FIW – Working Paper

FIW Working Paper N° 41
January 2010

Financial Frictions, Foreign Direct Investment, and Growth

Luis San Vicente Portes*

Abstract

This paper assesses the role of financial frictions and Foreign Direct Investment (FDI) on an economy´s growth rate, business cycle volatility, and firm´s capital structure. We gauge these effects within the Financial Accelerator framework, where entrepreneurs can establish affiliates of local firms abroad through Foreign Direct Investment. Model simulations suggest that in the presence of credit market imperfections FDI is associated with faster growth, less leverage, and lower aggregate volatility. These features are consistent with the macroeconomic dynamics of the more globally integrated economies over the last three decades.

JEL Codes: F43, E32, G32
Keywords: Output volatility; Foreign Direct Investment; International Diversification; Capital Structure.

The author

* Luis San Vicente Portes, Montclair State University, Upper Montclair, NJ, 07043. Email: PortesL@mail.montclair.edu.

Financial Frictions, Foreign Direct Investment, and Growth

Luis San Vicente Portes*
Montclair State University

Abstract

This paper assesses the role of financial frictions and Foreign Direct Investment (FDI) on an economy's growth rate, business cycle volatility, and firms' capital structure. We gauge these effects within the Financial Accelerator framework, where entrepreneurs can establish affiliates of local firms abroad through Foreign Direct Investment. Model simulations suggest that in the presence of credit market imperfections FDI is associated with faster growth, less leverage, and lower aggregate volatility. These features are consistent with the macroeconomic dynamics of the more globally integrated economies over the last three decades.

JEL Classification: F43; E32; G32.
Keywords: Output volatility; Foreign Direct Investment; International Diversification; Capital Structure.
Author age: 34 years old.

* Correspondence: Luis San Vicente Portes, Montclair State University, Upper Montclair, NJ, 07043. Email: PortesL@mail.montclair.edu.

1 Introduction

Over the last three decades the more globally integrated economies have exhibited faster growth, lower firm leverage, and a moderation in their business cycles. These trends have been observed in both emerging and developed economies. Our objective is to assess the extent to which greater financial integration, in the form of Foreign Direct Investment (FDI), can explain them.

For this purpose we work with a unified theoretical model that predicts the three observations as firms and countries engage in larger foreign operations. Using an extension of Bernanke et al. (1999) "Financial Accelerator" framework, in which firms are able to diversify internationally in the form of FDI, we find that not only aggregate volatility declines, but also countries exhibit faster growth and a decrease in firms' leverage. These results highlight the effect of greater international financial integration in the presence of credit market frictions.

This work relates to three strands of the literature and tries to identify a common theoretical thread between them. The first branch concerns the effect of greater openness on growth; the second refers to firms' financing behavior upon financial liberalization; and the third involves the moderation in aggregate volatility around the world.

While a large part of the debate on the link between openness and growth concentrates on whether greater openness is the outcome of better institutions, the consensus is that openness is associated to faster growth. At the firm level, studies have also shown that multinational corporations tend to grow faster relative to domestic firms, as foreign and domestic capital spending are positively associated generating a feedback effect. Furthermore, it has been observed that the expansion of U.S. multinationals have led to a shift towards more capital-intensive production of the parent firm. By working within a theoretical model we are able to show that larger FDI allows countries and firms to grow faster regardless of the institutional environment. This finding does not involve technological transfers nor spillovers usually associated with multinational corporations.[1]

Another branch of the literature that relates to this work concerns the effect of internationalization on firms' financing choices. Schmukler and Vesperoni (2004) study how access to international capital markets affects firms' capital structure in developing countries. Based on firm level data from emerging market economies in East Asia and Latin America they find that the debt to equity ratios tend to decline after

[1]For different views on openness and growth see Rodriguez and Rodrik (2000), Rodrik (2005), and Dollar and Kraay (2001, 2005). In terms of financial openness, Tornell et al. (2004) show that financial liberalization leads to larger growth. Razin (2002) and Desai et al. (2005a and 2005b) document the positive effect of FDI on domestic growth and capital accumulation. Lipsey (2002) shows that the expansion of U.S. multinationals have led to more capital-intensive production for the parent firm.

financial liberalization. In a related study Claessens and Schmukler (2007) using a sample of 111 countries generalize the findings from the developing countries. For the U.S., San Vicente Portes and Ozenbas (2007), document a secular decline in firm leverage over the last three decades as well. In addition, several studies have consistently shown that multinational corporations tend to have lower debt ratios than purely domestic firms.[2]

The third strand of the literature to which this paper relates is the moderation in business cycle volatility in both developed and developing countries. Kim and Nelson (1999), and McConnell and Perez-Quiros (2000) were the first to identify the moderation in output volatility in the U.S. Then Blanchard and Simone (2001) and Stock and Watson (2003) showed a similar decline in output volatility in other G-7 countries.[3] In recent work the IMF (2005) and Haskura (2007) document even larger drops in volatility in emerging markets and developing economies.

Closer to this paper is the work by San Vicente Portes (2007), who documents the expansion of U.S. multinationals since the mid 1980s, and explores their role in the U.S. moderation. He shows that the diversifying nature of multinational corporations could lead to a significant reduction in output and investment volatility in a calibrated model of the U.S. economy. Based on those findings we investigate whether such mechanism may also be at work in other countries, and if so what would the predictions on growth and capital structure be.

The starting point of the analysis consists on establishing whether FDI-moderation link holds in a sample of developing and developed countries. Then, we build a model that replicates this observation and endogenously generates other testable predictions on growth and financing patterns.

The initial observation is the negative relation between FDI and output volatility. Controlling for (log) real per capita income, inflation, and openness to trade (ratio of imports plus exports to GDP), Figure 1 plots the ratio of FDI to GDP against the 10-year rolling window standard deviation of GDP growth based on a sample 178 countries.

[2]See Burgman (1996), Chen et al. (1997), and Khambata and Reeb (2000).

[3]Stock and Watson (2002, 2003) and Blanchard and Simone (2001) further showed that the phenomenon is not unique to aggregate output but it is also present in most U.S. macroeconomic time series. Additional references on the moderation of output volatility include Ahmed, Levin and Wilson (2004), and Faust and Doyle (2004).

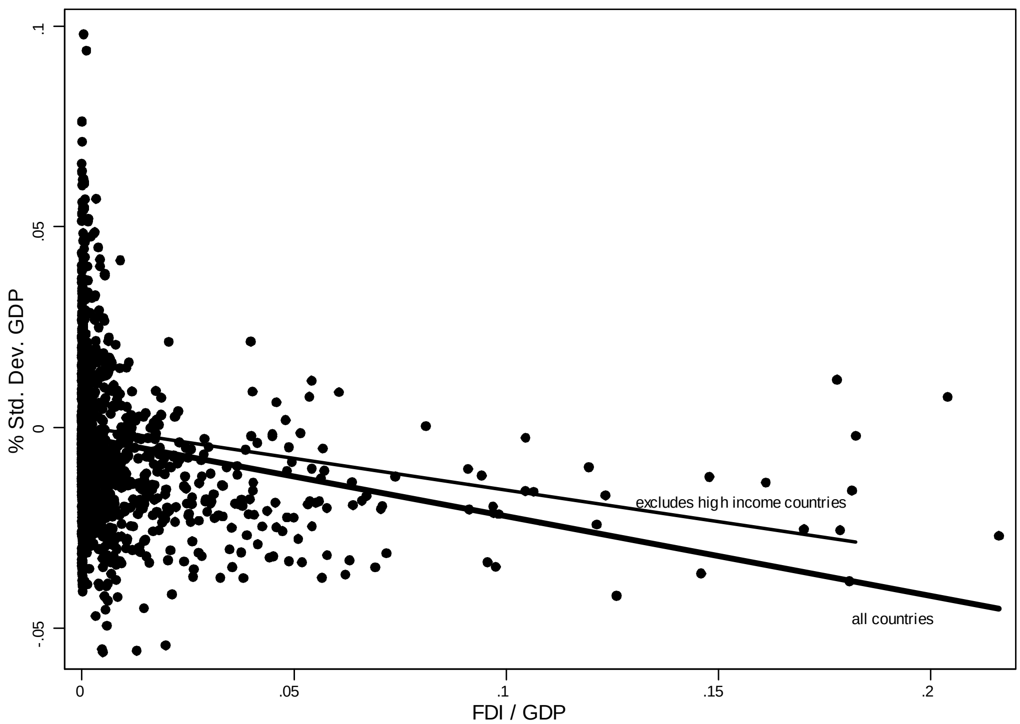

Figure 1. Foreign Direct Investment and Output Volatility

Notes: This figure plots the ratio of FDI to GDP against the 10-year rolling window standard deviation of GDP growth controlled for per capita income, inflation, and openness to trade. The full sample consists of 1403 observations from 178 coutries for the period between 1960-2000. Without high-income countries the subsample consists of 809 observations. The slope coefficient of each regression line is significant at a 5 percent level.

