)$$

Thus, U.S. FDI flows depend both on the determinants of the optimal capital stock (equation (8)) and the lagged value of U.S. capital stock at the foreign plant.

Foreign market demand is given by D_f in equation (8). In the literature, the usual proxies used for D_f are measures of either GDP or GNP to capture the effect of the host country market on FDI. This is referred to as the market size hypothesis (Moosa, 2002). It assumes a positive

relationship between host country demand and the expected sales of MNF subsidiaries. Positive and significant effects of GDP on FDI are in Bajo-Rubio and Sosvilla-Rivero (1994); Filippaios, Papanastassiou and Pearce (2003); Lall, Norman and Featherstone (2003); Love and Lage-Hidalgo (2000); and Marchant, Cornell and Koo (2002). Studies showing a positive relationship between FDI and GNP include Barrel and Pain (1996); Culem (1988); and Cushman (1985, 1987, 1988). Hence, both GNP and GDP are used to capture the effect of host country income in attracting FDI, and an increase in either GNP or GDP is expected to increase FDI.

Regarding the relationship between remittances and consumption, Glytsos (2005) estimates the demand generated by remittances on consumption, investment, and imports through a type of country disposable income. He develops the following macro-econometric model:

$$C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 C_{t-1},$$

$$I_t = \beta_0 + \beta_1 Y_t + \beta_2 K_{t-1},$$

$$M_t = \gamma_0 + \gamma_1 Y_t + \gamma_2 Y_{t-1} + \gamma_3 M_{t-1}, \text{ and}$$

$$Y_t = C_t + I_t + G_t + X_t - M_t + R_t$$

where C_t , I_t , and M_t represent consumption, investment and imports respectively. The identity shows that Y_t is a country's disposable income, and that remittances (R_t) are not part of GDP but part of a country's disposable income. He finds a positive and significant effect of income (Y_t) on consumption for Egypt, Greece, Jordan, Morocco and Portugal. Additionally, Taylor *et al.* (2005) report that in 2002 remittances accounted for 16 percent of rural household per capita income in Mexico. Therefore, it is likely that remittances through increasing disposable income may increase household's consumption demands in the host country.

Previous literature suggests controlling for the effects of exchange rate, exports, and inflation on FDI. Regarding exchange rate effects on FDI, foreign currency depreciation against the

MNF's home country currency can influence FDI flows to the host country. Host country currency depreciation gives the MNF an opportunity to capitalize its returns to a higher rate relative to host country firms (Aliber, as cited in Bajo-Rubio and Sosvilla-Rivero 1994). Also, host country currency depreciation can stimulate foreign investment (Froot and Stein 1991). Negative effects of exchange rate on FDI are in Cushman (1985), Blonigen and Feenstra (1996), and Froot and Stein (1991). In contrast, Waldkirch (2003) finds a positive relationship between exchange rate and FDI, while an ambiguous relationship between exchange rate and FDI is proposed by Stevens (1998). We expect exchange rate to negatively affect U.S. FDI flows⁸.

The relationship 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. Mundell's (1957) study on the international movement of goods and factors suggests that FDI and trade are substitutes. On the contrary, Markusen (1983) presents several models that suggest that factor mobility promotes trade. In addition, complementary relationships between international flows of goods and factors are in (Billington 1999; Brenton, Di Mauro and Lücke 1999; Globerman and Shapiro 1999). Barrel and Pain (1996) argue that MNFs' exports can promote FDI in downstream services which are consumer service facilities such as dealer works as well as after sale repairs and maintenance outlets. They argue that exports are jointly endogenous and include a lagged value of the MNF home country's exports in the estimated model. This study controls for U.S. exports to each host country lagged one period. U.S. exports are expected to be either a complement or a substitute to U.S. FDI flows.

