CAPITAL FLOWS TO LATIN AMERICAN COUNTRIES: EFFECTS OF FOREIGN DIRECT INVESTMENT AND REMITTANCES ON GROWTH AND DEVELOPMENT

A Dissertation

by

DIEGO EDUARDO VACAFLORES RIVERO

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2007

Major Subject: Economics

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Approved by:

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ABSTRACT

Capital Flows to Latin American Countries: Effects of Foreign Direct Investment and Remittances on Growth and Development. (August 2007)

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The significant restructuring of international capital flows to developing countries – in particular to Latin American countries – observed in the last quarter century has generated significant research in the area to examine its potential impact on development efforts. The resurgence of foreign direct investment (FDI) and the increasing significance of remittances, both as shares of gross domestic product (GDP), have made these types of capital flows the most analyzed.

Despite the large fraction of empirical studies that find a positive and significant relationship between FDI and economic growth, an important fact that has been so far overlooked in the literature is its impact on standards of living in host countries. This dissertation first establishes the strong complementary connection between FDI and economic growth in Latin America, measured by increases in GDP per capita growth rates, to then examine additional channels through which it could affect the welfare of the region. I first show that FDI has a positive effect on central government tax revenues, which is mainly channeled through its effect on taxes on goods and services. I then show that FDI has a positive and significant effect on the employment rates in these host countries, with female employment rate getting the largest impact – relative to males.

Remittances are another capital flow that plays a large and important role in certain economies, exceeding 10% of GDP in some countries. The impact of remittances on the main macroeconomic measures of a small open economy is analyzed in the last section using a stochastic limited participation model with cash in advance constraints and costly adjustment of cash holdings. After verifying that the model

responds adequately to standard shocks, a remittances shock is introduced to examine the dynamic response of the representative economy. The results show that a positive remittances shock forces the exchange rate to depreciate and lowers both output and consumption in the period of the shock. The positive shock lowers utility during the shock but raises it from the following period onwards, improving discounted utility after 10 years when remittances are 10% of GDP and there are no adjustment costs.

DEDICATION

To my parents Carlos and Marta, my wife Valeria, and my son Dieguito

ACKNOWLEDGEMENTS

I would like to thank all the people that supported me one way or another to achieve this goal. My most sincere appreciation to my parents Carlos and Marta for shaping my academic foundation earlier on, to my host-parents Bob and Barb for their unconditional support through my college life, and to Dr. Shailendra Gajanan for his mentoring and encouragement to pursue a higher understanding of economics.

A special thanks to my committee chair, Dr. Dennis Jansen, for his guidance and support throughout the course of this research and for the insightful comments that helped me shape my dissertation. Thanks also to my committee members, Dr. Glass, Dr. Ureta, and Dr. Gawande, for their invaluable contribution and feedback.

Finally, thanks to my wife Valeria for her patience and love, and to my son Dieguito for given me the motivation for the last push. Your emotional support made this journey much easier and enjoyable.

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1. INTRODUCTION

In the past quarter century we have observed a significant restructuring of international capital flows to many developing countries, especially through the resurgence of foreign direct investment (FDI) and the increasing importance of remittances. At the same time, other components – like international aid, portfolio equity investment, and portfolio debt investment – have decreased and become less influential. The flow of FDI and remittances to developing countries have increased significantly in this period, moving from $104 billion in 1980 to $472 billion in 2005[1].

Such capital flows from rich to poor countries are immensely interesting because they can finance investment and consumption, stimulating economic growth, helping improve the standard of living, and potentially increasing welfare in the developing world. Moreover, since a key aspect in economic development relies in the acquisition of financial and physical assets to incorporate advance technologies and create wealth, the reliance of foreign capital helps bridge the gap between savings and investment in capital-scarce economies. These capital inflows are also believe to encourage technological upgrade and financial modernization, and contribute to the growth and productivity of countries with enough human capital and infrastructure.

They are particularly important for Latin American economies for their technological lag and low levels of domestic savings, which has prompted local governments to engage in bold policies to circumvent their lack of capital. These countries have modified their government policies to become more attractive, abandoning their import-substitution policies, opening up their markets, liberalizing capital flows, loosening price and labor market controls, and making extensive use of tax incentives. At the same time they have reduced their public role in the generation of employment, privatized or capitalized most public enterprises, and concentrated on achieving a stable political and economic environment, thus increasingly relying on international capital flows for the propulsion of growth and development in the region.

This dissertation follows the style of the *American Economic Review*.

[1] World Bank's World Development Indicators.

These policy changes have not been without cost, and political unrest has grown in response to imbalances and perception of gains – or lack thereof – from such initiatives and the role of foreign capital flows, at least among some segments of society.

Recent capital flows data show that in the mid-1970s the region experienced a flood of dollars in the form of loans from U.S. and European banks (recycling Middle East oil revenues), followed by an economically devastating outflow of capital from the region after the Mexican debt default of 1982 (that spread throughout the region), with capital inflows resuming in the early 1990s (with portfolio and direct investment achieving prominence) and maintaining significant levels despite economic slowdowns, and introducing an additional important source of foreign capital in the form of immigrants' remittances beginning in the late 1990s. The last 15 years gave prominence to FDI and remittances in the overall capital flows into the region, both in terms of significance as a share of gross domestic product (GDP) and for their lower volatility compared to other types of capital flows.

Quantitatively, about $670 billion flowed to developing countries in Asia and Latin America in the 1990 – 94 period, which is about five times the $133 billion recorded in the previous five years, when there was a debt crisis and many of these countries had little o no access to international capital markets (Calvo *et. al.* (1996)). While this surge in capital inflows was initially attributed to significant improvements in domestic policies and stronger economic performance of some developing countries, it eventually became clear that this pattern was affecting countries with very diverse characteristics, thus suggesting that integration of world capital, globalization of investments, and other global factors – like cyclical movements in interest rates – were significantly important too.

The extensive structural reforms carried out by the majority of the countries in the region, together with relatively favorable external factors and increasing integration of global finance, seems to have achieved the intended goal of attracting significant amounts of foreign investment throughout this period, and particularly during the 1990s. As observed in Figure 1.1, aggregate FDI inflows to Latin America and the Caribbean

have reached record levels in the past decade, jumping from $6.1 billion in 1980 (around 0.87 percent of GDP) to $7.8 billion in 1990 and to a remarkable $76.9 billion in 2000 (around 4 percent of GDP)[2], with the major recipients in the region being Brazil, Mexico, and Argentina, accounting for around 60 percent of total flows. While this increase in FDI into the region is of an important magnitude it is somewhat misleading, since the actual share of FDI flowing to developing economies has fallen for Latin America from 52 percent in the 1970s to around 33 percent since the 1990s.

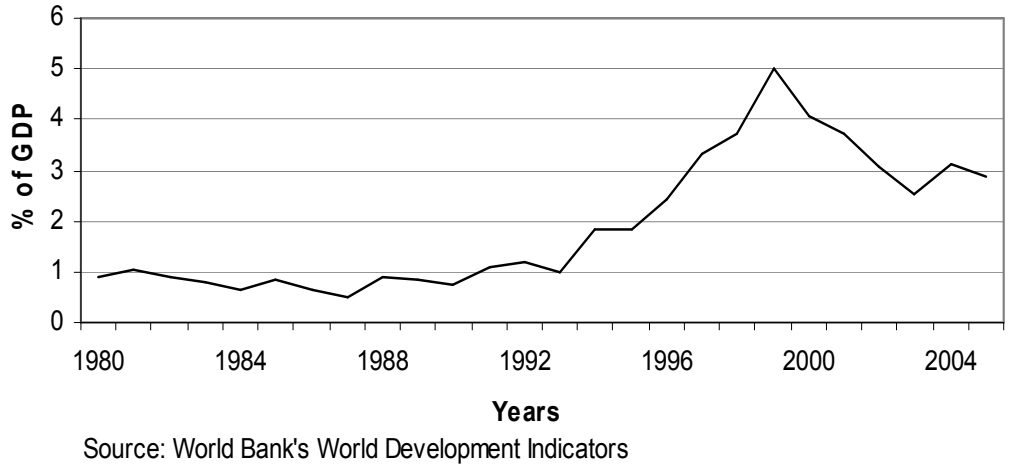
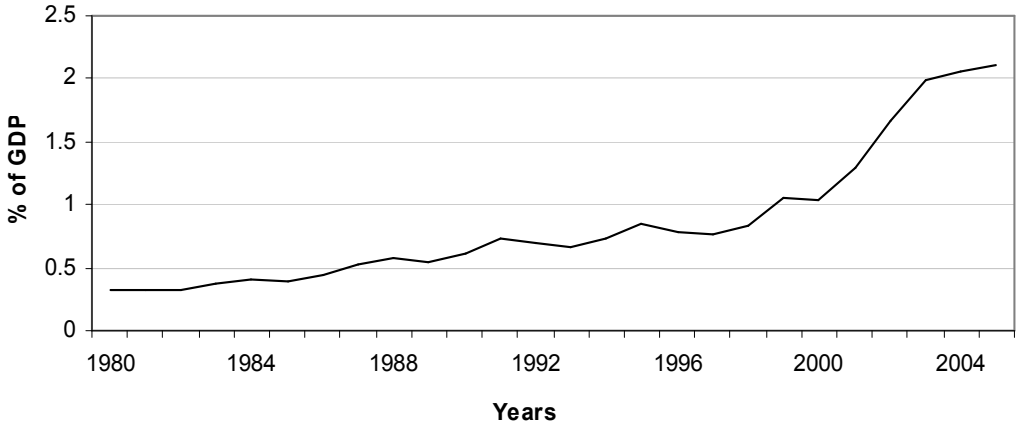


Figure 1.1: Trends of net FDI into Latin American and the Caribbean

The integration of global finance, combined with continuous flow of immigrants to developed economies, and to some degree better reporting methodology, has also resulted in a significant increase of immigrants' remittances into the region during the same period, as shown in Figure 1.2. While by the end of the 1980s the flow of remittances into Latin America slowly reached $5 billion (around 0.55 percent of GDP), by 2000 this flows reached $20 billion, and since then it almost tripled until 2005, reaching $54 billion (2 percent of GDP). Its estimated growth rate is around 10 percent per year, and it is expected to keep increasing at this pace. This graph also shows that

[2] Based on data from the Economic Commission for Latin America and the Caribbean (ECLAC) and World Bank.

while international capital flows have fluctuated with market cycles, remittances into the region have consistently increased, even during global slowdowns.



Source: World Bank's World Development Indicators

Figure 1.2: Trends of immigrant's remittances into Latin America and the Caribbean

These two flows have clearly outpaced the other components of international capital movements, and multinational development institutions have intensively examined their potential links to economic growth, becoming prominent actors in the promotion of FDI and remittances to induce faster and more efficient growth of less developed economies. While the great intensification of global trade and increased FDI – which are profit driven – has been accompanied by the increasingly accepted belief that this flows are strongly related, directly and indirectly, to growth and development, recent research also points out to immigrants' remittances as an additional source of growth, which despite not being profit driven also can promote economic growth by fueling domestic demand and improving human capital. Independently of the way in which they can generate economic growth, the understanding of the channels through which they can affect growth efforts in developing countries become crucial for policy enactment, and unveiling their impact in the region is the purpose of this dissertation.

The importance of FDI for growth and development arises from the widely accepted notion that FDI has the potential to increase the volume of investment and its efficiency, generate technological diffusion, augment the existing stock of knowledge, allow local firms to learn by watching, and finance flows that do not generate repayments of principal and interests from the local government. At the same time, this perception has given multinational corporations (MNCs) a strong bargaining position as countries intensively compete amongst themselves to attract such investment. As a result, MNCs often get significant subsidies for FDI, which gives rise to the question of whether the potential benefits of FDI are sufficient to justify subsidies and still yield a positive return to the countries involved. Theoretical models provide the framework for such positive effects of FDI on economic growth, but empirical studies are still not able to systematically corroborate this notion.

This perceived importance of FDI on economic growth is probably best described by the quote from the United Nations Conference on Development in Monterrey, Mexico, posted in the Business Roundtable's[3] web page:

> Private international capital flows, particularly foreign direct investment ... are vital complements to national and international development efforts. Foreign direct investment contributes toward financing sustained economic growth over the long term. It is especially important for its potential to transfer knowledge and technology, create jobs, boost overall productivity, enhance competitiveness and entrepreneurship, and ultimately eradicate poverty through economic growth and development.

The site further emphasizes the concrete ways in which FDI stimulates global economic growth, highlighting that "FDI creates jobs and improves worker's wages," "stimulates competitive markets," and "contributes to growth in government revenues."

However, even though a large fraction of empirical studies find a positive and significant relationship between FDI and economic growth (i.e. Borensztein *et. al.* (1998), De Mello (1999), Bengoa and Sanchez-Robles (2003), Choe (2003), Li and Liu (2005)), suggesting that FDI does in fact spur growth, an important fact that has been so

[3] Business Roundtable is an association of chief executive officers of leading U.S. corporations, committed to advocating public policies that ensure vigorous economic growth, a dynamic global economy, and the well-trained and productive U.S. workforce essential for future competitiveness.

far overlooked in the literature is the real improvement in the standards of living in the host countries, by some palpable measure, questioning the validity of those concepts of growth and development heavily measured by traditional national economic terms, like GDP. That is why assessing the influence of FDI on developing countries should also include its effect on factors that affect the standard of living more directly such as its effect on tax revenues and employment generation. Assessing the consequences of promoting FDI for national welfare through these additional measures is clearly an important task that will help scholars and policy makers to better understand the overall relevance of FDI for economic growth and development.

The first part of this dissertation fills this gap. I go beyond the increasingly accepted notion that FDI positively affects economic growth, measured as improvements in GDP or GDP growth rates, to empirically study how that positive relationship translates into palpable benefits for the host country, specifically measuring its effect on employment generation and collection of central government tax revenues in the host country. This section starts from the view that FDI's effect on economic growth should not only be measured through its effect on the level and growth rate of real GDP per capita, but also through its influence on other factors that are relevant to domestic governments, like on government tax revenues and employment levels. This is related to the study of Braunstein and Epstein (2002), but differs in the modeling strategy, the analysis of Latin American economies instead of Chinese provinces, and in the econometric specification. Here the econometric specification is based on a more comprehensive theoretical background that enables one to control for the main determinants. This study is also able to examine more closely the channels through which FDI has its greatest impact. This has the potential of yielding important insight because, from a theoretical perspective, understanding the way in which FDI affects specific sectors or components may have important repercussions for development efforts.

The second section shows that there is a strong complementary connection between FDI and economic growth in Latin America, showing that foreign investment

does contribute to the economic growth of Latin American countries, at least in terms of improvements in the real GDP per capita growth rate, so the policies implemented in order to attract FDI to foster economic growth seems to have generated the expected results. Once this positive relationship is established, I introduce the notion that developing countries are perhaps more interested on the effect of FDI on more relevant indicators, from their perspective.

In the third section I examine the effect of FDI on the performance of central government tax revenues. The idea here is that while greater foreign investment will generally lead to the production of greater output, both directly and indirectly, the intensive use of tax incentives and frequent adjustments of the tax systems to attract FDI makes its effect on tax revenues uncertain. This counteracts to some extent the traditionally conceived tax gains that occurs if FDI spurs growth, and potentially distorts this link. However, the results show that FDI has indeed a positive effect on central government tax revenues, which is mainly channeled through its effect on taxes on goods and services. FDI is found to be beneficial to less developed countries and that its effect became positive during the later period of the sample – period when inflows of FDI increased significantly.

Further insight on the effect of FDI on economic growth and development is found in the fourth section when I examine its impact on the employment rate in the region. The rise of concerns about the overall effect of FDI on domestic employment is examined using real remunerations to proxy for average wages. I also examine its specific effect on both male and female employment rates to examine if its impact has a differential effect on these gender groups. The results show that FDI has a positive and significant effect on total employment rate in these host countries, and this effect is larger for female employment rate than for male employment rate. This positive effect is particularly important for economies with low level of development and for those attracting low inflows of foreign investment, but also shows that only countries with high level of informality accrue this benefit. FDI's exerts a positive impact on periods of low inflation, with its effect becoming significant on the later period of the sample.

I then move to the examination of the other capital flow that has gained importance in the last few years, remittances, as its share has recently surpassed FDI in many countries of the region. While most of the literature on remittances has examined the immigrant's behavior and the factors that determine its remittances pattern, or the effects of such remittances on the welfare of the relatives left behind in the country of origin, here I analyze the effect of remittances flows at the macroeconomic level. In particular, the impact of remittances' shock on consumption, output, interest rates, and exchange rates is analyzed. Since this approach is novel, the effect of monetary and technology shocks on these real variables are also examined to verify consistency with existing analyses.

Section 5 shows that a remittances shock in the model without adjustment costs will slightly increases the nominal interest rate, decreasing slightly output and consumption, and generating a small but continuous depreciation of the nominal exchange rate. When there are adjustment costs the dynamic response of the nominal interest rate is reversed in sign and increased in magnitude. The response of output and consumption are also magnified. In addition, adjustment costs also produce the overshooting of the nominal exchange rate. It is also found that relaxation of the cash-in-advance constraint or the loanable-funds constraint have only marginal impact on the dynamic responses of the main variables to a shock, with only the magnitudes being affected but not the signs. Also, its impact on the steady state of the economy shows that a doubling of remittances decreases output, physical capital, and worked hours, while it slightly increases consumption.

The results show that utility falls as a result of a one percent positive remittances shock irrespective of the existence of adjustment costs or the share of remittances in the economy, but it quickly recovers to levels above the initial utility level and remains higher thereafter. This means that while the positive remittances shock has a negative effect on utility the period of the shock, the negative effect slowly diminishes as we discount future utility, and can even result in a welfare improvement as shown in the case of no adjustment cost for the economy with remittances being 10 percent of GDP.

With regards to the impact of the remittances shock on the trade balance, I find that the positive remittances shock decreases the trade deficit the period of the shock irrespective of the existence of adjustment costs or the share of remittances in the economy, but that while the trade deficit quickly returns to levels beyond the initial deficit when there are no adjustment costs, the improvement in the trade balance is long lived when there are positive adjustment costs, having smaller deficits for up to 10 periods.

2. FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH

2.1 Introduction

The objective of this section is to determine if there exists a positive impact of FDI on economic growth in Latin America, measured by the traditional GDP per capita growth rate. Theoretical models provide the framework for a positive effect of FDI on economic growth, but empirical studies are still not able to corroborate this notion consistently, perhaps due to the different econometric techniques and samples used. While a large fraction of empirical studies find a positive and significant relationship between FDI and economic growth for developing economies, suggesting that FDI does in fact spur economic growth, specific studies of such relationship to measure its impact in Latin America is minimal.

This section analyzes the different factors that contribute in the actual allocation of FDI in Latin America and its influence in promoting growth and development in these developing nations, to then establish in the next two sections if the perceived link between the relative national economic growth of each country and the implied relative improvement in the standard of living of their people is in fact accurate. The main-stream studies in this area are largely concentrated in the growth induced at a national level, GDP, standardized economic mean, per-capita GDP (in levels or growth rates), or other close variations of these economic measures - which is done in this section - but they only imply that such effect would translate in real improvement in the standards of living in developing countries, which at the end is perhaps more relevant to developing countries and their people.

The economic literature suggests that a higher level of foreign investment contributes to the creation of wealth in host countries, in particular in developing countries. When one examines the relationship between inflows of FDI and the level of

GDP per capita in Latin America, for the period 1980 – 2002, a clear positive relationship is observed if one excludes the outliers at low levels of real GDP per capita. The high levels of FDI at low levels of GDP per capita shown as outliers are the massive investments done in Bolivia and Nicaragua in the late 1990's. This initial positive interdependence between FDI and GDP per capita is shown in Figure 2.1 below, with FDI as a percentage of GDP graphed in the vertical axis and real GDP per capita in the horizontal axis.

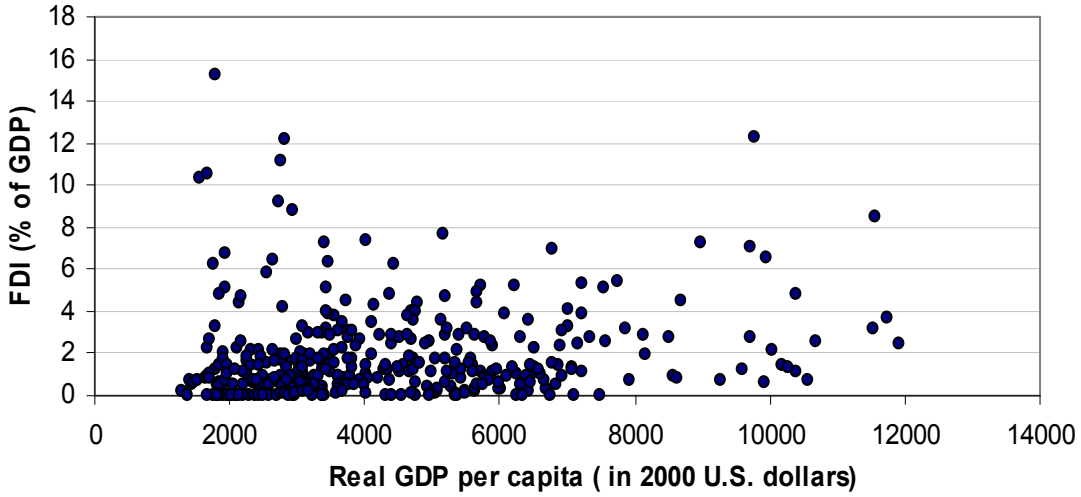


Figure 2.1: FDI and real GDP per capita for sample countries

However, when one uses real GDP per capita growth rates to measure economic growth this relationship becomes less clear, as observed in Figure 2.2. Here we have FDI as a percentage of GDP in the vertical axis and the annual real GDP per capita growth rates in the horizontal axis. The large cluster at low levels of FDI and growth rates is still present if one controls for outliers. In addition, while no basic relationship can be found between these two measures, a bigger concerns arises when one tries to establish causality, since solid arguments suggests both that higher levels of FDI will fuel higher

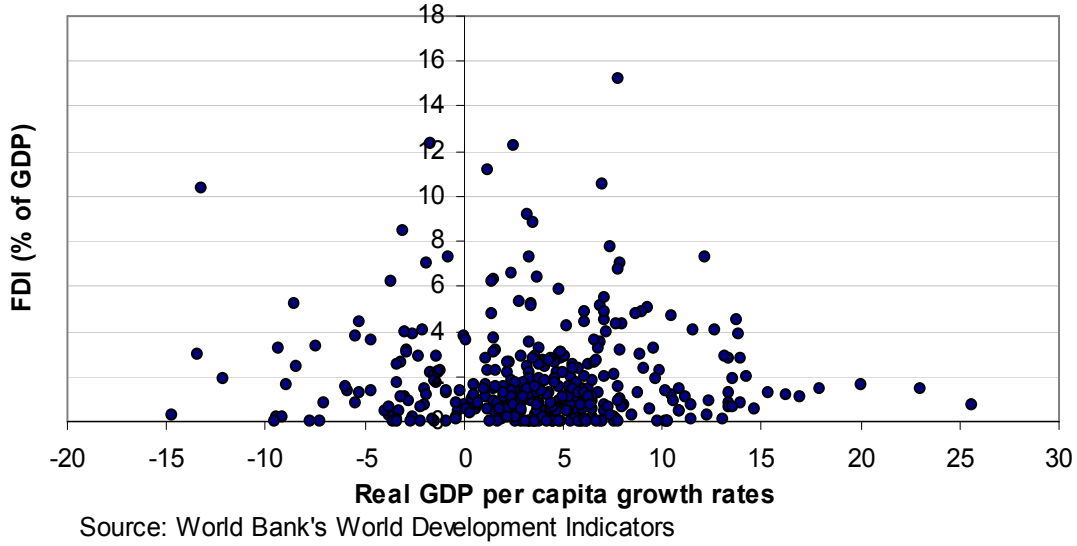


Figure 2.2: FDI and real GDP per capita growth rates for sample countries

rates of growth and that higher rates of economic growth will generate higher levels of FDI into the country.

The expected positive impact of FDI on economic growth arises from the perception that FDI increases the stock and quality of physical capital in the recipient economy, and by inducing human capital development – both in MNCs and domestic firms – that promotes technological upgrading throughout the economy. Additionally, potential externalities also contribute to fuel economic growth, like from the implementation of superior managerial practices and improved chains of production. This positive effect on growth requires some degree of complementary with domestic investment, infrastructure, and human capital (De Mello (1999), Borensztein *et. al.* (1998), Alfaro *et. al.* (2004), Damijan *et. al.* (2003)), at least in the short run.

FDI is an instrument that allows firms to transfer capital, technology, and organizational skills from one country to another. It requires the parent company to hold at least 10 percent of equity in the affiliate of the receiving country. The considerations that influence the firm's investment abroad can be described as stressing differences in the cost and quality of productive factors in different countries, the possibility of using

entirely different technological processes, and the use of economies of scale in production. The essence of FDI for MNCs lies in the transfer and exploitation of knowledge, and maximizing economic rent on that knowledge follows as the appropriate aim for choosing this type of operation.

From the perspective of developing countries, particularly since the new growth theory highlighted the role of technology, human capital, and knowledge, the MNCs are seen as a major vehicle for accessing technology and frontier knowledge. This is because MNCs are characterized by high levels of research and development, placing them amongst the world's most technologically advanced enterprises, and hence, potentially major sources of knowledge. Clearly, for a given firm to have become international suggests that it has outperformed domestic competition as well as foreign competition in some dimension. Moreover, local governments tend to favor MNCs since they are usually larger, more capital intensive, have higher factor productivity, hire more skilled labor, pay their workers higher wages, and are greatly inclined to export relative to domestic firms.

These potential benefits – and the liberalization of international trade – have provided the incentives for both sides to increase foreign investment, with developing countries competing amongst themselves to attract a larger share of FDI and with MNCs capitalizing on this notion to achieve the largest concessions possible. But are incentives that important in attracting FDI? Most governments seem to agree that they are, but many economists place them only at the margin, arguing that other factor act as more important determinants.

MNCs are usually more inclined to penetrate foreign markets through FDI when trade costs are low, firm-level scale economies are high, plant-level scale economies are low, and when the host-country's market size is large. They also respond to the existing stock of FDI, the quality of infrastructure, and the level of industrialization of the receiving economy. In addition, MNCs will also take into account differences in labor costs, tax rates, and economic conditions when making their location decisions. Furthermore, theory also predicts that firms will penetrate foreign markets through

vertical FDI when factor-costs differences between countries are large and through horizontal FDI when countries are similar in terms of markets size and factor cost.

Because FDI affects growth directly by increasing the stock of physical capital in the recipient economy, and indirectly by inducing human capital development and promoting technological upgrading, international organization like the World Bank, World Trade Organization, and the International Monetary Fund have being promoting FDI as the best way to channel funds and technology to developed and developing countries in order to promote higher rates of economic growth. Countries have systematically embarked on this reasoning and began to actively promote their countries in order to attract MNCs (FDI).

Among the approaches taken by countries to attract more FDI include a general improvement in the investment environment in the receiving countries, mainly through improvements in infrastructure, liberalization of the economy, and granting of various incentives, among them tax incentives. These improvements induce multinational firms to invest abroad as they lower production costs and so raise the incentives to create patents, trademarks, or other assets which sustain headquarters activities. It raises the economic benefits of FDI relative to exporting and arms-length production in the host country, with subsidies only enhancing the relative attractiveness of locating production in the country offering the largest incentives.

Borensztein *et. al.* (1998) findings also suggest that FDI is in fact an important vehicle for the transfer of technology, contributing to growth in larger measure than domestic investment. Moreover, they find that there is a strong complementary effect between FDI and human capital. That is, the contribution of FDI to economic growth is enhanced by its interaction with the level of human capital in the host country, which tends to improve the human capital levels in the domestic economy. In a similar note, De Mello (1999) argues that the extent in which FDI is growth enhancing depends on the degree of complementarity and substitution between FDI and domestic investment. While these contemporaneous effects are established under such interactions, UNCTAD

(1999) shows that FDI also affects the following period's growth rate if a given level of human capital is present.

Tsai (1994) points out that the market size and the growth rate of the host country are two significant determinants in the allocation of FDI too. The market size becomes important for MNCs interested in servicing the host market, as it requires a significant market size to allow the MNCs to efficiently utilize their economies of scale and scope. The idea is that the host country would need to be of an acceptable market size to attract FDI, and after reaching a given threshold it is expected to induce a continuous inflow of FDI. This in turn will induce further growth through the additional foreign investment flowing into the country due to this positive signal. So, if the host country hast a growing economy, it will attract FDI – as it provides better opportunities to make profits than a static or slow growing one – and if more FDI flows into a country, it will accelerate economic growth in the receiving country.

This last point is the center of discussion of recent research, as the relevance of the potential endogeneity between economic growth and FDI became central for estimation accuracy, and recent studies actively test for its existence. Choe (2003) uses panel VAR to show that there exists a strong positive association between FDI inflows and economic growth (FDI Granger-causes growth, and vice versa), while Bengoa and Sanchez-Robles (2003) and Li and Liu (2005), among others, tackle this issue applying various econometric methods in their panel data samples, and they find a significant endogenous relationship between FDI and economic growth. The approach taken here is similar to the one taken in these studies, actively testing for endogeneity between FDI and economic growth, and correcting for it if necessary in the corresponding estimation.

2.2 Data and Methodology

The data for this section comes from the World Bank's World Development Indicators 2004 (WDI), from the Economic Commission for Latin America and the Caribbean's (ECLAC's) 2004 Statistical Yearbook, and from Barro and Lee's measures

of educational attainment (1995). The sample used is composed of 17 Latin American countries and encompasses the period 1980-2002, with yearly observations.[4] The sample excludes countries that serve as offshore financial centers, are too small, have special governmental controls, or lack adequate data. These countries are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Rep., Ecuador, Guatemala, Honduras, Jamaica, México, Nicaragua, Paraguay, Perú, Uruguay, and Venezuela.

Following Romer (1990), Levine and Renelt (1992), and Li and Liu (2005), a set of robust variables for modeling growth are identified. In addition to the standard determinants used in the literature to explain economic growth, the world interest rate is also used to incorporate the notion that international economic conditions also matter in the decision to invest abroad (Calvo *et. al.* (1996)).[5] However, measures like black market premium and the inflation rate were omitted in the analysis, as it was not possible to obtain sufficient data for the former and the latter had an extremely volatile behavior in the sample period, with many countries experiencing hyperinflations.

The growth equation used in the study is:

$$g_{i,t} = \beta_0 + \beta_1 \ln y_{i,t-5} + \beta_2 POP_{i,t} + \beta_3 SCH_{i,t-5} + \beta_4 INV_{i,t} + \beta_5 FDI_{i,t} + \beta X_{i,t} + \varepsilon_{i,t}$$

where $g_{i,t}$ is the GDP per capita growth rate of country *i* at time *t*, $y_{i,t-5}$ is the lagged by five years GDP per capita to account for initial economic conditions, $POP_{i,t}$ is the population growth rate to control for market size growth, $SCH_{i,t-5}$ is a lagged by five years measure of education to evaluate existing human capital (proxied by secondary school attainment), $INV_{i,t}$ is the ratio of gross domestic investment to GDP (% of GDP), and the $FDI_{i,t}$ is the ratio of FDI inflow to GDP (% of GDP). The matrix $X_{i,t}$ is composed of additional variables used to include further determinants, like an infrastructure measure given by the number of fixed and mobile telephone lines per 1000

[4] Li and Liu (2005) have used a panel of yearly observations. In order to control for business cycles here, similar analysis was done with 5-year averages also, but the tests for endogeneity were negative.

[5] Measures for civil liberties and political rights were also included to incorporate Bengoa and Sanchez-Robles (2003) notion of the importance of domestic stability in investment decisions, but they did not add any significant effect nor altered significantly the results, so they are not included in the results.

people and a *gap* measure to calculate the technological disadvantage of a country relative to a leading economy (here I use the U.S. as the leading economy).[6] This last measure is expected to be negatively related to growth, as a larger technology gap makes harder the adoption of new technology and thus tend to slow down economic growth.

The second equation is given by a foreign direct investment equation:

$$FDI_{i,t} = \alpha_0 + \alpha_1 g_{i,t} + \alpha_2 \ln y_{i,t} + \alpha_3 SCH_{i,t-5} + \alpha_4 trade_{i,t} + \alpha X_{i,t} + \varepsilon_{i,t}$$

where $y_{i,t}$ is the current GDP of country *i* at time *t* and measures income and the strength of the market, $trade_{i,t}$ is the ratio of trade to GDP and measures trade openness (imports plus exports over GDP). The matrix $X_{i,t}$ is composed of additional variables used to include further determinants, like the domestic interest rate, world interest rate, political rights, civil liberties, and others.