This figure suggest a negative relationship between FDI and output volatility for both developed and developing countries. For the whole sample (thicker marker) and for the subsample that excludes high income countries (thinner marker), the slope estimates are statistically significant at a 5 percent level.[4] The mechanism underlying this relationship can be attributed to a standard diversification argument. To the extent that the operations of a firm's domestic and foreign affiliates are not perfectly positively correlated, the multinational corporations will exhibit smoother patterns of investment, production, sales, profits and earnings.[5]

A major feature of Figure 1 is that once we control for country size and international exposure, both developed and developing countries exhibit the same moderation effect from international diversification. Figure 2 displays individual country scatters for the U.S., New Zealand, Chile, and Morocco. In this diverse set of countries we find the same pattern.

[4] We use the 2006 World Bank classification to group countries into high-income and the rest.
[5] See Wan (1998); Kim et al. (2001); and San Vicente Portes (2007).

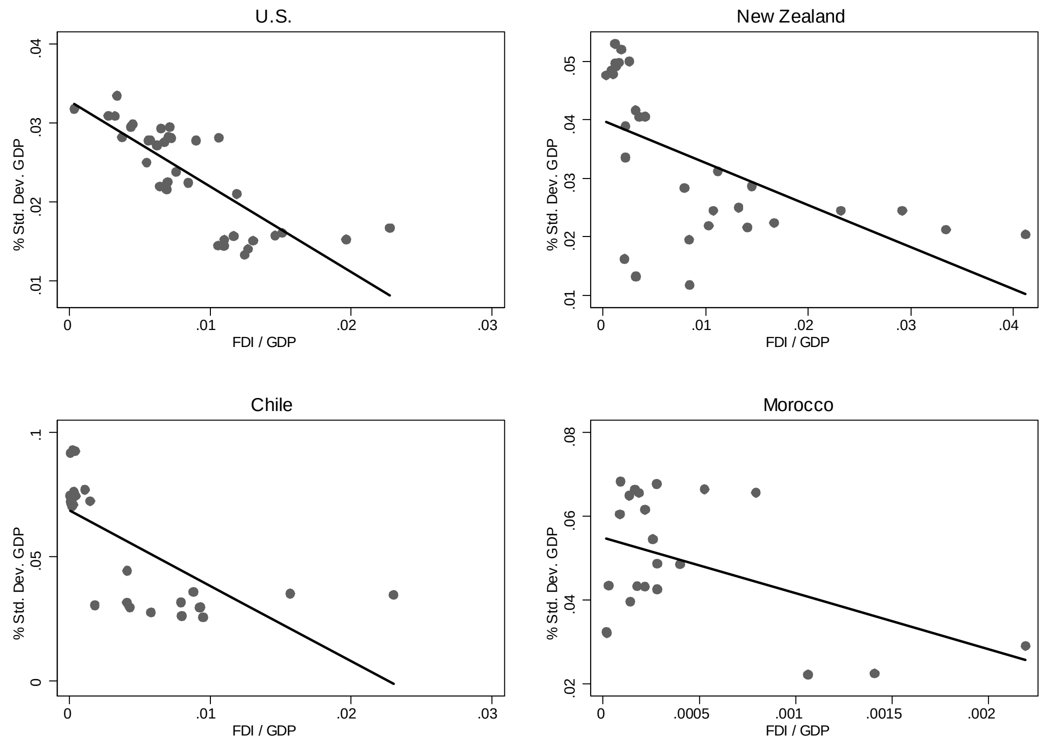

Figure 2. Selected Countries: FDI and Output Volatility

Notes: This figure plots the ratio of FDI to GDP against the 10-year rolling window standard deviation of GDP growth for selected countries. The slope estimates are at least significant at a 10 percent level.

Hence, as countries have integrated to the rest of the world through FDI, international diversification seem to have provided them with a mechanism that reduces the volatility of their business cycles. As to whether FDI promotes faster growth, the literature does point out towards that direction. And can FDI be part of the changing financial structure of firms remains an open question. Next we layout a general equilibrium model with credit market frictions that allows for FDI, which connects and yields new insights into these matters.

The contribution of this paper is to provide the theoretical linkages among the trends identified in the literature. With this in mind, we use a theoretical model that allows us to qualitatively explore the channels through which FDI could affect the home economy, and quantitatively determine their importance. Following San Vicente Portes (2007) we work with an extension of the "Financial Accelerator" framework that allows entrepreneurs to diversify internationally through FDI. In that work it is shown that in the presence of credit market imperfections international diversification is associated with lower output volatility, as smoother dynamics of net worth, translate into less volatile terms of credit, investment and production. However, the ramifications of FDI on aggregate growth rates and firms' capital structure are left unexplored. This paper seeks to simultaneously analyze the effects of FDI on growth, capital structure and volatility within a unified framework, and test the model's predictions against the observed trends.

Our main finding is that in spite of international diversification being a mitigating force on credit cycles, larger firm operations could result in larger borrowing costs, which steer firms away from debt towards internal financing. Larger internal financing increases the economy's rate of capital accumulation and therefore of growth. Higher net worth, in addition to the diversifying benefits of FDI, dampens the credit market friction leading to smoother credit cycles, and thus smoother investment and production.

The paper is organized as follows: Section 2 presents the model, Section 3 describes the calibration of the model and the solution method, Section 4 reports the model's results, Section 5 presents the model's sensitivity to changes in the diversification parameters, and Section 6 provides concluding remarks.

2 The Model

To explore the linkages between FDI, growth, aggregate volatility, and firms' financing decisions, we work with a model that introduces FDI to Bernanke et al. (1999) "Financial Accelerator" framework. The "Financial Accelerator" framework is a general equilibrium model in which the firms' ability to borrow to finance their investment depends on the firms' net worth. Specifically, the lower the net worth the higher the interest rate at which a firm borrows. This mechanism amplifies the propagation of shocks through the economy and underlies the economy's ability to grow. For instance, in bad times firms are not only hit by lower productivity but also tighter credit conditions that decrease investment and output further. After a positive productivity shock, high net worth leads to better terms of credit that boost investment and expand the business cycle.[6]

The choice of this theoretical framework stems from its rich structure and suitability for our research questions. In particular, it is an stochastic dynamic general equilibrium growth model that endogenously generates business cycle statistics that can be compared to the data, and it embeds a realistic debt contract that in turn determines a firm's capital structure. Furthermore, the model accounts for the interaction of aggregate and firm-specific (idiosyncratic) shocks. The latter feature is of special importance as our interest lies in assessing the effect of firm-specific shocks at home and abroad on aggregate dynamics and firm financing.

Following San Vicente Portes (2007) we add FDI as part of the entrepreneurs'

[6] See Kiyotaki and Moore (1997) for a propagation mechanism based on collateral constraints rather than moral hazard.

business plan.[7] That is, a local firm can have foreign affiliates and essentially become a multinational corporation. To solely focus on the effect of FDI outflows on the home economy we rule out that foreign aggregate productivity shocks pass through to the parent firm; though aggregate technology shocks at home pass through to foreign affiliates.[8] By doing this, any macroeconomic change can only be attributed to the firms' foreign investment. This modelling approach also controls for the transmission of international business cycles on the home economy or changes in business cycle correlations across countries, which could potentially also lead to a moderation in business cycles.[9]

The model consists of *households* who hold deposits with a *financial intermediary* that lends to *domestic firms (DCs)* and home based multinational corporations *MNCs* to finance the purchases of their desired capital stock from *capital producers*. *Entrepreneurs* own the firms (DC or MNC) and hire labor from households in order to produce the consumption good. However, the financial intermediary cannot observe the firms' returns on their assets unless the intermediary pays a verification cost. The solution to this credit market imperfection consists of a standard debt contract, which generates the "Financial Accelerator".

The model consists of two building blocks. One involves the design of the optimal contract due to the Costly State Verification, and the second comprises real business cycle (RBC) features of the model such as household behavior, the evolution of the capital stock, and the technology available to firms.

To focus on the effect of larger international diversification on macroeconomic dynamics, the paper abstracts from some of the features associated to FDI such as knowledge and technology transfers, and vertical integration; and there is only one type of multinational: home–based.[10] In the model there is only one consumption good, which is produced at home by DCs and the parents of MNCs, and abroad by the MNCs' affiliates.[11]

[7] To keep the focus of the investigation on the real side of the economy, we abstract from the monetary side of Bernanke et al. (1999); whose motivation included the study of nominal rigidities.

[8] Desai and Foley (2004) find a high correlation between parents' and affiliates' return and investment rates; this being consistent with the transmission of productivity shocks within the MNC. Furthermore, they establish that the direction of causality goes from parents to foreign affiliates.