One possible proxy for host country macroeconomic stability is inflation (Barro and Sala-i-Martin 2004, p. 520). Romer (2006, p. 550) argues that higher inflation can discourage long term

⁸ Appreciation of host country's currency against the U.S. dollar is expected to negatively affect U.S. FDI flows.

investment because it can be perceived as government inefficiencies that can indicate government policies that hurt capital holders. High inflation is also tied to exchange rate volatility, political instability and other undesirable factors (Temple 1999, p. 144). Negative relationships between inflation and investment, and between inflation and growth are in Bruno and Easterly (1998); Cukierman *et al.* (1993); and Fischer (1993). Thus, host country's macroeconomic instability may affect U.S. direct investors' expectations about profits. Inflation is expected to have a negative impact on U.S. FDI flows.

Additionally, we control for the effects of openness, infrastructure availability, and country risk on FDI. These three variables are part of the variables that comprises the UNCTAD's Inward FDI Potential Index (UNCTAD, 2002). Openness represents the ratio of trade (exports plus imports) to GDP. The effect of openness on FDI is ambiguous, for market-seeking FDI, a lower level of openness can have a positive effect because of high level trade barriers. On the other hand, a higher level of openness can have positive effect on export-platform FDI. Because our measure of FDI does not differentiate between these types of FDI, openness can have either a positive or negative effect on FDI. Host country's infrastructure availability is an important factor to conduct and coordinate international business. As in Asiedu (2002) and UNCTAD (2002), we use number of telephones per 1,000 people as a proxy for infrastructure availability. It is expected that infrastructure affects FDI positively. As a proxy for country risk, we use the political rights index from the Freedom House. The values of the index range from 1 to 7, with 1 being the highest degree of freedom and 7 the lowest. The index is based on information about the electoral process, political pluralism and participation, and functioning of government. We expect the political rights index to have a negative effect on FDI.

The above discussion suggests that it is likely that remittances affect the desired capital stock in equation (8) through foreign market demand (D_f). Therefore, the model for the desired capital stock at the foreign plant should be extended to include the effects of remittances, exchange rate, U.S. exports, inflation, openness, infrastructure, and country risk. The extended model is given by

$$K_f^* = f(D_f, v_h/v_f, w_h/w_f, REM, ER, EX, INF, OPEN, INFR, PRI) \quad (11)$$

where D_f , v_h/v_f , w_h/w_f , REM , ER , EX , INF , $OPEN$, $INFR$, and PRI denote host country demand which is proxied by per capita GDP, the ratio of home country to host country cost of capital, the ratio of home country to host country wages, remittances as a share of GDP, real exchange rate, U.S. exports as a share of host country GDP lagged one period, host country inflation, openness, infrastructure, and political rights, respectively.

The empirical specification of equation (10) is defined as

$$FDI_{it} = \beta_0 + \beta_1 LnGDPP_{it} + \beta_2 LnREM_{it} + \beta_3 LnGDPP_{it} * LnREM_{it} + \beta_4 LnER_{it} + \beta_5 EX_{i,t-1} + \beta_6 INF_{it} + \beta_7 (w_h/w_f)_{it} + \beta_8 OPEN_{it} + \beta_9 INFR_{it} + \beta_{10} PRI_{it} + \beta_8 K_{i,t-1} + a_i + \mu_t + \varepsilon_{it} \quad (12)$$

where a_i denotes the unobservable country effect; μ_t denotes the unobservable time effects; and ε_{it} is the idiosyncratic error which is assumed to be independently and identically distributed with zero mean and variance σ_ε^2 . Ln is the natural logarithm operator.

B. Data

This study covers the period from 1983 to 2010 for a sample of 15 LAC countries. The dependent variable is U.S. FDI flows as share of host country GDP. It is constructed using data on the U.S. direct investment position abroad from BEA. Per capita GDP and openness are obtained from the Penn World Tables version 7.1. Real exchange rate is constructed using data from the International Financial Statistics (IFS) CD-ROM (2012). U.S. export data is obtained

from OECD Statistics. Inflation data is obtained from the IFS CD-ROM (2012). The data used to construct the proxy for wages is obtained from the BEA and the U.S. Bureau of Labor Statistics (BLS). U.S. FDI stock in the host country data is obtained from BEA. The political rights index is obtained from the Freedom House. Infrastructure availability is obtained from the World Development Indicators online version.