Common in the growth literature was to estimate these two equations separately, which will give rise to biased estimates if there is an endogenous relationship between FDI and economic growth, and vice versa. Furthermore, even if one corrects for such endogeneity by employing instrumental variable estimation, there is still the omission of the potential correlation among the disturbances of the different structural equations, thus requiring the use of a system of equations to take into account the variance-covariance matrix of the disturbances of the whole system. In order to decide if it is necessary to use an instrumental variable, i.e., whether a set of estimates obtained by least squares is consistent or not, the Durbin–Wu–Hausman test (augmented regression test, referred as DWH from here on) for endogeneity is performed on each equation separately, as suggested by Davidson and MacKinnon (1993).[7]

If the DWH endogeneity test suggests that FDI is endogenous in the growth regression, and that GDP per capita growth is endogenous in the FDI equation, then the

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[6] Explicitly, $gap_{i,t} = (y\max_t - y_{i,t}) / y_{i,t}$, where U.S. GDP per capita (constant 2000 US$) is used as *ymax*.

[7] Davidson and Mackinnon (1993) suggest an augmented regression test (DWH test), which can easily be performed by including the residuals of each endogenous right-hand side variable, as a function of all exogenous variables, in a regression of the original model. If the estimate of the "endogenous" variable is significantly different from zero, then the estimate is not consistent and we have endogeneity.

appropriate estimation technique should be simultaneous equations (Baltagi (2001)). Consequently, when endogeneity runs both ways, a 3SLS estimation procedure would be implemented in order to study the effect of FDI on economic growth, following Baltagi's (1981) error components methodology. His proposed estimator is given by:

$$\hat{\delta}_{EC3SLS} = \left[\widetilde{Z}'(\Sigma_{\upsilon}^{-1} \otimes P_{\widetilde{X}})\widetilde{Z} + \overline{Z}'(\Sigma_1^{-1} \otimes P_{\overline{X}})\overline{Z}\right]^{-1}\left[\widetilde{Z}'(\Sigma_{\upsilon}^{-1} \otimes P_{\widetilde{X}})\widetilde{y} + \overline{Z}'(\Sigma_1^{-1} \otimes P_{\overline{X}})\overline{y}\right]$$

where variables with a tilde represent within transformations and variables with a bar represent between transformations. P_A represents the projection matrix of A. This estimator is obtained by first estimating the within and between 2SLS estimates of each structural equation, computing the disturbances of the covariance matrix $\hat{\Sigma}_1$ and $\hat{\Sigma}_{\upsilon}$ and then obtaining the Cholesky decomposition of $\hat{\Sigma}_1^{-1}$ and $\hat{\Sigma}_{\upsilon}^{-1}$, transforming the system by the resulting matrices and applying 3SLS on the transformed system with the relevant set of instruments.

Consistent estimates of $\hat{\Sigma}_1$ and $\hat{\Sigma}_{\upsilon}$ can be obtained using within 2SLS and between 2SLS residuals with

$$\hat{\sigma}^2_{\nu_{jl}} = (y_j - Z_j\hat{\delta}_{j,W2SLS})'Q(y_l - Z_l\hat{\delta}_{l,W2SLS})/N(T-1)$$

$$\hat{\sigma}^2_{1_{jl}} = (y_j - Z_j\hat{\delta}_{j,B2SLS})'P(y_l - Z_l\hat{\delta}_{l,B2SLS})/N$$

where Z_i is the matrix composed of right-hand side endogenous and exogenous variables for each structural equation i, y_i is the $NTx1$ matrix of left-had side dependent variables for each structural equation i, P is a matrix which averages the observations across time for each individual country, Q is a matrix which obtains the deviations from individual means, and the $\hat{\delta}_i$ is the vector of parameter estimates through within estimation in the first equation and through between estimation in the second equation, for each structural equation i.

2.3 Results

In order to decide if fixed-effects or random-effects is the right specification for

the estimation of each equation, I first perform a Hausman tests on each of the basic specifications, rejecting the null that the individual invariant effects are not correlated with the explanatory variables. These tests suggest that fixed effects should be used for both the growth and the foreign direct investment equation[8], and that is how estimation proceeds.

The results for the growth equation are presented in Table 2.1, with column 1 showing the estimates of the basic specification that led to the use fixed-effects (F.E.). The coefficients are in general consistent with previous estimates obtained in the growth literature, with the exception that two of the "robust" determinants of growth are not statistically significant even if they have the correct sign.[9] The effect of the lagged GDP measure is negative and significant, which is in accord with the convergence literature that indicates that countries further away from their steady state will grow faster, and the effect of the human capital measure is positive and significant, indicating that higher levels of human capital facilitate economic growth. The measure for technology gap is negative and significant, also in accord with the notion that countries with further lags from leading technological levels will grow slower. With regards to the infrastructure measure, its effect is in the opposite direction than hypothesized, but it is statistically insignificant at any conceivable level.

The effect of the variable of interest in this study, the foreign direct investment measure, is positive and significant when entered alone, indicating that a higher level of FDI – as a percentage of GDP – leads to a higher growth rate of GDP per capita in Latin American economies. The estimate suggests that a 10 percentage point increase in the share of FDI to GDP will result in almost a 1 percentage point increase in the growth rate of GDP per capita. When FDI is interacted with the technology gap measure, the estimate is negative and statistically significant, indicating that a higher level of FDI combined with a smaller technological gap leads to higher growth rates.

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[8] A poolability test was performed for each specification across countries, but the results are not fully satisfactory in all of its dimensions. Given that this is the norm rather than the exception, I continue using the panel.

[9] The population growth measure is not significant throughout the study, perhaps for the way that yearly data is constructed, while the domestic investment measure insignificance is perhaps due to potential substitutability with foreign investment.

Table 2.1 – Growth Specification

	(1) F.E.	(2) Early Period	(3) Later Period	(4) Less Developed	(5) More Developed
Const.	44.602**	23.167	104.13***	36.740**	70.972*
	(17.831)	(31.657)	(31.555)	(18.777)	(41.751)
Log(Lagged GDP)	-5.3555**	-3.5672	-11.107***	-5.115**	-5.6438
	(2.2227)	(4.0368)	(3.9743)	(2.3905)	(5.2653)
Pop. Growth	-1.2910	.75059	-3.2005	-.22911	-5.4610**
	(1.0399)	(2.0126)	(2.1980)	(1.1529)	(2.4708)
Dom. Investment	.01906	.01233	.00095	.11466**	-.15389
	(.04892)	(.08867)	(.07495)	(.05002)	(.12450)
Sec. School Attain	3.1540*	1.2654	-.73575	-.68234	3.6774
	(1.9156)	(5.0273)	(3.4806)	(2.7085)	(3.2074)
FDI	.62140*	.77426	-.14378	.89714**	.05703
	(.32915)	(2.1358)	(.36526)	(.36790)	(1.0533)
Infrastructure	-.00574	.06245	-.01146**	.00785	-.01151
	(.00502)	(.05590)	(.00521)	(.00676)	(.00914)
Tech. Gap	-.18372*	-.13311	-.63919***	-.05827	-2.2123**
	(.10636)	(.16838)	(.23615)	(.10601)	(.95739)
FDI*Infrastructure	-.00094	.00887	.00106	-.0023**	-.00148
	(.00109)	(.02560)	(.00111)	(.00117)	(.00307)
FDI*Tech. Gap	-.00174	-.04322	.01000	-.01014	.14669
	(.01029)	(.08447)	(.01148)	(.01127)	(.14027)
R-square	0.0962	0.0576	0.2439	0.1362	0.1628

Notes: Values with *** are significant at the 1% level, ** are significant at the 5% level, and * are significant at the 10% confidence level. Standard Errors in parentheses.

The remaining columns are part of a sensitivity analysis. Columns two and three present the results for the 1980-1991 and 1992-2002 sample periods, respectively. In the first sample period most of the independent variables have the correct sign, with the exception of the human capital, but are not statistically significant at any conceivable level. While this cut surprisingly lacks explanatory power, these results are in a sense expected since the 1980's are considered as the "lost decade" for Latin America, a period with high volatility of many economic indicators and slow growth rates. The second sample period has the initial economic level and the technological gap measure being statistically significant, with their impact in the expected direction, but results in the infrastructure measure being statistically significant and negative, suggesting that

less infrastructure accelerates economic growth. This result contradicts previous findings, and is perhaps driven by the proxy for infrastructure.

Even if the 1990's were more stable and the region grew at a higher rate, it seems that the "robust determinants" are not as strong as believed to explain growth in the region. Columns four and five present the results for samples with lower and higher GDP per capita levels, with an initial GDP per capita of U.S. $2,500 being the threshold. In the sample for countries with low GDP per capita levels we have four statistically significant variables, all with the expected sign, with the FDI measure having a larger effect on economic growth than in the whole sample (0.897 instead of 0.621), while in the sample for countries with higher GDP per capita we can observe that we loose explanatory power with relation to the previous cut, with the technology gap having the expected negative impact and with the population growth having the expected negative effect on economic growth. The rest of the determinants are not statistically significant at any conceivable level. So in general, while FDI affects positively the growth rates of Latin American economies, it does it in a larger scale in poorer countries relative to the whole sample.

The results for the foreign direct investment equation are presented below in Table 2.2, where column one also shows the basic specification that leads to the use fixed effect. Here the estimates are also consistent in general with results previously found in the growth literature, with the exception of the human capital and the domestic interest rate. The purchasing power of the economy has a positive and significant effect on the attraction of FDI, signaling that increases in income make countries more attractive for MNCs, perhaps indicating that the type of foreign investment in Latin America is to satisfy domestic demand. The effect of the trade and the infrastructure measures are both positive and statistically significant, indicating that countries with higher levels of openness and with higher infrastructure are able to attract higher levels of foreign direct investment into their economies, and the effect of the world interest rate is negative and statistically significant. This last estimate supports the point that external conditions are also important in the determination of investment patterns in Latin

America raised by Calvo *et. al.* (1996). The effect of GDP per capita growth rate is positive and statistically significant, which indicates that higher growth rates lead to higher flows of FDI coming into the domestic economy.

As it is done in Table 2.1, here the remaining columns are also part of a sensitivity analysis, with columns two and three presenting results for the 1980-1991 and 1992-2002 sample periods, and columns four and five presenting results for countries with lower and higher levels of initial GDP per capita, respectively. In the first sample period, the purchasing power of the domestic economy and the openness measures are positive and statistically significant, while in the second sample period the purchasing power of the domestic economy and the infrastructure measures are positive and statistically significant. Having higher incomes helps attract higher levels of FDI, irrespective of the sample period. When looking at countries according to their level of development, I find that the infrastructure measures and the growth rate of the economy

Table 2.2 – Foreign Direct Investment Specification

	(2) F.E.	(3) Early Period	(4) Later Period	(5) Less Developed	(6) More Developed
Const.	-8.6670	-26.470***	-62.358***	-10.395	-2.8544
	(6.2719)	(6.1570)	(17.245)	(7.3844)	(11.414)
GDPPC growth	.06656***	.00635	.02990	.09660***	.04596**
	(.02079)	(.01323)	(.04545)	(.03078)	(.02273)
Log(GDP)	1.3380*	3.3441***	8.2961***	1.5889	.36848
	(.80305)	(.80559)	(2.2868)	(1.0170)	(1.3675)
Trade	.01783**	.01812***	.00483	.01435	.03600**
	(.00783)	(.00607)	(.01756)	(.00935)	(.01403)
Sec. School Attain	.53824	1.8248	.71704	2.7549**	-1.5355*
	(.73902)	(.83898)	(1.8869)	(1.1838)	(.78681)
Interest Rate	.00040	.00011	-.01029	.00121	.00028
	(.00175)	(.00090)	(.01195)	(.00200)	(.00428)
World Int. Rate	-.15258***	.00566	-.04010	-.17958***	-.03464
	(.03160)	(.02798)	(.11104)	(.04144)	(.04213)
Infrastructure	.00518***	-.00077	.00379**	.00406**	.00721***
	(.00136)	(.00792)	(.00185)	(.00202)	(.00155)
R-square	0.3806	0.1876	0.2328	0.4303	0.4116

Notes: Values with *** are significant at the 1% level, ** are significant at the 5% level, and * are significant at the 10% level. Standard errors in parentheses.

exert a positive and statistically significant effect on the attraction of FDI, irrespective of the level of development of the economy. The world interest rate measure has a negative and statistically significant effect on FDI, and the human capital measure has a positive and significant effect on FDI, for countries with a low GDP per capita, while openness has a positive and statistically significant on FDI, but the human capital present a negative and statistically significant effect on FDI, for the other set of countries. This last negative effect of human capital is the only effect which is not in accord with previous results, perhaps suggesting that MNCs are looking for countries with large pools of unskilled labor – low levels of education.

It is interesting to note that the suggestion that GDP per capita growth rates affect FDI decisions positively is confirmed here for the whole sample and for more and less developed countries.

The results above clearly show that FDI is a significant determinant of real GDP per capita growth rate, and the real GDP per capita growth rate is a significant determinant of FDI. This means that FDI has a positive impact on economic growth, which in turn also affects positively the level of FDI, implying that the results found with separate equations may be biased estimates. This gives rise to the need to test for the interdependency of these two variables. As mentioned earlier, the Durbin-Wu-Hausman test for endogeneity is applied to each equation, and since the test was not able to reject the null of endogeneity in neither equation, 3SLS estimation is used to estimate the system of the two equations.

The results of the error components 3SLS estimation are presented below in Table 2.3, which summarizes the estimates of all of the parameters obtained by applying 2SLS to the within dimension of the data, EC2SLS[10], and EC3SLS. As the interest of this analysis is in the effect of FDI on economic growth, I will concentrate in the estimated coefficients of the two variables of interest, the FDI measure and the growth rate. In column one it is shown that all of the within estimates that are statistically significant have the theoretically expected signs, with the exception of the purchasing

[10] Since the within and between estimates are obtained in order to perform the error components three-stages least squares, the results are also included in the table for comparison.

Table 2.3 – Simultaneous Equation Estimation

	(1)	(2) EC2SLS		(3) EC3SLS	
Variables	Within	Growth	FDI	Growth	FDI
Constant	____	15.003*	____	13.474	____
		(5.4429)		(9.1878)	
FDI	6.1502*	3.4025*	____	1.6591*	____
	(1.6301)	(0.5936)		(0.6814)	
Education	-3.7134	-0.7361	____	-0.8568	____
	(3.1875)	(0.6757)		(1.1840)	
Pop. Growth	4.2023*	-1.0993*	____	-0.7134	____
	(2.0760)	(0.3175)		(0.5024)	
Infrastructure	0.0221*	0.0086*	____	-0.0170*	____
	(0.0103)	(0.0045)		(0.0049)	
Investment	-0.0178	-0.0166	____	-0.0042	____
	(0.0652)	(0.0317)		(0.0382)	
Lagged GDP	-1.7847	-1.8933*	____	-1.2822	____
	(3.0950)	(0.6128)		(1.0349)	
Tech. Gap	0.2683	0.0004	____	-0.2061*	____
	(0.1899)	(0.0639)		(0.0750)	
FDI*Tech.gap	-0.1435*	-0.0826*	____	0.0033	____
	(0.0425)	(0.0173)		(0.0179)	
FDI*Infrastructure	-0.0132*	-0.0075*	____	-0.0002	____
	(0.0037)	(0.0016)		(0.0017)	
Constant	____	____	9.2601*	____	9.6550*
			(2.1300)		(2.0310)
RGDPPCG	0.4785*	____	0.3562*	____	0.4727*
	(0.0825)		(0.0595)		(0.0466)
World Int. Rate	-0.0519	____	-0.0878*	____	-0.0561*
	(0.0488)		(0.0445)		(0.0336)
Education	-0.3218	____	0.5773	____	0.5040
	(1.0654)		(0.6032)		(0.5444)
Trade	0.0163	____	0.0055	____	0.0046
	(0.0111)		(0.0062)		(0.0054)
Infrastructure	0.0126*	____	0.0093*	____	0.0102*
	(0.0024)		(0.0018)		(0.0016)
Log(GDP)	-3.1209*	____	-1.0492*	____	-1.1430*
	(1.4391)		(0.2845)		(0.2699)
Dom. Int. Rate	0.0042*	____	0.0022	____	0.0009
	(0.0020)		(0.0024)		(0.0017)

Note: Values with * represent significance at least at the 10% confidence level. Standard Errors in parentheses.

power of the domestic economy[11] in the foreign investment equation, and the population growth measure and the interaction of FDI and infrastructure in the economic growth equation. Beginning in this step, the results show that both variables of interest – FDI and the growth rate – are positive and statistically significant.

The second column of Table 2.3 presents the error components 2SLS as derived by Baltagi (1981), where the dependent variable of each equation is the indicated in the heading of each column. In the growth equation all the statistically significant variables – with the exception of the measure that accounts for the initial economic conditions – have the expected sign, as it does the FDI measure when entered alone and when entered in the interaction with the technology gap measure, but it presents a somehow conflicting sign when entered in the interaction with the infrastructure measure, indicating that higher levels of FDI together with higher levels of infrastructure lead to lower growth rates. In the foreign direct investment equation both the growth rate and the infrastructure measures are still positive and statistically significant, while the international interest rate also becoming statistically significant and presenting the expected sign. The purchasing power of the domestic economy is still statistically significant and continues to the opposite sign than expected (see footnote 11 above).

The results obtained when accounting for the variance-covariance matrix of the disturbances of the whole system in the error components estimates are presented in the last column. This is the econometric technique that accounts for all the specification concerns raised in previous analyses. The results of the growth equation show that the technology gap measure and infrastructure are both negative and statistically significant, indication that closing the technological difference to the leading economy will contribute to higher growth rates in the first case, which is in accord to the theory discussed above, but that further improvement in infrastructure will slow down economic growth in the region, which opposes existing arguments on the expected effect of infrastructure. With regards to FDI, it continues to exert a positive and significant

[11] All of the estimates of the domestic purchasing power in the simultaneous-equations estimation are negative and statistical significant, indicating that a MNCs investment in the region is attracted by cheap labor costs (workers in countries with low incomes) and perhaps producing for foreign markets.

effect on economic growth, indicating that a 1 percentage point increase in the share of FDI to GDP will increase the growth rate of the receiving economy by more than 1.6 percentage points.

The results of the foreign direct investment equation show that the positive effect of infrastructure on the attraction of FDI is statistically significant, corroborating the previous findings that have led developing countries eager to attract foreign investment to invest heavily in their infrastructure capability to facilitate the production efforts of MNCs. The results also show the negative and statistically significant effect of both the international interest rate and the domestic purchasing power on FDI, the first in accord with the claim that MNCs will take advantage of lower international interest rates to expand production to foreign markets (Calvo *et. al.* (1996)) but the second in contradiction with its hypothesized effect, which suggests that MNC's are perhaps chasing lower labor costs to produce for foreign markets instead of domestic ones. It also shows that economic growth has a positive and significant effect on the attraction of FDI, indicating that a 10 percentage points increase in the growth rate will lead to almost 5 percentage points increase in the share of FDI to GDP.

These results show that the main variables of interest are both positive and statistically significant throughout the estimation, and only their magnitude fluctuates as we introduce the additional steps required to estimate the system of equation through error components 3 stages least-squares. The magnitude of the unbiased FDI coefficient is almost a third of the estimate under the within dimension and almost half of the estimate obtained in the 2SLS, while the magnitude of the unbiased FDI coefficient is practically the same than the one obtained under the within dimension of the data and almost 30 percent larger than the one obtained through the error components 2SLS estimation. These results are consistent with those found in other studies, in the sense of the positive and significant effect, and while not comparable, shows its effect being around three times larger than that found by Li and Liu (2005) for a group of 84 countries and Bengoa and Sanchez-Robles (2003) for 18 Latin American countries, both using data from 1970 to 1999. Even if some of the determinants of economic growth are

not statistically significant in the simultaneous-equations estimation, the fact that they are used as controls to investigate the effect of FDI on economic growth should lessen their statistical importance here.

It can be argued that one of the problems of the current specification is the fact that yearly observations are used in the analysis, thus incorporating all the noise that arises from the business cycles that have affected the region in the sample period. In trying to deal with this matter, the same analysis was done with 5-year averages but the DWH endogeneity tests came out negative, allowing one to conclude that endogeneity is not present and that single equation estimation is the proper estimation technique to be used. Also, while some researchers argue that FDI's impact on economic growth presents a lag, the estimation through a system of equations does not allow one to examine this. However, it is also argued that most of FDI's effect occurs in the implementation of the project, and thus being contemporaneous, which seems reasonable since enough time is allowed then for FDI to exert its impact in the receiving economy. Here the estimation using yearly data then is the appropriate choice for this study.

2.4 Conclusions

This section shows that there is a strong complementary connection between FDI and economic growth in Latin America. This gives support to the economic policies implemented in Latin America for the last decades in order to spur economic growth. The potential benefits attributed to FDI seems to have materialized, and that the increase in the volume of investment and its efficiency has generated technological diffusion sufficient to augment the existing stock of knowledge, facilitating the use and exploitation of local raw resources, and thus enhancing the growth initiatives in the region.

While the modeling strategy used in the analysis does not allows one to fully determine the impact of the main variables that influence economic growth in the region, the contribution of these determinants to control for such effects and allow one to

estimate the impact of FDI on economic growth is what is important. However, this modeling strategy allows one to incorporate the simultaneous dynamics of foreign investment and economic growth, and the results reinforce the advice given by the multinational organizations working in the promotion of economic growth about the importance of infrastructure and the health of the receiving economy to attract FDI. The study quantifies the effects of the main determinants of economic growth and FDI inflows, accounting for the interdependency of economic growth and FDI, and provides unbiased estimates of these two effects.

The results indicate that foreign direct investment does contribute to the economic growth of Latin American countries, at least in terms of improvements in GDP per capita growth rates. However, the current analysis shows the economic improvements in Latin America brought about by the inflow of FDI but does not indicate improvements in the living standard of its population. As previously noted, improvements in GDP per capita do not necessary translates in higher incomes, lower unemployment rates, or higher tax revenues in the future, so this results provide us with the general benchmark of economic growth to allow us to further explore the ways in which economic growth might translate in better standards of living. More specifically, in the next two sections I examine the effect of FDI on central government tax revenues (as total tax revenues and as the main components of it) and employment levels to verify if the economic growth induced by FDI in fact generates palpable benefits for its people, measured by these additional indicators.

3. FOREIGN DIRECT INVESTMENT'S EFFECT ON CENTRAL GOVERNMENT TAX REVENUES

3.1 Introduction

In the previous section it was established that FDI exerts a positive and significant effect on GDP per capita growth rates, which usually fuels economic growth and generates higher levels of output. Following this notion, the conventional wisdom presumes that FDI also increases government tax revenues. It can affect government tax revenues in a variety of ways. For example, higher investment levels in a country are expected to increase production, thus directly increasing domestic taxes on income and on goods and services if the production is sold in the country, and indirectly through increases in the quantity and perhaps quality of domestic income that result in higher levels of income taxes if it is sold abroad. Part of the inputs of production could be imported, thus constituting in a potential increase in taxes on international trade. Furthermore, as it is also argued that FDI will foster greater activity in the domestic firms participating in the production chain, and thus, expected higher productivity of these firms provide an additional channel through which tax revenues are expected to increase. Of course, the above analysis is dependent on the type of FDI, the sector where it is embedded, and the potential externalities that it is expected to generate.

This view is shared by many of the leading economic and political scholars, and assumes that higher levels of economic activity generate higher levels of production, and consequently higher levels of government revenue, all else equal. This implied additional benefit have led developing countries in Latin America, and the rest of the world, to further compete amongst them in order to attract potential foreign investment. While countries usually improve their investment environment through infrastructure upgrading, macroeconomic stabilization, and liberalization of the economy, they are increasingly granting firm specific incentives, among them tax incentives like tax

holidays, tax breaks, and subsidies. However, while intense competition for FDI makes the granting of tax incentives almost inevitable, with tax incentives becoming tools that are actually preferred by the governmental departments in charge of attracting FDI, the inherently competitive dynamics of promotion diminishes the potential benefits of FDI, at least in terms of revenue collection.

Governments implement tax policies to raise revenues for their public sector, correct market distortions, provide protection for their local industry, improve the terms of trade by favorably affecting world market prices, and to improve the distribution of income at home, all geared to maximize social welfare, but the implementation of second-best tax policies to attract FDI creates distortions that can contradict these goals, affect the competitiveness of domestic firms, and influence in the collection of tax revenues. As such, quantifying the magnitude of the hypothesized effect of FDI on government tax revenues and understanding the channels through which FDI affects the main components of total tax revenue is of vital importance.

The performance and evolution of central government tax revenues in the sample of Latin American countries is presented below in Table 3.1, and shows similar trends than those observed for other regions. For the period 1980 to 2002, the average total tax revenue of the countries in the sample is about 14 percent of GDP. The main contribution comes from taxes on goods and services, which is almost twice the contribution from taxes on individuals, profits, and corporations, and almost three times the contribution from taxes on international trade. The second set of rows show with 5-year averages the evolution of total tax revenue and its main components for the sample period, demonstrating that the collection of total tax revenues increased by almost 1 percentage point of GDP during this period, that taxes on individuals, profits, and corporations have stagnated throughout the period, and that the region has adequately shifted its reliance towards taxes on goods and services and away from taxes on international trade.

Table 3.1 – Evolution of Tax Revenues and FDI (as a % of GDP)

	Total Tax Revenue	Taxes on Individuals, Profits, and Corporation	Taxes on Goods and Services	Taxes on International Trade	FDI
1980-2002	14.199	3.132	6.194	2.217	2.054
Evolution during sample period					
1980-84	13.318	3.312	4.982	2.541	0.728
1985-89	13.980	2.953	5.695	2.673	0.933
1990-94	14.899	3.102	5.962	2.312	1.599
1995-99	14.545	3.065	7.369	1.767	3.974
2000-02	14.288	3.293	7.474	1.505	3.687
By time periods					
1980-91	13.808	3.161	5.347	2.575	0.909
1992-2002	14.626	3.101	7.117	1.825	3.303
By level of development					
Less Dev.	11.927	2.207	5.151	2.402	2.130
More Dev.	16.471	3.925	7.088	2.057	1.986

Note: Shares are obtained from the sample of 17 Latin American economies, author's calculations.

These dynamics are better contrasted when the sample period is analyzed accounting for the two economically distinct time periods: the earlier economically stagnant period and the more economically vibrant later period. Here the transition away from international trade taxes, which show a decline of 30 percent from the earlier to the later periods, and towards a greater reliance on taxes on goods and services, which show an increase of almost 35 percent in the later period compared to the earlier period, is clearly seen. When the sample is examined according to the countries' level of development, additional dynamics are uncovered, such as the greater capacity to collect higher taxes for the more developed countries. This greater tax collection in more developed countries arises mainly from the higher contribution of taxes on individuals, profits, and corporation and taxes on goods and services.

The importance of FDI to economic growth is commonly analyzed in the economic literature through its effect on GDP per capita growth rates, and while the

consensus suggests that greater foreign investment will generally lead to the production of greater output and consequently higher tax revenues – making the analysis of the effect of FDI on GDP levels or growth rates perhaps sufficient to measure its importance – the fact that governments make intensive use of tax incentives to attract FDI introduces a potential distortion on this link. Furthermore, as countries continuously adjust their tax system to be able to compete in the attraction of FDI, it further accentuates the potentially different effect of FDI on tax revenues then its effect on some measure of GDP, making it necessary to explicitly analyze this particular channel.

This section and the next one – builds on the idea that FDI's effect on economic growth should not only be measured through its effect on the level and growth rate of GDP per capita, but also through its influence on other factors that are relevant to domestic governments, such as on government tax revenues. This is related to views expressed in Braunstein and Epstein (2002), but differs in the modeling strategy, the analysis on Latin American economies instead of Chinese provinces, and in the econometric specification. Here the econometric specification is based on a more comprehensive theoretical background that enables one to control for the main determinants of tax revenue performance. This paper is also able to examine more closely the channels through which FDI can affect the collection of central government tax revenues. This has the potential of yielding important insight because from a theoretical perspective the disaggregated tax revenues may respond differently to changes in FDI.

In this section I examine the different factors that contribute to the generation of government tax revenues in Latin American countries, with a special focus on the effect of FDI, but the effectiveness in the use of the potentially higher tax revenues is not discussed here. While the tax systems of Latin American countries share many features with those of the rest of the world, the regional macroeconomic difficulties encountered in the last 20 years have prompted a high degree of tax adjustments, which has resulted in a gradual reform that has improved the tax system, making it simpler to administer and easier for taxpayers to achieve compliance (Tanzi 2000).

The performance of government tax revenues is mainly determined by a number of structural factors. The adequate modeling of the behavior of government tax revenues emphasizes the structural characteristics of the countries in question, but also incorporates macroeconomic policies and international factors that affect economic activity in general, and tax revenue performance in particular. These main factors have been already identified in the existing literature, and for convenience are briefly discussed below.

The so-called *structural characteristics* that affect the tax revenue performance of a country are the factors that influence the tax handles of an economy - like the level of income, the existence of subsistence sectors, and the dependence on the taxation of trade - and determine the magnitude of the tax base. Countries with large populations may be able to exploit economies of scale in the collection of tax revenues. However, the informal nature of much of the economic activity also becomes important when they are large, as in the case of Latin America. The tax bases in the region are notoriously difficult to assess in rural areas, prompting governments to concentrate in taxing incomes, goods, and services in the traditional urban areas, as well as industrial output and agricultural exports. But as urbanization increases the capacity to tax, it also increases the need for tax revenues, as greater urbanization leads to a greater need for public services. In addition, as a large percentage of the agricultural production is intended for self-consumption or commercialized in small-scale (or informal markets), the performance of tax revenues is also thought to depend on the relative size of the agricultural sector.

Among the *macroeconomic policies* that exert the greatest influence on tax revenue performance are the governmental debt stance, the government's current and past budget position, and the potential reliance on inflationary tax in order to generate revenue, all extremely important in Latin America. The first affects the tax collection by altering the pressure to collect taxes in order to finance public spending, as it happened in the 1980s when most Latin American countries were forced to cut public spending and increase taxation levels in the debt crises. Ghura (1998) shows that increases in

external grants lowers tax revenue, which could be indicative of a substitution between domestic tax revenue mobilization and the availability of external grants, but could also reflect a reverse causality problem, whereby countries with lower tax revenue to GDP ratios receive larger loans. With respect to the budget position, it is expected that governments incurring in budget deficits will be pressured by lending organizations to improve their fiscal accounts and to generate higher revenues, including tax revenues.

Perhaps the factor that has affected tax performance in the region the most is the use of loose monetary policy, with inflationary financing of public spending becoming rampant in the region throughout the 1980s, and reaching hyperinflationary levels in many countries, including Argentina, Bolivia, and Brazil, to name a few. The problem arises when inflation reaches high levels and tax collection lags are significant, making the positive impact of the fiscal drag on tax revenue to be overwhelmed by the negative impact of the Tanzi effect[12], which could be reinforced the higher the initial average tax ratio (Tanzi 1978). This negative effect has its largest impact on income taxes, as they generally have longer lags than other taxes. High inflation also reduces the tax base because in order to protect the real value of their wealth, economic agents make portfolio adjustments in favor of assets that typically escape the domestic tax net (such as land, jewelry, and foreign capital).

Among the most important *external factors* effecting government's tax revenue performance are the terms of trade, the exchange rate, and the liberalization of the economy. A strengthening of the terms of trade, measured as the export price index divided by the import price index, makes exporting industries more profitable and consequently generates higher tax revenue from income and possibly from imports used as inputs, but has a negative effect on the level of imports, and consequently any tax revenues gained from imports. Changes in the exchange rate directly alters the size and composition of the tax base through its effect on imports and exports, affecting the level

[12] If tax revenue assessed in a year's income is received in the following year and meanwhile prices have increased, the real value of these revenues will have fallen in comparison with their value in the assessed year. The higher the rate of inflation and the greater the lags on tax collection the lower will be tax revenue in real terms for any given set of formal tax rates.

and composition of aggregate demand according to the own-price elasticity's of both tradable and non-tradable goods.

While these two factors continually affect tax systems, the factor that perhaps influenced the tax system the most in Latin America, and the rest of the world, is trade liberalization. Liberalization usually takes the form of lower non-tariff barriers, larger import quotas, easier capital flows, and lower trade taxes, but also involves a reduction of the effective tariff rate, a movement towards a uniform tariff rate on all imports, and the eventual phasing out of tariffs. However, while the relative simplicity to assess and enforce trade taxes makes developing countries prone to use them as a major source for government revenue, the liberalization process has a direct effect on the collection of this type of taxes, and consequently on the others as well.