[9] Heathcote and Perri (2004) document a significant decline in output, investment and employment correlations between the U.S. and the rest of the industrialized world after 1987. Other references about the decline in international business cycle correlations include Stock and Watson (2003) and Faust and Doyle (2004).

[10] By only modelling home-based multinationals, the effect of larger foreign investment is simultaneously captured in the model's GDP (by means of the multinationals' parents) and GNP (through the multinationals' parents and affiliates).

[11] The decision to be a domestic or a multinational company, and the determinants of the size of foreign affiliates are beyond the scope of the study. For the calibration of the model these features are taken as given from the data.

2.1 The "Financial Accelerator"

The "Financial Accelerator" arises due to the inability of the financial intermediary (the principal) to costlessly observe the firm's (the agent) idiosyncratic return on its assets. This induces borrowers to understate the return on their assets. Following Townsend (1979) and Bernanke et al. (1999) we design a truth-telling optimal contract so that the firm and the financial intermediary agree on a non-default interest rate and a cutoff return, for which realizations below it trigger the lender's verification.

San Vicente Portes (2007) extends Bernanke et al. (1999) framework by introducing FDI. By doing so firms are exposed to shocks at home and abroad. In such framework an internationally diversified firm consists of a *parent* firm and a *majority owned foreign affiliate (MOFA)*. The financial structure of a multinational corporation in a given period is made up by its assets $(QK + QK^*)$, liabilities $(B + B^*)$,and its net worth $(N + N^*)$; where the MOFA's variables are denoted by an '$*$' and Q denotes the price of capital in terms of the consumption good. What distinguishes a MNC from a DC is that DCs do not have affiliates, so that for a DC all 'starred' variables are zero.[12]

In the model there is a continuum of firms indexed by $j \in [0, 1]$. Every period each firm's assets are subject to an idiosyncratic shock to the return on their assets ω_j at home and ω_j^*abroad. The return on an internationally diversified firm's assets is given by: $\omega_j R^k QK_j + \omega_j^* R^k QK_j^*$. Where R^k denotes the economy-wide gross return on capital, and ω_j and ω_j^* are assumed to be two jointly distributed random variables with mean $\mu_\omega = \mu_{\omega^*} = 1$; variance $\sigma_\omega^2 = \sigma_{\omega^*}^2$; and correlation ρ_{ω,ω^*}.

In the model the degree of international diversification is given by their FDI. For this purpose let σ_j denote the parent's share of MNC's assets. The smaller the parent's share of the multinational's assets (σ_j) , the larger the importance of its affiliates (FDI). Since DCs do not hold any assets abroad, by definition σ_j is equal to one for a domestic company. When the parent and the affiliate hold an equal share of the MNC's assets, σ_j equals one half.[13]

This way, let $K_j = \sigma_j K_{MNC,j}$ and $K_j^* = (1-\sigma_j)K_{MNC,j}$ represent the parent's and the affiliate's capital stock holdings within the j^{th} multinational, respectively. Thus the affiliate's assets can be expressed as $K_j^* = \left(\frac{1-\sigma_j}{\sigma_j}\right) K_j$, and the multinational's return on its assets by $\left[\omega_j + \left(\frac{1-\sigma_j}{\sigma_j}\right) \omega_j^*\right] R^k QK_j$.

[12]Since all variables are contemporaneous, for expositional simplicity time subscripts are omitted in this subsection.

[13]The study of determinants of the parent's share of the multinational's assets (σ_j) is beyond the scope of the paper. However, σ bridges the models with and without multinationals. By setting $\sigma_j = 1$ for every j, the model collapses to Bernanke et al. (1999). See section 3 for a the description of the calibration of σ used for the model simulations.

In terms of the firms' capital structure, entrepreneurs finance their desired capital stock with their own funds (net worth) and by borrowing from the financial intermediary. The capital structure of the j^{th} firm is given by its total debt $\left(B_j \text{ and } B_j^*\right)$ and net worth $\left(N_j \text{ and } N_j^*\right)$. However, because of Costly State Verification, the Modigliani-Miller theorem does not hold and there is a wedge in the cost of external and internal financing.[14] The firm-specific cost of external financing is greater than the opportunity cost of internal funds, where the latter is given by the economy–wide risk–free rate. In a given period, a firm's debt is given by $B_j + B_j^* = \left[B_j + \left(\frac{1-\sigma_j}{\sigma_j}\right) B_j\right] = \frac{1}{\sigma_j} B_j$.[15]

As before, for DCs σ_j is equal to one implying that B_j^* is equal to zero. Because international financial markets are not explicitly modeled, MNCs are assumed to borrow from the home country the difference between their net worth and their desired capital stock for domestic and foreign operations.[16]

2.1.1 International Diversification

When home and foreign firm-specific shocks are not perfectly positively correlated a good realization of a shock in one location may offset a poor realization from another location; leading to more stable net worth, to a lower probability of default and to smoother terms of credit. Given the parent's capital stock (K_j), debt (B_j), borrowing interest rate (Z_j), the economy-wide price of capital (Q) and return on capital (R^k), a firm's performance is determined by the realizations of its idiosyncratic shocks. This gives rise to the following cases.[17]

Case 1: The firm repays its debt and disappears.

$$\left[\omega_j + \left(\frac{1-\sigma_j}{\sigma_j}\right) \omega_j^*\right] R^k Q K_j = \frac{1}{\sigma_j} Z_j B_j$$

Case 2: The firm pays back its debt and accumulates the difference as net worth.

$$\left[\omega_j + \left(\frac{1-\sigma_j}{\sigma_j}\right) \omega_j^*\right] R^k Q K_j > \frac{1}{\sigma_j} Z_j B_j$$

[14] Bernanke and Gertler (1989) present evidence from the U.S. manufacturing industry, where informational asymmetries in credit markets raise the firms' cost of external financing relative to internal funds. More recently, Levin et al. (2004), based on a sample of publicly traded firms for the period between 1997 and 2003, consistently reject the hypothesis of frictionless financial markets in different tests, as they document a significant increase in the external finance premium for these firms during the 2001 recession.

[15] For the U.S. it has been observed that the parents' share of the MNCs' assets has coincided with their share of debt, net worth, employment and capital expenditure during the 1984-2000 period (Bureau of Economic Analysis, 2002). This way, σ_j is also used to represent the parent's share of the MNC's debt.

[16] In practice, foreign affiliates borrow from local and international sources. Nonetheless, Desai, Foley and Hines (2004) document that parents are an important source of funding for foreign affiliates. Furthermore, Altshuler and Grubert (1996) report evidence that U.S. multinationals use assets held abroad to support loans at home.

[17] The performance of a DC is also characterized by these cases, provided that σ_j is equal to 1.

Case 3: The firm defaults on its debt.
$\left[\omega_j + \left(\frac{1-\sigma_j}{\sigma_j}\right)\omega_j^*\right] R^k QK_j < \frac{1}{\sigma_j} Z_j B_j$

In this event, the financial intermediary incurs verification cost μ, and keeps the liquidation value
$(1-\mu)\left[\omega_j + \left(\frac{1-\sigma}{\sigma}\right)\omega_j^*\right] R^k QK_j$.

Case 1 is the basis of the debt contract between the firm and the financial intermediary. The contract is characterized by the amount borrowed, the borrowing interest rate, and the set of cutoff values for ω and ω^* for which there is verification. Let $l_j \equiv \frac{Z_j B_j}{R^k QK_j}$, be a measure of the firm's leverage. This way, case 1 can be expressed as: $\left[\sigma_j \omega_j + (1-\sigma_j)\,\omega_j^*\right] = l_j$.

The hedge against domestic risk depends on the importance of a firm's foreign operations. To illustrate this, figure 3 presents the three cases for two values of σ_j.

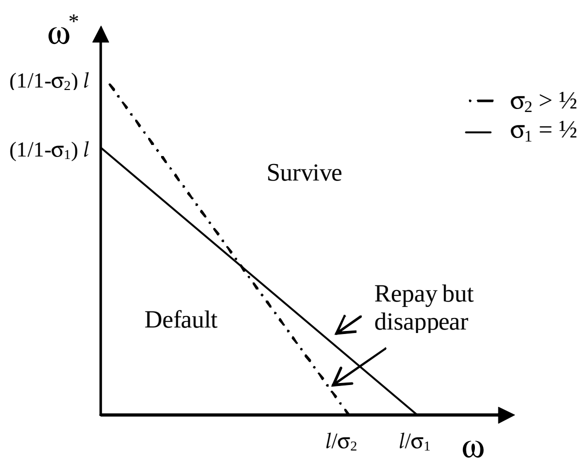

Figure 3. Firm's Performance: Shocks to Domestic and Foreign Operations
Notes: This figure shows the combinations of idiosyncratic shocks at home and abroad for which a firm survives, breaks even, and defaults on its debt, for different levels of international diversification. The larger σ the less internationally diversified the firm is.