Remittances comprise workers' remittances, compensation of employees and migrants' transfers received by individuals in the migrant home country. Remittances data is obtained from the World Development Indicators online version. Workers' remittances are private transfers from migrant workers who reside in the migrant host country for more than a year to people in the migrant home country. Compensation of employees is the income of migrants who lived in the migrant host country for less than a year. Migrant transfers are transfers from one country to another, at the time of migration, of the worth of migrants who lived in the migrant host country for more than a year. Remittances are expressed as a share of GDP. Variable definitions, data sources, and descriptive statistics are in Appendices 1 and 2, respectively.

V. EMPIRICAL RESULTS

This section presents the results of the regressions based on the specification given by equation (12). We use panel generalized method of moments with instrumental variables (PGMM-IV) to analyze an unbalanced panel data set. We suspect that the errors in equation (12) are no longer independent and identically distributed (iid). The errors may be heteroskedastic and autocorrelated over time for each cross section in the sample. Under these circumstances, PGMM-IV allows for a robust estimation that controls for intra-cluster correlation and heteroskedasticity. It also allows for instrumental variable estimation since remittances are assumed to be endogenous. Remittances can be contemporaneously correlated with the errors

due to reverse causality, measurement error, or omitted variable issues. We assume weak exogeneity, so past values of remittances would be uncorrelated with the errors in period t and used as instruments (see Cameron and Trivedi (2005) for the details about PGMM-IV).

Our estimations also include three exogenous instruments. One is the ratio of remittances to GDP for all other countries in the LAC region⁹ as in Chami et al (2008). Following Aggarwal, Dermirgüç-Kunt, Peria, and Soledad (2011), we construct two instruments by multiplying the U.S. GDP per capita and the U.S. unemployment rate by the share of remittances received from the U.S. by each of the 31 countries for which the World Bank reports data on remittances received from the U.S. The Hansen J-statistic, an overidentification test for all instruments, is reported in Table 1 and suggests that the instruments are valid¹⁰. As suggested in Wooldridge (2002), a robust regression-based Hausman test was applied to an OLS version of equation (12) and suggested that country fixed effects are appropriate. A linear time trend is also included to control for time effects.

[TABLE 1 ABOUT HERE]

Table 1 shows three models. Model 1 is OLS estimation. Model 2 is PGMM-IV estimation and uses internal instruments (first and second lag of remittances) only. Model 3 uses model 2's instruments and the remittance weighted U.S. per capita GDP and U.S. unemployment rate. The results are qualitatively the same for all models. However, given the statistical significance and the overidentification test for the instruments, the discussion of the results comes from model 3. There is a significant positive effect of per capita GDP on U.S. FDI flows to LAC. This result is in line with the market size hypothesis. MNFs tend to be attracted to larger markets in order to

⁹ This ratio is given by $\left(\frac{\text{Other countries' remittances}}{\text{Other countries' GDP}}\right)_i = \frac{\sum \text{Remittances}_j - \text{Remittances}_i}{\sum \text{GDP}_j - \text{GDP}_i}$, $i = 1, \dots, 31$, $j = 1, \dots, 31$, and $i \neq j$. To compute this instrument, we use 31 countries from the LAC region for which the World Bank reports data on remittance flows from the U.S. to LAC.

¹⁰ The null hypothesis states that the instruments are uncorrelated with the error term. Thus, failing to reject this hypothesis suggests that the instruments are valid.

exploit economies of scale. In the case of LAC, positive relationships between FDI and market size are reported in Lall, Norman and Featherstone (2003), Love and Lage-Hidalgo (2000), and Tuman and Emmert (2004).

The results on the relationship between remittances and per capita GDP and U.S. FDI flows suggest that remittances have a positive effect on U.S. FDI flows to LAC, but only for certain levels of host country per capita GDP. The coefficients on remittances and the interaction term are significant and suggest that a threshold of host country per capita GDP is required for remittances to have a positive effect on U.S. FDI flows¹¹. In addition, the positive sign of the interaction term suggests that remittances and per capita GDP have a complementary effect on U.S. FDI flows. The estimates on remittances and the interaction term indicate that in a country with a log value of per capita GDP greater than 8.88 (a per capita real GDP value of \$7186.79) remittances positively affect U.S. FDI flows. In our sample, eight countries have period average values for real per capita GDP that pass this threshold¹². In contrast, remittances negatively affect FDI flows in countries with per capita GDP below this threshold. Note that all models include per capita GDP and remittances alongside their products, so the significance of the interaction term cannot be the result of the omission of any of these two factors. Garcia-Fuentes and Kennedy (2011) also find a positive effect of remittances on aggregate FDI inflows to LAC that depends upon the level of real per capita GDP of the economy.