That is why one of the main concerns with liberalization is that efforts to liberalize trade could result in revenue losses, unless the liberalizing countries successfully replace the foregone revenue from trade with revenue from other (domestic) sources. These effects on trade tax revenues – and on government revenues in general – depends on several factors, including the structure of liberalization, how the level and coverage of tariffs changes, and the elasticity of supply of import substitutes.

Given that trade liberalization was one of the major structural changes in the last quarter century, and was perceived to have influenced the tax revenue performance the most, it is the factor that has generated the largest amount of research in the tax revenue literature. Khattry and Rao (2002) find that both low-income and upper middle-income countries of a sample of 80 countries have experienced declines in total tax revenues, which was attributed to the falling of both income and trade tax revenues since the onset of trade liberalization. They argue that structural characteristics associated with these developing countries have limited their ability to make the transition from trade to domestic taxes. Agbeyegbe *et. al.* (2004) argue that the relationship between trade liberalization and tax revenue is sensitive to the measure used to proxy trade liberalization. Their results show that the traditional measure of trade liberalization is not strongly linked to aggregate tax revenue or its main components in general, but that the

collected-tariff liberalization measure is linked to higher income tax revenue. This undermines Ghura's (1998) earlier finding that the level of openness of an economy is positively related to tax revenues, in addition to income and improvements in human capital.[13]

With an emphasis on the external factors, Adam, Bevan, and Chambas (2001) examine the relationship between tax revenue, exchange rates, and trade openness in Sub-Saharan Africa and find that openness raises overall tax revenue in CFA Franc zone countries while it has little effect in countries outside the zone.[14] They conclude that the poor tax revenue performance in this group of countries reflected mainly differences in environmental and structural factors, with misalignments of the exchange rate exacerbating its impact. The inverse relationship between a country's tax revenues and the real level of its official exchange rate was earlier noted by Tanzi (1989), who argued that overvaluations have a direct effect on taxes by suppressing import and export bases measured in domestic currency terms, thus reducing the collection of international trade, sales, and excise taxes.

While trade liberalization was geared to achieve gains from trade, the subsequent awareness about the importance of new technologies for economic growth has further expanded the liberalization movement to also include foreign investment, with the majority of emerging economies dramatically reducing barriers to FDI and implementing attractive tax incentives. The anticipation that their tax structure affects the firm's choice to locate in a particular country has led them to adjust it and make it more flexible to international firms, becoming in many cases even more attractive than for domestic firms.

Current literature in the area provide increasing agreement that taxation strongly influences both the volume of FDI and the operational behavior of multinational firms, all else equal. The evidence suggests that high tax rates discourage FDI by depressing

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[13] The human capital index constructed in his study is meant to proxy for the provision of public services by the government, such that a satisfactory level would induce people to contribute with higher tax rates.

[14] Adam, Bevan, and Chambas (2001) develop a comprehensive theoretical model, and analyze the effect of the real exchange rate and its misalignment on the tax revenue, especially on its three components: indirect taxes, trade taxes, and income taxes.

after-tax investment returns and by changing the opportunities available to firms that have discretion in reporting the location of taxable income. For example, before investing abroad, MNCs contemplate the tax structure of its own country – as it may offer relief from double taxation – and the bilateral treaties in place between its own country and the potential host country. These treaties lower trade barriers and reduce tax uncertainty over the long term (Chisik and Davies (2004)).

However, the most important tax consideration for their investment decision is perhaps the tax incentives offered by the host-country. High tax rates are usually associated with reduced investment by multinational firms and with reported profit rates that are lower than industry averages. Desai *et. al.* (2002) find that 10 percent higher taxes are associated with 5 percent lower FDI, controlling for parent company and observable aspects of local economies. The effort to lower taxes include the extension of tax holidays, exemptions from import duties, investment allowances, tax credits, accelerated depreciation, and the offer of direct subsidies. While there is a general trend to lower corporate income tax rates, most countries have extended the use of such incentives to stretch even further the granting of exemptions to foreign corporations making inward direct investments. These exemptions usually lower the tax rate but some times eliminates all tax liabilities, generally lasting for periods up to 10 years - although long-lived exemptions are also found in some cases.

Other important incentives that MNCs receive come in the form of subsidies. Direct subsidies are usually offered in a case-by-case basis and are generally unpublicized arrangements, but their granting is common and can reach important magnitudes. Some examples - among others - of this type of incentives are the $400 million subsidy to Multibras to construct a manufacturing plant for air conditioners and microwave ovens in Brazil in 1998, the $230 million spent by the state of Alabama in order to induce Mercedes-Benz to locate its new assembly plant in the state, and the $250 million each - in straight subsidies and temporary exemptions from value-added taxes and import duties - granted to General Motors and Ford Motors by the Brazilian state of Rio Grande do Sul (Keller and Yeaple (2003), Hanson (2001)).

This subsidization of FDI through tax incentives brings to light the potential harm that greater foreign participation can produce on domestic firms, as the partial or total crowding out of domestic firms increases the possibility that some domestic factors of production may loose with higher levels of FDI. Glass and Saggi (1999) show that if the impact of MNCs on the profitability of domestic firms is sufficiently negative, FDI may lower host-country welfare, such that the optimal policy towards FDI should indeed be a higher level of taxation. Hanson (2001) also finds that, in his case study of General Motors and Ford Motors in Brazil and Intel in Costa Rica, subsidy-induced increases in production appears that have laid upward pressure on the relative wages of skilled workers, thus reducing the profitability of domestic firms, and that while there were only a few firms in their line of business that faced the increase in relative wages, it also meant that there were only a few firms that benefited from the potential spillovers.

However, the effectiveness of these policies in attracting FDI is highly uncertain. Beyer (2002) shows in his study of 15 post-socialist countries that having tax holidays or other relieves which affect taxation in the short-term appears to be less important than risk, success in their political transformation, or economic stability, finding no significant relationship between the introduction of tax incentives and the level of FDI inflows. This finding seems logic since investors generally do not consider incentives as a determining factor in their investment strategies if the incentives are more or less matched by competitor countries. In other words, only when investors are considering alternative locations that offer acceptable and roughly comparable conditions for producing for foreign markets, the potential tax reductions obtained helps them shield themselves from potential competition from investors who could choose one of the alternative locations (Bergsman 1999).

While the above analysis represents a wide range of research examining the determinants of tax revenues and the implications of such for the attraction of foreign investment, empirical work on the effect of FDI on government tax revenues is almost nonexistent, and thus its direction and magnitude still unreported. The only exception is

the aforementioned work of Braunstein and Epstein (2002)[15], who study the impact of inward FDI on tax generation in China during 1986-1999, by running a panel regression analysis on provincial level data, and distinguishing the impact of FDI inflows to that of economic liberalization. They find that inward FDI has a negative impact on tax revenue while trade has a positive impact. To the extent that FDI contributes to trade, they argue that it may be contributing indirectly to tax revenue.

One common problem in the empirical work that examines impacts on government tax revenues is that it is often difficult to control for the impact of all relevant regional characteristics, the firm specific level of taxation and subsidies, and the changing structure of the tax systems in each country. Since my interest on the effect of FDI on government tax revenues is rather narrow, I abstract from the implications of varying and changing tax rates and the inherent aggregation problems of the tax revenue measures used in the study, and provide a general explanation of how tax revenues are affected in the short run by changes in FDI. This task is done in the following sub-sections.

3.2 Data and Methodology

The data for this study comes from the World Bank's World Development Indicators 2004 (WDI) and Global Development Finance (GDF), from the Economic Commission for Latin America and the Caribbean's (ECLAC's) 2004 Statistical Yearbook, from the Government Finance Statistics yearbooks (IMF), and from the Oxford Latin American Economic History Database. The sample consists of the same 17 Latin American countries used in the previous section over the period 1980-2002, with annual observations. The sample excludes countries that serve as offshore financial centers, are too small, have special governmental controls, or lack adequate data.

While it is not possible to control directly for the evolving structure of the tax system, the use of panel data methods allows one to control for unobservable time-

[15] This study is related to the idea that the effect of FDI on economic growth should include additional factors, but I am looking at the specific effects on tax revenues more systematically.

invariant country-specific characteristics that determine tax revenue performance. With respect to the nature of the observations, it is argued that yearly observations introduce noise from the cyclical dynamics of some explanatory variables. In this case the potential benefit of accounting for such dynamics on a yearly basis gives me a reason to use them instead of few-years averages.

I examine the performance of tax revenue by regressing the share of central government tax revenue to GDP (and its main components) on the variables that reflect the structural characteristics of the economy (tax base), the macroeconomic policies, and the main external factors. Early econometric specifications for analyzing government tax revenue performance use a fixed effects model to account for the unobserved time-invariant country-specific effects (Khattry and Rao (2002)). The recognition of the high degree of persistence of the tax revenues over time has moved recent empirical analysis to use dynamic panel data estimation (Agbeyegbe et. al. (2004)). This method was originally developed by Holtz-Eakin, Newey and Rosen (1988) and Arellano and Bond (1991), and it has been widely implemented since.

However, the linear generalized method of moments (GMM) estimator obtained after first differencing has been found to have large finite sample bias and poor precision when the autoregressive parameter is moderately large (or the relative variance of the fixed effects increases), the series are persistent, or the number of time series is moderately small (Arellano and Bover (1995), Blundell and Bond (1998), Bond, Hoeffler, and Temple (2001)). The bias and poor precision arises as the instruments used in the standard first-difference GMM estimator become less informative (weak), and can be corrected by using the system GMM estimator, which exploits additional initial condition and generates efficient estimators for dynamic panel data models when the above problems are present. The system GMM estimator is composed of equations both in first-differences and levels, and uses instruments in first differences for equations in levels and instruments in levels for equations in first differences.

The econometric specification is based on Khattry and Rao's theoretical model (2002) and considers the influential variables commonly used in the tax literature, but it

presents a slight deviation as it accounts for the effect of government expenditures through the governmental budget stance instead of just government expenditures, and uses the central government long-term debt instead of the more broad measure of a country's external debt. It also includes a measure of the variable of interest (FDI) to estimate its effect on tax revenues. The estimated econometric model[16] is:

$$\left(\frac{tr}{y}\right)_{i,t} = \alpha_0 + \alpha_1\left(\frac{tr}{y}\right)_{i,t-1} + \alpha_2 GDEBT_{i,t-k} + \alpha_3 FDI_{i,t} + \alpha_4 lPOP_{i,t} + \alpha_5 URB_{i,t} + \alpha_6 TRADE_{i,t}$$
$$+ \alpha_7 SURPLUS_{i,t-1} + \alpha_8 AGS_{i,t} + \alpha_9 INF_{i,t} + \alpha_{10} lGDPpc_{i,t} + s_t + \varepsilon_{i,t}$$

where $k = 0,1$, according to the specification of the tax revenue under consideration. Here $\left(\frac{tr}{y}\right)$ is the tax yield as a percentage of GDP, $GDEBT$ is the central government long-term debt as a percentage of GDP, FDI is the ratio of foreign direct investment to GDP, $lPOP$ is the natural logarithm of the population of each country, URB measures the percentage of the population that lives in urban areas, $TRADE$ is the level of trade openness measured as the ratio of imports plus exports to GDP, $SURPLUS$ is the central government budget stance as a percentage of GDP, AGS measures the economic activity of the agricultural sector as a percentage of GDP, INF measures the level of inflation of each country, and $lGDPpc$ is the natural logarithm of real GDP per capita. The vector of time dummy variables that controls for common time-varying effects is denoted by s_t, and the error term follows the standard one-way error specification

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

where μ_i denotes the unobservable individual specific effect and $\nu_{i,t}$ denotes the remainder disturbance.

Drawing from the existing literature, the conjecture is that population, real GDP per capita, and urbanization are positively related to tax revenues, while the agricultural share, the budget stance, and the inflation rate are expected to be negatively

[16] This is the base specification in order to estimate the effect of FDI of total tax revenues controlling for all the relevant determinants of tax revenues, and it is slightly modified in order to better specify its effect on each of the main components.

related to tax revenues. Given that contracting new debt exposes countries to international pressure, the current changes in debt are expected to be positively related to tax revenues, but the lagged effect is expected to be negative, as countries would be less constrained to finance public spending.[17] The measure of trade openness ($TRADE$) has an ambiguous a priori effect. The effect of FDI was found to be negative in Braunstein and Epstein (2002), but the theoretical literature suggests that it should be positively related to tax revenues, so the direction of such effect here is ambiguous.

Since the time series of some of the variables are clearly persistent ($lGDPpc$, $lPOP$, URB), the lagged levels of the series provide weak instruments for subsequent first-differences, providing the initial reason to lean towards the system GMM estimation. This estimation technique is asymptotically more efficient relative to either of the alternatives when instruments are weak. Bond, Hoeffler, and Temple (2001) also note the considerable strength of the system GMM estimator to obtain consistent parameter estimates even in the presence of measurement error and endogenous variables, so that endogeneity concerns arising from independent variables like the government stance, inflation, and debt can be disregarded.

Given the nature of the data, and to detect whether serious finite sample biases are present, a comparison of the first-differenced GMM results to alternative estimates of the autoregressive parameter is first performed. As it is well known, the OLS on levels will give an estimate of the autoregressive parameter that is biased upwards in the presence of individual-specific effects. The within group estimator will give an estimate of the autoregressive parameter that is seriously biased downward in relatively short panels. From the above specification[18] we obtain an estimate of 0.88970 for the autoregressive parameter using OLS, and an estimate of 0.62156 for the autoregressive parameter using fixed effects. The autoregressive parameter estimate using the traditional first-differenced Arellano and Bond (1991) method is 0.62673, which lies

[17] Measures for terms of trade and the exchange rate are also used in the specification for taxes on international trade, with the expected effect being ambiguous a priori for both.
[18] Complete results are included in the Appendix in Table A.1.

only slightly above the within group estimate, a signal that biases due to weak instruments may be important in the first-difference estimator.

The parameter estimate of the autoregressive coefficient of total tax revenue using system GMM is 0.76880, which lies comfortably above the fixed-effects estimate and below the OLS estimate. The additional instruments from the system GMM seem to be valid and highly informative in this context. In addition, neither the Hansen's over-identification test nor the tests for second-order serial correlation detect any problems with neither instrument validity nor the serial correlation assumptions.[19] The results suggest that there is a finite sample bias problem caused by weak instruments in the first-differenced GMM results, which I address in the remaining analysis by using the system GMM.

3.3 Results

The results obtained in this study are short from perfect given that many details and dynamics of the tax systems of the sample countries cannot be observed and consequently cannot be addressed. One of the main difficulties is that neither MNCs nor host-country's publish or are willing to describe the incentive's packages (tax breaks or subsidies) that are provided to the specific MNCs in order to entice them to set their production facilities in their countries. Another important limitation is the lack of data to discern the industry participation of foreign investment, as it is hypothesized that FDI could have a significantly different effect according to the industry where it is injected. While corporate taxes – a subcomponent of taxes on individuals, profits, and corporations – suggests itself as the most adequate measure to analyze the effect of FDI on tax revenues, the lack of consistent data makes its use unfeasible. These limitations are taken into account when interpreting the results, and caution is exercised when making generalizations.

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[19] In order to have the disturbances $\nu_{i,t}$ not being serially correlated, there should be evidence of significant negative first order serial correlation and no evidence of second order serial correlation in the differenced residuals.

While the emphasis of my empirical analysis is to estimate the effects of FDI on government tax revenues, I also stress the channel through which FDI may influence tax collection in Latin American countries. In particular, through the estimation of the main components of the overall government tax revenue, I try to disentangle the main channels through which FDI potentially has an effect on government tax revenues.

In Table 3.2 the main regression results are presented, where one can immediately observe the high degree of persistence that tax revenue collection presents. The estimation for the overall government tax revenue is presented in the first column, which represents the broader measure of tax revenues. It shows that FDI has a positive and significant impact on total tax revenues, after controlling for the main determinants (the structural characteristics, macroeconomic policies, and external sector). This estimate implies that an increase in FDI of 10 percentage points results in slightly more than a 1 percentage point increase in total tax revenues. This finding suggests that the greater attraction of FDI into the region has indeed benefited the local governments, and its people, through higher collection of tax revenues.

Inflation also has a positive and significant effect, suggesting that higher inflation – a proxy for expansionary fiscal policies – improves tax revenue collection. This finding contradicts Tanzi's hypothesis but it could be explained by the significant deceleration of inflation after the hyperinflationary episodes. However, this effect is small, as a 10 percentage point decrease in the inflation rate decreases the tax yield by around 0.003 percentage points. The effects of current and lagged government debt are also significant, indicating that as a country increases its long-term debt, in the current period, it falls under greater international pressure to improve its tax collection ratio and does so, while if it has increased its long-term debt in the previous period it can have some slack in its current tax collection effort. Also positive and statistically significant is the effect of real GDP per capita, indicating that a increase in income raises the collection of tax revenues, which is also in accord with the existing literature. The remaining control variables are not statistically significant but have the expected signs.

Table 3.2 – Effect of FDI on Total Tax Revenues and Main Components

	Total Tax Revenues	Taxes on Individuals, Profits, and Corporations	Taxes on Goods and Services	Taxes on International Trade
Constant	-2.6562	-3.2320*	-2.5880	-1.8091
	(2.5698)	(1.5015)	(2.1904)	(1.1135)
Taxlag	.76880***	.77196***	.67263***	.70199***
	(.05242)	(.02550)	(.04623)	(.10133)
Inflation	.00032***	-.00005	.00011	____
	(.00008)	(.00004)	(.00006)	
Gov. debt	.01174***	.00407***	.00570***	.00228***
	(.00199)	(.00062)	(.00100)	(.00050)
Gov. debt -1	-.00858***	-.00356***	-.00430***	-.00067
	(.00178)	(.00066)	(.00102)	(.00054)
FDI	.11108**	.01280	.06407**	-.00302
	(.03978)	(.01560)	(.02747)	(.02071)
ln of GDP per capita	.61434*	.27808*	.23024	.00639
	(.35818)	(.15463)	(.26515)	(.12000)
Agricultural Share	-.04900	-.01680	____	____
	(.03901)	(.02856)		
ln of Population	-.37826	.26533**	-.24164	-.07773
	(.35906)	(.12144)	(.25530)	(.09244)
Urbanization	.00689	-.01414**	.02940**	.00470
	(.01170)	(.00585)	(.01039)	(.00507)
Budget Surplus	-.00411	-.00418	-.02108	.02974**
	(.01955)	(.00626)	(.03074)	(.01287)
Trade	.45243	.59932*	.34577	.50313**
	(.45598)	(.33239)	(.49344)	(.20829)
Terms of Trade	____	____	____	.00294
				(.00198)
Exchange Rate	____	____	____	-.00002
				(.00007)
Hansen Over-Id.	1.000	1.000	1.000	1.000
AR(1) Test	0.001	0.124	0.003	0.020
AR(2) Test	0.299	0.330	0.605	0.479

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not presented. Standard Errors in parentheses.*

The exception is the population measure, which coefficient suggests that diseconomies of scale are present in the region.

In order to analyze the channels through which FDI affects government tax collection, I estimate specific formulations for the main components of government tax revenue. The specification for taxes on goods and services omits the agricultural

share since most agricultural production escapes this type of taxation anyway. The specification for taxes on international trade also omits the agricultural share and includes measures for the terms of trade and the exchange rate, due to their importance to determine trade performance, and omits inflation, since its effect is indirectly accounted for in the fluctuations of the exchange rate.

As I report in the second column, FDI has a positive effect on taxes on individuals, profits, and corporations but it is no longer statistically significant at standard significance levels. Government debt still has the same influence than in total taxes but its effect is much smaller for both current and lagged one period government debt. With respect with the level of income, and in accord with previous analyses, I find that an increase in real GDP per capita in the current period raises the percentage of taxes on individuals, profits, and corporations. Economies of scale are also found to be statistically significant for these taxes, as the population size measure has a positive effect. The effect of trade is also found to be positive and significant, also in accord with the existing literature, but the effect of urbanization is found to be negative and significant, perhaps because it is accompanied by a proliferation of small-scale enterprises and a growth in the informal sector in Latin America, affecting these types of taxes negatively (Rao (1999)). With respect to inflation, it has a negative effect, in accordance with the Tanzi effect, but it is not statistically significant.

The estimates of the regression of taxes on goods and services – presented in the third column – shows that it is through this channel that the effect of FDI on government tax revenues exerts in main influence. The effect of FDI on taxes on goods and services is positive and statistically significant, indicating that a 10 percentage points increase in FDI leads to a 0.64 percentage point increase in taxes on goods and service. The dynamics of the effect of government debt on taxes on goods and services is similar to that on total taxes for the current and lagged-one-period debt, but its effect is less than half its magnitude on the effect on total taxes. The urbanization measure indicates that as a country becomes more urbanized it increases the share of taxes on goods and services, which is understandable given the fact that taxes on goods and services are more easily

imposed and collected in contrast with the taxes on individuals, profits, and corporations. Inflation is found to be positive here, suggesting also a reverse Tanzi effect, but it is not statistically significant.

The final column of Table 3.2 presents the results on the specification for taxes on international trade. The effect of FDI on these taxes is negative, but it is not statistically significant at any conceivable confidence level. The effect of government debt is dynamically similar to the previous tax shares but only the positive current effect is statistically significant. Not surprisingly, the effect of trade is positive and significant, due to the fact that this factor is the base for the collection of this tax component. These results also show that the variable measuring the lagged-one-period surplus of the central government has a positive and significant effect, perhaps reflecting the fact that countries with budget surpluses during the previous year are indicative of good economic performance, affecting the overall economy in general and the collection of international trade taxes in particular. With respect to the additional variables, while they contribute as controls and present the correct sign, they are not statistically significant.

The results shown in Table 3.2 show that FDI exerts a positive effect on total tax revenues, which is channeled through its effect on taxes on goods and services, but is leaves questions about individual contribution of each tax component on the overall effect since it does not add up to the effect on total tax revenues. Given that there is no data available for the remaining components, calculating the remaining portion of the tax share and estimating the effect of FDI on this remain one obtains a positive but insignificant effect of FDI of 0.02386, which added to the contribution of the previous shares gives us close to the overall effect. Also, since the estimated effect of FDI is for current flows, and since there are some arguments that the effect of FDI is delayed, I also estimated the same specification using lagged FDI by one and two years.[20] The results show that lagged-one-year FDI has a negative effect on total tax revenues, on taxes on individuals, profits and corporation, and on taxes international trade, and a positive effect on taxes on goods and services, but the estimates are not statistically

[20] See Table A.2 for magnitudes and standard errors of all FDI estimates.

significant at any conceivable levels. These same dynamics are also present in the specification using the lagged-two-years FDI, but its effect is not statistically significant in this case either.

In order to exploit the dimensionality of the data and investigate the robustness of these results, in Table 3.3 I also consider the potentially different effects that FDI could have on government tax revenues according to the level of development of the country, as less developed countries are hypothesized to be able to reap greater benefits from FDI than do more developed countries, with its corresponding repercussion on the collection of taxes. The assumption of same variance across the two groups is used here – and in the specifications that follow – as there is no indication suggesting that these two groups of countries have different volatility. To this end, a dummy variable DEV is introduced, with the dummy taking the value of one for countries that had an initial real GDP per capita higher than U.S. $2,500 in the year 1980 and zero otherwise.

While the effects of inflation and government debt on total tax revenues are similar than those of Table 3.2, accounting for the level of development reveals how distinct are the effects of FDI on the two country classifications, as an increase of 10 percentage points in FDI – on less developed countries – results in slightly less than a 1.5 percentage point increase in total tax revenues. For the most developed countries, while the estimates suggest that the same 10 percentage points increase in FDI leads to a small but positive 0.12 percentage point increase in total tax revenues, statistical tests reveal that this effect is not statistically different than zero. It is also observed that the income measure looses its statistical significance on total tax revenue when one accounts for the level of development of the receiving country.

The effect of FDI on total tax revenue for the group of less developed countries also come from the effect of FDI on taxes on goods and services, as it is found that the positive effect is statistically significant. However, while the estimates also suggest that this effect is only slightly smaller for the most developed countries, statistical tests show that when both estimates are taken together they are not statistically different than zero. The dynamics for the other two components of total tax revenues are similar to those

Table 3.3 – Effect of FDI on Total Tax Revenues and Main Components by Level of Development

	Total Tax Revenues	Taxes on Individuals, Profits, and Corporations	Taxes on Goods and Services	Taxes on International Trade
Constant	-1.2586	-4.8395**	3.4467	-3.1304
	(3.4741)	(2.1824)	(3.4934)	(2.3112)
Taxlag	.76013***	.76506***	.64717***	.69712***
	(.04702)	(.02990)	(.04763)	(.09899)
Inflation	.00031***	-.00004	.00009	____
	(.00008)	(.00004)	(.00007)	
Gov. debt	.01167***	.00432***	.00577***	.00229***
	(.00191)	(.00054)	(.00112)	(.00050)
Gov. debt -1	-.00876***	-.00345***	-.00463***	-.00055
	(.00165)	(.00074)	(.00117)	(.00046)
DEV	1.0672**	-.35943	1.3152**	-.33038
	(.48786)	(.30376)	(.43959)	(.34939)
FDI	.14750***	.02584	.05101**	-.00488
	(.03374)	(.01740)	(.02113)	(.02281)
*FDI * DEV*	-.13522	-.02652	-.01357	.01672
	(.08003)	(.05350)	(.04364)	(.03605)
ln of GDP per capita	.30336	.51130**	-.56557	.18585
	(.52028)	(.20426)	(.45280)	(.22901)
Agricultural Share	-.02748	-.02589	____	____
	(.03528)	(.02614)		
ln of Population	-.35880	.24942*	-.22344	-.09366
	(.34027)	(.11752)	(.26920)	(.09253)
Urbanization	.00647	-.01364*	.02595**	.00619
	(.01200)	(.00640)	(.01112)	(.00554)
Budget Surplus	-.00328	-.00406	-.02074	.02991**
	(.01967)	(.00587)	(.03058)	(.01305)
Trade	.52594	.63906	.28215	.51094**
	(.40227)	(.38435)	(.42500)	(.21605)
Terms of Trade	____	____	____	.00313
				(.00217)
Exchange Rate	____	____	____	-.00004
				(.00008)
Hansen Over-Id.	1.000	1.000	1.000	1.000
AR(1) Test	0.001	0.116	0.004	0.018
AR(2) Test	0.298	0.330	0.570	0.489

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not presented. Standard Errors in parentheses.*

presented in Table 3.2, and suggest that the effect of FDI on taxes on individuals, profits, and corporations and on taxes on international trade is null, irrespective of their level of

development.

As the sample spans the period from 1980 to 2002, I also examine the potentially different effect of FDI on tax revenue performance by dividing the sample into two comparatively distinct time periods. The natural break is given by the fact that the 1980's have been considered as the "lost decade" for economic development in Latin America, while the more prosperous 1990's presented the region with a significantly improved economic prospect and performance. In addition, the investment activity in the region also presents this distinct pattern according to these two time periods, with the share of FDI flowing into the region more than tripling in the later period. I incorporate this distinction through the dummy variable *Later* that takes the value of one for the period between 1992 and 2002, and zero otherwise.

The results are presented in Table 3.4 below, and show that FDI's effect on total tax revenue is positive but is not statistically significant for the earlier period of the sample. With regards to the effect of FDI on the main tax components, I find that its effect on taxes on individuals, profits, and corporations and on taxes on goods and services is negative, while its effect on taxes on international trade is positive during this earlier period. However, neither of these effects is statistically significant at any conceivable level.

FDI's effect on the later period of the sample is more informative, because even if the individual coefficients are still not statistically significant, testing of the two relevant estimates together show that FDI has a positive and statistically significant effect on total tax revenues and on its main component (taxes on goods and services). The results show that a 10 percentage points increase in FDI results in a 1.1 percentage point increase in total tax revenues, and that a similar 10 percentage points increase in FDI results in almost 0.8 percentage point increase in taxes on goods and services. The effect on total taxes is similar than the effect on the whole sample period, but the effect on the main component is almost 20 percent larger than the effect on the whole sample period (Table 3.2). As the magnitude of FDI as a share of GDP has grown by more than 300 percent in this later period, it seems that the higher levels of FDI did in fact exert a

Table 3.4 – Effect of FDI on Total Tax Revenues and Main Components by Time Periods (1980-1991 and 1992-2002)

	Total Tax Revenues	Taxes on Individuals, Profits, and Corporations	Taxes on Goods and Services	Taxes on International Trade
Constant	-2.6513	-3.3647**	-2.8310	-1.7255
	(2.5545)	(1.4730)	(2.1224)	(1.0975)
Taxlag	.76880***	.77119***	.66768***	.69945***
	(.05231)	(.02790)	(.04915)	(.10006)
Inflation	.00032***	-.00005	.00010	____
	(.00008)	(.00004)	(.00006)	
Gov. debt	.01175***	.00400***	.00562***	.00238***
	(.00197)	(.00069)	(.00101)	(.00053)
Gov. debt -1	-.00858***	-.00353***	-.00423***	-.00071
	(.00175)	(.00070)	(.00100)	(.00053)
Later	1.1843	-.29473	.49197	-.14902
	(.70316)	(.72215)	(.33322)	(.32754)
FDI	.11256	-.03417	-.06313	.05385
	(.12190)	(.08830)	(.08750)	(.09835)
*FDI * Later*	-.00166	.05330	.14400	-.06529
	(.12431)	(.09858)	(.10473)	(.09524)
ln of GDP per capita	.61405*	.28585*	.24271	.00158
	(.33833)	(.14309)	(.26710)	(.11402)
Agricultural Share	-.04903	-.01598	____	____
	(.03900)	(.02759)		
ln of Population	-.37841	.27169*	-.23574	-.08108
	(.35937)	(.13235)	(.25617)	(.09231)
Urbanization	.00688	-.01389**	.03060**	.00446
	(.01173)	(.00568)	(.01073)	(.00523)
Budget Surplus	-.00410	-.00445	-.02197	.02995**
	(.01950)	(.00587)	(.02942)	(.01244)
Trade	.45170	.62167	.40666	.48518**
	(.44815)	(.36885)	(.48742)	(.22391)
Terms of Trade	____	____	____	.00287
				(.00199)
Exchange Rate	____	____	____	-.00002
				(.00007)
Hansen Over-Id.	1.000	1.000	1.000	1.000
AR(1) Test	0.001	0.122	0.003	0.021
AR(2) Test	0.281	0.330	0.600	0.478

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not presented. Standard Errors in parentheses*

positive effect on total tax revenues, effect that became channeled through its effect on taxes on goods and services again.

While the results presented until now mainly investigate the potentially different impact of FDI on total tax revenues and its main components, through the general specification but also controlling for specific factors that could give rise to differential effects, the fact that the reverse Tanzi effect found in these results are somehow at odds with other empirical studies (Tanzi (1978), Ghura (1998), Adam, Bevan, and Chambas (2001), Agbeyegbe *et. al.* (2004)) necessitates further examination. To this end, I now also control for the potentially different effect of inflation on tax revenues by also subjecting to the possibility that its slope could be different according to the level of inflation – as it is known that hyperinflationary pressures affected many countries in the sample. The dummy variable used for this purpose is HI and it has the value of one for years when inflation reached levels higher than 50%, and zero otherwise.

Table 3.5 below presents the results. I find that the effect of inflation on total tax revenues - and its main components – is negative for low levels of inflation and it remains positive (almost identical to the estimates of the general specification) for higher levels, but neither effect is statistically significant. It seems that the deceleration of inflation after the hyperinflationary episodes is indeed driving the reverse Tanzi effect found on the estimation. However, interesting dynamics are found for the effect of FDI on total tax revenues and its main components. The estimation for the overall government tax revenue shows that FDI has a positive and significant impact on total tax revenues, implying that an increase in FDI of 10 percentage points results in slightly less than a 1 percentage point increase in total tax revenues when inflation is below 50 percent per year, but it increases by more than 4 percentage points when inflation is above 50 percent per year. This larger effect is corroborated when statistical testing of both estimates together is performed.