For a given value of l_j and σ_j, the straight lines represent the combinations of (ω_j, ω_j^*) for which an internationally diversified firm breaks even (case 1). Realizations under the line lead to bankruptcy and to the lender's verification (case 3), while with realizations above the line the firm accumulates net worth (case 2). In contrast, a non-diversified firm does not have the safeguard against a poor realization at home. By comparing the frontiers associated with σ_1 and σ_2, one can observe that the less diversified the MNC is (larger σ_j), low realizations of ω (close to zero) require increasingly large realizations of ω^* for the firm to survive. That is, the MNC must get a high realization abroad to make up for the poor performance at home.[18] This way, $\sigma_j < 1$, implies lower risk, better terms of credit, and more stable net worth, investment, and output relative to a non-internationally diversified firm.[19]

From the figure we note that the probability of default of a MNC is given by:[20]

$$\Psi(l_j) \equiv \int_0^{l_j/\sigma_j} \int_0^{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)} f(s,s^*)ds^*ds.$$

In summary, when a DC and a MNC have the same capital stock, unless home and foreign idiosyncratic shocks are perfectly positively correlated, the volatility of the return on the multinational's capital will always be less than that of a domestic corporation.

2.1.2 The Financial Contract

The debt contract is realized within each period. The timing is as follows. The firm enters the period with a given net worth. Then, observes the realization of the aggregate technology shock, hires labor and decides how much to borrow in order to finance the difference between its net worth and its desired capital stock; then the firm's idiosyncratic shock(s) are realized and pays back its debt, labor costs, sells its capital, and keeps any remaining funds as net worth with which it goes into the next period.

Firms borrow from a Financial Intermediary. The financial intermediary is assumed to be a competitive entity that funds itself from households' deposits, on which it pays the risk-free gross interest rate R. Zero-profits in financial intermediation implies that the funding of a firm must satisfy the following participation constraint:

$$(1-\mu)\int_0^{l/\sigma_j} \int_0^{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)} \left[s + \left(\frac{1-\sigma_j}{\sigma_j}\right)s^*\right] f(s,s^*)ds^*dsR^kQK_j +$$
$$[1-\Psi(l_j)]\frac{1}{\sigma_j}Z_jB_j = \frac{1}{\sigma_j}RB_j.$$

The first term of this equation represents the financial intermediary's expected recovery value in the event of default, after accounting for the verification cost. The second term accounts for the expected non-default payback of the loan by the firm. The right side of the equation represents the financial intermediary's funding costs;

[18] Though, when the MNC is less diversified (high σ_j) poor realizations abroad require smaller realization at home to survive.

[19] See San Vicente Portes (2007) for a formal proof of this argument.

[20] The notation convention adopted in the paper is that ω_j and ω_j^* represent the firm specific realizations of the random variables ω and ω^*. When either ω or ω^* are part of the limits of integration, integrals are defined over s and s^*, which stand for ω and ω^*, respectively.

that is, the gross risk-free interest rate on the amount borrowed. Using the firm's balance sheet this expression becomes:

$$[1-\Psi(l_j)]\,\frac{1}{\sigma_j}Z_j(QK_j-N_j)+(1-\mu)\Upsilon(l_j)R^kQK_j=\frac{1}{\sigma_j}R(QK_j-N_j), \tag{1}$$

where $\Upsilon(l_j)\equiv\int_0^{l/\sigma_j}\int_0^{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)}\left[s+\left(\frac{1-\sigma}{\sigma}\right)s^*\right]f(s,s^*)ds^*ds.$

The borrowing side of the contract corresponds to the firm. Entrepreneurs are assumed to be risk neutral, and borrow from the financial intermediary the difference between their desired capital stock and their net worth. Their objective is to maximize the difference between the expected return on their assets and the expected financing costs. From figure 3, it can be seen that this is given by:[21]

$$\int_0^{l/\sigma_j}\int_{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)}^{\infty}\left[s+\left(\frac{1-\sigma_j}{\sigma_j}\right)s^*\right]f(s,s^*)ds^*dsR^kQK_j+$$
$$\int_{l/\sigma_j}^{\infty}\int_0^{\infty}\left[\omega+\left(\frac{1-\sigma_j}{\sigma_j}\right)\omega^*\right]f(\omega,\omega^*)d\omega^*d\omega R^kQK_j-[1-\Psi(l_j)]\,\frac{1}{\sigma_j}Z_jB_j.$$

Given that the mean of the two idiosyncratic shocks is equal to one, this expression can be further simplified to:[22]

$$\left[\frac{1}{\sigma_j}-\Upsilon(l_j)\right]R^kQK_j-[1-\Psi(l_j)]\,\frac{1}{\sigma_j}Z_j(QK_j-N_j). \tag{2}$$

Where the first term is the expected non-default return on the firm's assets and the second term represents the non-default financing costs.

This way, given the entrepreneur's net worth, the price of capital and the economy-wide return on capital, the profit-maximizing contract between the firm and the financial intermediary is such that the choice for the capital stock (K_j) maximizes equation 2 such that Z_j solves equation 1. That is,

$$\max_{\{K_j,Z_j\}}\quad\left[\frac{1}{\sigma_j}-\Upsilon(l_j)\right]R^kQK_j-[1-\Psi(l_j)]\,\frac{1}{\sigma_j}Z_j(QK_j-N_j)$$
$$\text{s.t. }\;[1-\Psi(l_j)]\,\frac{1}{\sigma_j}Z_j(QK_j-N_j)+(1-\mu)\Upsilon(l_j)R^kQK_j=\frac{1}{\sigma_j}R(QK_j-N_j).$$

[21] This formulation is equivalent to the firm maximizing its expected net worth. Refer to section 2.2.4.

[22] Details presented in Appendix A.

The optimal contract implies a unique cutoff value for l_j that determines the combinations of ω and ω^* for which there is verification (refer to case 1).[23] The solution to this problem is part of the model's general equilibrium.

2.1.3 The Financial Accelerator and Aggregation

The "Financial Accelerator" arises from equation 1. It implies that the borrowing interest rate is decreasing in net worth and the firms' demand for capital is increasing in net worth. The inverse relation between net worth and interest rates generates the amplification mechanism since the firms' investment and output depend on the terms of borrowing, which are in turn determined by the dynamics of net worth.[24] To see this, equation 1 can be re-written as follows:

$$Z_j = \left\{ \frac{1}{[1 - \Psi(l_j)]} \right\} \left[R - \frac{\sigma_j (1-\mu) \Upsilon(l_j) R^k Q K_j}{(QK_j - N_j)} \right].$$

This expression shows that in equilibrium the borrowing interest rate is decreasing in net worth N_j, and increasing in the probability of default, $\Psi(l_j)$.

In the model the demand for capital is linear in net worth. This in turn allows for the aggregation of firms in the model into a representative one. Different levels of net worth across firms requires keeping track of each firm when solving the model. However, as noted by Bernanke et al. (1999) the problem of accounting for firm heterogeneity need not arise since firms are scaled versions of each other. Constant returns to scale in production, together with the demand for capital being linear in net worth, suffice to determine the aggregate demand for capital given the total stock of net worth.[25] In particular, equation 1 can be written as:

$$QK_j = \left\{ \frac{R - [1 - \Psi(l_j)]}{R - [1 - \Psi(l_j)]\, Z_j - \sigma_j (1-\mu) \Upsilon(l_j) R^k} \right\} N_j.$$

This equation shows that the firms' demand for capital is increasing in net worth (N_j) and in the economy's return on capital (R^k); and decreasing in the risk free interest rate (R). However, to aggregate across firms, the term in brackets should be a the same for every firm. When this term is a constant that only depends on economy–wide variables, one can integrate over the continuum of firms to determine the aggregate demand for capital.

However, the model with MNCs adds a dimension in which firms can differ: the size of their FDI. In addition to different net worth, MNCs can also vary in the parent's share of the multinational's assets (σ). San Vicente Portes (2007) shows

[23] For a non-diversified company, l_j represents the upper bound of a range of realizations of ω for which there is verification (see Bernanke et al., 1999). The equilibrium allocation that solves the debt contract is Pareto efficient (see Townsend, 1979).

[24] The derivations of the results presented in this subsection are collected in Appendix B.

[25] Constant returns to scale imply that in equilibrium the capital-labor ratio is constant across firms.

that when σ is constant across firms, the term in brackets is only determined by economy-wide variables $\left(R^k, R \text{ and } Q\right)$, thus allowing for aggregation. This way, the aggregate demand for capital is given by:

$$QK = \left\{ \frac{R - [1 - \Psi(l)]}{R - [1 - \Psi(l)]\, Z - \sigma(1-\mu)\Upsilon(l) R^k} \right\} N.$$

2.2 The RBC Model

The optimal contract between firms and financial intermediaries is embedded into a standard real business cycle model. This side of the model involves the households' problem, the suppliers of physical capital, the production technology, and the dynamics of the capital stock.