Additionally, in a country with a real per capita GDP log value of 8.95 (the sample average and equivalent to US\$8,955.61), an increase in remittances of 0.0401 as a share of GDP (one standard deviation) which is an increase of 148 percent relative to remittances' sample mean will

¹¹ The appropriate per capita GDP threshold is the log value of per capita GDP that makes the sum of remittances and the interaction term positive, or $\log \text{ per capita GDP} \geq \left(-\frac{\beta_{\text{remittances}}}{\beta_{\text{interaction term}}}\right)$. But, if both estimates are positive (negative), then remittances has an unambiguously positive (negative) effect on U.S. FDI flows.

¹² The countries are Argentina, Barbados, Chile, Costa Rica, Jamaica, Mexico, Trinidad and Tobago, and Venezuela.

raise U.S. FDI flows to a LAC country by 0.0014 percentage points per year. The same increase in remittances and using the sample's maximum per capita GDP log value of 10.38 (per capita GDP value of US\$32,266.08), U.S. FDI flows rise by 0.0300 percentage points a year. Next, the same increase in remittances in a country with a period average for per capita GDP log value of 10.16 (Barbados' real per capita GDP value of US\$25,894.91), the maximum period average for a country in the sample, U.S. FDI flows rise by 0.0252 percentage points a year. Additionally, given the same increase in remittances and using the period average real per capita GDP log value (9.28) for the eight countries that pass the threshold, U.S. FDI flows increase by 0.0079 percentage points per year. Therefore, on average, increasing remittances has a positive impact on U.S. FDI flows to a LAC country.

The positive effect of remittances on U.S. FDI given the threshold of per capita GDP suggests that, on average, remittances strengthen the impact of market size in attracting U.S. FDI flows to LAC. It may be that by increasing disposable income remittances may increase aggregate demand in a LAC economy and, conditional on a per capita GDP threshold, increase U.S. FDI in a LAC economy. Furthermore, if FDI positively affects economic growth in LAC countries as suggested in Bengoa and Sanches-Robles (2003), then remittances may indirectly contribute to economic growth.

The real exchange rate effect on U.S. FDI is negative as expected but not significant. U.S. exports to LAC have a significant positive effect on U.S. FDI flows. This suggests a complementary relationship between trade and FDI. Trade between the U.S. and LAC has been growing during the past two decades, and LAC absorbed 23 percent of U.S. goods exports in 2010, which makes the U.S. the main export supplier to LAC (ECLAC, 2010). Also, the U.S. has been the main investor in LAC for more than a decade (ECLAC, 2008). Further, the U.S. holds

17 percent of total FDI in LAC making it the main investor (ECLAC, 2010). Positive associations between FDI and trade are in Brenton, Di Mauro and Lücke (1999) and Brouwer, Paaap and Viaene (2008). A positive association between U.S. FDI and exports to developing countries is in Marchant, Cornell and Koo (2002). Inflation has the unexpected sign but is not significant.

The ratio of U.S. wages to host country wages has a negative and significant effect on U.S. FDI flows. It shows the unexpected relationship; that is, increased U.S. wages raise U.S. FDI flows to LAC. Chakrabarti (2001) argues that the effect of wages on FDI has been controversial since the literature reports host country wages negatively affecting FDI, having no effect, or having a positive effect. Garcia-Fuentes and Kennedy (2011) report a positive effect of the ratio of home country wages to host country wages on FDI for a sample of 14 LAC countries. Positive and significant effects of host country wages on FDI are also in Filippaios et al. (2003); Marchant et al. (2002); Swedenborg (2001); and Wheeler and Mody (1992).