The results for the estimation of the main components of tax revenue shows that the effect of FDI on tax revenues is mainly channeled through its effect on taxes on goods and services when the inflation level is below 50 percent, as a 10 percentage points increase in FDI results in a half a percentage point increase in taxes on goods and services. However, when the inflation level is above 50 percent per year, FDI's effect on

Table 3.5 – Effect of FDI on Total Tax Revenues and Main Components Controlling for the Level of Inflation (Inf<50 and Inf>50)

	Total Tax Revenues	Taxes on Individuals, Profits, and Corporations	Taxes on Goods and Services	Taxes on International Trade
Constant	-2.7456	-2.9181	-2.2794	-2.0021*
	(2.4233)	(2.0689)	(2.1345)	(1.1208)
Taxlag	.77360***	.71964***	.68068***	.70219***
	(.05061)	(.05975)	(.04084)	(.10275)
HI	-.67311	-1.3592*	-.07749	-.14480
	(.6002)	(.77561)	(.30443)	(.10144)
Inflation	-.01110	-.02546	-.00085	____
	(.01756)	(.02008)	(.00839)	
Inflation*HI	.01144	.02543	.00096	____
	(.01752)	(.02006)	(.00839)	
Gov. debt	.01198***	.00519***	.00571***	.00239***
	(.00206)	(.00059)	(.00100)	(.00051)
Gov. debt -1	-.00883***	-.00375***	-.00444***	-.00064
	(.00177)	(.00076)	(.00104)	(.00053)
FDI	.09068**	-.01061	.04947*	-.00229
	(.04120)	(.02257)	(.02654)	(.02038)
*FDI * HI*	.33777**	.37662***	.27377**	-.02716
	(.13153)	(.09691)	(.09988)	(.05938)
ln of GDP per capita	.62397*	.37118	.17167	.04317
	(.34916)	(.23883)	(.24902)	(.12347)
Agricultural Share	-.04773	-.03575	____	____
	(.03696)	(.03029)		
ln of Population	-.37351	.31652	-.26137	-.07112
	(.38037)	(.18711)	(.24581)	(.09425)
Urbanization	.00940	-.01942	.03114**	.00441
	(.01269)	(.01154)	(.01059)	(.00523)
Budget Surplus	-.01028	-.01706	-.01895	.02609*
	(.01920)	(.01331)	(.02826)	(.01394)
Trade	.45926	.69709	.35667	.48957**
	(.50258)	(.45631)	(.51234)	(.21088)
Terms of Trade	____	____	____	.00283
				(.00199)
Exchange Rate	____	____	____	-9.76e-06
				(.00007)
Hansen Over-Id.	1.000	1.000	1.000	1.000
AR(1) Test	0.001	0.095	0.004	0.020
AR(2) Test	0.273	0.310	0.544	0.537

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not presented. Standard Errors in parentheses.*

tax revenues is much stronger, and is channeled through two of the main components: through taxes on individuals, profits, and corporations, which increases by almost 4 percentage points as a result of the same 10 percentage points increase in FDI, and through taxes on goods and services, which increases by around 3 percentage points as a result of the 10 percentage points increase in FDI. Statistical testing shows that both effects for periods of high inflation are statistically different than zero when both estimates are tested together. This result indicates that the level of inflation influences FDI's effect on tax revenues, and somewhat surprisingly, it shows that FDI's largest effect is when the inflation level is relatively high.

Since the level of inflation that could affect the fundamental behavior of the tax system, and other important determinants of the economy, varies according to the view of different authors, I have also performed the analysis using thresholds of 20 percent and 100 percent inflation levels, and the results are attached in the Appendix as Table A.3 and Table A.4, respectively. The results are similar than those of Table 3.5 for the case when the threshold is 100 percent inflation and show that the reverse Tanzi effect found in this study arises from the periods of high inflation levels, while is not that conclusive for the case of 20 percent inflation. In additional, the effect of FDI on tax revenues is also similar than that found in Table 3.5 for periods with low inflation levels, but that this effect is null for periods with high inflation levels when one tests for the overall effect of FDI on tax revenues for both total taxes and taxes on goods and services. Interestingly, when the threshold inflation level is 20 percent, the only channel through which FDI affects tax revenues positively when inflationary periods are relatively high is through its effect on taxes on international trade.

Additional robustness check was performed relaxing the initial assumption of same variance across the two relevant groups, and while they are differences in magnitude, the qualitative validity of the results is reinforced.[21] To conclude this section, it is noteworthy to point out that econometric methods may ignore the potential heterogeneity of the slope parameters of the data, as well as of other panel data used to

[21] Results are not included in the Appendix but available from the author on request.

analyze structurally different countries (Pesaran and Smith (1995), and Lee, Pesaran and Smith (1997)), and thus produce results that are biased. However, given that the sample period of this study is relatively short, the individual country equations cannot be estimated separately to calculate explicitly the best possible parameters from the averages of the estimated country-specific parameters. While this problem is inherent in the sample data, the use of interactive groups for the main variable of interest and time dummy variables ameliorates this bias.

3.4 Conclusions

This section shows that FDI exerts a significant positive effect on central government tax revenues, which is channeled through its effect on the most important component of tax revenues, the taxes on goods and services. This positive effect on tax revenues is perhaps reinforced by the fact that greater foreign investment increases production in the formal sector, thus contributing to the collection of tax revenues. It also shows that such effect is also channeled through its effect on taxes on international trade when inflation is above 20 percent per year and through taxes on individuals, profits, and corporations when inflation is above 50 percent per year.

The positive effect of FDI on tax revenues is especially important for less developed economies, which corroborates the notion that less developed countries have a greater opportunity to benefit from the potential spillovers from foreign direct investment. Also, the larger inflows of FDI of the 1990s has had a positive impact on the effect of FDI on the collection of taxes on goods and services, which has risen by almost 20 percent relative to FDI's effect on the overall sample period, but its effect on total taxes on this later period has remained the same than the effect on the whole sample period. Another interesting result found is the existence of a reverse Tanzi effect in Latin America during the sample period. While this effect is in conflict with that of other studies, mainly African countries, the particular dynamics of the highly inflationary episodes experienced in Latin America in the 1980s and early 1990s leads me to

conclude that it is driven by the subsequent deceleration of inflation rates, and perhaps by the changing expectations of inflation (see also Tanzi (2000) for further analysis of this reversal).

These results render support to the economic policies implemented in Latin America for the last decades in order to spur economic growth. I find evidence that the larger flows of FDI into the region not only contributes to improvements of real GDP per capita growth rates, but it also contributes to the better performance of a factor that perhaps is more relevant to domestic standards of living, from the perspective of the host-countries. While these results could induce developing countries to intensify the promotion of FDI through enhanced incentives, the structural changes generated after the disappointing 1980s should also be taken into consideration. In addition, further examination of the ways in which FDI can affect positively receiving economies needs to be undertaken before accepting the conventional wisdom unchallenged. This task is taken in the next section.

4. FOREIGN DIRECT INVESTMENT'S EFFECT ON EMPLOYMENT

4.1 Introduction

The previous two sections demonstrate that FDI has a positive effect on economic growth in Latin America, measured by improvements in GDP per capita growth rates, and on the collection of tax revenues, especially taxes on goods and services. Such positive effects seem to back up the claims of the leading development agencies and growth theorists, making local governments restructure their incentive policies even further to compete for foreign investment. However, while most countries consider foreign investment important for the above reasons, another channel through which FDI can potentially affect the standard of living of people in countries receiving this inflow is through its effect on employment levels, an effect that has been so far overlooked in the literature and to which we turn in this section.

While Multinational Corporations (MNCs) engage in productive activities in host countries for a variety of reasons and in a variety of ways, they all have the potential to generate additional employment. They can do so through direct hiring of people for their plants, through indirect employment as they create links with suppliers and service providers as well as with other affiliates that are attracted to the country by their entry, and through their contribution towards higher incomes, which can also increase employment through the inducement of higher levels of consumption, savings and investment[22]. Resource and cost considerations influences the MNC's decision to relocate the operation of their labor-intensive stages to developing countries, with manufacturing being the main industry sector taking advantage of the lower wages in developing countries (Lipsey (2004)).

[22] See Lall (2004) for a comprehensive review.

Of course, these positive effects on employment induced by larger FDI flows have to be weighted against the potential employment losses to really understand the overall effect. The MNCs' entry could induce local competitors to reduce employment to become competitive, force existing firms out of business if they introduce cost-saving technology, or shed employees themselves if entry is by acquiring control of local firms. However, even if the aggregate employment effect results in short-term employment losses, these losses may be more than offset by longer-term employment gains if FDI raises the competitiveness, efficiency and export-orientation of domestic firms, or generates chains of new local suppliers (Lee and Vivarelli (2006)).

Despite the remarkable flows of FDI into the region during the 1990s, and the induced higher rates of economic growth, the rate of growth in employment has been lower in the 1990s than in the second half of the 1980s, both in the region as a whole and in most individual countries (Marquez and Pages (1997), Lora and Olivera (1998)). At the same time, the region has experienced a significant expansion of employment in the informal sector, with 80 percent of the net increase in employment during this period going into this sector. Also increasing in Latin America during this period – and putting downward pressure on employment rates – was labor supply, mainly due to the increase in women's labor participation, being draw in both formal and informal markets through increases in female schooling and through increases in participation rates at given schooling levels (Duryea, Cox, and Ureta (2004)). This disappointing pace in job creation has prompted governments to reassess whether the newly introduced structure of international trade and investment are part of the cause of their economies' unsatisfactory performance with respect to employment, and whether changes in government trade and investment policies might help restore better employment conditions. This perception is magnified for the lack of research in the area at the regional level, and filling this gap is the objective of this study.

Understanding the effects of FDI on employment rates requires the recognition of the existence of factors that inherently cause employment rates to vary. Among the structural factors that determine the rate at which participants enter and leave the labor

market and the ease with which they can find employment are the sociodemographic characteristics (such as age, fertility, and education) and institutional aspects (such as labor laws, minimum wage, etc), while among the cyclical factors related to fluctuations in aggregate economic activity are the domestic aspects (such as changes in interest rates and productivity) and international aspects (such as changes in the terms of trade and openness of the economy). While the structural factors become of special importance in the determination of employment participation at the micro level, the increasing degree of international trade and FDI flows have contributed significantly to the innovation of production techniques, and consequently has had an important role in the determination of employment rates too. This internationalization of production is thus associated with reassignments of labor resources owing to changes in the composition of production, production techniques, and methods of work organization.

Acknowledgment of the importance of these international linkages has guided current research towards international trade theory to understand its influence on labor markets and employment generation. The traditional Heckscher-Ohlin (H-O) model predicts that an increase in trade will increase the demand for the products that use the relatively more abundant factor more intensively, and consequently its relative price too, normally presumed to be labor in the developing countries – particularly unskilled labor. In the context of a full employment model of the labor market, this implies that there will be a reallocation of output towards labor-intensive goods, implicitly increasing the demand for unskilled labor. While this is commonly taken to mean that H-O predicts employment growth in developing countries, it is not strictly true. Since in H-O all markets clear with macroeconomic equilibrium and full employment throughout, a rise in trade can only cause an inter-sectoral shift towards labor-intensive activities (and so higher wages), not greater employment.

Once labor market rigidities and unemployment are allowed, an increase in trade between the relatively labor-abundant developing countries and the relatively labor-scarce developed countries is predicted to result in an increase in employment in the former, a result that is usually recognized for manufacturers (Lall (2004)). But this

prediction of a rise in employment from greater openness to trade is based on strong simplifying assumptions, curtailing important facts of competitive advantage. Rapid exposure to market forces in a world of falling natural protection – i.e. lower transaction costs – may in fact reduce employment and freeze comparative advantage in stagnant or low-return activities. Even more, although the internationalization of production shifts employment to relatively labor-intensive activities, it may not raise net employment if it destroys local enterprises without stimulating the growth of new, more efficient ones.

While recent extensions and developments on these types of models were not able to overcome conflicting result on employment generation, researchers have embraced the new trade theory – best exemplified by Grossman and Helpman (1990). This approach takes technological differences, scale economies and externalities into consideration, providing further insight into the subject but still producing ambiguous predictions for employment. The specific pattern of comparative advantage is indeterminate to a large extent and opening up to trade does not show how factor use will change, leaving the effect on employment creation to a large degree unsolved.

Consequently, the effect of trade on aggregate employment cannot be predicted theoretically *a priori* for developing countries. The only thing that can be said is that the probability of aggregate employment rising is significantly higher for developing countries because growth on export oriented industries are more labor-intensive than other industries, sector particularly affected as trade openness and foreign investment tend to be export-oriented to a high degree. This export expansion stimulates output growth in other industries of the economy also, including in import-competing industries.

While the theoretical link between trade liberalization and employment presents its own problems, the search for answers though empirical studies has been proved to be more difficult than initially perceived. Most studies are country specific, if not industry specific, and consequently the results are highly dependent in the specific characteristics of the economy and of the relevant labor market. In addition, the time dimension of such studies has brought additional complications to reach a consistent result, as studies of

Mexico by Revenga and Maloney (1994) and Revenga (1997) show. While in the first study they find that a reduction in tariffs decreased employment by 2 to 3 percent, in her latter study (using a more recent sample period) she shows that the reduction of restrictions on imported inputs (including capital goods) had a positive effect on employment – perhaps implying that labor and the constrained input are complements in the production process – at the industry level, while the reductions in the licensing coverage of inputs and output quotas are associated with increases in employment at the firm level.

An additional difficulty in the examination of the effects of trade liberalization on employment generation arises from the fact that employment tends to move in the same direction as industry product demand, but employment movements could be dampened depending on the wage adjustments incurred in the process. Consequently, if workers are able to absorb the bulk of the effect through wage concessions – which is difficult to measure – the magnitude of the effect can be minimized, but if workers choose to maintain the wage level, we would expect to see the full employment effect. This seems to be at work in Lang's (1998) study of New Zealand, as he finds no statistically significant impact of liberalization on employment, and while liberalization decreased employment in protected industries somewhat, its significant effect on wages diminished the effect of liberalization on employment in previously protected industries and thus reduced the post liberalization shift in the industrial composition of employment.

Further results on the effect of trade liberalization on employment generation have not been able to narrow down the direction of such effect. For example, while Ghose's analyses (2000 and 2003) of trade liberalization and manufacturing employment find that higher trade in manufactured products has resulted in a large positive effect on manufacturing employment, the study of Currie and Harrison (1997) finds no statistically significant effect of trade reform on employment in Morocco.

Another point that has become controversial is the identification of the employment sector that is supposed to benefit and the sector that is supposed to be

harmed. Contrary to theoretical predictions, while it is expected that trade will increase the relative demand of unskilled workers, the fact that most export-oriented industries upgrade their technology in the process suggests that the higher requirement of skill causes firms to increase their demand for skilled labor. In addition, the skill-intensive (import-competing) industries do not necessarily decline in the wake of trade liberalization as predicted by theory, but instead the evidence seems to suggest that growth of export-oriented industries stimulates growth in all other industries including import-competing industries, increasing demand for both skilled and unskilled workers.

Ghose (2000) argues that, in developing countries, job gains seem to accrue to both skilled and unskilled workers though unskilled workers generally derive larger benefits (because more of them work in the export-oriented industries). However, results on the increases of skilled workers' employment are also found in studies for Mexico. Wood (1997), Hanson and Harrison (1999), and Robertson (2000), among others, show that the relative employment of skilled workers increased after trade liberalization in this country. These results could be driven by the fact that unskilled labor-intensive industries were the ones that have been more heavily protected than the skill labor-intensive industries, contrary to trade theory, so that one of the effects of trade liberalization has been a relative decline of unskilled labor-intensive industries.

But trade reforms usually come together with accompanying policies that also affect employment levels. For example, while the usual relaxation of the foreign exchange constraint induces a growth in exports, it also creates second-order effects on employment in import-competing industries, raising employment in these industries and, more importantly, raising the growth rate of the economy as a whole, which could encourage further investment in export-oriented as well as import-competing industries. Also used with liberalization – for the promotion of exports – is the gradual depreciation of the domestic currencies, which are intended to give specific sectors a competitive edge against international rivals. While some empirical studies find that manufacturing employment increases in response to depreciation of the real exchange rate (i.e. Lora and Olivera (1998), Klein *et. al.* (2003)), others find that such depreciations have no effect

on employment rates in Latin America (Marquez and Pages (1997)), but that the negative effect of trade reforms on employment has been lessened by the depreciation of the real exchange rate.

While trade liberalization and the accompanying policies were geared to achieve gains from trade, the subsequent awareness about the importance of new technologies for economic growth has further expanded the liberalization movement to include foreign investment, with most emerging economies also reducing barriers to FDI. This further liberalization was encouraged by the leading international organization pursuing development and stabilization efforts, as noted before. MNC's bring relatively new technology, so its impact on employment depends on the interaction between productivity growth, output growth, and the specialization of labor. Also, the perceived importance of FDI on the generation of employment is magnified by the fact that MNCs are usually large, and large firms are the ones that have the greatest effect on employment creation (Levinsohn (1999)).

According to the theory of relative comparative advantage, FDI should take advantage of the relative abundance of labor in the developing countries and trigger a trend of specialization in domestic labor-intensive activities and so involve an expansion in local employment. But whether FDI is induced by lower production costs in the host country or the relative abundance of "unskilled" labor, foreign firms have shown to have a tendency to invest in relatively high-wage industries within a host country, in high-wage locations within the country, or to hire higher-wage higher-skill workers, so the sector where it exerts its greater impact it still unresolved.

Further complications for the prediction of its effect on employment are brought by the chosen mode of entry. While "greenfield" FDI – which entails the creation of new manufacturing plants – is assumed to have the greater and most direct positive effect on employment, it potential to introduce labor-saving technologies and its tendency of crowding-out non-competitive and previously sheltered domestic firms can diminish its expected positive effect. The alternative mode of entry that takes advantage of already established assets – through mergers and acquisitions – is broadly conceived to be

neutral to employment in the short run, as it is just a transfer of ownership, or even negative as many MNCs attempt to cut costs and increase efficiency through downsizing and layoffs in the newly acquired subsidiaries. However, the presumed greater efficiency induced by the takeover should lead to better quality – and perhaps more – jobs in the long run. These concerns on the mode of entry, together with the fact that privatization programs accounted for about 20 percent of the foreign direct investment in Latin America and that mergers and acquisitions account for 75-80 percent of investment flows (Andersen and Hainaut (1998)), makes the employment effect of FDI highly uncertain.

However, while Blomstrom *et. al*. (1997) corroborates the idea that MNCs allocate the more labor-intensive stages of production to the foreign operations, implying a relative increased demand for unskilled labor, the recognition that the classification of skill and unskilled labor varies somewhat between developed and developing countries can explain why the relative demand for low-skill workers did not increased in host countries as predicted by theory. In the more developed countries, the division is usually done between those with education of high school or less, and those with education of some college or more. In developing countries, however, high school graduates are often grouped with those with more education into the skilled worker group. Thus, a significant portion of skilled workers in developing countries would be considered less skilled workers in the more developed countries (Lora and Olivera (1998)).

In addition, the acceleration in the transfer of skill-biased technology brought about by FDI forces domestic firms to invest in advanced technology in order to compete, further increasing the relative demand for skilled labor. Results about the effect of FDI on the employment by skill groupings also show an ambiguous impact. While Feenstra and Hanson (1997) corroborate the existence of positive effects on the demand for skilled labor in Mexico, Lall (2004) finds instead that no general conclusions can be made about the correlation between FDI and domestic employment skills.[23]

[23] However, when adequate absorptive capacities are present, FDI was seen to have a positive impact on domestic employment.

Despite the growing importance of FDI and the increased desire of many countries to attract FDI, the impact of FDI on aggregate employment at the regional level has received scant attention in the empirical literature. To my knowledge, the only two studies that explicitly account for the effect of FDI and examine its impact on economy-wide aggregate employment are the studies of Braunstein and Epstein (2002) and Spiezia (2004).[24] Braunstein and Epstein (2002) find that FDI has no independent effect on employment in Chinese provinces, and even if a positive effect is found by adjusting their investment measure, the potential impact of FDI on employment is nonetheless very small. Spiezia (2004) finds that the impact of FDI on employment is increasing with per-capita income for a group of 49 countries, but its effect is not significant for low-income developing countries.

So, while the quantification of the overall impact of FDI on employment is still uncertain from both theoretical and empirical points of view, the need to determine the direction and magnitude of such effect becomes more pressing as governments increasingly rely on FDI to generate growth, and, at the same time, promote employment generation. Aggressive policies in Latin America have fostered increases in FDI that have presumably caused renewed economic growth. This should indirectly have promoted employment generation through greater output levels. To the extent that FDI contributes to economic growth, it may be contributing indirectly to the creation and improvement of employment.

Since my examination of the effect of FDI on aggregate employment is rather narrow, I abstract from the implications of varying and changing labor laws and the inherent aggregation problems of the employment measures used in the paper, and concentrate in explaining how aggregate employment is affected in the short run by changes in FDI. This task is done in the following sub-sections.

[24] Lee and Vivarelli (2004) point out that even if trade and FDI are expected to positively affect employment, employment creation can not be automatically assured, as the employment effect can be very diverse in different areas of the world.

4.2 Data and Methodology

The data for this study comes from the World Bank's World Development Indicators 2004 (WDI), the Economic Commission for Latin America and the Caribbean (ECLAC) 2004 Statistical Yearbook, and the International Labour Office's (ILO) Key Indicators of the Labour Market (KILM). The sample is based on a subset of the 17 Latin American countries used in the previous sections, covering the period 1980-2002, with yearly observations. It excludes countries that serve as offshore financial centers, are too small, have special governmental controls, or lack adequate data. These countries are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, México, Nicaragua, Paraguay, Perú, Uruguay, and Venezuela.

While it is not possible to control directly for the evolving structure of domestic labor laws and policies geared to promote employment, which affect the employment rate performance, the use of panel data methods allows one to control for unobservable time-invariant country-specific characteristics that determine the employment rate. With respect to the nature of the observations, while it is argued that yearly observations introduce noise from the cyclical dynamics of some explanatory variables, the potential benefit of obtaining better estimates through such dynamics gives me a reason to use them instead of few-years averages.

The econometric specification is based on Revenga's empirical model (1997) and considers the influential variables commonly used in the labor literature, but also considers macroeconomic effects specifically. The employment rate specification includes measures of both domestic and foreign investment, and measures that account for international factors through the inclusion of exports, terms of trade, and openness of the economy. The econometric model is:

$$emp_{i,t} = \alpha_0 + \alpha_1 emp_{i,t-1} + \alpha_2 \ln RGDP_{i,t} + \alpha_3 wages_{i,t} + \alpha_4 DI_{i,t} + \alpha_5 EX_{i,t} + \alpha_6 TOT_{i,t} + \alpha_7 OPEN_{i,t} + \alpha_8 FDI_{i,t} + \beta\tau_t + \varepsilon_{i,t}$$

where $emp_{i,t}$ denotes the employment rate in country i in period t, $\ln RGDP_{i,t}$ is the output measure given by the natural logarithm of the GDP of country i in period t,

$wages_{i,t}$ is the measure for average wage in each country given by real remunerations, $DI_{i,t}$ is the ratio of domestic investment to GDP, $EX_{i,t}$ is the share of exports to GDP, $TOT_{i,t}$ is the terms of trade measured as the ratio of price of exported goods over the price of imported goods, $TRADE_{i,t}$ is the traditional measure of trade openness (imports plus exports over GDP), and $FDI_{i,t}$ is the ratio of FDI to GDP. As is usually done with panel data, the subscript *i* denotes the country and the subscript *t* the year. The vector of time dummy variables that controls for common time-varying effects is denoted by τ_t, and the error term follows the standard one-way error specification

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

where μ_i denotes the unobservable individual specific effect and $\nu_{i,t}$ denotes the remainder disturbance.

The employment rate is assumed to depend positively on the prior employment rate and on the average wage in the country, while it is expected to also be positively associated with the output level. The expected effect of investment, both domestic and foreign, is to increase the level of the productive capacity as well as its efficiency, so its impact should be positively related to employment. But, as discussed in the previous section, and particularly for foreign investment, it could also be neutral or even negative if the higher levels of investment are geared to technological upgrades. In the case of FDI, its effect also depends on the mode of entry and whether the market being serviced is the domestic or international one.

International aggregate shocks are expected to affect employment levels by altering the terms of trade and the magnitude of exports, both positively as improves the cost advantages of the economy in the first case and induces higher production for foreign markets – and consequently employment – in the second case. The inclusion of these two measures indirectly accounts for the effect of the stabilization policies that manipulate the exchange rate following large capital inflows. The effect of trade policies that open up the domestic economies to international trade is indeterminate at priori, as a

decrease in trade distortions could lead to an expansion of labor-intensive sectors, sectors that have competitive advantage given the new set of prices, but this positive effect could also be hindered because it affects the level and composition of aggregate demand, because of allocation costs that slows down the shrinking of non-competitive sectors, or because workers do not find attractive to reallocate to emerging sectors because of nominal rigidities. Therefore, the question about whether more openness increases or reduces employment has to be examined empirically.

Although the econometric specification is dynamic in nature, because the linear generalized method of moments (GMM) estimator obtained after first differencing has been found to have large finite sample bias and poor precision when the autoregressive parameter is moderately large (or the relative variance of the fixed effects increases), the series are persistent, or the number of time series is moderately small (Arellano and Bover (1995), Blundell and Bond (1998), Bond, Hoeffler, and Temple (2001)), and because the sample data used in the study is suspect of at least one of the previous characteristics, testing will determine if system GMM estimation is used in this study. The system GMM estimator exploits additional initial conditions and generates efficient estimators for dynamic panel data models when the above problems are present. The system GMM estimator is composed of equations both in first-differences and levels, and uses instruments in first differences for equations in levels and instruments in levels for equations in first differences.

Given the nature of the data, and to detect whether serious finite sample biases are present, a comparison of the first-differenced GMM results to alternative estimates of the autoregressive parameter is first conducted. As it is well known, the OLS on levels will give an estimate of the autoregressive parameter that is biased upwards in the presence of individual-specific effects. The within group estimator will give an estimate of the autoregressive parameter that is seriously biased downward in relatively short panels. From the above specification[25] we obtain an estimate of 0.89671 for the autoregressive parameter using OLS, and an estimate of 0.66329 for the autoregressive

[25] Complete results are included in the Appendix in Table A.5.

parameter using fixed effects. The autoregressive parameter estimate using the traditional first-differenced Arellano and Bond (1991) method is 0.62636, which lies below the within group estimate, a signal that biases due to weak instruments may be important in the first-difference estimator.

The parameter estimate of the autoregressive coefficient using system GMM is 0.77275, which lies comfortably above the fixed-effects estimate and below the OLS estimate. The additional instruments from the system GMM seem to be valid and highly informative in this context. In addition, neither the Hansen's over-identification test nor the tests for second-order serial correlation detect any problems with neither instrument validity nor the serial correlation assumptions (see footnote 19). The results suggest that there is a finite sample bias problem caused by weak instruments in the first-differenced GMM results, which I address in the remaining analysis by using the system GMM.

The estimate of the FDI variable is statistically significant in the OLS and the dynamic panel data system GMM estimations. When I account for the cross section and time series nature of the data and the inherent problems of the sample at hand and estimate the dynamic specification with the system GMM, the estimate of FDI is 12% lower than the OLS estimate.

I focus on the system GMM estimator, as it is asymptotically more efficient relative to either of the alternatives. Bond, Hoeffler, and Temple (2001) also note the considerable strength of the system GMM estimator to obtain consistent parameter estimates even in the presence of measurement error and endogenous variables, so that endogeneity concerns arising from independent variables like the level of the economic activity (output) or average wages can be disregarded. The remainder of the analysis addresses the finite sample bias problem caused by weak instruments in the first-differenced GMM results and makes use of system GMM on the estimations in the following section.

4.3 Results

The results obtained in this study have limitations because many details and dynamics of the labor markets of the sample countries cannot be fully addressed. One of the main difficulties is that existing surveys do not collect the relevant information in a sustained base, nor in the necessary depth to be able to study adequately the topic at hand. Another important limitation is the lack of data to discern the industry participation of foreign investment, as it is hypothesized that FDI could have a significantly different effect on employment according to the industry where it is injected. In addition, because employment creation is of great concern for domestic governments, and policies are continuously used to expand it, the adequate measurement of the effect of FDI on employment rates becomes illusive. These limitations are taken into account when interpreting the results and I exercise caution when making generalizations.

As the emphasis of the empirical analysis is to estimate the effects of FDI on employment rates[26], and because one of the main determinants of employment is not available for the sample (the yearly average wage), I use real remunerations to proxy for average wages. While the main regression has the total employment rate as the dependent variable, given that female participation rate has increased significantly in Latin America – while male participation rate have stagnated – and that some researches attribute this increase to the greater employment opportunities brought by foreign investment, I also estimate FDI's effect on each of these employment rates.

In Table 4.1 below the main regression results are presented. One can immediately observe the high degree of persistence that the employment rate presents. The main specification – in column one – shows that FDI has a positive and significant impact on total employment rate, indicating that a 10 percentage point increase in foreign investment raises employment in the host country by almost 1.3 percentage

[26] I will also stress the channels through which FDI may influence employment generation in Latin American countries. In particular, through the estimation of the main economic sectors I will try to disentangle the main channels through which FDI potentially has an effect on domestic employment.

point. It also shows that domestic investment also has a positive and significant effect on employment, rising by almost 1 percentage point in response to a 10 percentage point increase in FDI. These results suggest that independently of the type of investment, any additional investment in the domestic economy contributes to the generation of employment. With respect to the changes in exports, the results show that its effect is also positive and significant, with its impact being between the impacts of the two investment measures – an increase of 10 percentage points in the share of exports to GDP raises total employment rate by 1 percentage point. With regards to real remunerations, its effect is marginal but positive and statistically significant. The three remaining explanatory variables are not statistically significant at any conceivable level.

Table 4.1 – Effect of FDI on Employment Rate

	Total	Male	Female
Constant	25.791**	28.366**	21.673*
	(10.687)	(10.202)	(11.522)
Lagged Employment	.77275***	.77519***	.77089***
	(.03952)	(.05269)	(.02975)
Real Remuneration	.00802**	.00792***	.00913**
	(.00271)	(.00228)	(.00364)
FDI	.12957**	.11745**	.14688**
	(.05268)	(.05143)	(.06112)
Dom. Investment	.08658***	.07761***	.09701***
	(.02105)	(.02223)	(.02767)
Exports	.10206*	.10643*	.09270
	(.05744)	(.05324)	(.06665)
ln *RGDP*	-.11668	-.19055	.00691
	(.25054)	(.23034)	(.27080)
Trade Openness	-1.9134	-2.1932	-1.4898
	(1.5768)	(1.4073)	(1.8511)
Terms of Trade	-.00515	-.00413	-.00768
	(.00591)	(.00607)	(.00565)
Hansen Over-Id.	1.000	1.000	1.000
AR(1) Test	0.009	0.009	0.015
AR(2) Test	0.916	0.109	0.361
N. Observations	264	264	264

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not reported. Standard Errors in parentheses.*

These results suggest that the implemented policies in the region to attract FDI have indeed increased the domestic employment rates. Also, finding that both types of investment exert a positive effect on employment is consistent with the results found by Spiezia (2004), indicating that increases in productive capacity – investment – are important for employment generation.

The estimation using the employment rate of males as the dependent variable is presented in the second column. The results show that while the effect of FDI on the employment rate is also positive and statistically significant, it is slightly smaller than the effect on total employment rate – almost 10 percent smaller. Domestic investment also has a positive and statistically significant effect on male employment rate, with its effect also being around 10 percent smaller than its effect on total employment rate. I also find that real remunerations and exports exert a positive and statistically significant effect on male employment rate, effects of similar magnitude as the ones observed on total employment rate.

The results in the third column are those for the specification using the employment rate of females, and shows that FDI has a stronger impact on the employment generation of this gender group. The estimates indicate that a 10 percentage point increase in FDI results in almost 1.5 percentage point increase in female employment rate, slightly more than 13 percent of its effect on total employment rate and almost 25 percent larger than its effect on male employment rate. For this group, the effect of both real remunerations and domestic employment are also statistically significant, being somewhat stronger than their effect on total employment rate. The effect of exports on employment is still positive and of similar magnitude than its effect on total employment rate – and on male employment rate – but it is not statistically significant at any conceivable level.

The results of Table 4.1 add an additional determinant to the rise in female labor force participation rate observed in the late 1990s by Duryea, Cox, and Ureta (2004), placing FDI as another force in increasing labor employment, in addition to their findings about the positive role that increases in education, in participation rates at given

schooling levels, and in female wages play in the increases in female employment in Latin America. The results above show that while FDI exerts a positive effect on total employment rate, it does so relatively more in female employment rate than in male employment rate.

Also, since the estimated effect of FDI above is for current flows, and since there are some arguments that FDI's effect on employment should be delayed, I have also estimated the same specification using lagged FDI by one and two years. The results show that lagged-one-year FDI has a larger and statistically significant positive effect on employment rates, on total as well as on male and female employment rates (0.15278, 0.12400, and 0.19295 respectively). This provides support to the idea that the full effect of foreign investment on employment materializes only after one year. The lagged-two-year FDI effect on employment continues to be positive but is no longer statistically significant, for total as well as for male and female employment rates.[27] Clearly, FDI's effect on female employment rate gets even larger after one year relative to its effect on male employment rate, becoming 50 percent larger.