2.2.1 Households

In the model there is a continuum of infinitely-lived households of measure one, whose preferences are defined over consumption and leisure. Households maximize their discounted lifetime utility and hold deposits with the financial intermediary, who pays a riskless rate of return. Household utility is separable over time, consumption, and leisure. The i^{th} household problem is:

$$\begin{aligned} &\max \qquad U_i = E_0 \sum_{t=0}^{\infty} \beta^t u(C_{t,i}, H_{t,i}) \\ &\{C_{t,i}, H_{t,i}, D_{t+1,i}\} \\ &\text{s.t.} \quad C_{t,i} + D_{t+1,i} = W_t H_{t,i} + R_t D_{t,i}. \end{aligned}$$

Where $C_{t,i}, H_{t,i}$ and $D_{t+1,i}$ are period t decisions over consumption, labor, and period $t+1$ available deposits with the financial intermediary, who pays gross return R_t. The intertemporal discount factor is given by $\beta \in (0,1)$.

Since the households' choices are determined by economy-wide variables (W_t and R_t), individual values of consumption and labor correspond to their aggregate counterparts.

2.2.2 Capital Producers

In the model, entrepreneurs buy their desired capital stock from capital producers. Capital producers are competitive entities that transform investment expenditures (I_t) and the undepreciated capital stock into new capital. All capital is homogeneous so new capital is indistinguishable from used capital. Q_t is the relative price of capital, and represents the amount of the consumption good that must be exchanged for a unit of capital. The capital producers problem is:

$$\max_{\{I_t\}} \quad \Pi_t^{cp} = Q_t \left[\Phi\left(\frac{I_t}{K_t}\right) K_t + (1-\delta)K_t \right] - I_t - (1-\delta)Q_t K_t.$$

The first term corresponds to the value of the newly produced capital; where the term $\Phi\left(\frac{I_t}{K_t}\right)$ represents the production function for capital. This production function is assumed to exhibit diminishing marginal productivity ($\Phi'(\cdot) > 0$ and $\Phi''(\cdot) < 0$), implying that large changes in the capital stock are increasingly costly, reflecting adjustment costs in the capital stock. The second and third terms represent the cost of producing the new capital.

The solution to the capital producers' problem determines the economy-wide price of capital.[26] Based on the above, the law of motion of the capital stock is given by:

$$K_{t+1} = \Phi\left(\frac{I_t}{K_t}\right) K_t + (1-\delta)K_t.$$

2.2.3 Production

The production technology for the consumption good requires capital and labor, and these inputs are subject to aggregate productivity shocks. In addition, entrepreneurs are assumed to supply their labor inelastically.[27] In each period t the aggregate production function is given by:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}.$$

Where $L_t = H_t^{\Omega}(H_t^e)^{1-\Omega}$, is a composite of household labor, H_t, and entrepreneurial labor, H_t^e; and A_t represents the aggregate technology shock. In the model, the wage rate for households is denoted by W_t and by W_t^e for entrepreneurs. Following Bernanke et al. (1999), H_t^e is normalized to one.

The technology shocks are characterized by the following autoregressive process:

$$A_t \equiv e^{z_t}, \quad \text{where } z_t = \rho_z z_{t-1} + \varepsilon_t; \quad \text{with } \varepsilon_t \sim N\left(0, \sigma_\varepsilon^2\right).$$

The mean gross return on a unit of capital (in units of capital), R_t^k, is given by:[28]

$$R_t^k = \frac{\alpha A_t K_t^{\alpha-1}[H_t^{\Omega}(H_t^e)^{1-\Omega}]^{(1-\alpha)}}{Q_t} + (1-\delta).$$

[26] The first order condition of the capital producers' problem is $Q_t = \Phi'\left(\frac{I_t}{K_t}\right)^{-1}$, for every t. This expression determines the economy–wide price of capital.

[27] Entrepreneurial labor is introduced to avoid firms eventually having zero net worth and to keep the optimal contract well defined. Note from section 2.1.3 that zero net worth implies that the demand for capital is zero (see Bernanke et al., 1999).

[28] Since $E[\omega] = E[\omega^*] = 1$ the mean return on capital across firms is R_t^k.

The first term on the right side of the equation corresponds to the marginal product of capital in units of capital, and the second term represents the undepreciated portion.

2.2.4 Evolution of Net Worth

Like in Bernanke et al. (1999), in addition to bankruptcy, firms might exit exogenously on a given period with probability $(1-\theta)$. Firm turnover along with the equilibrium bankruptcy rate determine the evolution of aggregate net worth. The law of motion of net worth is given by the economy's non–default expected asset return net of the financial intermediaries funding costs (weighted by the probability of survival) plus entrepreneurial wages. This is given by:[29]

$$N_{t+1} = \theta \left\{ \left[\frac{1}{\sigma} - \mu \Upsilon(l_t) \right] R_t^k Q_t K_t - \frac{1}{\sigma} R_t \left(Q_t K_t - N_t \right) \right\} + W_t^e$$

"Dying" firms are assumed to consume their net worth giving rise to entrepreneurial consumption (C_t^e) that is used to start up new firms. Entrepreneurial consumption is defined as:

$$C_t^e = (1-\theta) \left\{ \left[\frac{1}{\sigma} - \mu \Upsilon(l_t) \right] R_t^k Q_t K_t - \frac{1}{\sigma} R_t \left(Q_t K_t - N_t \right) \right\}.$$

2.3 Equilibrium

An equilibrium for this economy is given by a sequence of prices $\{W_t, W_t^e, R_t^k, R_t, Q_t, Z_t\}_{t=0}^{\infty}$; decision rules for $\{C_t, H_t, I_t\}_{t=0}^{\infty}$; and laws of motion for $\{K_{t+1}, N_{t+1}, D_{t+1}, A_{t+1}\}_{t=0}^{\infty}$, such that every period:

1. The households' problem is solved.
2. Firms' maximize the expected return on their assets (the agency problem is solved).
3. Capital producers maximize profits.
4. The labor market clears:[30]

$$\begin{aligned} W_t &= (1-\alpha)\Omega A_t K_t^{\alpha} H_t^{(1-\alpha)\Omega-1}; \\ W_t^e &= (1-\alpha)(1-\Omega) A_t K_t^{\alpha} H_t^{(1-\alpha)\Omega}. \end{aligned}$$

[29] The term in brackets is obtained from value function associated to the optimal contract—substituting equation 1 into equation 2.

[30] The firm's demand for labor represents the profit maximizing condition that the marginal product of labor should be equal to the real wage. These conditions arise when $R_t^k Q_t K_t$ is replaced by $A_t K_t^{\alpha} [H_t^{\Omega} (H_t^e)^{1-\Omega}]^{1-\alpha} - w_t H_t - w_t^e H_t^e + (1-\delta) Q_t K_t$, in the firm's problem and H^e is normalized to one. See appendix A.

5. The market for savings clears:

$$\frac{1}{\sigma}Q_tK_t = \frac{1}{\sigma}(B_t + N_t);$$
$$\frac{1}{\sigma}B_t = D_t.$$

6. The goods market clears:

$$\frac{1}{\sigma}Y_t = C_t + C_t^e + I_t + \mu\Upsilon(l_t)R_t^kQ_tK_t.$$

The last equilibrium condition states that the goods market clears when national income is allocated between household consumption, entrepreneurial consumption, investment, and audit costs spent on bankrupt firms. The model is closed by including the affiliates' production in this equilibrium condition since the "rest of the world" is not explicitly modeled. That is, revenue from foreign operations is repatriated.

3 Solution Method and Calibration

We solve the model by linearizing around the steady state, and then applying the Schur decomposition to compute the decision rules of non-predetermined variables and the laws of motion of pre-determined variables.