Infrastructure availability is positive and significant as expected. It suggests that infrastructure is very important in attracting U.S. FDI flows to LAC. Asiedu (2002) reports positive and significant effects of infrastructure on FDI flows to developing countries. Recently, Abbott, Cushman, and De Vita (2012) find positive and insignificant effect of infrastructure development for the entire sample of developing countries, but they find mixed and insignificant results when their sample include upper-middle income developing countries only. Openness is negative but is not significant.

Political rights (country risk) have a negative and significant effect on U.S. FDI flows to LAC as expected. Asiedu (2002) reports negative and insignificant effects of political risk on FDI flows to developing countries. Abbott, Cushman, and De Vita (2012) find a negative and

significant effect of government stability, a measure of host country risk, on FDI flows to developing countries. Lastly, as expected, the lagged U.S. capital stock has a negative and significant effect on U.S. FDI flows to LAC. Thus, a higher level of last period U.S. capital stock at the foreign plant decreases next period U.S. FDI flows to LAC.

VI. CONCLUSIONS

This study assesses the effect of remittances and per capita GDP on U.S. FDI flows to LAC. To investigate about this issue, this research uses a sample of 15 LAC countries and covers the period from 1983 to 2010. The most important finding of this research is a positive effect of remittances on U.S. FDI flows given a threshold of host country per capita GDP. The results also suggest a complementary effect of remittances and per capita GDP on U.S. FDI flows to LAC. Additionally, per capita GDP has a positive and significant effect on U.S. FDI flows to LAC. This is consistent with the theory of market size and the literature that finds positive relationships between U.S. FDI and market size for developing countries (Lall, Norman and Featherstone 2003; Love and Lage-Hidalgo 2000; and Tuman and Emmert 2004).

It is important to mention that the effect of remittances on U.S. FDI may be affected by some uncertainties in measuring remittances. Our data on remittances represents the sum of workers' remittances, compensation of employees, and migrants' transfers as defined in the fifth edition of the IMF's Balance of Payments Manual. However, some countries report remittances data to the IMF as only workers' remittances or compensation of employees. In addition, the true size of remittance flows may be greater than the actual flows. Therefore, the measure of remittances may underestimate the total value of remittances sent by migrants to their home countries. To the extent that this bias in remittances is constant across remittance receiving countries and over time, the qualitatively results are not affected.

With respect to future research, it would be interesting to analyze the relationship between remittances and sectoral U.S. FDI such as that of the services and manufacturing sectors that seek to serve host country markets. It would also be interesting to assess the effect of remittances on U.S. FDI while using data from household surveys in developing countries that collect data on migration and remittances.

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Appendix 1. Variable definitions and data sources

Variable name	Variable definition	Source
U.S. FDI flows	First difference of the U.S. direct investment position in each LAC country divided by each LAC country's nominal GDP.	Own calculations.
Per capita GDP	Real per capita GDP.	Penn World Tables version 7.1, 2012.
Remittances	Annual values of remittances as a share of GDP.	World Development Indicators, online version, World Bank 2012.
Real 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.
U.S. exports	U.S. exports to each LAC country.	SourceOECD ITCS international trade by commodities statistics.
Inflation	Annual percentage change of GDP deflator.	International Financial Statistics CD-ROM, IMF 2012.
U.S. wage/Host wage	Ratio of U.S. wages to host country wages.	Own calculations.
U.S. capital stock	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, the U.S. Bureau of Economic Analysis.
U.S. CPI	U.S. consumer price index.	International Financial Statistics CD-ROM, IMF 2012.
Host country CPI	Consumer price index for each LAC country.	International Financial Statistics CD-ROM, IMF 2012.
U.S. wage	Real U.S. wage. 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.	The U.S. Bureau of Labor Statistics.
Earnings/hour	Average earnings per hour in a year.	The 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.
Political rights	A measure of country risk.	Freedom House. http://www.freedomhouse.org/report-types/freedom-world
Openness	Trade (exports plus imports) to GDP ratio.	Penn World Tables version 7.1, 2012.

Appendix 1 (continued)

<i>Variable name</i>	<i>Variable definition</i>	<i>Source</i>
Infrastructure	Phones per 1,000 people.	World Development Indicators, online version, World Bank 2012.
GDP deflator	GDP deflator	International Financial Statistics CD-ROM, IMF 2012.
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, the 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, the Bureau of Economic Analysis.
Nominal GDP	Nominal GDP.	World Development Indicators, online version, World Bank 2012.