In order to exploit the dimensionality of the data and investigate the robustness of these results, in Table 4.2 below I also consider the potentially different effects that FDI could have on employment according to the level of development of the receiving country, as less developed countries are hypothesized to be able to reap greater benefits from FDI than do more developed countries, with its corresponding repercussion on output and consequently employment. This is done with the introduction of the dummy variable DEV that takes the value of one for countries that had a real GDP per capita higher than U.S. $2,500 in the year 1980, and zero otherwise. While the effect of the control variables on employment rates are similar than those of Table 4.1, when I account for the level of development I find that FDI's effect on the employment rates of both genders are more close in magnitude to the effect on total employment rate. Another interesting insight is that domestic investment's effect continues to be positive and significant for all employment rates.

[27] See Table A.6 for magnitudes and standard errors of all FDI estimates.

Column one shows that when one accounts for the level of development the effect of FDI on total employment rate is almost 20 percent larger in less developed countries relative to the overall effect. An increase in FDI of 10 percentage points – in less developed countries – results in slightly more than a 1.55 percentage point increase in total employment rate. While the effect of FDI on total employment rate seems to still be positive for the more developed countries by adding up the individual coefficients, statistical testing of both estimates together reveal that this effect is not statistically

Table 4.2 – Effect of FDI on Employment Rate by the Level of Development

	Total	Male	Female
Constant	22.325**	25.705**	18.685
	(10.079)	(9.8679)	(11.129)
Lagged Employment	.77417***	.78006***	.76816***
	(.03811)	(.05231)	(.02784)
Real Remuneration	.00803**	.00770***	.00929**
	(.00291)	(.00247)	(.00377)
Dev	-.00167	.16843	-.24545
	(.42938)	(.26846)	(.74727)
FDI	.15512***	.15157***	.15445***
	(.03649)	(.03780)	(.04589)
*FDI * Dev*	-.07500	-.10499	-.01911
	(.09663)	(.08101)	(.12816)
Dom. Investment	.08145***	.07379***	.09334***
	(.01630)	(.01730)	(.02437)
Exports	.09744*	.10263*	.09249
	(.05054)	(.04768)	(.06069)
ln *RGDP*	-.00900	-.12582	.12610
	(.24301)	(.22971)	(.28195)
Trade Openness	-1.6104	-1.9587	-1.2901
	(1.4259)	(1.2917)	(1.7163)
Terms of Trade	-.00607	-.00481	-.00853
	(.00585)	(.00594)	(.00557)
Hansen Over-Id.	1.000	1.000	1.000
AR(1) Test	0.010	0.010	0.015
AR(2) Test	0.938	0.121	0.359
N. Observations	264	264	264

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not reported. Standard Errors in parentheses.*

different than zero.

With respect to the specification for male employment rate (column two), the results show that an increase in FDI of 10 percentage points in less developed countries results in a 1.51 percentage point increase in the employment rate, and while FDI's effect in the more developed countries seem to impact positively male employment rate when adding the individual coefficients, further testing indicates that its effect is not statistically different than zero. These results show that FDI's effect on male employment is only 2 percent smaller than the effect on total employment rate for less developed countries.

In the last column I present the results for the effect of FDI on female employment rate, and it shows that while such effect is also larger than its effect on male employment rates for less developed countries, it is slightly smaller than its effect on total employment rate. Also, while the effect of FDI on female employment rate for the more developed countries seems positive when the estimates are added together, it is also statistically not different than zero when tested together. These results show that while FDI still exerts a positive effect on total employment rates, it does so on less developed countries, and while this impact is stronger for female employment, its differential effect relative to male employment is much smaller than the overall impact found in Table 4.1 – 2 percent larger rather than 25 percent.

As it is known that many Latin American countries have experienced hyperinflationary pressures during the sample period, and that is possible that such abrupt changes in the inflation level could potentially affect the macroeconomic fundamentals of the economies being examined, and consequently employment generation, I now allow for the slope of FDI to vary according to the level of inflation. The dummy variable used for this purpose is HY and it has the value of one for years when inflation reached levels higher than 50 percent, and zero otherwise.

Table 4.3 below presents the results. Here I find that the effect of the main determinants of employment that were found to be statistically significant in the base specification – Table 4.1 – continue to be significant when one accounts for the level of

inflation, with the exception of the effect of exports on total employment rate, which maintains its magnitudes but loses its statistical significance. The effect of FDI on total employment rate is positive and significant for periods with low inflation level, suggesting that a 10 percentage point increase in FDI results in almost a 1.4 percentage point increase in the employment rate. The effect of FDI on total employment rate for periods with high inflation levels is small but positive when both estimates are added, but statistical testing shows that such effect is not statistically different than zero.

Table 4.3 – Effect of FDI on Employment Rate by the Level of Inflation (Yearly Inflation less than 50% and greater than 50%)

	Total	Male	Female
Constant	25.423**	28.166**	22.030*
	(10.825)	(10.373)	(11.807)
Lagged Employment	.77250***	.76819***	.77639***
	(.04348)	(.05879)	(.03075)
Real Remuneration	.00802**	.00812**	.00879**
	(.00296)	(.00264)	(.00345)
HY	.28550	.43695	-.09775
	(.53080)	(.44672)	(.70368)
FDI	.13819**	.13040**	.14415**
	(.05648)	(.05519)	(.06356)
*FDI * HY*	-.11518	-.15288	-.01800
	(.17351)	(.13032)	(.24763)
Dom. Investment	.08640***	.07771***	.09766***
	(.02078)	(.02194)	(.02634)
Exports	.10047	.10342*	.09625
	(.06004)	(.05746)	(.06570)
ln *RGDP*	-.11453	-.18019	-.01143
	(.25544)	(.23254)	(.27935)
Trade Openness	-1.8282	-2.0376	-1.6196
	(1.7225)	(1.5625)	(1.9592)
Terms of Trade	-.00506	-.00423	-.00738
	(.00564)	(.00582)	(.00555)
Hansen Over-Id.	1.000	1.000	1.000
AR(1) Test	0.009	0.009	0.015
AR(2) Test	0.850	0.124	0.362
N. Observations	264	264	264

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not reported. Standard Errors in parentheses.*

In column two we observe that FDI's effect on male employment rate is slightly smaller than its effect on total employment rate for low inflation years – around 5 percent smaller. As the results show, a 10 percentage point increase in FDI in low inflation years results in 1.3 percentage points increase in male employment rate When we add the estimates that show FDI's effect on employment rate for periods with high inflation levels we find a small and negative effect for this gender group. However, statistical testing of both estimates together reveals that FDI's effect it is not statistically different than zero.

When controlling for inflationary periods I also find that the effect of FDI on female employment rate is positive and significant for low inflation years. Column three shows that FDI's effect on female employment rate is larger than its overall effect on total employment rate, and almost 10 percent larger than its effect on male employment rate. This indicates that a 10 percentage point increase in FDI results in almost 1.5 percentage point increase in female employment rate in periods with low inflation. While FDI's effect of female employment rate for periods of high inflation also seem to be positive (adding both estimates), statistical testing of both estimates together show that such effect is not statistically different than zero.

Table 4.3 also shows that FDI exerts its greater effect on female employment rate even after one controls for the level of inflation, reinforcing the results found in the previous tables. It also shows that both domestic investment and real remunerations have a consistent positive and statistically significant effect on total, as well as on male and female, employment rates.

Another interesting aspect that affects the employment rate is the growing percentage of workers that end up holding jobs in the informal sector, particularly in Latin American labor markets. Many Latin American countries suffer from high levels of employment in the informal sector, and that such high levels of informal activity may affect how enacted policies – and the other determinants of employment – affect the employment rate. In order to control for the degree of informality in employment I

introduce the dummy variable *Infor* that takes the value of zero for countries with an informality level below 50 percent, and one otherwise.

Table 4.4 below presents the results, and shows similar effects of the main determinants of employment than those found in the base specification – Table 4.1 – even after the level of the informal sector is accounted for. In column one I find that FDI's effect on total employment rate is negative in countries with low levels of employment in the informal sector, but such effect is statistically insignificant at any

Table 4.4 – Effect of FDI on Employment Rate by Level of Informality (Average Informality less than 50% and greater than 50% of Economic Activity)

	Total	Male	Female
Constant	22.873*	24.985**	19.977
	(10.779)	(10.021)	(12.238)
Lagged Employment	.77728***	.78278***	.77028***
	.03745()	(.05108)	(.02682)
Real Remuneration	.00802**	.00787***	.00914**
	(.00290)	(.00248)	(.00385)
Infor	-.27922	-.28114	-.21814
	(.42045)	(.32798)	(.63208)
FDI	-.02219	-.03153	.01187
	(.08668)	(.07851)	(.11082)
*FDI * Infor*	.20006**	.19696**	.17738*
	(.08048)	(.07365)	(.09883)
Dom. Investment	.08426***	.07461***	.09659***
	(.01646)	(.01677)	(.02501)
Exports	.10532*	.10816**	.09978
	(.04968)	(.04717)	(.05888)
ln *RGDP*	-.03062	-.10101	.07368
	(.26979)	(.23726)	(.31686)
Trade Openness	-1.7121	-1.9545	-1.4123
	(1.4701)	(1.3219)	(1.7482)
Terms of Trade	-.00604	-.00502	-.00842
	(.00601)	(.00604)	(.00594)
Hansen Over-Id.	1.000	1.000	1.000
AR(1) Test	0.011	0.011	0.016
AR(2) Test	0.942	0.119	0.372
N. Observations	264	264	264

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not reported. Standard Errors in parentheses.*

conceivable level. However, for countries with high levels of employment in the informal sector I find that a 10 percentage point increase in FDI results in almost 1.8 percentage points increase in total employment rate, and this positive effect is statistically significant. This positive effect on total employment rate perhaps reflects the fact that while greater foreign investment increases production in the formal sector, the readily available pool of labor available in countries with high levels of activity in the informal sector makes the generation of further employment easier. This is related to the positive effect of FDI on taxes on goods and services of the previous section, result that emanates from the formalization of economic activity brought about by higher participation of MNCs in the production process.

In column two I find that FDI also exerts a negative impact on male employment rate in countries with informality levels below 50 percent, but this effect is not statistically significant. However, FDI's effect of male employment rate is positive and statistically significant for countries with informality levels above 50 percent, significance that is corroborated when testing both estimates together. The results show that a 10 percentage point increase in FDI in countries with informality levels above 50 percent raise male employment rate by slightly more than 1.6 percentage points. Also, the results of column three show that while FDI's effect on female employment rate is small but positive for countries with low levels of informality, its effect is not statistically significant at any conceivable level. However, such effect on female employment rate is positive and statistically significant for countries with informality levels above 50 percent, indicating that a 10 percentage point increase in FDI results in almost 1.9 percentage points increase in the employment rate of this gender group.

Table 4.4 again shows that the effect of FDI on female employment rate is almost 5 percent larger than its effect on total employment rate and almost 20 percent larger than its effect on male employment rate. This tendency of FDI affecting female employment rate relatively more when one accounts for the degree of informal sector could be due to the traditionally higher pool of female workers ready to be introduced in the formal sector, the increase in labor force participation rate, and the formalization of

employment brought about by the higher rates of production done by MNCs, all resulting in the employment improvement in this gender group.

I also examine the potentially different effect that FDI can exert on the employment rate according to level of foreign investment that each country was able to attract. This is done by dividing the sample into two comparatively distinct groups of countries based on the average share of FDI to GDP that they were able to attract, which account for inherently better investment prospects. To this end, the dummy variable *More* is introduced, which takes the value of zero for countries with average FDI inflows below 1.8 percent of GDP, and one otherwise.

The results are shown in Table 4.5, and show that both real remunerations and domestic investment continue to exert a positive and significant effect on total, male, and female employment rates, and also shows that – when one controls for the degree of FDI inflows – exports also exert a positive and significant effect on employment rates, both on the overall employment rate as well as on the employment rate of each gender group. Column one shows that FDI has a positive and significant effect on total employment rate in countries with average foreign investment below 1.8 percent of GDP, which implies that a 10 percentage point increase in FDI results in around 1.7 percentage points increase in total employment. When the average foreign investment is above 1.8 percent of GDP, the effect is almost half this size but still positive, but statistical testing shows that is not different than zero.

With respect to the specification for male employment rate (column two), the results show that an increase in FDI of 10 percentage points in countries receiving an average of foreign investment below 1.8 percent of GDP result in a 1.53 percentage points increase in the employment rate, and while FDI's effect in countries with an average of FDI inflows above 1.8 percent of GDP seem to impact positively male employment rate when adding the individual coefficients, further testing indicates that its effect is not statistically different than zero. These results show that FDI's effect on male employment is almost 15 percent smaller than the effect on total employment rate for countries with low levels on FDI inflows.

In the last column of Table 4.5 I present the results for the effect of FDI on female employment rate, and it shows that for countries with low foreign investment levels such effect is larger than its effect on total employment rate – by 20 percent – and than its effect on male employment rate – by almost 40 percent. An increase in FDI of 10 percentage points in countries with low levels of foreign investment results in a 2.11 percentage point increases in female employment rate. While the effect of FDI on female

Table 4.5 – Effect of FDI on Total Employment by Magnitude of Flows of Foreign Investment (Average Inflows less than 1.8% of GDP and greater than 1.8% of GDP)

	Total	Male	Female
Constant	28.868**	31.036***	25.579**
	(9.8893)	(9.5399)	(10.773)
Lagged Employment	.76075***	.76286***	.76568***
	(.03693)	(.05041)	(.02859)
Real Remuneration	.00949***	.00922***	.01106***
	(.00178)	(.00156)	(.00255)
More	.77723	.79164*	.73528
	(.49213)	(.43108)	(.60928)
FDI	.17618*	.15305*	.21157*
	(.09238)	(.07649)	(.11905)
*FDI * More*	-.09723	-.08648	-.11490
	(.08877)	(.07290)	(.12079)
Dom. Investment	.09342***	.08377***	.10435***
	(.02236)	(.02440)	(.02566)
Exports	.11948**	.12144**	.11539*
	(.05450)	(.05029)	(.06339)
ln *RGDP*	-.14365	-.20329	-.06656
	(.23832)	(.22384)	(.25793)
Trade Openness	-2.5062*	-2.7331**	-2.2370
	(1.4151)	(1.2169)	(1.6943)
Terms of Trade	-.00677	-.00580	-.00899
	(.00557)	(.00576)	(.00532)
Hansen Over-Id.	1.000	1.000	1.000
AR(1) Test	0.009	0.009	0.015
AR(2) Test	0.927	0.106	0.351
N. Observations	264	264	264

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not reported. Standard errors in parentheses.*

employment rate – for countries with high levels of foreign investment – also seem positive when the estimates are added together, it is not statistically different than zero when tested together. These results show that while FDI still exerts a positive effect on total employment rates, particularly in countries with average inflows of FDI below 1.8 percent of GDP, and this impact is stronger for female employment than for total or male employment rates.

To conclude this robustness check, I have also examined the potentially different effect of FDI on employment generation by dividing the sample into two comparatively distinct time periods, to account for the considered "lost decade" for economic development in Latin America. The results are shown in the Appendix in Table A.7, and shows that the effect of FDI on total, male, and female employment rates is not statistically significant in the earlier period of the sample (1980s), and while such effect seems also not significant in the later period of the sample by examining the individual coefficients, statistical testing of both estimates together reveal that FDI has a positive impact on the overall as well as on the employment rate by gender. Here I find again that FDI's effect on female employment rate is almost 5 percent larger than its effect on total employment rate and almost 15 percent larger than its effect on male employment rate. This positive effect on the later period of the sample should reflect the greater flows on foreign investment flowing into the region, and its consequent positive effect on economic growth, production, and employment.

While general conclusions cannot be drawn on how each of the determinants of the employment rate exerts their effect in general, we can clearly see the measures which affect employment generation in a consistent way. Real remuneration and domestic investment are found to affect the employment rates positively, irrespective of the way in which one controls for the peculiarities of the sample (controlling for level of development, inflation level, degree of informal sector, averages of FDI inflows, or time periods). Another measure that has in general a positive and statistically significant effect on total employment rate is the level of exports of the host country, suggesting that increases in exports are given way to higher levels of employment, as expected. In

accord with findings of both Braunstein and Epstein (2002) and Spiezia (2004), I find that both domestic and foreign investment have a positive and significant effect on total employment rate. The positive effect of FDI on employment is particularly important for the female labor force, group that achieves the largest gains from higher levels of foreign investment. It is also important for the less developed Latin American economies, for periods with low inflation levels, countries with large activity in the informal sector, countries with low levels of foreign investment, and for the later portion of the sample.

While the results are insightful, some caveats need to be taken into consideration. One common problem in the empirical work that examines the effect of FDI on aggregate employment is that it is often difficult to control for the impact of all relevant regional characteristics, the firm specific level of employment, and the changing structure of the labor market in each country. Also, while many researchers take as granted that the larger flows of FDI have had the effect of boosting aggregate employment in developing countries, the dualistic economic structure of Latin America introduces specific challenges into the quantification of the effect on employment. Although labor participation is adequately quantified in the formal sector, the employment fluctuations in the informal sector are much more complicated to follow.

Because most studies use industry-level data, or economy wide data, there are a number of important issues that simply cannot be addressed, or for which we obtain misleading answers. While we are able to obtain net employment changes of the employment rate, the reshuffling of jobs can potentially create significant reallocation costs that are not being explicitly picked up by the results. Furthermore, aggregate employment measures do not pick up participation changes that occur through changes in worked hours.

Whether FDI induces changes in net employment through job creation or job destruction is qualitatively important too, as it can lead to quite different results. A reduction in job creation affects individual employment prospects only indirectly, but increases in job destruction have more deleterious effects. Job destruction inherently raises worker layoffs that, if permanent, involve the depreciation of human capital and a

costly search and relocation process that often leaves dislocated workers with much lower subsequent earnings (Klein *et. al*. 2003).

To conclude this sub-section, it is noteworthy to point out that econometric methods may ignore the potential heterogeneity of the slope parameters of the data, as well as of other panel data used to analyze structurally different countries (Pesaran and Smith (1995), and Lee, Pesaran and Smith (1997)), and thus produce results that are biased. However, given that the sample period of this study is relatively short, the individual country equations cannot be estimated separately to calculate explicitly the best possible parameters from the averages of the estimated country-specific parameters. While this problem is inherent in the sample data, the use of interactive groups for the main variable of interest and time dummy variables ameliorates this bias.

4.4 Conclusions

This section shows that FDI has a positive and significant effect on the employment generation in Latin American countries, in addition to the positive effect of real remunerations, domestic investment, and exports. Such beneficial impact of FDI is larger on female employment than on male employment rates. This larger impact of FDI on female employment rate is around 13 percent larger than its effect on total employment rate and almost 25 percent larger than its effect on male employment rate in the overall estimation, but such differential effect can be as small as only 2 percent higher than male employment rate when one accounts for the level of development and as large as 40 percent when one accounts for the level of foreign investment flowing into the host country.

This positive effect of FDI on employment is especially important for the less developed economies, for periods with low inflation levels, for countries with high levels of activity in the informal sector, for countries attracting low average inflows of FDI, and for the later period of the sample. The results found about the positive impact on employment rates for countries with high levels of informality is somewhat in

agreement with the idea that higher levels of foreign investment induce businesses operating in the informal sector to expand and formalize their activities (see section 3). The positive impact on employment rates in less developed countries and on periods with low inflation levels are in accord with the expectations that the expected externalities of FDI can be maximized in stable investment environments and countries with significant underutilized resources.

FDI affects the employment rate through direct hiring of people for their plants, through indirect employment as they create links with suppliers and service providers as well as with other affiliates that are attracted to the country by their entry, and through their contribution towards higher incomes, which can also increase employment through higher levels of consumption, savings and investment. In addition, the formalization of the domestic economy brought about by the increase of MNCs presumably also bring better condition in the work place and improved – if even present before – benefits for the participants.

These results give support to the economic policies implemented in Latin America for the last decades in order to spur economic growth. With this section I find evidence that the larger flows of FDI into the region not only contributed to improvements of real GDP per capita growth rates and to increases in government tax revenues, but it also contributes to increases in employment rates in Latin America, factors that are perhaps more relevant to the governments and people of the region. The fact that this period of higher levels of FDI has been accompanied by a significant inclusion of women in the labor market also is significant to close the gender gap.

5. MACROECONOMIC CONSEQUENCES OF REMITTANCES

5.1 Introduction

Remittances have been on the rise for the last several decades. International estimates of official remittances flows suggest that the total amount of remittances received by developing countries has reached 167 U.S. billion dollars in 2005, up by 73 percent from 2001 (World Bank's Global Economic Prospects). Moreover, remittances constitute a significant share of some countries' gross domestic product (Neyapti (2004) and Heilman (2006)). The apparent increase in remittances may in part be attributed to the rapid growth of money transfer institutions, making the money flows more visible and decreasing the average transaction cost of remitting. However, the increase in measured remittances is also indicative of an actual increase in these monetary flows, with remittance flows growing from only satisfying basic needs to also providing durable goods for the recipient households.

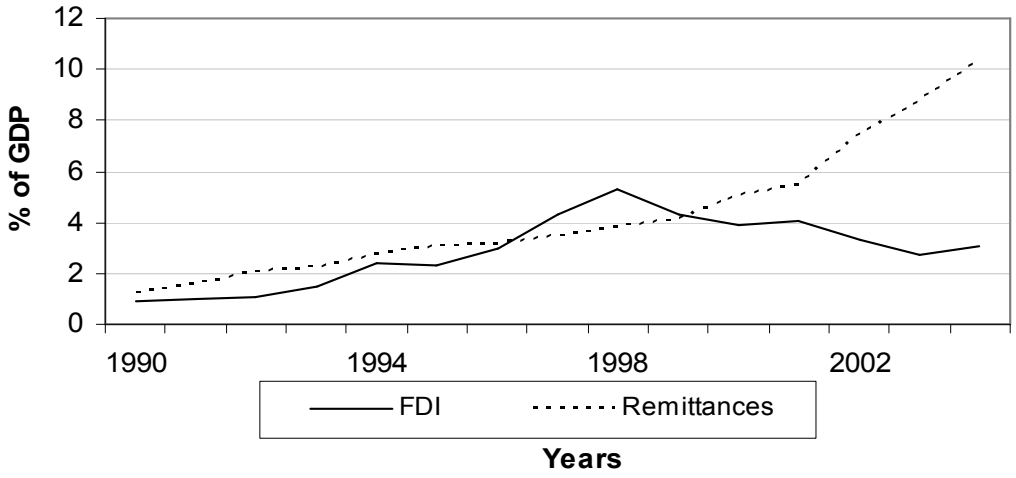
Remittances gain their significance not just from their size but from the potential and actual effects of these money flows on both the society and the individual. Remittances affect labor market decisions, school retention levels, export sector competitiveness, and create moral hazard problems (Funkhouser (1992), Glytsos (2002), Edwards and Ureta (2003), Amuedo-Dorantes and Pozo (2004), Amuedo-Dorantes and Pozo (2006) and Chami, Fullenkamp, and Jahjah (2005)).

The increasing volume of monetary remittances has led to an interest in studying the effects of remittances. Several studies have documented that for several developing countries total remittances already exceeded foreign aid and compete in size with foreign direct investment or FDI (Connell and Brown (2004), De Haas (2006), Heilmann (2006) and Chami *et. al.* (2006)). While FDI flows are assumed to be profit driven and therefore

considered as a source of development, the increase in remittances also has the potential to promote economic growth.

Remittances may be motivated by many factors. Lucas and Stark (1985) look at remittances as motivated by either altruism or self-interest. The principal motivation behind remittances may have important implications for the effect of remittances on output in the recipient country. Some researchers believe that altruistically motivated remittances are countercyclical with domestic output, while others consider remittances as procyclical with domestic output when they are mainly motivated by self-interest plans.

Figure 5.1 indicates the increasing importance of remittances in selected Latin American countries, comparing remittances and FDI as shares of GDP. Remittances have surpassed FDI in magnitude starting in about 1999, and remittances have been growing while FDI is shrinking.



Source: World Bank's World Development Indicators

Figure 5.1: Trends of FDI and remittances for a sample of Latin American countries

Most of the remittance literature focuses on the microeconomic implication of such flows, for the sender or the receiver of these funds. The literature on the macroeconomic impact of remittances on the recipient country is sparse. This section

explores the impact of remittances flows on output, consumption, interest and exchange rates in the recipient country. In particular, I explicitly model remittances in a small open economy and analyze the impact of shocks to money, remittances, and technology on these main macroeconomic measures. I expand a limited participation model that requires that money balances be held to finance certain types of purchases and agents incur adjustment costs on money holdings. These two requirements generate a large and persistent liquidity effect consistent with the stylized facts (Hairault *et. al.* (2004)). The impact of the adjustment costs on the predetermined allocation of money cash available for consumption is then analyzed to see how the main real variables of the economy respond to a remittances shock.

The main contribution of this section is the ability to examine the impact on the main economic variable when one allows for different end uses of remittances, and monetary injections. In fact, many domestic governments are currently trying to develop policy tools to direct a portion of remittances towards investment. Thus I am able to distinguish between the direct effect of remittances on output through investment and the indirect effect through consumption and its multiplier effects. Being able to distinguish the end use of remittances is crucial in looking at the final effect on output in the economy (Burgess and Haksar (2005), Heilmann (2006) and Sayan (2006)).

Residents of labor exporting countries receive substantial annual flows of remittances. Countries like India and Mexico received documented remittances of more than 9 billion U.S. dollars in 2001[28] (IMF Balance of Payments Yearbook). Figure B.1 in the Appendix shows that remittances were 40% of GDP in Guatemala by 2004, approaching 15% in Honduras, above 8% in Ecuador, and over 30% in El Salvador. Even in larger economies such as Mexico remittances approached 1% of GDP by 2004.

Durand *et. al.* (1996) argue that remittance can stimulate the economic activity both directly through investment and indirectly through consumption. Even if the large percentage of remittances is used for private consumption, some smaller portion is used in productive investment. When applied to large sums of remittances this investment

[28] Several researchers believe that undocumented remittances are twice the recorded amounts. Refer to Freeman (2006) for more details.

portion may be significant. Furthermore the authors argue that large use of remittances for consumption stimulates the demand for goods and services in the receiving country, leading to increases in production, employment and disposable income.

Widgren and Martin (2002) include remittances with FDI and foreign aid as possible sources of accelerating economic growth, although they warn about the nature of remittances. Remittances are not profit driven and are often thought to be intended to mitigate the burden of poor economic performance on the local recipients. Chami, Fullenkamp, and Jahjah (2005) also suggest that remittances are compensatory in nature, and document a negative correlation between remittances and GDP growth

Heilmann (2006) argues that remittances differ from other capital flows. Remittances consist of a transfer of ownership between two individuals, and one objective is to increase the recipients' disposable income. Further, remittances are not evenly distributed. Heilmann outlines the case for remittances promoting a sustainable level of development but also warns of potential inflation due to stimulation of internal demand for imports due to remittances.

Chami *et. al.* (2006) develop a stochastic dynamic general equilibrium model that includes government policies to study the implication of remittances for monetary and fiscal policy in the recipient country. They explore the behavior of a subset of real and nominal variables in remittance-dependent economies and in economies where remittances are not significant. The authors demonstrate that optimal monetary policy will differ between the remittance-dependent economy and an economy with no significant remittances.

The literature seems to present two opposing positions concerning the effects of remittances on the economy of the receiving country (Keely and Tran (1989), León-Ledesma and Piracha (2004) and De Haas (2006)). On the one hand, remittances do increase the standard of living of receiving households.[29] These flows of funds are spent on consumption, health and education. On the other hand, remittances are mainly spent

[29] Djajić (1998) show that remittances can also increase the welfare of all residents in the labor exporting countries not just those receiving positive amount of remittances.

on consumption and rarely directly invested in productive projects. Remittances increase dependency and may increase economic instability.

In the following sub-sections I develop a theoretical model to investigate the effect of remittances on key variables in a small open economy, and then the impulse response functions of monetary, technological, and remittances shocks are analyzed.

5.2 Model

This sub-section presents a Limited Participation Model that requires money balances be held to finance certain types of purchases, and agents incur an adjustment cost when altering their money holdings. This model has been used to rationalize a large and persistent liquidity effect. I assume that any monetary shock occurs after households have decided on their deposit balances, and therefore these will generate a liquidity effect. This is not sufficient to yield a persistent liquidity effect, however, so an adjustment cost on cash money holdings, M_t^c, is also introduced.

I model the cost of changing money holdings similarly to Hairault *et. al.* (2004), who take into account the time spent on reorganizing the flow of funds. The adjustment cost equation is given by:

$$\Omega_t = \frac{\xi}{2}\left(\frac{M_{t+1}^c}{M_t^c} - \theta\right)^2 \qquad (1)$$

Here the long run value of $\frac{M_{t+1}^c}{M_t^c}$ is equal to the parameter θ, so both the level of Ω_t and its derivative with respect to $\frac{M_{t+1}^c}{M_t^c}$ is zero in the steady state. The cost of changing M_t^c is an increasing function of the parameter ξ.

The cost of adjusting money holdings implies that bank deposits would not change significantly following a monetary shock, and consequently, the firm will have more funds to absorb as the decrease in the interest rate is stronger and more persistent. Given uncovered interest rate parity (UIP) this large and persistent fall in the interest rate

differential generates an overshooting in the exchange rate in accord with the stylized facts.

The model is described in the following sub-sections.

5.2.1 Timing of Decisions

I model a small open economy that includes a representative consumer-household, a goods-producing firm, a central bank, and a financial intermediary. I have a market for goods, labor, loanable funds, foreign assets, and a money market. Within each period the timing of decisions follows these five stages:

- At the end of period $t-1$ the representative household decides the amount of deposits it wants to hold during the next period, and also the amount of cash. When the household chooses these variables, deposits (M_t^b) and cash (M_t^c), it does so taking into account that changing money cash holdings (M_t^c) is costly.
- At the beginning of period t, migrants living abroad remit funds to agents in the small country. After observing the remittances flow, the Central Bank decides on a monetary injection in order to achieve its desired level of money in the economy.
- The credit market then opens. Bank deposits are available in quantity M_t^b and the firm determines its demand for capital and labor to produce an internationally identical good. The firm borrows from the financial intermediary to finance the needed investment for production.
- The perfectly competitive goods market then opens, and both production and purchasing decisions are made.
- Finally, the foreign asset market opens at the end of the period, and the representative household makes its decision to purchase or sell foreign assets, with returns given by the exogenous world interest rate. Labor gets paid at this stage, and firms pay off their loans to the financial intermediary. As the household owns both the bank and the firm, household receive dividend payments from the bank and firm as part of household income.

It is assumed that the evolution of money follows the time line presented below in Figure 5.2, with the flow of remittances ($\Re$) happening before the Central Bank decides on the monetary injection (X) necessary to achieve the desired monetary growth (M) of the small open economy. Consequently, the money growth rate is a function of the remittances flow into the economy.

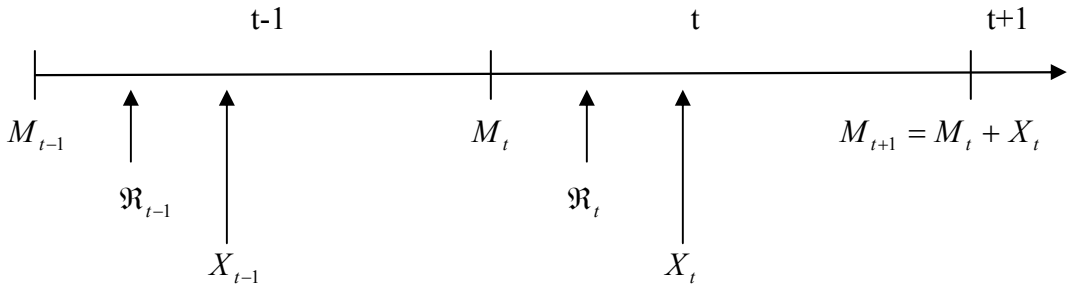


Figure 5.2: Evolution of money

5.2.2 *Structure of the Model*

The goods market is characterized by perfect competition, as the domestic firms and the rest of the world compete in the production of an identical good, whose price in domestic currency is given by P_t. The law of one price holds. Letting e_t denote the price of foreign currency in terms of domestic currency, and keeping in mind that the small open economy assumption implies that the price of the good in foreign currency (P^*) and the foreign interest rate (i^*) are exogenous, then purchasing power parity is given by:

$$P_t = e_t P^* \tag{2}$$

The Household

The representative agent's objective is to choose a path for consumption and asset holdings to maximize

$$\sum_{t=0}^{\infty} \beta^t U(C_t, L_t) \tag{3}$$

where C is consumption and L is leisure hours. We normalize the time endowment to unity, so leisure is given by

$$L_t = 1 - H_t - \Omega_t$$

where H is worked hours. The per-period utility function is log-linear in consumption and leisure, as in Hairault *et. al.* (2004), given by

$$U(C_t, L_t) = \log C_t + \gamma \log(1 - H_t - \Omega_t) \qquad (4)$$

When the goods market opens – in the fourth stage – the cash-in-advance (CIA) constraint takes the form:

$$P_t C_t \leq M_t^c + \phi \Re_t + \varphi X_t \qquad (5)$$

where M_t^c denotes the amount of cash hold by the household for consumption purchases at the beginning of the period, $\Re_t$ is the amount of money received as remittances by the household, and X_t is the amount of money being injected by the central bank. Here ϕ and φ are parameters that take values between 0 and 1, the first one determining the percentage of remittances available for consumption – as opposed to being held as bank deposits – and the second one determining the percentage of the monetary injection available for consumption – as opposed to being first channeled through the financial intermediary.[30] These parameters allow us to change the channel in which remittances and monetary injections affect the economy, and to see how the end use of remittances and monetary injections matter.