The numerical solution involves the following functional forms:

$$\begin{aligned}
\text{Utility function} &: \quad u(C_t, H_t) = \log(C_t) + \psi\log(1 - H_t). \\
\text{Production function} &: \quad Y_t = A_tK_t^{\alpha}L_t^{1-\alpha} \ \text{ with } \ L_t = H_t^{\Omega}(H_t^e)^{1-\Omega}. \\
\text{Productivity shock} &: \quad A_t \equiv e^{z_t}, \ \text{ where } \ z_t = \rho_z z_{t-1} + \varepsilon_t; \\
&\quad\ \text{with } \varepsilon_t \,\tilde{}\, N\left(0, \sigma_{\varepsilon}^2\right). \\
\text{Idiosyncratic shocks} &: \quad \omega_t \equiv e^{x_t} \text{ with } x_t \sim N(0, \sigma_x^2), \text{ and } \omega_t^* \equiv e^{x_t^*} \\
&\quad\ \text{with } x_t^* \,\tilde{}\, N(0, \sigma_{x^*}^2); \text{ and } \sigma_x^2 \text{ equal to } \sigma_{x^*}^2. \\
\text{Capital production function} &: \quad \Phi\left(\frac{I_t}{K_t}\right) = \left(\delta^* - \frac{\delta^*}{\gamma}\right) + \left(\frac{1}{\gamma\delta^{*(\gamma-1)}}\right)\left(\frac{I_t}{K_t}\right)^{\gamma}, \\
&\quad\ \text{where } \delta^* \text{ is the steady state } \left(\frac{I}{K}\right) \text{ ratio.}
\end{aligned}$$

The definition of ω_t and ω_t^* imply that their distribution is lognormal with $E(\omega_t) = E(\omega_t^*) \simeq 1$, and $var(\omega_t) = var(\omega_t^*) \simeq \sigma_x^2$.

Given that both developed and developing countries exhibit the same trends in output volatility and capital structure we calibrate the model to match certain features of the U.S. economy. This is particularly helpful for a data based calibration of the international related parameters; namely, the share of the parent's assets and correlation between idiosyncratic shocks. For the calibration exercise each model period represents one quarter of a year. In Table 1, we present the parameter values used for solving the model. The structural parameters, commonly used in the business cycle literature, were borrowed from Bernanke et al. (1999) and Cooley (1995).

Table 1. Model Parametrization

Preferences	Discount factor	$\beta = 0.99$
	Labor weight	$\psi = 2$
Technology	Capital share	$\alpha = 0.36$
	Persistence of prod. innovations	$\rho = 0.95$
	Std. Dev. of prod. innovations	$\sigma_\varepsilon = 0.01$
	Depreciation rate	$\delta = 0.02$
	Capital adjustment	$\gamma = 0.86$
Fin. Accelerator	Verification cost	$\mu = 0.12$
	Firm's probability of surviving	$\theta = 0.97$
	Std. Dev of idiosyncratic shocks	$\sigma_\omega = 0.07$
	Entrepreneur's share	$1 - \Omega = 0.01$
Int'l Diversification	Share of capital at home	$\sigma = 0.95$
	Correlation of idiosyncratic shocks	$\rho_{\omega,\omega^*} = 0.2$

Notes: This table reports the parameter values used to solve the model.

The variance of ω was calibrated to match the model's output volatility with that observed for the U.S. between 1960 and 1983, since 1984 is often cited as the year in which the break in U.S. volatility took place.[31] This in turn allows for a direct assessment of the role of FDI in the moderation in output volatility.

The parameter values associated with international diversification are taken from San Vicente Portes (2007). In particular, σ is calibrated such that it represents the share of the home-based U.S capital stock relative to the total U.S. capital stock (home fixed assets and direct investment position abroad). For aggregation to hold all firms in the economy are treated as "small" multinationals with an equal share of capital abroad. The correlation between domestic and foreign idiosyncratic shocks is constructed from a model equivalent series of R^kQK for U.S. parents and affiliates for the agriculture, mining, utilities, primary metals, fabricated metals, wholesale trade, retail trade, transportation and accommodation industries, with data from the Bureau of Economic Analysis Annual Survey of U.S. Direct Investment Abroad for the period 1994 to 2003. For each industry the correlation between the deviations from trend of the parents and affiliates HP-filtered series was calculated and ρ_{ω,ω^*} is the average correlation across industries.

[31] See Kim and Nelson (1999), and McConnell and Perez-Quiros (2000).

4 Results

Referring back to the motivation of the study, we wish to establish the role of greater economic integration in the form of outward FDI on firms' capital structure, and on countries' growth rates and aggregate volatility. We begin the analysis by comparing the deterministic transitional dynamics to the steady state of an economy with no FDI to one internationally diversified. Then, we run a series of simulations of the two types of economies and calculate their corresponding output, investment, and net worth volatilities; and contrast the implied capital structure to trace the mechanisms at work.

We begin the analysis of the quantitative predictions of the model by exploring the growth implication of FDI. We do this by calculating the speed of convergence to the steady state. For a given initial level of capital we test the elapsed time for the economy to reach the long run capital stock and thus GDP.

In particular, we study an economy without FDI and one internationally diversified, and start them at half the steady state level of capital. Then, we track the transition to the steady state in the absence of any shocks. Figure 4 plots the level of capital relative to the steady state for the two economies. From it we observe that the economy that allows for FDI converges much more rapidly to the steady state that one with out it.

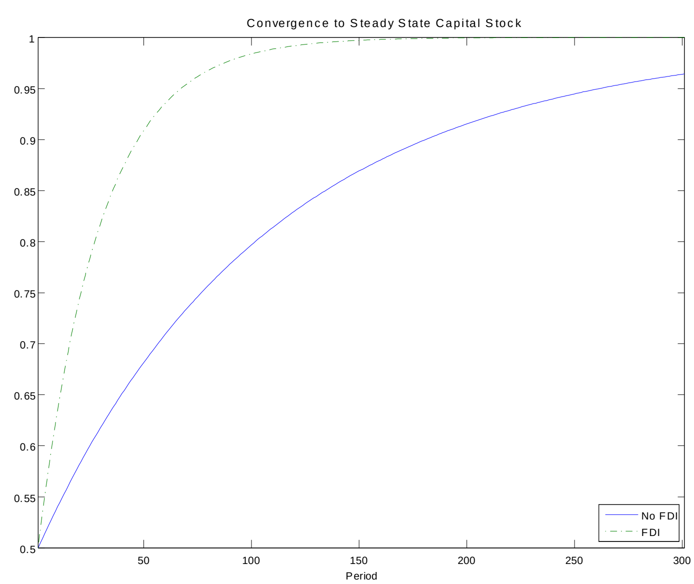

Figure 4. Transitional Dynamics

Notes: This figure shows the path of capital relative to the steady state for an economy with FDI and one without international diversification in the absence of shocks.

From the comparison above we find support for the positive effects of openness on growth. All else equal, the model suggests that countries more financially integrated in the form of FDI would tend to grow faster. The reason for this is the effect of diversification on the firms' financing decisions in combination the credit market frictions. We discuss these effects below as we integrate our findings.

Next we explore stochastic implications of greater FDI and whether it can provide some insights into the moderation of business cycles around the world. To this effect we calculate the volatility of output, investment and net worth associated with different levels of FDI. Again we work with an economy without FDI and another in which firms run operations at home and abroad. The simulation assumes the economies start of at their steady state.

For the analysis we simulate 100 model periods 10,000 times for the two economies. Then, we compute the variance of the deviations from trend of the HP-filtered series for output, investment and net worth for each 100 period simulation. Then we calculate the average volatility of the 10,000 simulations. In Table 2 we report the average percentage standard deviation of output, investment, and net worth for both models. These results suggest that larger international diversification is associated to lower aggregate volatility.

Table 2. Volatility and Capital Structure

	No FDI	FDI
Volatility		
% Std. Dev. Output	1.77	1.41
% Std. Dev. Investment	5.32	3.56
% Std. Dev. Net Worth	3.48	1.66
Capital Structure		
Net Worth / Assets	0.22	0.30

Notes: This table reports the volatility of output, investment and net worth, and the steady state capital structure for a model without FDI and a model with FDI. The volatility measures represent the average percentage standard deviation from 10,000 simulations of a 100-period economy.

Table 2 also presents the steady state capital structure for both models. The results indicate an increase in the ratio of net worth to assets as firms expand internationally. This implies a decrease in leverage, as firms shift their capital structure away from debt toward equity.

Based on the Federal Reserve's (2006) Flow of Funds Accounts of the United States, the ratio of corporate debt to financial assets in the U.S. was around 0.65 in 1984, the year corresponding to the benchmark calibration. By the year 2004, this ratio had fallen to approximately 0.5. Based on Table 2, the model accounts for more than half the decrease, as it predicts an 800 basis points reduction in leverage due to FDI.[32]

To understand the shift in capital structure we turn to the financial contract. As noted before, the borrowing interest rate is decreasing in the probability of default, and increasing in the size of the loan relative to net worth. Hence, all else equal there are two opposite effects on the external finance premium associated to FDI. On one hand, it reduces the interest rate on loans due to diversification; but on the other, more borrowing (to finance larger firms) raises the external finance premium. To counteract the latter, entrepreneurs raise internal financing relative to debt.

Since the optimal capital structure is determined in general equilibrium, simultaneously with all the other variables of the model, all we observe are two reinforcing effects that dampen the "Financial Accelerator": less debt and greater international diversification. This way, the decrease in leverage along with the diversifying effect from foreign operations lead to smoother credit cycles, and thus to less volatile investment and production. Furthermore, larger internal financing boosts aggregate capital accumulation and the rate of economic growth (see Figure 4).