Appendix 2. Summary statistics, annual values for the period 1983-2010

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
U.S. DI position/host GDP	405	0.0798	0.1054	0.0081	0.8770
U.S. FDI flows/GDP	411	0.0092	0.0860	-0.7905	0.8512
U.S. capital stock/host GDP _{t-1}	411	0.0890	0.1613	0.0083	1.4170
Ln real per capita GDP	411	8.9471	0.5216	7.9571	10.3818
Real per capita GDP	411	8955.61	5913.25	2855.79	32266.08
Ln Remittances/GDP	411	-5.2139	2.4346	-12.4147	-1.5249
Interaction	411	-46.6890	21.9113	-105.5899	-12.4172
Remittances/GDP	411	0.0271	0.0401	4.05E-6	0.2177
Ln Real exchange rate	410	-3.4501	2.8540	-10.5653	1.0001
U.S. exports/host GDP	411	0.1008	0.0792	0.0078	0.4465
U.S. exports/host GDP _{t-1}	411	0.0999	0.0787	0.0078	0.4465
Inflation	409	0.7307	3.8729	-0.3152	53.6173
U.S. wage/host wage	373	9.8912	8.7125	9.73E-10	49.2470
Infrastructure	411	13.1094	9.9941	0.8890	55.1106
Openness	411	0.6310	0.2980	0.1235	1.3649
Political rights	411	2.3309	1.1251	1.0000	6.0000
year				1983	2010

Note: Ln is the natural logarithm operator. Interaction: Ln Remittances/GDP*Ln real per capita GDP.

Table 1. Remittances, per capita GDP and U.S. FDI flows to Latin America and the Caribbean,
Panel GMM-IV Estimation, 1983-2010

Explanatory Variables	Model 1	Model 2	Model 3
Constant	2.0688 (0.64)	2.1250 (0.91)	2.8401 (1.31)
Ln per capita GDP	0.1019* (1.69)	0.1054** (2.22)	0.0920** (2.02)
Ln remittances/GDP	-0.1356** (2.17)	-0.1586** (2.40)	-0.1181** (2.25)
Ln remittances/GDP * Ln per capita GDP	0.0151** (2.13)	0.0176** (2.41)	0.0133** (2.26)
Ln real exchange rate	-0.0099 (0.44)	-0.0067 (0.56)	-0.0078 (0.75)
U.S. export/GDP _{t-1}	0.2601 (1.58)	0.2325** (2.59)	0.2225** (2.50)
Inflation	0.0006 (0.45)	0.0013 (1.54)	0.0011 (1.52)
Real U.S wage/Real host country wage	-0.0025*** (3.18)	-0.0024** (2.59)	-0.0019** (2.58)
Infrastructure	0.0072*** (4.38)	0.0075** (2.24)	0.0066** (2.32)
Openness	-0.0491 (0.78)	-0.0419 (0.84)	-0.0493 (1.07)
Political rights	-0.0058 (1.10)	-0.0063** (2.13)	-0.0054** (2.13)
U.S. capital stock/GDP _{t-1}	-0.4560*** (9.79)	-0.4962** (2.48)	-0.5451*** (3.22)
Time	-0.0015 (0.91)	-0.0016 (1.24)	-0.0019 (1.56)
Country Dummies	yes	yes	yes
R-squared	0.2428	0.2373	0.1923
Obs.	372	366	366
Countries	15	15	15
Hansen J-statistic		2.611	4.042
Hansen J-statistic p-value		0.2710	0.5434

Note: Asterisks indicate significance at the 10 percent (*), 5 percent (**) and 1 percent (***) levels respectively. Model 1 is OLS estimation. Model 2 is panel GMM-IV estimation with country fixed effects and uses the first and second lags of remittances as instruments. Model 3 is panel GMM-IV estimation with country fixed effects and uses the first and second lags of remittances as instruments as well as three external instruments. Values in parenthesis are t-values. Country fixed effects are not reported to save space. The p-value for the Hansen J-statistic suggests failure to reject the null hypothesis, so the instruments are valid. Ln is the natural logarithm operator.