The household can hold foreign assets that yield a risk-free nominal interest rate i^*. In each period the household buys foreign assets B_{t+1} (denominated in the foreign currency). Because these foreign assets are denominated in the foreign currency, the nominal exchange rate becomes a key variable in the portfolio decision of the household.

[30] I introduce ϕ to allow for the possibility of policies that induce (force) agents to keep a certain amount of remittances as deposits (increasing funds available for investment) and φ to allow for different channels through which money is injected by the central bank, helicopter drops directly to households or through banks.

The household budget constraint is given by:

$$M_{t+1}^{c} + M_{t+1}^{b} + e_t B_{t+1} + P_t C_t \le M_t^{c} + \phi\Re_t + \varphi X_t + P_t w_t H_t + (1+R_t)M_t^{b} + e_t(1+i_t^{*})B_t + D_t^{f} + D_t^{b} \qquad (6)$$

thus at time *t* the household determines consumption C_t and labor supply H_t, as well as the amount of money deposited in banks, M_{t+1}^{b}, the amount of money kept as cash, M_{t+1}^{c}, and the foreign asset position B_{t+1}. Household income is determined by the real wage w_t, and the profits (or dividends) received at the end of the period from the firm and the bank, D_t^{f} and D_t^{b}. The nominal interest rate on deposits is given by R_t.

The household's maximization problem can be represented by the value function

$$V(M_t^{c}, M_t^{b}, B_t) = \underset{\{C_t, H_t, M_{t+1}^{c}, M_{t+1}^{b}, B_{t+1}\}}{Max} \left\{ U(C_t, 1-H_t-\Omega_t) + \beta \underset{t}{E} V(M_{t+1}^{c}, M_{t+1}^{b}, B_{t+1}) \right\}$$

subject to the cash-in-advance constraint (5) and the budget constraint (6). Letting λ_t denote the Lagrangian multiplier associated with the budget constraint, the first order necessary conditions for the household's choice of consumption, labor, money deposits, money-cash holdings, and foreign assets take the form

$$\lambda_t = \beta \underset{t}{E}\left[(1+R_{t+1})\lambda_{t+1}\right] \qquad (7)$$

$$-U'_{H_t} = w_t P_t \lambda_t \qquad (8)$$

$$e_t \lambda_t = \beta E_t[e_{t+1}(1+i^{*})\lambda_{t+1}] \qquad (9)$$

$$P_t w_t \lambda_t \frac{\xi}{M_t^{c}}\left(\frac{M_{t+1}^{c}}{M_t^{c}} - \theta\right) + \lambda_t = \beta \underset{t}{E}\left[\frac{U'_{Ct+1}}{P_{t+1}}\right] + \beta \underset{t}{E}\left[P_{t+1} w_{t+1} \lambda_{t+1} \frac{\xi M_{t+2}^{c}}{(M_{t+1}^{c})^2}\left(\frac{M_{t+2}^{c}}{M_{t+1}^{c}} - \theta\right)\right] \qquad (10)$$

Equation (7) requires equality between the costs and benefits of bank deposits, while equation (8) requires equality between the marginal disutility of working and the marginal benefit – the real wage multiplied by the Lagrange multiplier. Equation (9) requires equality of the current marginal cost of buying foreign assets (in terms of

wealth) with the gains in the following period from holding such assets today, and equation (10) equates the costs and benefits related to the choice made at time *t* of money holdings available for consumption in the following period. It is clear that if the adjustment costs are zero (ξ=0) then equation (10) will just equate the household's cost of holding money in the current period to the marginal utility of consumption in the following period, properly discounted. However, when adjustment costs exist ($\xi \neq 0$), the household will compare the cost of changing money holdings (cash) today to the benefits accrued in the next period with respect to the purchasing power of money holdings and the in-advance time saved rearranging the household portfolio.

The Firm

The production technology of the firm is given by the Cobb-Douglas function

$$Y_t = e^{z_t} K_t^{\alpha} H_t^{1-\alpha} \tag{11}$$

where $\alpha \in [0,1]$. *K* is the usual physical capital. The firm's objective is to maximize the discounted stream of dividend payments, where we consider the value of this discounted dividend stream to its owner, the household. Thus the firm's decision trades off paying dividends at the end of the current period versus reinvesting those dividends in physical capital of the firm. The firm receives its profits at the end of the period, so the firm borrows funds from the bank to invest in physical capital at the beginning of the period, with the cost of borrowing given by the nominal interest rate R_t. Consequently, the profits of the firm are given by[31]

$$D_t^f = P_t Y_t - P_t w_t H_t - P_t (1 + R_t) I_t \tag{12}$$

with investment evolving according to the law of motion of the stock of physical capital,

$$I_t = K_{t+1} - (1 - \delta) K_t \tag{13}$$

where δ is the (constant) depreciation rate. The decision about the use of dividends, either payments to households or reinvestment in the firm, is captured by the ratio of the multipliers associated with the budget constraint of the household in the value function

[31] Note that I assume that firms can only borrow for incremental investments, which need to be paid off completely by the end of the period.

(see equation (7)), as it reflects the consumer's variation in wealth. The value function of the firm is then

$$V(K_t) = \underset{\{H_t, K_{t+1}\}}{Max} \{D_t^f + E_t\left[\beta \frac{\lambda_{t+1}}{\lambda_t}\right] V(K_{t+1})\} \tag{14}$$

Note that the discount factor $\beta \frac{\lambda_{t+1}}{\lambda_t}$ can be written as $[E_t(1+R_{t+1})]^{-1}$, reflecting the fact that the appropriate discount rate is time varying and reflects the market-determined interest rate.

The first order necessary conditions for the household's choice of labor and capital take the form:

$$w_t = (1-\alpha)\frac{Y_t}{H_t} \tag{15}$$

$$1 + R_t = \beta E_t\left[\frac{P_{t+1}\lambda_{t+1}}{P_t\lambda_t}\left(\alpha \frac{Y_{t+1}}{K_{t+1}} + (1-\delta)(1+R_{t+1})\right)\right] \tag{16}$$

equation (15) indicates that the cost of hiring an additional worker should equal that worker's marginal productivity, and equation (16) requires equality between the cost and benefit of the marginal investment.

The Central Bank

In each period the economy's monetary authority first observes the remittances flow and then injects a given amount of money into the loanable funds market, X_t. Thus the money stock evolves according to

$$M_{t+1} = M_t + X_t \tag{17}$$

where the Central Bank's money injection is defined as

$$X_t = (\theta_t - 1)M_t \tag{18}$$

and where θ_t represents the monetary growth factor, itself possibly a function of the size of the remittances flow. Equation (17) indicates that money growth in the economy depends on the existing stock of money M_t and the monetary injection implemented by the Central Bank X_t.

The monetary growth factor θ_t is allowed to respond to remittances flows (sterilization, etc.) and is written as:

$$\log(\theta_{t+1}) = (1-\rho_\theta)\log(\bar{\theta}) + \rho_\theta \log(\theta_t) + \rho_g \log(g_t) + \varepsilon_{\theta,t+1} \tag{19}$$

We also define g_t as the growth factor for remittances, which evolves according to the first order autoregressive process

$$\log(g_{t+1}) = (1-\rho_g)\log(\bar{g}) + \rho_g \log(g_t) + \varepsilon_{g,t+1} \tag{20}$$

and we specify the shock to the production function in its usual form

$$\log(z_{t+1}) = (1-\rho_z)\log(\bar{z}) + \rho_z \log(z_t) + \varepsilon_{z,t+1} \tag{21}$$

Here $\varepsilon_{g,t+1}, \varepsilon_{\theta,t+1}$, and $\varepsilon_{z,t+1}$ are white noise innovations with variance $\sigma_g^2, \sigma_\theta^2$, and σ_z^2, respectively.

The Financial Intermediary

At the beginning of the period, the commercial bank (our financial intermediary) receives deposits from the household M_t^b, receives a portion of remittances as deposits, and receives a portion of the monetary injection from the monetary authority, X_t.[32] These funds are then available for lending to the firm to pay for the firm's investment in physical capital. At the end of the period, the firm repays its loans, and the bank returns deposits to the household along with the appropriate interest payment.

To make this clearer, the bank's asset balance is given by

$$P_t I_t = M_t^b + (1-\phi)\Re_t + (1-\varphi)X_t \tag{22}$$

where $P_t I_t$ are the loans made to the firm and the right hand side lists sources of funds including deposits, a portion of remittances, and a portion of the monetary injection.

Bank profits per period are equal to the interest on loans minus interest paid on deposits and on remittances deposited in banks. Note that the monetary injection directly into banks is a subsidy to the bank in that there is no interest on those funds.

---

[32] The monetary injection X_t is a helicopter drop with the additional condition that (i) can be injected into the financial intermediaries at the beginning of the period, they can lend it out, and then are distributed to the households, together with the earned interest, (ii) can be injected directly to the household for consumption, or (iii) any combination of (i) and (ii).

$$D_t^b = (1+R_t)P_t I_t - (1+R_t)M_t^b - (1+R_t)(1-\phi)\Re_t \tag{23}$$

Putting both expressions together results in profits of the intermediary depending only on the money injection provided by the monetary authority

$$D_t^b = (1+R_t)(1-\varphi)X_t \tag{24}$$

5.2.3 Closing the Model

To complete the model specification it is worth to note that there is an uncovered interest rate parity condition (UIP) from combining equations (7) and (9):

$$\underset{t}{E}\left[\Lambda_{t+1}\frac{(1+R_{t+1})}{\pi_{t+1}}\right] = \underset{t}{E}\left[\Lambda_{t+1}\frac{e_{t+1}}{e_t}\frac{(1+i_{t+1}^*)}{\pi_{t+1}}\right] \tag{25}$$

Since I am modeling a small open economy with international assets freely traded, the no-arbitrage condition leads to UIP.

Remittances are defined as follow. I assume that remittances are based on the income of the receiving economy, and I further assume that remittances are negatively correlated with output – income – deviations from the steady state. Thus remittances increase when the receiving country experiences an economic downturn. The specification follows Chami *et. al.* (2006), and is written as

$$\Re_t = E_t\left[\vartheta P_t\left(\frac{Y^{ss}}{Y_t}\right)^{\tau} e^{g_t}\right] \tag{26}$$

5.2.4 Equilibrium

The system's equilibrium is characterized by the set of prices and quantities

$$\Omega_t^P = \{w_t, R_t, P_t, e_t\}_{t=0}^{\infty}$$

$$\Omega_t^C = \{C_t, H_t, B_{t+1}, M_{t+1}, M_t^b, \Re_t\}_{t=0}^{\infty}$$

$$\Omega_t^Q = \{Y_t, H_t, K_{t+1}\}_{t=0}^{\infty}$$

and the vector of exogenous foreign variables $\{P^*, i^*\}$. Given these prices and quantities, the set of quantities Ω^C maximizes the household's expected inter-temporal utility subject to (5) and (6), the set of quantities Ω^Q maximizes the profits of the firm subject to (11) and (14), and the set of prices Ω^P ensures that the labor market, the

loanable funds market, and the money market all clear, all while satisfying purchasing power parity.

Note that the household can hold any quantity of foreign assets that it finds optimal, subject only to its budget constraint. From equation (6) and market equilibrium we can infer that foreign asset holdings evolve according to

$$e_t B_{t+1} - e_t(1+i^*)B_t = P_t(Y_t - C_t - I_t) + (1-(1+R_t)(1-\phi))\Re_t \qquad (27)$$

Equation (27) relates domestic production and absorption to an economy's foreign asset position, giving the balance of payments equilibrium. If a country's production is greater than its absorption, that country has a balance of trade surplus and a negative capital account, so its foreign asset holdings will increase.

The set of equations given by the first order conditions, the market equilibriums, and the laws of motion for physical capital, domestic money supply, foreign assets, and the monetary growth factor constitute a non-linear dynamic stochastic system. The system of equations is presented in the Appendix (B.1) together with the log-linearized system following Uhlig's (1997) methodology. To solve this system we calibrate certain basic parameters and find the steady state values of the relevant variables to characterize the long-run equilibrium of the economy.

5.3 Calibration and Steady State Equilibrium

The calibration of the standard parameters is based in part on Hairault *et. al.* (2004), supplemented with specific parameters that are derived from the sample of countries used in this section: Bolivia, Brazil, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, and Peru.

Table 5.1 below lists the values that are assigned to the basic parameters. The first three parameters have a standard calibration. The capital share, α, is set to 0.35. The subjective discount factor β is set at 0.952, implying a real interest rate equal to 4.8% per year. The depreciation rate on capital is set to roughly 10% per year. We set the parameter γ to 1.99, which implies that the representative household devotes 80% of

its time endowment to non-working activities. The remaining parameters are derived from data from the sample of Latin American countries covering the period 1990 to 2004. The data come from the World Bank's World Development Indicators database. The parameter v represents the average of the trade balance to GDP, and is used to determine the long-run real debt-to-GDP ratio in our steady state calculation. The long-run inflation factor is given by π, and is based on the average inflation factor of the countries in our sample (θ). Remittances are calibrated to be 5 percent of GDP. The persistence coefficient of the remittance's shock, ρ_g, and the standard deviation of the remittance's innovation, σ_g, are obtained from regressions on the remittance's base of the countries in the sample. Similarly, the persistence coefficient of the monetary shock, ρ_θ, and the standard deviation of the monetary innovation, σ_θ, are obtained from regressions on the adjusted monetary base of the countries in the sample[33]. Finally, I also calibrated the technology shock, persistence and variance, to match the parameters of Chami *et. al.* (2006).

Table 5.1 – Steady State Values

$\alpha = 0.36$	$\gamma = 1.99$	$g = 1.2408$	$\rho_g = 0.1143$	$\sigma_\theta = 0.0575$
$\beta = 0.952$	$\vartheta = 0.0012$	$\theta = 1.1626$	$\rho_z = 0.81$	$\sigma_g = 0.000034$
$\delta = 0.1$	$\phi = 0.99$	$v = -0.03$	$\rho_\theta = 0.193$	$\sigma_z = 0.007$

I explicitly consider two values for the adjustment cost parameter, ξ. I first examine the benchmark case of no adjustment cost, $\xi = 0$, but I also examine the case of a small adjustment cost, $\xi = 20$, which represent around 8 minutes per week of lost time rearranging the portfolio (Karame *et. al.* (2003)).

The equations are written to describe a stationary system and are the ones presented in the beginning of B.1 in the Appendix. Nominal variables are made

[33] The relevant monetary base is the country's monetary base minus the monetary inflows of remittances, such that the Central Bank decides on the monetary growth after it sterilizes the monetary inflows.

stationary by dividing them by the lagged domestic price level. The main variables are:

$$m_t = M_t / P_{t-1}; m_t^b = M_t^b / P_{t-1}; \pi_t = P_t / P_{t-1}; b_t = e_{t-1} B_t / P_{t-1}; \Gamma_t = \Re_t / P_{t-1}$$

In order to evaluate the implications of the positive exogenous shock in the limited participation model, different adjustment costs are introduced to observe the behavior of the nominal interest rate, output, nominal exchange rate, and consumption following such shocks, both in terms of impulse response functions as well as in quantitative terms.

I outline the calculation of steady state equilibrium values for the remaining variables below. Obviously adjustment costs disappear in the steady state, and steady state values do not need time subscripts. In the long-run equilibrium I assume the domestic inflation rate is given by the money growth rate, see equation (40), so that $\pi = \theta$.

In the steady state the domestic and foreign inflation levels are the same, so equation (35) implies that the change in the nominal exchange rate, $\Delta e = \frac{e_t}{e_{t-1}}$, is constant and equal to unity. Consequently the uncovered interest rate parity condition implies that the domestic and the foreign interest rates are equal ($R = i^*$). Finally, combining equations (30) and (32) and, after some manipulation, one has that the domestic nominal interest rate in steady state is

$$R = \frac{\pi}{\beta} - 1$$

One can derive the steady state level of remittances from equation (26) as

$$\Gamma = \vartheta \pi$$

To find the steady state capital/output ratio (denoted κ), from the stationarity of equation (39) one gets:

$$1+R=\beta\left[\alpha\frac{Y}{K}+(1-\delta)(1+R)\right]$$

$$\frac{1+R}{\beta}-(1-\delta)(1+R)=\alpha\frac{Y}{K}$$

$$\kappa\equiv\frac{K}{Y}=\alpha\left[\frac{\beta}{1+R-(1-\delta)(1+R)\beta}\right]$$

Then from the production function we can solve for the output/labor ratio

$$\frac{Y}{H}=\kappa^{\frac{\alpha}{1-\alpha}}$$

which can be used in equation (38) to solve for the real wage

$$w=(1-\alpha)\frac{Y}{H}$$

Solving for H in equation (29), and substituting Λ from equation (32), we can solve for the consumption/output ratio

$$\frac{C}{Y}=\frac{w\beta}{\pi\gamma}\left[\frac{1}{Y}-\kappa^{-\frac{\alpha}{1-\alpha}}\right]$$

Letting $TB=Y-C-I+(1-(1+R)(1-\phi))\frac{\Gamma}{\pi}$ to be the domestic trade balance, and using the calibration for $v=TB/Y$, we obtain the long-run real debt-to-GDP ratio that is equal to the domestic trade balance as a share of GDP

$$\frac{b}{Y}\left(1-\frac{1+i^{*}}{\pi}\right)=\frac{TB}{Y}=v$$

This and equation (42), together with the capital/output ratio, allows us to write the steady state output as

$$Y=\frac{\left(\left[1-(1+R)(1-\phi)\right]\vartheta-\frac{w\beta}{\pi\gamma}\right)}{\left(v-1-\frac{w\beta}{\pi\gamma}\kappa^{-\frac{\alpha}{1-\alpha}}+\delta\kappa\right)}$$

Then the steady state physical capital stock will be given by $K=\kappa Y$, and the steady state investment rate will be given by $I=\delta K$.

The steady state stock of foreign assets in real terms is derived from the balance of payments equilibrium (42), so the household's stock of foreign assets in real terms is

$$b = \left(\frac{1}{1 - \frac{1+i^*}{\pi}} \right) vY$$

Consequently, the steady state consumption level is given by:

$$C = Y + (1 - (1+R)(1-\phi))\frac{\Gamma}{\pi} - I - \left(1 - \frac{1+i^*}{\pi}\right)b$$

Given that real money balances is defined by equation (33), its steady state level is:

$$m = m^b + m^c$$

Combining equations (34) and (41), the steady state for real money balances is:

$$m = C - \frac{1}{\theta}\Gamma + I$$

Then using (34), the household's steady state deposit balances are

$$m^b = [\pi - (1-\varphi)(\theta-1)]I - (1-\varphi)(\theta-1)C + \left[\frac{(1-\varphi)(\theta-1)}{\theta} - (1-\phi)\right]\Gamma$$

From the definition of preferences, the marginal utility of wealth in the steady state is given by

$$\Lambda = \frac{\beta}{\pi C}$$

The steady state values of these variables are presented in Table B.1 in the Appendix, and gives the steady state values under two alternative calibrations of remittances: one with remittances equal to 5% of GDP, and the other with remittances equal to 10 % of GDP. The nominal interest rate is 22.12% in either instance, and the capital output ratio is unaffected by the level of remittances. I have the same inflation rate for either level of remittances – which is only dependent on the steady state money growth rate, and thus independent of the level of remittances. Output is affected somewhat by remittances, and falls almost 4% when remittances rise from 5% to 10%.

This occurs because the capital stock and labor hours worked are also about 4% lower. Meanwhile consumption is higher by about 1%. Thus a steady flow of outside purchasing power results in households choosing more leisure while also having more consumption. Remittances are good for households but do not necessarily lead to an increase in steady state domestic production.

5.4 Results

Given the steady states values from the previous sub-section, I analyze the aggregate dynamics of the nominal interest rate, output, the nominal exchange rate, and consumption following expansionary monetary, technological, and remittances shocks. I examine such dynamics under the assumption that remittances depend on the level of output of the receiving economy, thus being endogenously determined. Also, as the model with no adjustment costs does not generate the large and persistent liquidity effect observed in the data, I introduce adjustment costs equivalent to 8 minutes per week rearranging money deposits ($\xi = 20$). Since I consider a small open economy, foreign variables are constant.

The model allows a variety of specifications for the percentage of remittances going to consumption and investment, and similarly for the monetary injection. It turns out that the main dynamics can be observed in our baseline specification, with remittances going almost entirely for consumption ($\phi = 0.99$) and the monetary injection going first through the financial intermediary for investment ($\varphi = 0$). Therefore, in the interest of a concise exposition, I present only the impulse responses for this case here. I briefly discuss at the end of each sub-section how different assumptions on the distribution of remittances and monetary injections – between consumption and investment – will affect the magnitude of the impulse responses of the main variables studied here.

5.4.1 Monetary Shock

The impulse response functions presented in this sub-section are those following a 1% increase in the home money growth factor in period 0, under the assumptions described above. The cases when there are no adjustment costs is illustrated with dashed lines, and the case when there is an adjustment cost with solid lines.

Nominal Interest Rate Response

The monetary injection leads to a drop in the nominal interest rate, falling on impact by 6 basis points when there is no adjustment cost ($\xi = 0$), and by 43 basis points when there is adjustment cost ($\xi = 20$). At the time the shock occurs, the increased monetary injection increases the money supply, increasing inflation and putting downward pressure on the nominal interest rate because households cannot withdraw their deposits within the period. This is the liquidity effect, and its persistent effect on the interest rate can be observed below in Figure 5.3.

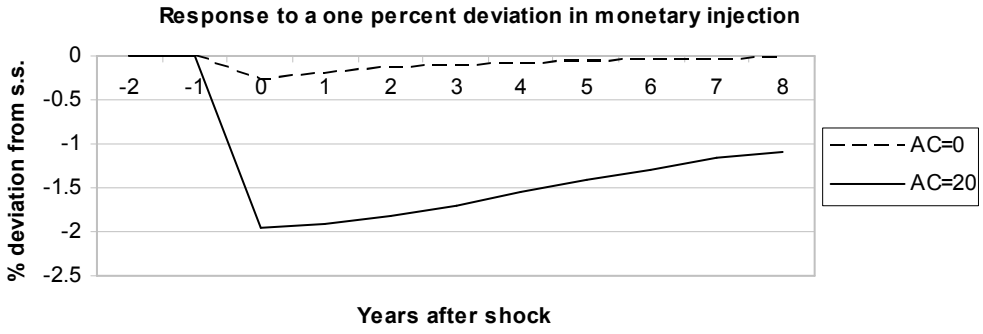


Figure 5.3: Nominal interest rate dynamics following a monetary shock

The monetary shock raises inflation momentarily, which reduces the value of real money balances and induces households to increase their holdings of money cash the following period to satisfy their consumption level, thus reducing its money deposits (M_{t+1}^{b}). The magnitude of the drop in the interest rate is determined by the cost of money adjustments. However, even if the household reduces its money deposits the following period, the liquidity effect is persistent because firms raise their investment the period of

the shock to take advantage of the lower interest rate and in anticipation of the relatively lower money supply that would result from the expected deposit withdrawals. This increased investment results in a larger capital stock, which lowers its marginal productivity, and forces firms to reduce their demand for loans more than the household's reduction of money deposits the following period, maintaining the nominal interest rate below its steady state level and producing a persistent liquidity effect.

Output Response

The output dynamics following a monetary shock are in accord with the dynamics observed in the data, but as the adjustment cost increases the recovery in output is less strong, and full recovery does not occur in the medium term when $\xi = 20$. After an initial decline below its steady state level resulting from the instantaneous fall in labor, the subsequent increase in labor and the increase in the capital stock resulting from the greater investment lead to an increase in output, as shown in Figure 5.4. The initial fall in output is much larger when we introduce the adjustment cost, as labor falls 700 percent more at impact, and it peaks below the initial steady state value at a later period and at a lower level than when there is no adjustment cost[34].

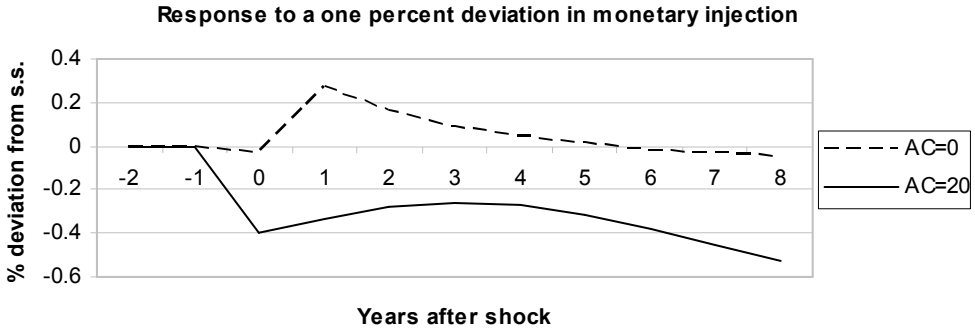


Figure 5.4: Output dynamics following a monetary shock

The expansionary monetary shock generates a positive wealth effect, which is allocated to increase leisure in the first period because of the cash-in-advance constraint

[34] When adjustment costs are equivalent to 4 minutes per week rearranging money balances ($\xi = 10$), output becomes temporarily positive after 3 years from the shock.

and adjustment cost of money holdings. However, from the second period onwards, when there is no adjustment costs the increase in real wages induce agents to increase labor above the initial steady state level, which combined with the surge in capital from the second period onwards due to the lower cost of investment explains the increase in output in the short run. When adjustment costs are as large as 20, work hours recover slightly but never reaches its initial steady state level, while the surge in investment that leads to increases in capital the following period is much weaker, not enough to outweigh the fall in labor and thus results in a momentary output recovery that does not returns to its initial steady state level.

Nominal Exchange Rate Response

The monetary injection leads to the instantaneous fall in the nominal interest rate, reducing the return on domestic savings, and inducing households to hold more foreign assets. This leads to an instantaneous depreciation of the nominal exchange rate on impact, depreciating by 1.3 percent on impact when there is no adjustment cost ($\xi = 0$), and by 4.5 percent when there is adjustment cost ($\xi = 20$). The overshooting of the nominal exchange rate shown in Figure 5.5 is due to the uncovered interest rate parity (equation (25)), which requires the interest rate differential to be equal to the expected rate of appreciation, leading to the subsequent appreciation until it reaches its new steady state, as the liquidity effect is expected to be persistent.

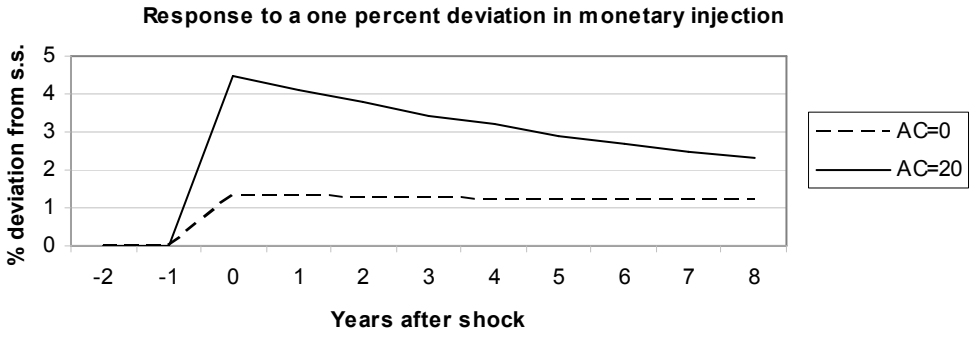


Figure 5.5: Nominal exchange rate dynamics following a monetary shock

The overshooting of the nominal exchange rate is accentuated by the existence of adjustment costs, as it creates a larger and persistent liquidity effect that requires a more accentuated appreciation. In fact, the higher ξ the more limited the withdrawal of private deposits, the farthest the fall in the interest rate, and the larger the initial depreciation of the exchange rate. Also, even if agents respond to the below-steady-state domestic interest rate with a continuously increase in their holdings of foreign bonds, the initial overshooting of the exchange rate is strong enough to allow for the subsequent appreciation, even if the demand for the foreign asset is still rising.

Consumption Response

The consumption dynamics following a monetary injection is primarily generated from the inflationary pressure during the period of the shock. Given that the consumption level is determined by the cash-in-advance constraint, and since the amount on money-cash can not be changed during the period of the shock, the inflation generated by the larger money supply reduces consumption instantaneously, mimicking the inverse dynamics of inflation when there is no adjustment costs, but returning to steady state more monotonically when there is an adjustment cost. The consumption dynamics from the second period onwards arises from the rearrangement between money-cash and money deposits. Since agents anticipate inflation, and in order to preserve their consumption in the future, households increase their future amount of nominal money balances the period of the shock (M_{t+1}^{c}). However, while it is relatively inexpensive to change the ratio $\frac{M_{t+1}^{c}}{M_{t}^{c}}$ when there is no adjustment cost, thus adjusting consumption quickly, this ratio would be adjusted smoothly when there is adjustment cost, thus inducing persistence in the adjustment of consumption. This is shown below in Figure 5.6.

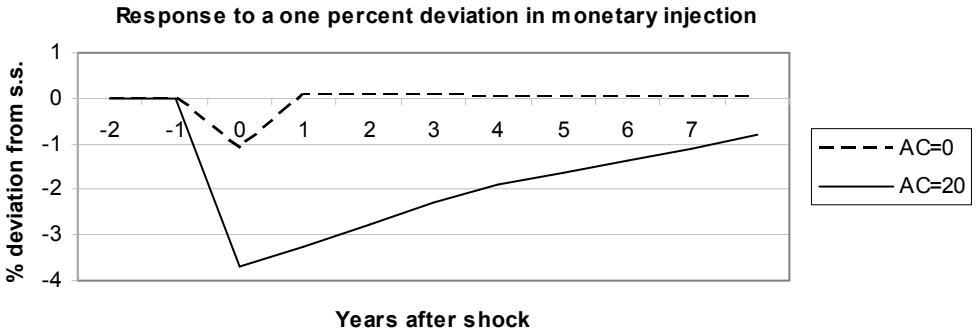


Figure 5.6: Consumption dynamics following a monetary shock

The model allows one to consider the influence, if any, of how we specify the channel by which remittances first impacts the economy. I can specify that remittances first end up in the hands of households as cash, loosening the cash in advance constraint. I can also specify that some portion of remittances end up in banks as deposits, which in the period of impact will mean additional funding available for bank loans to fund firm investment. However, it is worth to note that the impact of a monetary shock is not influenced by this modeling choice. The method by which remittances first enter the economy has almost nothing to do with the responses of the economy to a monetary shock.

The model also allows one to consider the influence, if any, of how the channel by which a monetary injection first impacts the economy is specified. I consider monetary injections that are basically helicopter drops on households, loosening the cash in advance constraint, and helicopter drops on banks. As the fraction of a monetary injection that is initially channeled through the financial intermediary is reduced, so that monetary injections directly fall to households and hence impact household consumption, the impulse response functions show very similar patterns that vary only slightly in magnitude but not in qualitative impact or in timing.[35] For example, as one increases the fraction of the monetary injection that goes to the household for

[35] Results are available upon request.

consumption, the initial decline in the nominal interest rate and the exchange rate overshooting are reduced in magnitude, while the output and consumption responses are also reduced in magnitude, with the 'hump' in the output response also slightly delayed. These smaller dynamic responses also occur if the fraction of remittances available for consumption is reduced.

These results we find here are similar to those obtained in related papers (i.e. Hairault *et. al.* (2004), Chari *et. al.* (2001), Christiano and Eichenbaum (1992)).