We end this section by showing the response of the two economies to a common 100-period sequence of shocks. In Panel A of Figure 5 we show that when subject to the same shocks, the economy with FDI presents a lower fall in output after a negative productivity shock as firms are internationally diversified and exhibit stronger balance sheets. In upturns, the relatively higher net worth curbs the firms' demand for external financing and thus the response in output and investment. In contrast, in the economy with no FDI upon a positive productivity shock firms take full advantage of the better terms of credit to increase production.

In Panel B we show the difference in the response of each of the two economies to the same aggregate shock. For this purpose we subtract the deviation from trend in the economy with FDI from the economy without. For both, positive and negative shocks, the non-diversified economy responds more as it exhibits a stronger financial accelerator. Moreover, the mirror pattern between the panels suggests that the difference in the propagation of shocks between these economies is proportional to the magnitude of the shocks: the larger the shock, the larger the difference in the deviation from trend between the economies.

[32] The corresponding figures implied by the model are 0.78 under the benchmark calibration and 0.7 in the model with FDI (see Table 3).

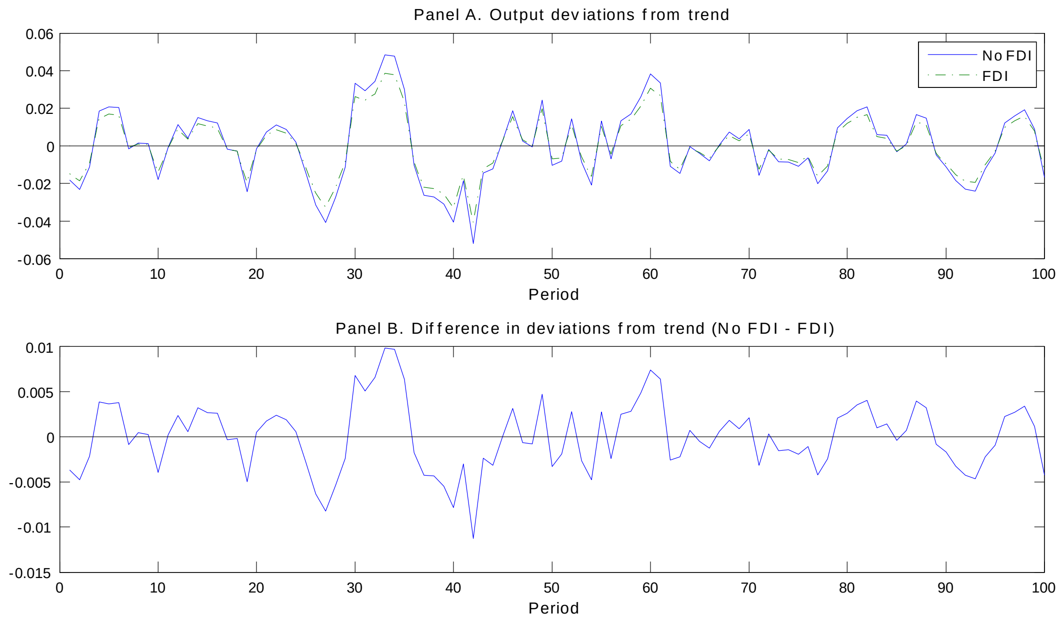

Figure 5. Output Simulation

Notes: Panel A shows the path of output of the economy without FDI and that from the economy with FDI when subject to the same sequence of shocks. Panel B shows the difference in the response of each of the economies to the same aggregate shock. The difference is calculated by subtracting the deviation from trend in the economy with FDI from that of the non-diversified economy.

The quantitative analysis of our model rationalizes three trends observed in the more globally integrated economies around the world: 1) faster growth, 2) lower volatility of the business cycles, and 3) a decrease in firms' leverage. International diversification through FDI allows firms (and countries) to hedge against domestic risk leading to more stable net worth, investment and output. Though in the presence of credit market frictions, firms trade off the benefits of diversification against higher external finance premia due to higher capital needs. In equilibrium, to counteract higher financial costs firms lower their debt in favor of higher net worth. Thus, larger capital accumulation leads to faster output growth.

5 Sensitivity

Having observed that larger FDI is associated to lower output volatility, faster growth and lower leverage, in this section we report the model's sensitivity to changes in the parameters that underlie the diversification mechanism. Namely, the share of capital at home (σ) and the correlation between idiosyncratic shocks. In Table 3 we present the volatility of output associated to changes in these parameters. The middle column reproduces the results from the benchmark calibration.

Table 3. Diversification and Aggregate Volatility
(% Std. Dev. Output)

Share of capital at home (σ)	0.975	0.95	0.925
	1.49	1.41	1.24
Correlation of idiosyncratic shocks	0.4	0.2	0.0
	1.47	1.41	1.33

Notes: This table reports the volatility of output for different degrees of international diversification (lower sigma implies larger diversification) and for varying levels of correlation between home and foreign idiosyncratic shocks. The middle column corresponds to the behcnmark parametrization.

From Table 3 we confirm that larger international diversification is associated with lower aggregate volatility. This can happen in one of two ways. One is by firms increasing the relative size of their foreign operations, and the other is by a lower correlation between firm specific shocks at home and abroad. While we did not explicitly model the firms' choice for their foreign operations, it is certainly a margin under the firms' control. On the other hand, the correlation of idiosyncratic shocks is exogenous. These results provide us with testable predictions about the relative benefits of FDI in different locations according to the degree of correlation between economies, and to the extent of firms' foreign operations.

6 Conclusion

Over the last three decades economic ties among countries have deepened and branched out in different directions. While some forms of integration can increase a country's vulnerability to external shocks, others could hedge against internal events. One of these forms is Foreign Direct Investment. By diversifying geographical risk firms can, in principle, smooth their profits, earnings and sales cycles. Whether these benefits spill to the aggregate economy, foster faster growth, or alter firms' financing decisions remain open questions.

On closer look we find that larger FDI can be a common thread behind the lower volatility, faster growth, and lower leverage observed in both developed and developing countries. Based on an extension of Bernanke et al. (1999) "Financial Accelerator" framework that allows for international diversification, we find that in the presence of credit market frictions international diversification is associated with the three trends.

The model suggests that in spite of international diversification being a mitigating force on the external financing premia, larger overall firm operations could result in larger borrowing costs, which steer firms away from debt towards internal financing. Larger internal financing increases the economy's rate of capital accumulation and therefore of growth. Higher net worth (collateral) in addition to the diversifying benefits of FDI dampens the credit market friction leading to smoother credit cycles, and thus smoother investment and production.

Quantitatively, for a country like the U.S., larger FDI investment could decrease output volatility up to 20 percent, raise firms' net worth relative to assets by close to 8 percentage points, and significantly reduce the time it takes for an economy to reach its steady state capital stock.

A Mathematical Derivations

In this appendix we provide the derivation of some expressions used in the paper.

A.1 Firm's Return on Capital

This subsection shows that $R^k QK_j$ is equivalent to $Y_j + (1-\delta)QK_j - WL_j$. This result follows from constant returns to scale in the production function and the firm's equilibrium conditions.

Let $L_{t,j}$ denote firm's j household and entrepreneurial labor. Constant returns to scale imply:

$$\begin{aligned}
Y_{t,j} &= (MPK_{t,j})K_{t,j} + (MPL_{t,j})L_{t,j} \quad \text{in equilibrium.}\\
Y_{t,j} &= [Q_t R_t^k - Q_t(1-\delta)]K_{t,j} + W_t L_{t,j}\\
Y_{t,j} &= R_t^k Q_t K_{t,j} - (1-\delta)Q_t K_{t,j} + W_t L_{t,j}\\
R_t^k Q_t K_{t,j} &= Y_{t,j} + (1-\delta)Q_t K_{t,j} - W_t L_{t,j}.
\end{aligned}$$

That is, firm specific shocks to the firms' asset return is equivalent to a firm specific shock on the value of the firm: output plus undepreciated capital minus labor costs.