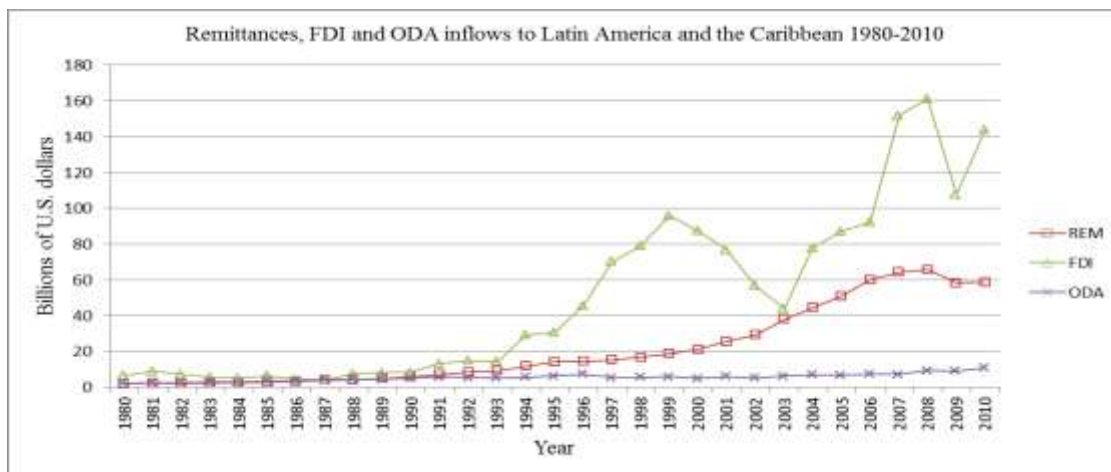


Figure 1. Net FDI, remittances, and ODA inflows in billions of dollars to LAC, 1980-2010
Source: World Development Indicators online version, United Nations Conference on Trade and Development Statistics (UNCTADSTAT), and authors calculations.

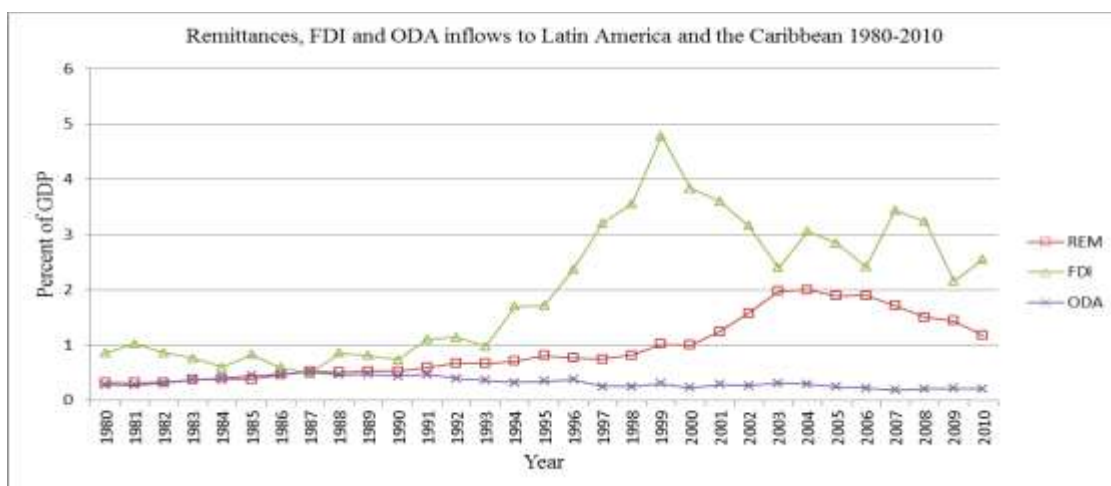


Figure 2. Net FDI, remittances, and ODA flows as percent of GDP to LAC, 1980-2010.
Source: World Development Indicators online version, United Nations Conference on Trade and Development Statistics (UNCTADSTAT), and authors calculations.