5.4.2 Technology Shock

Since technological change and international links can bring abrupt changes in production, which can potentially affect the behavior of the representative household, I now analyze the behavioral response of the main macroeconomic variables to a positive 1 percent technology shock. From the specification of the production function and the modeling of technological upgrading, equation (21), its effect is examined using the baseline specification: more specifically, under the assumption that remittances go almost completely into consumption ($\phi = .99$) and monetary injections go completely into investment through the financial intermediary ($\varphi = 0$).

Following the previous sub-section, impulse response functions are presented with dashed line for the case of no adjustment cost, and with solid lines for the case allowing adjustment costs.

Nominal Interest Rate Response

The introduction of the technology shock has a direct effect on output, which outweighs the fall in inflation to put upward pressure on the nominal interest rate. On impact, the nominal interest rate increases by 62 basis points when there is no adjustment cost ($\xi = 0$), and increases by 88 basis points when there is adjustment cost ($\xi = 20$). The increase in output brought about by the technology shock lowers inflation and raises consumption the period of the shock, which fuels a 2 percent increase in investment to raise physical capital. This higher demand for loans exerts the pressure to raise the nominal interest rate above its initial steady state level as shown below in Figure 5.7.

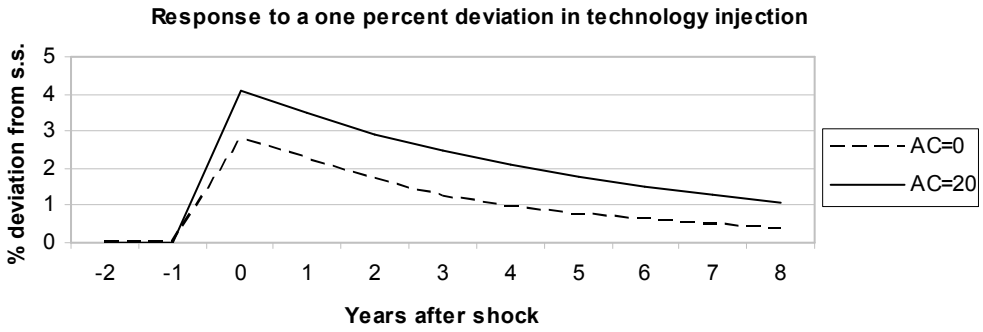


Figure 5.7: Nominal interest rate dynamics following a technology shock

The dynamics of the nominal interest rate after the period of the shock is determined by the adjustment of cash balances. When there is no adjustment cost, the period fallowing the shock is still dominated by the further increase in investment to satisfy the above-steady-state consumption level, and while the rise in inflation contributes to the continuous upward pressure on the interest rate, the larger increase in money deposits exerts a stronger pressure on the opposite direction, forcing the nominal interest rate down. The fall of the interest rate towards its steady state continuous thereafter as investment, inflation, and money deposits returns to their initial steady state levels. These dynamics are also observed for the case of positive adjustment cost, but the nominal interest rate returns to the initial level at a much lower pace, which is mainly do to the much smaller increase in money deposits, whose continuous increase for couple more periods is enough to outweigh the much lower decline in investment.

Output Response

The technology shock increases output by almost 1.5 percent on impact, irrespective of the existence of adjustment costs or not. The positive impact on physical capital is reinforced by the increase in hours worked fueled by the rise in real wages. Since these two factors are the main determinants of the production function, their rise results in an increase in output that continues for another 4 years, peeking at almost 2.5 percent above the initial steady state level before starting to decline. These subsequent dynamics arise from the continuous increase in both physical capital and hours worked

during these years, with the increase in physical capital being fueled by the above-steady-state levels of investment and the increase in labor supply being brought about by the direct effect on the real wage.

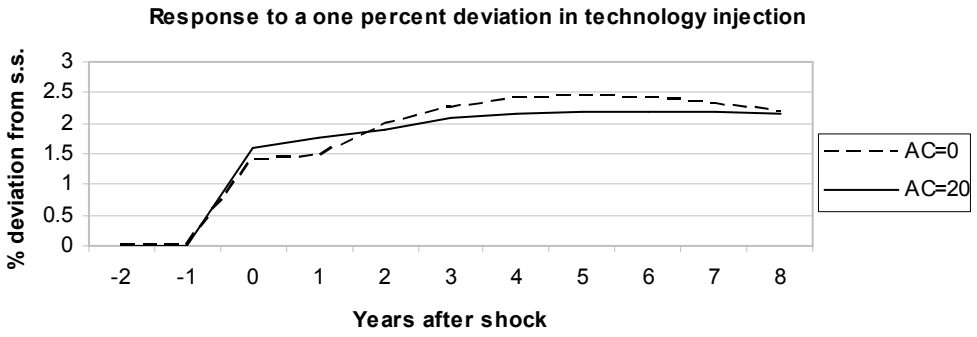


Figure 5.8: Output dynamics following a technology shock

The positive effect on output shown above in Figure 5.8 is in accord with existing analyses of technological shocks, with its long lasting effect being determined by the continuous investment brought about by the large increase in money deposits that outweighs the higher than steady state interest rate.

Nominal Exchange Rate Response

The initial nominal exchange rate response to the positive technology shock is determined by the rise of the nominal interest rate, which is only partially neutralized by the fall in inflation. The nominal exchange rate appreciates by 2 percent on impact when there are no adjustment costs ($\xi = 0$), and by almost the double when there are adjustment cost ($\xi = 0$), as shown in Figure 5.9. The overshooting of the exchange rate is governed by the uncovered interest rate parity condition that requires that the interest rate differential is equal to the expected rate of depreciation, which is accentuated when there is a positive adjustment cost. Since the increase in the nominal interest rate is expected to be persistent ($E_t R_{t+1} > 0$), the persistent positive interest rate differential generates the expected further depreciation of the exchange rate ($E_t \hat{e}_{t+1} - \hat{e}_t > 0$).

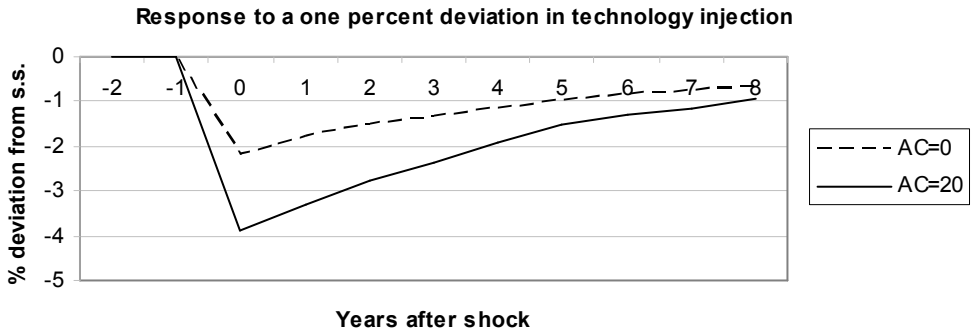


Figure 5.9: Nominal exchange rate dynamics following a technology shock

From a balance of payments perspective, the above steady state domestic interest rate induces agents to reduce the holdings of foreign bonds, forcing the initial appreciation in the process. As the domestic interest rate return to its initial level, the rearrangement of foreign bonds gets reversed, with the resulting higher demand for foreign bonds pressuring the nominal exchange rate upwards and producing its continuous depreciation. The higher the adjustment cost the slower return of the nominal interest rate to its initial level, causing a larger and longer fall in the demand for foreign bonds.

Consumption Response

The effect of the positive shock to technology on consumption is primarily determined by the cash-in-advance constraint, which is mainly influenced by the inflation dynamics and the flexibility to adjust the money balances. In the period of the shock, and since the amount of money-cash can not be changed during the period, the fall in inflation is almost fully translated in an increase in consumption, rising by almost 2 percent when there are no adjustment costs and by almost 4 percent when there are adjustment costs. However, the consumption dynamics following the period of the shock are affected by other factors. In the case of no adjustment costs, while consumption drops immediately in response to the rise in inflation to levels above the initial steady state, the downward pressure is somewhat ameliorated by the holding of higher money

cash (which can be adjusted immediately), maintaining consumption at levels above steady state. From the second period onwards the higher money cash holdings get only reinforced by the return of inflation to steady state levels, giving way to a monotonic increase in consumption that leads to a higher steady state consumption level.

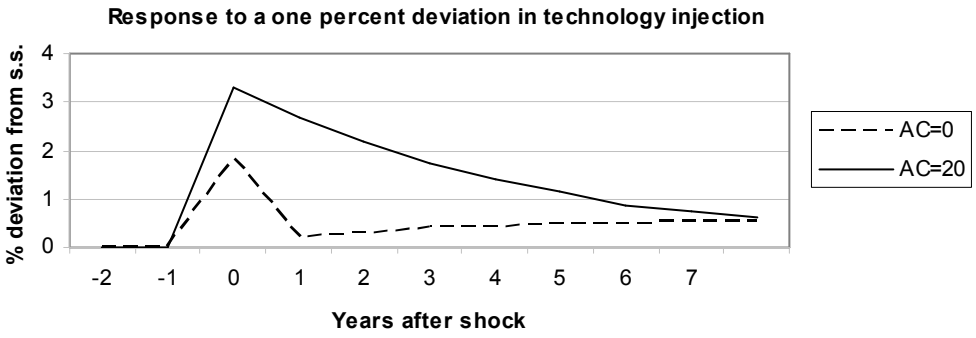


Figure 5.10: Consumption dynamics following a technology shock

The consumption dynamics following the period of the shock are much more stable when there is an adjustment cost, which is clearly expected when we take into account the much milder adjustment in money balances. In this case, while the inflation dynamics are only enhanced, the fact that money cash is brought back to its initial steady state level only slowly allows for levels of consumption above steady state that only return to the new and somewhat higher steady state at the same rate that money cash. This is why consumption falls only monotonically and slowly in this case, as shown above in Figure 5.10.

The effect of the positive technology shock on the model is in accord with the existing literature, with the representative agent being able to increase output and consumption, which raises the domestic nominal interest rate and allows agents to reduce their holdings of foreign bonds at least in the short run, which produces the initial nominal exchange rate appreciation described above. These results are robust to the alternative distributions of remittances and monetary injection, as described in the

monetary shock sub-section, and the dynamics are only affected by small changes in magnitude.

5.4.3 Remittances Shock

Since continuous remittances flows can alter the behavior of the representative household, I analyze the behavior of the main macroeconomic variables to a positive 1 percent remittances shock. As modeled in equation (19), the monetary growth factor is assumed to respond to remittances flows, and consequently it is also affected by the remittances shock[36]. Again, the baseline analysis is done under the assumption that remittances go almost completely into consumption ($\phi = .99$) and monetary injections go completely into investment through the financial intermediary ($\varphi = 0$).

Nominal Interest Rate Response

The introduction of a remittances shock also increases the money supply through the monetary growth specification, although to a much lower degree, and consequently also raises inflation momentarily during the period of the shock. This higher inflation produces a continuous depreciation of the nominal exchange rate when there is no adjustment cost, and an overshooting of the nominal exchange rate when there is an adjustment cost, leading to a slight increase in the interest rate in the first case and a fall in the interest rate in the second case. This is shown below in Figure 5.11.

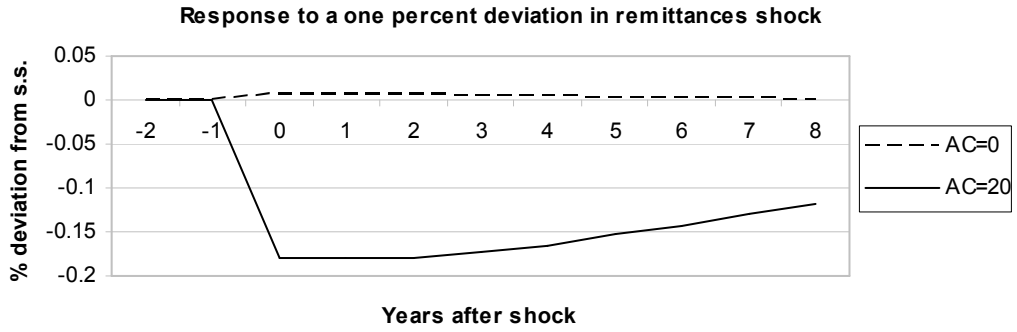


Figure 5.11: Nominal interest rate dynamics following a remittances shock

[36] I also analyze the dynamic response of the main variables when the remittances shock does not affect the monetary growth factor.

The dynamics of the nominal interest rate after the period of the shock are governed by the dynamics of investment and money deposits. When there is no adjustment cost ($\xi = 0$), the partial recovery in investment combined with the reduction in money deposits in the subsequent period further increases the nominal interest rate. However, as investment continues to return to its steady state level in the following periods, real money deposits recover at a faster pace, thus creating downward pressure on the nominal interest rate that continues from then on. When there is an adjustment cost ($\xi = 20$), the increase in investment in the period following the shock, combined with the reduction in money deposits, exerts a positive pressure on the nominal interest rate, which is counteracted by inflation below steady state, so that the nominal interest rate is almost unchanged from its previous level. It is only when money deposits also start to increase that there is upward pressure on the nominal interest rate. In fact, both investment and money deposits bounce back to levels above their initial steady state two periods after the remittances shock, and inflation rises slowly back to its steady state level, forcing the interest rate to rise back to its original level monotonically, creating a persistent liquidity effect.

Output Response

The remittances shock decreases output irrespective of the existence of adjustment costs, but its long term dynamics are affected by the adjustment cost. When there is no adjustment costs the remittances shock slightly increase the real wage in the period of the shock, lowering the amount of time spend working, and as the capital stock is fixed, output also falls slightly. However, since labor further decreases in the next two periods, as well as the capital stock, output continues to decline. This decline on labor and capital is only reversed three periods after the remittances shock, partly in response to the rise in the real wage and partly in response to the recovery of investment, increasing both labor and physical capital, and consequently monotonically raising output as shown below in Figure 5.12.

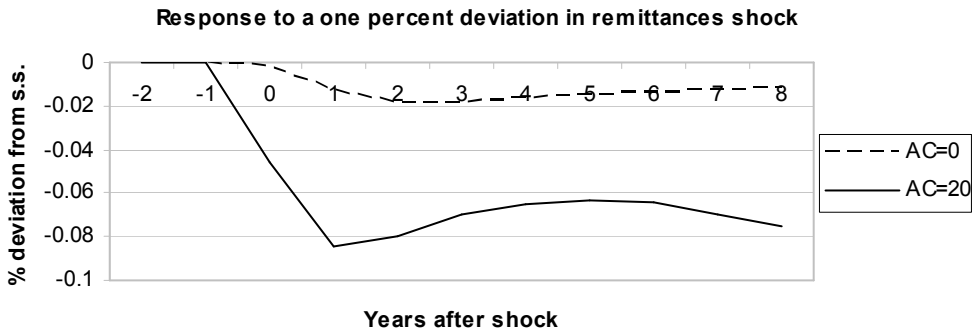


Figure 5.12: Output dynamics following a remittances shock

When adjustment costs are introduced into the model the decrease in output in the period of the shock is much larger, which is due to the much larger fall in labor resulting from the larger increase in the real wage. In fact, the real wage stays above its steady state levels for the remaining periods, causing labor to remain around 1 percent below its initial steady state level. This fall in labor combined with the fall in the capital stock below its steady state level for the periods following the remittances shock decreases output. While capital recovers somewhat for a few years, both labor and capital remain below their steady state values, thus overturning the temporary output recovery and pulling output to a lower long-run steady state. It is worth noting that downward pulling gets accentuated as adjustment costs increase.

Nominal Exchange Rate Response

The initial exchange rate response to a positive remittances shock is mainly determined by the inflationary pressure emanating from the monetary growth factor specification, which leads to a proportional depreciation of the exchange rate on impact. In particular, the positive 0.14 percent deviation from steady state in inflation is directly translated in a 0.14 percent depreciation from steady state in the nominal interest rate when there is no adjustment costs, while the positive 0.5 percent deviation from steady state in inflation is directly translated in a 0.5 percent depreciation from steady state in the nominal exchange rate when there is an adjustment cost, as observed in Figure 5.13 below.

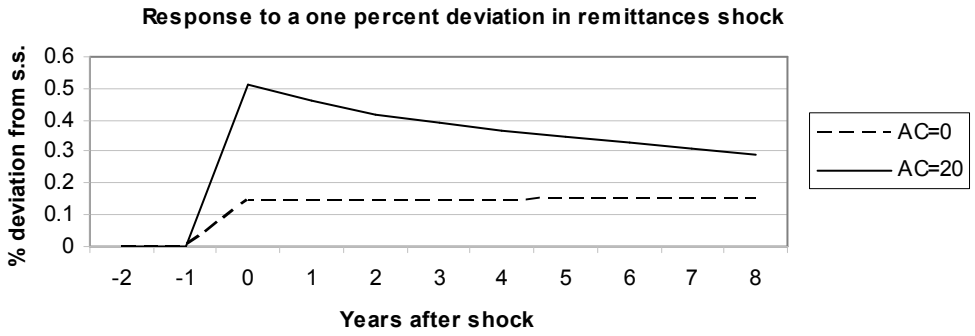


Figure 5.13: Nominal exchange rate dynamics following a remittances shock

Note that while subsequent dynamics are determined by the uncovered interest rate parity condition, they are dependent on the existence of adjustment costs. When there is no adjustment costs the increase in the nominal interest rate resulting from larger fall in real money deposits is expected to be persistent ($E_t R_{t+1} > 0$), and this persistent positive interest rate differential in counterbalanced by the expected further depreciation of the exchange rate ($E_t \hat{e}_{t+1} - \hat{e}_t > 0$). When a positive adjustment cost is introduced, and with a liquidity effect that is expected to be persistent ($E_t R_{t+1} < 0$), the persistent negative interest rate differential in counterbalanced by the expected appreciation of the exchange rate in this case ($E_t \hat{e}_{t+1} - \hat{e}_t < 0$), given rise to an overshooting of the exchange rate.

The remittances shock induces agents to hold more foreign bonds in both cases, following interest parity condition. With no adjustment costs, the initial rise in the domestic interest rate gets outpaced by the return on foreign bonds brought about by the depreciation of the exchange rate, thus inducing agents to increase their holdings of foreign bonds the first two periods after the shock, but then starts to slowly decline as the interest rate returns to its initial level while the exchange rate continues to depreciate at a much slower rate. In the case of positive adjustment costs, the increase in foreign bonds is accentuated by the fall in the domestic interest rate during the period of the shock, but

it then decelerates as the domestic interest rate begins to rise while the return on foreign bonds decreases as the exchange rate appreciates.

Consumption Response

The consumption dynamics following a remittances shock – shown below in Figure 5.14 – are primarily generated from the inflationary pressure during the period of the shock, which emanates from the monetary growth factor specification discussed above. Even if remittances are assumed to go in its entirety for consumption ($\phi = 0.99$), the increase in inflation by 0.14 percent the period of the shock (when there is no adjustment cost) and the fall in real money balances depress consumption by less then 0.01 percent, but it then quickly recovers the following period and ends up slightly above the initial steady state level, staying above that level for the following periods. However, when there are adjustment costs ($\xi = 20$), the increase in inflation is almost 4 times larger, which outweighs the increase in remittances and fall in real money balances, resulting in a fall in consumption of about 0.4 percent. The following periods show consumption rising monotonically as a result of the subsequent fall in inflation to below-steady state levels and the recovery in both real money balances and money cash. This recovery is not strong enough to pull consumption back to its original steady state.

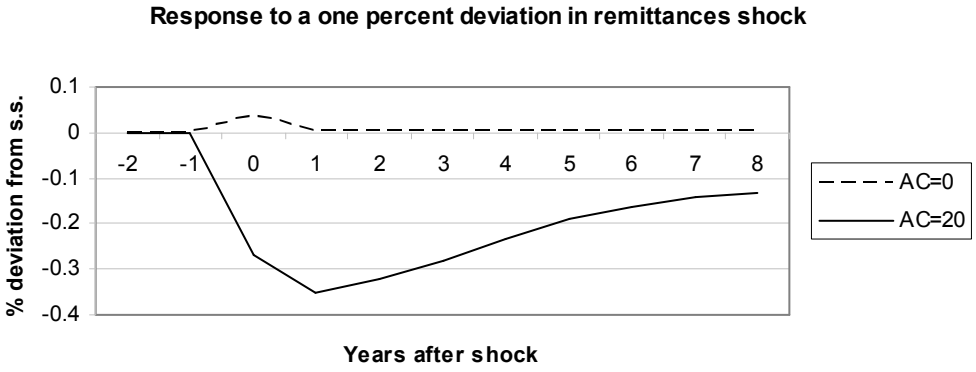


Figure 5.14: Consumption dynamics following a remittances shock

These dynamics can be explained by the rearrangement of money cash and money deposits. When there are no adjustment costs, the representative household reduces real money cash the period fallowing the remittances shock, enough to outweigh the greater consumption power brought by the remittances shock, but in the following periods it quickly increases money cash holdings above its steady state while inflation drops below its initial level, allowing the household to start to consume at levels slightly higher than steady state.

When there are adjustment costs, the reduction of real money cash the period following the remittances shock is much larger and outweighs the positive remittances shock. While it then increases monotonically, it stays below its initial steady state for the rest of the periods we graph, as consumption does.

When the amount of remittances and money injection used for consumption and investment is altered, the resulting dynamics are similar to those reported here, differing only in magnitude[37]. In particular, as one lowers the amount of remittances available for consumption, the nominal interest rate response becomes smaller, and even turns negative for fractions of remittances earmarked for investment greater than 20 percent. Output responses also show these dynamics, becoming smaller as one increases the fraction of remittances used for investment, and turning positive for fractions above 20 percent. The consumption's dynamic response also becomes smaller, dropping below steady state for a period, but then quickly recovering and staying above the initial steady state level as one increases the fraction of remittances used for investment, while the nominal exchange rate dynamics after the initial depreciation also slowly turns to a small appreciation as the fraction of remittances used for investment increase. All these dynamic responses are also affected by the size of the adjustment costs, becoming more pronounced as adjustment costs increase but maintaining their qualitatively effects.

To further investigate these relative small responses to various distributions of remittances and monetary injections for consumption and investment, I also allowed for remittances to be 10 percent of GDP, a magnitude that reflects a doubling in importance

[37] Results are available upon request.

of remittances in the receiving economy. However, while the rise in the nominal interest rate is 15 percent smaller and the fall in consumption is 30 percent smaller when there are no adjustment costs, the dynamics of all the variables are somewhat stable when there are adjustment costs.

While the impact of a remittances shock on the main macroeconomic variables of the small open economy provides an adequate understanding of its effect at the macro level, its overall impact on the welfare of the representative agent is still somewhat allusive. In order to obtain the agent's welfare gain from a remittances shock, I now analyze the utility of the representative agent under our previous cases. In the base case assuming that remittances are 5 percent of GDP, the steady state utility is -1.742.[38] When I introduce the positive one percent remittances shock utility falls in the period of the shock by 0.05 percent when there is no adjustment costs and by 17 percent when there is an adjustment cost. However, while utility bounces back in both cases to levels above its initial steady state level the following period, and remain above for the remaining periods as shown below in Figure 5.15, the discounted utility after five years continues to be 0.007 percent below the discounted utility if there was not any remittances shock in the case of no adjustment cost, and around 2.7 percent below the discounted utility without any remittances shock in the case of positive adjustment costs.

This gap in utility falls even further as one considers a longer period, being a mere 0.002 percent below the discounted utility without if there was not any remittances shock and around 1.13 percent below the discounted utility if there was not any remittances shock after 10 years in the case of no adjustment cost, while it gets even closer after 15 years, with discounted utility being only 0.0008 percent below the discounted utility if there was not any remittances shock when there is no adjustment cost and only 0.724 percent below the discounted utility if there was not any remittances shock when there is a positive adjustment cost.

[38] Note that utility will be negative in our model since the steady state values of consumption and leisure are less than 1.

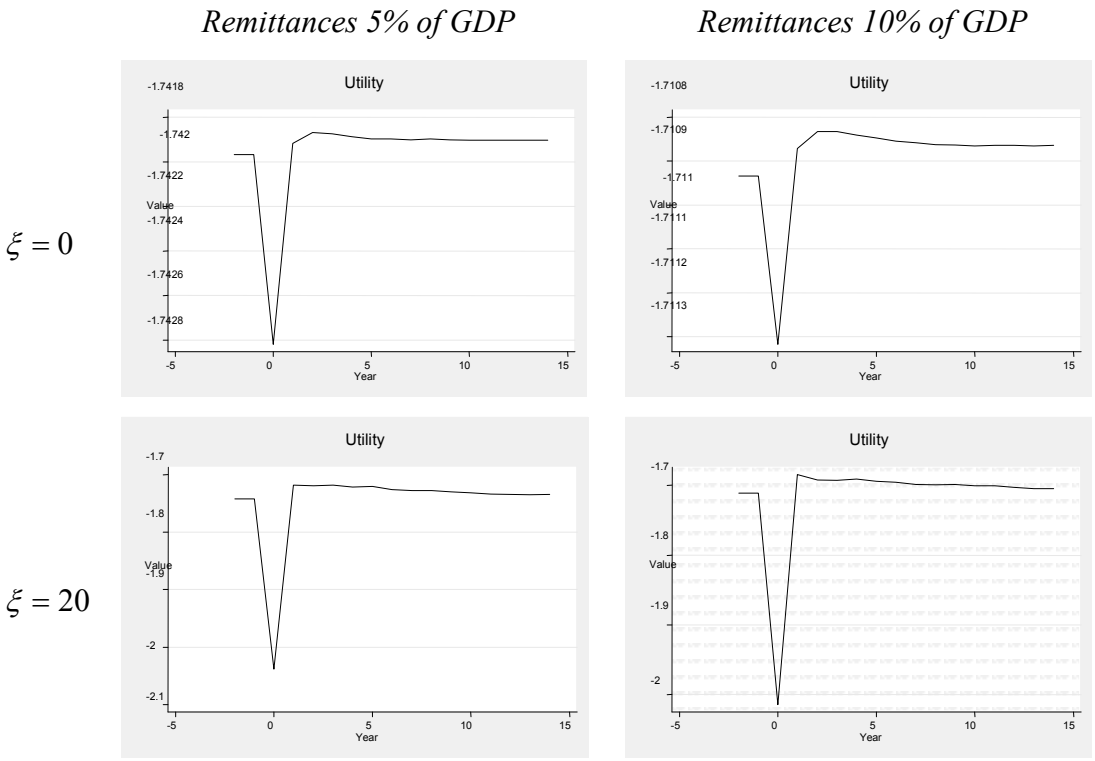


Figure 5.15: Utility dynamics following a remittances shock

When I assume that remittances are 10 percent of GDP, the steady state utility is -1.711. When I introduce the positive one percent remittances shock utility falls in the period of the shock by 0.022 percent when there is no adjustment costs and by 17.754 percent when there is an adjustment cost, relative to the utility if there was no remittances shock. However, while utility bounces back in both cases to levels above its initial steady state level the following period, and remain above for the remaining periods as shown above, the discounted utility after five years continues to be 0.0008 percent below the discounted utility if there was not any remittances shock in the case of no adjustment cost, and around 2.953 percent below the discounted utility without any remittances shock in the case of positive adjustment costs. This gap in utility disappears in the case of no adjustment costs as one considers a longer horizon, becoming 0.0015 percent above the discounted utility if there was not any remittances shock, and continues to decrease in the case of a positive adjustment cost, getting to 1.296 percent

below the discounted utility if there was not any remittances shock after 10 years in the case of no adjustment cost. After 15 years, the discounted utility continues to rise in the case of no adjustment cost, being 0.0021 percent above the discounted utility if there was not any remittances shock and becomes closer to the discounted utility if there was not any remittances shock when there is a positive adjustment cost, being only 0.841 percent below.

While in the period of the shock it is observed a decrease in utility in all the cases above, utility quickly recovers to levels above steady state, allowing the discounted utility to recover to levels closer to the discounted utility levels of the small open economy that does not experiences a remittances shock. In particular, the results show that economies with remittances levels as large as 10 percent of GDP in fact improve their discounted utility in the medium term when there is no adjustment cost in the rearrangement of money balances. Also, the impact of the introduction of adjustment costs in the discounted utility deteriorates welfare, irrespective of the share of remittances relative to output. This is expected since it is a restriction in the adjustment of money balances, so agents can not quickly rearrange their consumption portfolio.

Also interesting to examine is the impact of the positive remittance shock to the behavior of the trade balance. In Figure 5.16 below I show the dynamics of the trade balance, with the first column showing the cases of no adjustment cost followed by the case of a positive adjustment cost under the basic assumption of remittances being 5 percent of GDP, and with the second column showing the same two cases under the alternative assumption that remittances are 10 percent of GDP. It is clear that the remittances shock has a positive impact on trade balance in the short run. When remittances are 5 percent of GDP, the trade deficit falls in the period of the shock by 5.35 percent in the case of no adjustment cost and by 17.3 percent in the case of a positive adjustment cost, while when remittances are 10 percent of GDP, the trade deficit falls in the period of the shock by 4.4 percent of GDP in the case of no adjustment cost and by 17.3 percent in the case of a positive adjustment cost.

However, this initial improvement in the first couple periods is quickly reversed

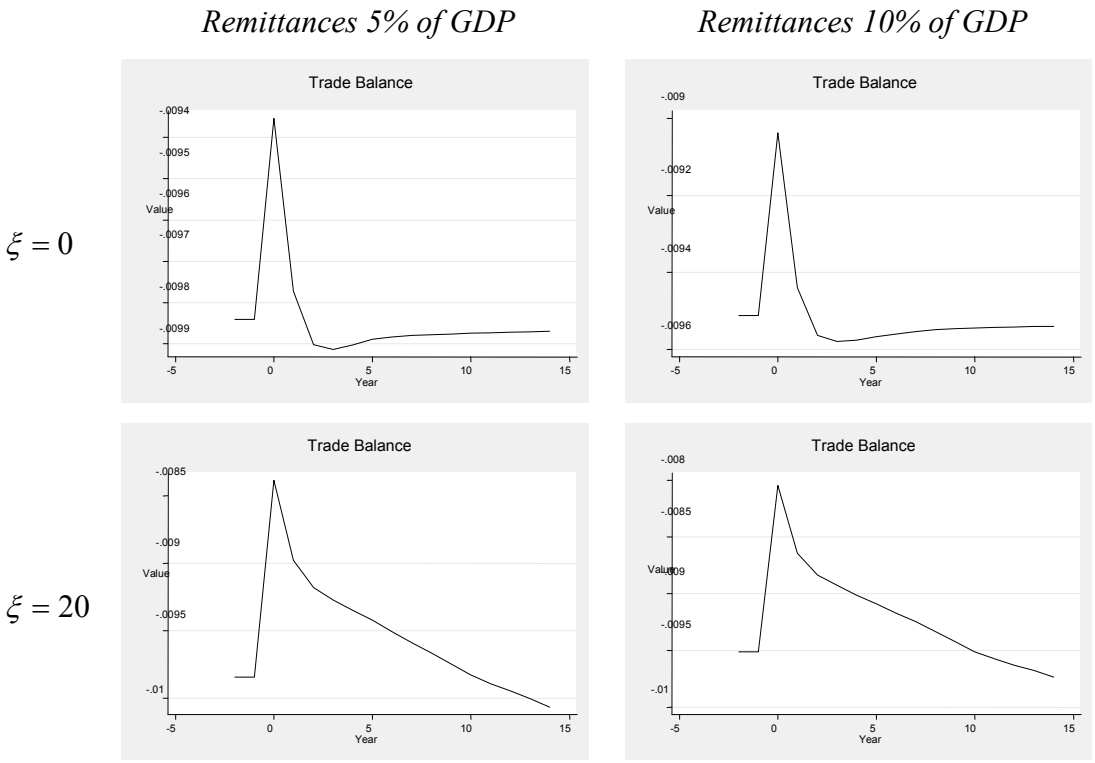


Figure 5.16: Trade balance dynamics following a remittances shock

in the case of no adjustment costs, with the trade deficit being larger than the initial level from the second period onwards, while the initial improvement in long lived in the case of positive adjustment costs, with the trade deficit getting larger than the pre-shock level only after 10 periods. In terms of its effect of the behavior of foreign bonds, it is clear that these dynamics exert a symmetric effect on foreign bonds, with the representative agent decreasing the holding of next-period foreign bonds in all cases in response to the lower trade deficit on the period of the shock. This drop in next-period foreign bonds in mainly determined by the fall in consumption and investment, which outweigh the rise in remittances and exchange rate (depreciation), and is relatively smaller than the improvement in the trade deficit.

The dynamics of the following periods are governed by the dynamics of the trade balance, with next-period foreign bonds first increase in an overshooting pattern for

couple periods before monotonically decrease in the case of no adjustment costs, and increasing at a decreasing rate in the case of positive adjustment costs.