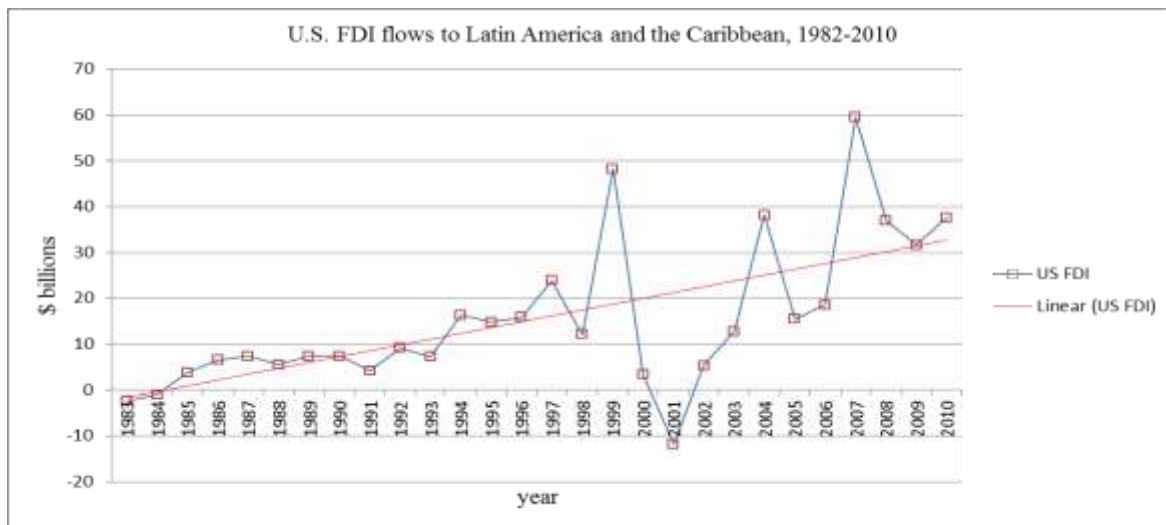


Figure 2. U.S. foreign direct investment flows in billions of U.S. dollars to LAC, 1983-2010

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

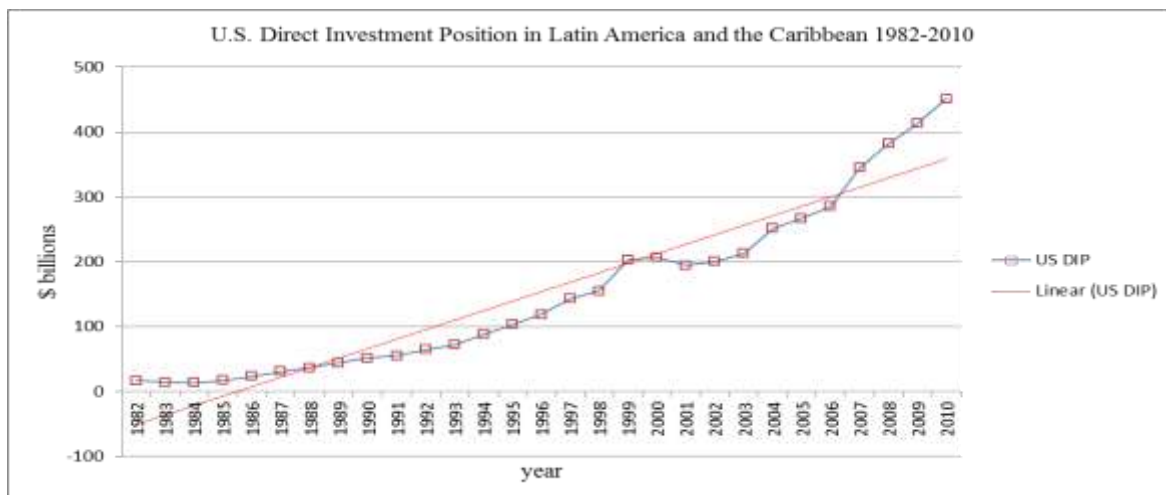


Figure 3. U.S. foreign direct investment position in LAC in billions of U.S. dollars, 1982-2010

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