5.5 Conclusions

This limited participation model for a small open economy with remittances explicitly incorporated is able to capture important features from observed empirical responses of economic variables to monetary shocks. In particular, I am able to capture important aspects in the dynamic response of the nominal interest rate, output, the exchange rate, and consumption. The introduction of adjustment costs on money holdings accentuate the persistence of the liquidity effect, and consequently expands the overshooting dynamics of the nominal exchange rate, both in accord with existing empirical evidence on the result of monetary innovations. The technology shock results are also in accord with existing findings, in particular with those regarding the overshooting exchange rate appreciation in response to a positive shock.

A novel contribution of this study comes from the ability to examine the dynamic response of major macroeconomic variables – namely the nominal interest rate, output, the nominal exchange rate, and consumption – to remittances shocks. I find that a remittances shock in the model without adjustment costs will slightly increase the nominal interest rate, while there is a slight drop in output and consumption, and a small but continuous depreciation of the nominal exchange rate. When there are adjustment costs the dynamic response of the nominal interest rate is reversed in sign and increased in magnitude. The response of output and consumption is also magnified, with consumption smoothly returning to its initial steady state due to the adjustment cost on money balances. In addition, adjustment costs produce the expected overshooting depreciation of the nominal exchange rate.

I also investigated the impact of different modeling assumptions with respect to the initial impact of remittances on the economy, whether to loosen the cash in advance constraint facing households or to increase the supply of loanable funds at financial

intermediaries. The findings show that these alternative specifications have scant impact on the dynamic responses of the variables we examine to a monetary shock, but these alternatives do affect the dynamic responses of macroeconomic variables to a remittances shock. The size of the adjustment cost magnifies the influence the remittances shock, but not the direction.

Perhaps more important is the welfare response to a positive remittances shock. The results show that utility falls as a result of a one percent positive remittances shock irrespective of the existence of adjustment costs or the share of remittances in the economy, but it quickly recovers to levels above the initial utility level and remains higher thereafter. This means that while the positive remittances shock has a negative effect on utility the period of the shock, the negative effect slowly decreases as we discount future utility, and can even result in a welfare improvement as shown in the case of no adjustment cost for the economy with remittances being 10 percent of GDP. With regards to the impact of the remittances shock on the trade balance, I find that the positive remittances shock decreases the trade deficit the period of the shock irrespective of the existence of adjustment costs or the share of remittances in the economy, but that while the trade deficit quickly returns to levels beyond the initial deficit when there are no adjustment costs, the improvement in the trade deficit is long lived when there are positive adjustment costs, having smaller deficits for up to 10 periods.

I have also examined the impact of a change in remittances on the steady state of the economy. As remittances change from 5 percent of output to 10 percent of output, I find that both output and work hours fall by almost 4 percent while consumption increases by slightly more than 1 percent. Physical capital also falls by almost 4 percent. The distribution of real money balances also becomes affected by the doubling of the share of remittances, with real money cash decreasing by almost 4 percent while real money deposits decrease by almost 4 percent. It can be observed that the representative household increases its leisure as the share of remittances increases, which together with the fall in physical capital reduces output. This negative effect is counterbalanced by the increase in consumption brought about by the doubling of remittances.

6. CONCLUSION

Foreign Direct Investment and Remittances are capital flows usually from rich to poor countries that are immensely interesting because they can finance investment and consumption in the receiving economies. They can stimulate economic growth, rise tax revenues to implement public projects, generate employment opportunities, and provide funds for domestic households to invest in their human capital and self-started economic endeavors. Moreover, since a key aspect in economic development relies in the acquisition of financial and physical assets to incorporate advance technologies and create wealth, the reliance on foreign capital helps bridge the gap between savings and investment in capital-scarce economies. These capital inflows are also believe to encourage technological upgrade and financial modernization, and contribute to the growth and productivity of countries with enough human capital and infrastructure. All these characteristics of these capital flows have the potential of rising the standard of living and increasing welfare in the developing world.

These two capital flows have clearly outpaced the other components of international capital movements, and multinational development institutions have become the main advocates in the promotion of FDI – and of remittances to a lesser extent – to induce faster and more efficient growth of less developed economies, after intense investigation of their potential links to economic growth. The great intensification of global trade and increased FDI – which are profit driven – has been accompanied by the increasingly accepted belief that these flows are strongly related, directly and indirectly, to growth and development. However, recent research also points out to immigrants' remittances as an additional source of growth, which despite not being profit driven also can promote economic growth by fueling domestic demand and improving human capital.

Independently of the way in which these capital flows can generate economic growth, the understanding of the channels through which they can affect growth efforts in developing countries become crucial for policy enactment, and understanding the way

in which they impact the receiving economies of Latin America is the contribution of this dissertation.

The first part of this dissertation deals with the effects of FDI on economic growth and development in the region. A large fraction of empirical studies find a positive and significant relationship between FDI and economic growth, suggesting that FDI does in fact spur growth. Yet, an important fact that has been so far overlooked in the economic literature is the way in which this improvement in economic performance translates in real improvement in the standards of living in the host countries, by some palpable measure. This is why the validity of those concepts of growth and development heavily measured by traditional national economic terms, like GDP, are being increasingly challenged. Assessing the influence of FDI on developing countries should consequently include the effects on factors that impact the standard of living more directly, such as on the collection of tax revenues and the generation of employment.

This dissertation fills this gap. I go beyond the increasingly accepted notion that FDI positively affects economic growth, measured as improvements in GDP or GDP growth rates, to empirically show how such positive relationship translates into palpable benefits for the host country, specifically measuring its effect on employment generation and collection of central government tax revenues in the host country. This part starts from the view that FDI's effect on economic growth should not only be measured through its effect on the level and growth rate of real GDP per capita, but also through its influence on other factors that are relevant to domestic governments, like on government tax revenues and employment levels.

The second section establishes the positive relationship between FDI and economic growth in Latin America, verifying that the endogenous relationship found by Li and Liu (2005) also holds for the Latin American sample of 17 countries over the period 1980-2002. Both single equation and simultaneous equation system techniques were applied in the estimation, and the results show that there exists a strong complementary connection between FDI and economic growth in the region, showing

that foreign direct investment does contribute to the economic growth of Latin American countries, at least in terms of improvements in the real GDP per capita growth rate.

The third section examines the effect of FDI on tax revenue performance for the same group of Latin American countries and time period. Estimation of the dynamic panel model was performed with system GMM, and the results show that FDI has a positive impact on central government tax revenues, which is mainly channeled through its effect on taxes on goods and services. This confirms the conventional wisdom that FDI's positive effect on economic growth indeed translates on improvements in the collection of tax revenues. In addition, FDI is found to be beneficial to less developed countries, and its positive effect became significant in the later period of the sample. Interestingly, it is also found that inflation has a positive and significant effect on total tax revenues and on taxes on goods and services, representing a reverse Tanzi effect due to the hyperinflationary episodes experienced in the region.

The fourth section examines the effect of FDI on employment generation for the same group of Latin American countries and time period. I control for the main determinants of the employment rate, and use real remunerations to proxy for the effect of average wages. The estimation of the dynamic panel model was performed with system GMM, and the results show that FDI has a positive and significant effect on the employment rate in host countries, and that this positive effect is larger for females than for males. In addition, this positive impact is particularly beneficial for less developed economies and countries with high level of informality, as well as for periods with low levels of inflation and foreign investment. Here I also find that this positive effect became significant the later period of the sample, period of renewed inflows of foreign investment.

The second part of the dissertation deals with the macroeconomic effect of remittances on the receiving economies. Remittances play a large and important role in certain economies, where they may exceed 5% or even 10% of GDP. Indeed, remittance flows in certain nations exceed FDI in magnitude. In section 5 I use a stochastic limited participation model with cash in advance constraints and costly adjustment of cash

holdings to examine the impact of remittances on the steady state of the economy and on the dynamic response of variables to shocks, including money shocks, output shocks, and shocks to remittance flows. The model performs well in terms of monetary and technology shocks, providing results in accord with the existing literature. In terms of remittances shocks, the results show that a positive remittances shock forces the exchange rate to depreciate and lowers both output and consumption in the period of the shock, irrespective of adjustment costs on money balances. Agents then quickly adjust to maximize their utility when there are no adjustment costs in money balances, but this adjustment is much more monotonic and slower then there is a positive adjustment cost. The results also show that the positive shock lowers utility, both during the period of the shock and for the near future (discounted utility), but that discounted utility improves after 10 years when remittances are as big as 10 percent of GDP and there are no adjustment costs.

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APPENDIX A

Table A.1 – Bias Comparison for Different Estimators of Total Tax Revenues

	OLS	Fixed Effects	DPD First Diff.	DPD System
Constant	-.69762	-11.885	-1.1767	-2.6562
	(2.5374)	(12.869)	(.71935)	(2.5698)
Taxlag	.88970***	.62156***	.62673***	.76880***
	(.02846)	(.04582)	(.06956)	(.05242)
Inflation	.00028***	.00025***	.00026***	.00032***
	(.00009)	(.00009)	(.00008)	(.00008)
Gov. debt	.01134 **	.01189***	.01126***	.01174***
	(.00549)	(.00304)	(.00237)	(.00199)
Gov. debt -1	-.01211**	-.00890***	-.00854***	-.00858***
	(.00579)	(.00271)	(.00184)	(.00178)
FDI	.06691	.15926***	.15207**	.11108**
	(.04804)	(.05876)	(.06102)	(.03978)
ln of GDP per capita	.14818	.26229	.12188	.61434*
	(.22187)	(.95305)	(1.0464)	(.35818)
Agricultural Share	-.01524	.03637	.04867	-.04900
	(.02661)	(.04889)	(.09605)	(.03901)
ln of Population	-.21085	-1.3466	-.64364	-.37826
	(.13371)	(2.6777)	(3.6544)	(.35906)
Urbanization	.00684	.23945***	.29794**	.00689
	(.01076)	(.05948)	(.13037)	(.01170)
Budget Surplus	-.01727	.00018	.00123	-.00411
	(.02178)	(.02029)	(.01587)	(.01955)
Trade	.21691	.52129	.85765	.45243
	(.26564)	(.51269)	(.54312)	(.45598)
R-square	0.8895	0.6561	-----	-----
Hansen Over-Id.	-----	-----	1.000	1.000
AR(1) Test	-----	-----	0.001	0.001
AR(2) Test	-----	-----	0.273	0.281

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are omitted. Standard Errors in parentheses.*

Table A.2 – Dynamic Effect of FDI on Tax Revenues

	Current	Lagged-one-year	Lagged-two-years
Total Tax Revenues	.11108**	-.02353	-.03856
	(.03978)	(.06217)	(.04971)
Taxes on Individuals, Profits, and Corporations	.01280	-.06910	-.01805
	(.01560)	(.07874)	(.03858)
Taxes on Goods and Services	.06407**	.03294	.01016
	(.02747)	(.03337)	(.02456)
Taxes on International Trade	-.00302	-.00196	-.01829
	(.02071)	(.01917)	(.01993)

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

Table A.3: Effect of FDI on Total Tax Revenues and Main Components Controlling for the Level of Inflation (Inf<20 and Inf>20)

	Total Tax Revenues	Taxes on Individuals, Profits, and Corporations	Taxes on Goods and Services	Taxes on International Trade
Constant	-2.7229	-3.3461*	-2.6574	-1.7596
	(2.7409)	(1.8056)	(2.1487)	(1.0621)
Taxlag	.76570***	.71634***	.67289***	.70003***
	(.05349)	(.07390)	(.04516)	(.09977)
HI	.09081	-.71156	.09390	-.14200
	(.59951)	(.64204)	(.37490)	(.11323
Inflation	.00559	-.02978	.01202	____
	(.02145)	(.02618)	(.02258)	
Inflation*HI	-.00527	.02973	-.01191	____
	(.02146)	(.02616)	(.02256)	
Gov. debt	.01189***	.00495***	.00576***	.00227***
	(.00208)	(.00062)	(.00098)	(.00048)
Gov. debt-1	-.00859***	-.00361***	-.00431***	-.00067
	(.00178)	(.00076)	(.00100)	(.00055)
FDI	.12084***	.01543	.06416**	-.02249
	(.03493)	(.01842)	(.02846)	(.01995)
FDI*HI	-.06326	-.06016	.01318	.11998**
	(.10645)	(.06945)	(.05263)	(.05553)
ln of GDP per capita	.62674*	.37353	.23577	-.01281
	(.34815)	(.21797)	(.25800)	(.10964)
Agricultural Share	-.05033	-.03077	____	____
	(.04009)	(.03136)		
ln of Population	-.37214	.39562	-.24651	-.10039
	(.36441)	(.23026)	(.26031)	(.09481)
Urbanization	.00603	-.02290	.02956**	.00673
	(.01229)	(.01547)	(.01082)	(.00534)
Budget Surplus	-.00384	-.00867	-.02182	.02878**
	(.02053)	(.00976)	(.02998)	(.01197)
Trade	.45751	.78904	.31887	.52005**
	(.48706)	(.50223)	(.50619)	(.20210)
Terms of Trade	____	____	____	.00294
				(.00196)
Exchange Rate	____	____	____	-.00004
				(.00007)
Hansen Over-Id.	1.000	1.000	1.000	1.000
AR(1) Test	0.001	0.106	0.003	0.020
AR(2) Test	0.277	0.317	0.610	0.584

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not presented. Standard Errors in parentheses.*

Table A.4: Effect of FDI on Total Tax Revenues and Main Components Controlling for the Level of Inflation (Inf<100 and Inf>100)

	Total Tax Revenues	Taxes on Individuals, Profits, and Corporations	Taxes on Goods and Services	Taxes on International Trade
Constant	-2.7415	-2.8346	-2.7307	-1.8972*
	(2.6797)	(1.7296)	(1.9909)	(1.0073)
Taxlag	.76530***	.74267***	.68415***	.70658***
	(.05023)	(.04101)	(.05449)	(.10061)
HI	-.11709	-.84159*	-.51956	.14720
	(.56787)	(.39935)	(.51710)	(.17516)
Inflation	-.00027	-.00462	-.00255	____
	(.00608)	(.00396)	(.00451)	
Inflation*HI	.00061	.00462	.00270	____
	(.00606)	(.00396)	(.00454)	
Gov. debt	.01165***	.00490***	.00592***	.00198***
	(.00205)	(.00059)	(.00094)	(.00046)
Gov. debt-1	-.00841***	-.00360***	-.00448***	-.00050
	(.00173)	(.00081)	(.00102)	(.00048)
FDI	.11278***	.00598	.05777**	.00046
	(.03802)	(.01561)	(.02494)	(.01986)
FDI*HI	-.23402	.08554	.39623	-.33227
	(.63548)	(.23329)	(.71430)	(.38254)
ln of GDP per capita	.63602*	.33030*	.24594	.01492
	(.35787)	(.17145)	(.24961)	(.11993)
Agricultural Share	-.05016	-.02821	____	____
	(.03746)	(.02436)		
ln of Population	-.37194	.29842*	-.23875	-.06807
	(.37098)	(.14407)	(.25702)	(.08738)
Urbanization	.00738	-.01676*	.02834**	.00477
	(.01203)	(.00844)	(.01134)	(.00480)
Budget Surplus	-.00575	-.01608*	-.02191	.02865*
	(.01615)	(.00887)	(.02354)	(.01515)
Trade	.42771	.55758	.31865	.50857**
	(.45756)	(.34129)	(.49804)	(.19440)
Terms of Trade	____	____	____	.00292
				(.00195)
Exchange Rate	____	____	____	-.00001
				(.00007)
Hansen Over-Id.	1.000	1.000	1.000	1.000
AR(1) Test	0.001	0.119	0.003	0.023
AR(2) Test	0.255	0.314	0.689	0.448

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not presented. Standard Errors in parentheses.*

Table A.5 – Bias Comparison for Different Estimators of Employment Rate

	OLS	Fixed Effects	DPD First Diff.	DPD System
Constant	6.8380	-65.920***	-.19260**	25.791**
	(4.7563)	(34.401)	(.08626)	(10.687)
Lagged Employment	.89671*	.66329	.62635*	.77275***
	(.03905)	(.04687)	(.02778)	(.03952)
Real Remunerations	.00221	.00461	.00407	.00802**
	(.00238)	(.00308)	(.00460)	(.00271)
FDI	.11154**	.05328	.01455	.12957**
	(.05343)	(.06807)	(.05256)	(.05268)
Dom. Investment	.05109	.09864*	.14657*	.08658***
	(.03184)	(.03325)	(.03908)	(.02105)
Exports	.03569	.10414**	.13509**	.10206*
	(.03442)	(.04930)	(.05481)	(.05744)
ln *RGDP*	.05686	4.2402*	3.3097	-.11668
	(.10228)	(1.4656)	(2.2085)	(.25054)
Trade Openness	-.27968	-2.5318**	-2.8265***	-1.9134
	(.87195)	(1.1882)	(1.4908)	(1.5768)
Terms of Trade	-.00162	-.01024**	-.01706**	-.00515
	(.00348)	(.00414)	(.00848)	(.00591)
R-square	0.8320	0.7719	-----	-----
Hansen Over-Id.	-----	-----	1.000	1.000
AR(1) Test	-----	-----	0.0092	0.009
AR(2) Test	-----	-----	0.6285	0.916

*Note: Statistical significance given by * for 1% confidence level, ** for 5% confidence level, and *** for 10% confidence level. Time dummies are included but not reported. Standard Errors in parentheses.*

Table A.6 – Dynamic Effect of FDI on Employment Rates

	Current	Lagged-one-year	Lagged-two-years
Total Employment Rate	.12957**	.15278***	.05120
	(.05268)	(.02932)	(.08149)
Male Employment Rate	.11745**	.12400***	.02747
	(.05143)	(.02768)	(.08261)
Female Employment Rate	.14688**	.19295***	.10197
	(.06112)	(.04124)	(.07762)

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

Table A.7 – Effect of FDI on Employment Rate by Time Periods (1980-1991 and 1992-2002)

	Total	Male	Female
Constant	25.944**	28.459**	21.739*
	(10.584)	(10.158)	(11.344)
Lagged Employment	.77086***	.77324***	.77010***
	(.04061)	(.05338)	(.03043)
Real Remuneration	.00762**	.00750**	.00894*
	(.00309)	(.00256)	(.00409)
Later	-1.5709	-1.1373	-2.0624
	(.99641)	(.81736)	(1.3020)
FDI	.00505	-.00952	.09321
	(.16982)	(.13410)	(.25527)
*FDI * Later*	.14209	.14489	.06120
	(.18130)	(.14044)	(.26643)
Dom. Investment	.08776***	.07869***	.09753***
	(.02204)	(.02305)	(.02872)
Exports	.10613*	.11023**	.09448
	(.05732)	(.05424)	(.06418)
ln *RGDP*	-.10687	-.17872	.01108
	(.25348)	(.23032)	(.27984)
Trade Openness	-1.9457	-2.2169	-1.5040
	(1.5745)	(1.4179)	(1.8241)
Terms of Trade	-.00503	-.00403	-.00762
	(.00594)	(.00612)	(.00562)
Hansen Over-Id.	1.000	1.000	1.000
AR(1) Test	0.009	0.009	0.016
AR(2) Test	0.871	0.120	0.349
N. Observations	264	264	264

*Note: Statistical significance given by *** for 1% confidence level, ** for 5% confidence level, and * for 10% confidence level. Time dummies are included but not reported. Standard Errors in parentheses.*

APPENDIX B

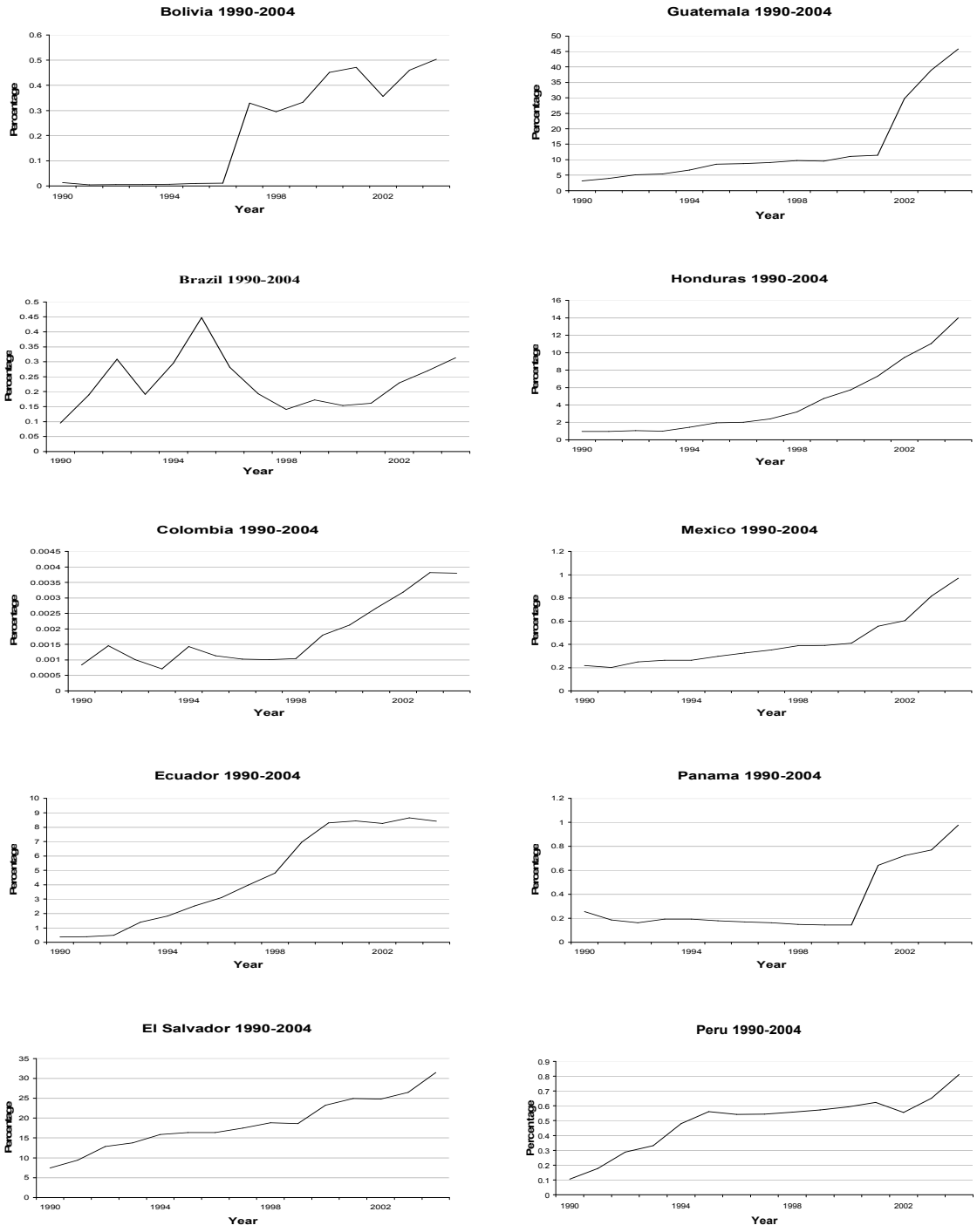

Figure B.1: Evolution of remittances in sample countries

Table B.1 – Steady State Values

	Remittances 5% GDP	Remittances 10% GDP
Nominal Interest Rate	0.2212	0.2212
Capital/output ratio	1.9598	1.9598
Output	0.3376	0.3259
Remittances	0.0169	0.0320
Capital	0.6616	0.6386
Investment	0.0662	0.0639
Bonds	0.1955	0.1887
Consumption	0.2956	0.2987
Real Money Balances	0.3473	0.3350
Real Money deposits	0.0203	0.0194
Real Money Cash	0.3270	0.3156
Real Wages	0.9344	0.9344
Lambda	2.7701	2.7415
Labor (hours worked)	0.2312	0.2232
Discounted Utility	-1.741968	-1.710935
Trade Balance	-0.0099	-0.0005

B.1. LPM Model

We denote the shadow price associated with the household real wealth by $\Lambda_t = P_t \lambda_t$. The relevant equations in the LPM model are defined the following way:

(26) $$\Gamma_t = \underset{t}{E}\left[\vartheta (Y^{ss})^{\tau} \pi_t Y_t^{-\tau} e^{g_t}\right]$$

(28) $$\Lambda_t = \beta \underset{t}{E}\left[(1+i_{t+1}^{*})\frac{e_{t+1}}{e_t}\frac{\Lambda_{t+1}}{\pi_{t+1}}\right]$$

(29) $$-U'_{H_t} = w_t \Lambda_t$$

(30) $$\Lambda_t = \beta \underset{t}{E}\left[\frac{\Lambda_{t+1}}{\pi_{t+1}}(1+R_{t+1})\right]$$

The following variable is introduced for technical convenience

$$\Delta M_t^c \equiv \frac{M_{t+1}^c}{M_t^c}$$

which can be stationarized (to be used in the next equation) as

(31) $$\Delta M_t^c = \frac{m_{t+1}^c \pi_t}{m_t^c}$$

(32) $$w_t \Lambda_t \xi \frac{\pi_t}{m_t^c}\left(\Delta M_t^c - \theta\right) + \Lambda_t = \beta \underset{t}{E}\left[\frac{U'_{Ct+1}}{\pi_{t+1}}\right] + \beta \underset{t}{E}\left[w_{t+1}\Lambda_{t+1}\xi \frac{\Delta M_{t+1}^c}{m_{t+1}^c}\left(\Delta M_{t+1}^c - \theta\right)\right]$$

(33) $$m_t = m_t^b + m_t^c$$

(34) $$\pi_t C_t = m_t^c + \phi\Gamma_t + \varphi(\theta_t - 1)m_t$$

(35) $$\pi_t = \frac{e_t}{e_{t-1}}\pi_t^{*}$$

(36) $$Y_t = e^{z_t} K_t^{\alpha} H_t^{1-\alpha}$$

(37) $$I_t = K_{t+1} - (1-\delta)K_t$$

(38) $$w_t = (1-\alpha)\frac{Y_t}{H_t}$$

(39) $$1 + R_t = \beta \underset{t}{E}\left[\frac{\Lambda_{t+1}}{\Lambda_t}\left\{\alpha \frac{Y_{t+1}}{K_{t+1}} + (1-\delta)(1+R_{t+1})\right\}\right]$$

(40) $$m_{t+1} = \theta_t \frac{m_t}{\pi_t}$$

(41) $$\pi_t I_t = m_t^b + (1-\varphi)(\theta_t - 1)m_t + (1-\phi)\Gamma_t$$

(42) $$b_{t+1} - \frac{e_t}{e_{t-1}}(1+i_t^{*})\frac{b_t}{\pi_t} = Y_t - C_t - I_t + [1-(1+R_t)(1-\phi)]\frac{\Gamma_t}{\pi_t}$$

(43) $\log(\theta_{t+1}) = (1-\rho_\theta)\log(\bar{\theta}) + \rho_\theta \log(\theta_t) + \rho_g \log(g_t) + \varepsilon_{\theta t+1}$

(44) $\log(g_{t+1}) = (1-\rho_g)\log(\bar{g}) + \rho_g \log(g_t) + \varepsilon_{gt+1}$

(45) $\log(z_{t+1}) = (1-\rho_z)\log(\bar{z}) + \rho_z \log(z_t) + \varepsilon_{zt+1}$

Consequently, the log-linearized system of equations, following Uhlig's methodology, is given by

(26') $0 = \underset{t}{E}\left[\hat{\pi}_t - \hat{\Gamma}_t - \tau\hat{Y}_t + \hat{g}_t\right]$

(28') $0 = \underset{t}{E}\left[-\hat{\Lambda}_t + \hat{\Lambda}_{t+1} + \hat{e}_{t+1} - \hat{e}_t - \hat{\pi}_{t+1}\right]$

(29') $0 = \hat{w}_t + \hat{\Lambda}_t - \frac{H}{1-H}\hat{H}_t$

(30') $0 = \underset{t}{E}\left[-\hat{\Lambda}_t + \frac{R}{1+R}\hat{R}_{t+1} + \hat{\Lambda}_{t+1} - \hat{\pi}_{t+1}\right]$

(31') $0 = -\hat{\Delta M}_t^c + \hat{m}_{t+1}^c + \hat{\pi}_t - \hat{m}_t^c$

(32') $0 = \underset{t}{E}\left[-\Lambda\hat{\Lambda}_t - \frac{\beta}{\pi C}\hat{\pi}_{t+1} - \frac{\beta}{\pi C}\hat{C}_{t+1} + \beta\pi^2\Lambda w\xi\frac{1}{m^c}\hat{\Delta M}_{t+1}^c - \pi^2\Lambda w\xi\frac{1}{m^c}\hat{\Delta M}_t^c\right]$

(33') $0 = -(m)\hat{m}_t + (m^b)\hat{m}_t^b + (m^c)\hat{m}_t^c$

(34') $0 = \hat{\pi}_t + \hat{C}_t - \frac{m^c}{C\pi}\hat{m}_t^c - \frac{\Gamma\phi}{C\pi}\hat{\Gamma}_t - \frac{m\varphi}{C}\hat{\theta}_t - \frac{m\varphi}{C\pi}(\theta-1)\hat{m}_t$

(35') $0 = -\hat{\pi}_t + \hat{e}_t - \hat{e}_{t-1}$

(36') $0 = -\hat{Y}_t + \alpha\hat{K}_t + (1-\alpha)\hat{H}_t + \hat{z}_t$

(37') $0 = \frac{I}{K}\hat{I}_t - \hat{K}_{t+1} + (1-\delta)\hat{K}_t$

(38') $0 = -\hat{w}_t + \hat{Y}_t - \hat{H}_t$

(39') $0 = \underset{t}{E}\left[\left(\alpha\beta\frac{Y}{K} + \beta(1-\delta)(1+R)\right)\hat{\Lambda}_{t+1} + \left(\beta(1-\delta)R\right)\hat{R}_{t+1} + \alpha\beta\frac{Y}{K}\hat{Y}_{t+1} - \alpha\beta\frac{Y}{K}\hat{K}_{t+1} - \left(\alpha\beta\frac{Y}{K} + \beta(1-\delta)(1+R)\right)\hat{\Lambda}_t - (R)\hat{R}_t\right]$

(40') $0 = -\hat{m}_{t+1} + \hat{m}_t - \hat{\pi}_t + \hat{\theta}_t$

(41') $0 = -\hat{\pi}_t - \hat{I}_t + \frac{m^b}{I\pi}\hat{m}_t^b + \frac{m}{I\pi}(\theta-1)(1-\varphi)\hat{m}_t + \frac{(1-\varphi)m}{I}\hat{\theta}_t + \frac{\Gamma}{I\pi}(1-\phi)\hat{\Gamma}_t$

(42') $0 = -\hat{b}_{t+1} + \frac{(1+i^*)}{\pi}\hat{e}_t - \frac{(1+i^*)}{\pi}\hat{e}_{t-1} + \frac{(1+i^*)}{\pi}\hat{b}_t + \left(\frac{Y-C-I-b}{b}\right)\hat{\pi}_t + \frac{Y}{b}\hat{Y}_t - \frac{C}{b}\hat{C}_t$

$$-\frac{I}{b}\hat{I}_t+\left(\frac{(1-(1-\phi)(1+R))\Gamma}{b\pi}\right)\hat{\Gamma}_t-\frac{(1-\phi)R\Gamma}{b\pi}\hat{R}_t$$

(43') $\hat{\theta}_{t+1}=\rho_\theta\hat{\theta}_t+\rho_g\hat{g}_t+\varepsilon_{\theta t+1}$

(44') $\hat{g}_{t+1}=\rho_g\hat{g}_t+\varepsilon_{gt+1}$

(45') $\hat{z}_{t+1}=\rho_z\hat{z}_t+\varepsilon_{zt+1}$

B.2. Solving

The system is given by 19 equations with 19 variables. The endogenous state variables $\{\hat{m}_t,\hat{b}_t,\hat{K}_t,\hat{m}_t^c,\hat{e}_t,\hat{\Lambda}_t\}$ include lambda and the nominal exchange rate in addition to the standard four variables, as Uhlig's toolkit suggests that variables dated *t-1* or earlier should be considered state variables (in the case of $\hat{e}_t$) while the matrix of other endogenous variables should be non-singular in order for its pseudo-inverse to exists, allowing to redeclare $\hat{\Lambda}_t$ as other endogenous state variable instead. The other endogenous variables of the system are $\{\hat{\pi}_t,\hat{m}_t^b,\hat{C}_t,\hat{R}_t,\hat{w}_t,\hat{H}_t,\hat{Y}_t,\hat{I}_t,\Delta\hat{M}_t^c,\hat{\Gamma}_t\}$, and the exogenous state variable are $\{\hat{\theta}_t,\hat{g}_t,\hat{z}_t\}$.

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