A.2 Multinational's Expected Return on Capital

Next we show the derivation of equation 2. Figure 3, summarizes the performance of an internationally diversified firm depending on the realizations of home and foreign firm level shocks. Realizations to the right of the frontier lead to the accumulation of net worth; realizations inside the frontier lead to the firm's liquidation. Then, the non-default expected return is given by:

$$\int_0^{l/\sigma_j} \int_{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)}^{\infty} \left[s + \left(\frac{1-\sigma_j}{\sigma_j}\right)s^*\right] f(s,s^*)ds^* ds R^k QK_j +$$
$$\int_{l/\sigma_j}^{\infty} \int_0^{\infty} \left[\omega + \left(\frac{1-\sigma_j}{\sigma_j}\right)\omega^*\right] f(\omega,\omega^*)d\omega^* d\omega R^k QK_j - [1-\Psi(l_j)]\frac{1}{\sigma_j} Z_j B_j.$$

Assumption that $E(\omega) = E(\omega^*) = 1$, this expression becomes:

$$\left[\frac{1}{\sigma_j} - \int_0^{l/\sigma_j} \int_0^{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)} \left[s + \left(\frac{1-\sigma}{\sigma}\right)s^*\right] f(s,s^*)ds^* ds\right] R^k QK_j.$$

This follows from:

$$\int_0^{l/\sigma_j}\int_{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)}^{\infty}\left[s+\left(\frac{1-\sigma_j}{\sigma_j}\right)s^*\right]f(s,s^*)ds^*dsR^kQK_j+$$
$$\int_{l/\sigma_j}^{\infty}\int_0^{\infty}\left[\omega+\left(\frac{1-\sigma_j}{\sigma_j}\right)\omega^*\right]f(\omega,\omega^*)d\omega^*d\omega R^kQK_j+$$
$$\int_0^{l/\sigma_j}\int_0^{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)}\left[s+\left(\frac{1-\sigma_j}{\sigma_j}\right)s^*\right]f(s,s^*)ds^*dsR^kQK_j;$$

being equal to:

$$\int_0^{\infty}\int_0^{\infty}\left[\omega+\left(\frac{1-\sigma_j}{\sigma_j}\right)\omega^*\right]f(\omega,\omega^*)d\omega^*d\omega R^kQK_j=$$
$$\int_0^{\infty}\int_0^{\infty}\omega f(\omega,\omega^*)d\omega^*d\omega R^kQK_j+\int_0^{\infty}\int_0^{\infty}\left(\frac{1\text{-}\sigma_j}{\sigma_j}\right)\omega^* f(\omega,\omega^*)d\omega^*d\omega R^kQK_j=$$
$$\int_0^{\infty}\omega f_{\omega}(\omega)d\omega R^kQK_j+\left(\frac{1-\sigma_j}{\sigma_j}\right)\int_0^{\infty}\omega^* f_{\omega^*}(\omega^*)d\omega^* R^kQK_j=\frac{1}{\sigma_j}R^kQK_j.$$

Thus:

$$\int_0^{l/\sigma_j}\int_{\left(\frac{1}{1-\sigma_j}\right)\ (l-\sigma_j\omega)}^{\infty}\left[s+\left(\frac{1-\sigma_j}{\sigma_j}\right)s^*\right]f(s,s^*)ds^*dsR^kQK_j+$$
$$\int_{l/\sigma_j}^{\infty}\int_0^{\infty}\left[\omega+\left(\frac{1-\sigma_j}{\sigma_j}\right)\omega^*\right]f(\omega,\omega^*)d\omega^*d\omega R^kQK_j=$$
$$\left[\frac{1}{\sigma_j}-\int_0^{l/\sigma_j}\int_0^{\left(\frac{1}{1-\sigma_j}\right)(l-\sigma_j\omega)}\left[s+\left(\frac{1-\sigma_j}{\sigma_j}\right)s^*\right]f(s,s^*)ds^*ds\right]R^kQK_j.$$

The last line plus the non-default financing costs are represented in equation 2.

B Data Sources

Foreign Direct Investment data for Figures 1 and 2 was taken from the United Nations Conference on Trade and Development (UNCTAD) Foreign Direct Investment Online Statistical Database. We transformed the nominal FDI series into real terms using the base year 2000 Implicit Price Deflator series from the Bureau of Economic Analysis. Real GDP series at purchasing power parity are drawn from the Penn World Table Version 6.1, published by the Center for International Comparisons at the University of Pennsylvania.

For the model calibration we used the following series from the Bureau of Economic Analysis.

1. U.S. Quarterly Real GDP.
   National Income and Product Accounts, Table 1.7.6.
   http://www.bea.gov/bea/dn/nipaweb/index.asp.
2. U.S. Quarterly Real Gross Private Domestic Investment.
   National Income and Product Accounts, Table 1.1.6.
   http://www.bea.gov/bea/dn/nipaweb/index.asp.
3. U.S. Direct Investment Position Abroad.
   http://www.bea.gov/bea/di/home/iip.htm.
4. U.S. Foreign Direct Investment.
   http://www.bea.gov/bea/di/home/directinv.htm.
5. U.S. Current-Cost Net Stock of Fixed Assets.
   http://www.bea.gov/bea/dn/home/fixedassets.htm.
6. Balance Sheet and Operational Indicators of U.S. Multinationals.
   http://www.bea.gov/bea/ai/iidguide.htm#USDIA.

References

[1] Ahmed, S., A. Levin and B. Wilson (2004), "Recent U.S. Macroeconomic Stability: Good Policies, Good Practices, or Good Luck?", The Review of Economics and Statistics, Vol. 86 (3), pp. 824–832.

[2] Altshuler, R. and H. Grubert (1996), "Balance Sheets, Multinational Financial Policy, and the Cost of Capital at Home and Abroad", Working Paper 5810, NBER.

[3] Bernanke, B. and M. Gertler (1989), "Agency Costs, Net Worth, and Business Fluctuations", American Economic Review, Vol. 79 (1), pp. 14–31.

[4] Bernanke, B., M. Gertler and S. Gilchrist (1999), "The Financial Accelerator in a Quantitative Business Cycle Framework", Handbook of Macroeconomics, Vol. 1C, Ch. 21, Elsevier.

[5] Blanchard, O. and J. Simon (2001), "The Long and Large Decline in U.S. Output Volatility", Brookings Papers on Economic Activity, Vol. 2001 (1), pp. 135–164.

[6] Bureau of Economic Analysis (2002), "U.S. Multinational Companies: Operations in 2000", Survey of Current Business, December.

[7] Burgman, T. (1996), "An Empirical Examination of Multinational Corporate Capital Structure", Journal of International Business Studies, Vol. 27(3), pp. 553-570.

[8] Chen, C., C. Cheng, J. He and J. Kim (1997), "An Investigation of the Relationship Between International Activities and Capital Structure", Journal of International Business Studies, Vol. 28(3), pp. 563-577.

[9] Claessens, S. and S. Schmukler (2007), "International Financial Integration Through Equity Markets: Which Firms from Which Countries Go Global?", IMF Working Paper WP/07/138.

[10] Cooley, T. (1995), "Frontier of Business Cycle Research", Princeton University Press.

[11] Desai, M. and C. Foley (2004), "The Comovement of Returns and Investment within the Multinational Firm", Working Paper 10785, NBER.

[12] Desai, M., C. Foley and J. Hines (2004), "A Multinational Perspective on Capital Structure Choice and Internal Capital Markets", Journal of Finance, Vol. 59 (6), pp. 2451–2487.

[13] Desai, M., C. Foley and J. Hines (2005a), "Foreign Direct Investment and Domestic Economic Activity", Working paper 11717, NBER.

[14] Desai, M., C. Foley and J. Hines (2005b), "Foreign Direct Investment and the Domestic Capital Stock", Working paper 11075, NBER.

[15] Dollar, D. and Kraay, A. (2001), "Trade, Growth, and Poverty", Development Research Group Working Paper 2615. The World Bank.

[16] _____________ (2005), "Spreading the Wealth". In International Economics and International Economic Policy, ed. by Philip King and Sharmila King, 4th. Ed., McGraw-Hill.

[17] Faust, J. and B. Doyle (2004), "Breaks in the Variability and Co-Movement of G–7 Economic Growth", Working Paper, International Finance Division, Federal Reserve Board, Washington, D.C.

[18] Federal Reserve (2006), Board of Governors of the Federal Reserve System. Flow of Funds Accounts of the United States: Flows and Outstandings Fourth Quarter 2005. Washington, DC. (http://www.federalreserve.gov/releases/Z1/Current/)

[19] Hakura, D. (2007), "Output Volatility and Large Output Drops in Emerging Market and Developing Countries", IMF Working Paper WP/07/114.

[20] Heathcote, J. and F. Perri (2004), "Financial Globalization and Real Regionalization", Journal of Economic Theory, Vol. 119 (1), pp. 207–243.

[21] IMF (2005), "World Economic Outlook: Globalization and External Imbalances", World Economic and Financial Surveys, International Monetary Fund.

[22] Khambata, D. and D. Reeb (2000), "Financial aspects of the multinational firm: A synthesis", Multinational Business Review, Vol. 8(1), pp. 74–86.

[23] Kim, C., S. Kim and C. Pantzalis (2001), "Firm Diversification and Earnings Volatility: An Empirical Analysis of U.S.–Based MNCs", American Business Review, Vol. 19 (1), pp. 26–38.

[24] Kim, C. and C. Nelson (1999), "Has the U.S. Economy Become More Stable? A Bayesian Approach Based on a Markov-Switching Model of the Business Cycle", The Review of Economics and Statistics, Vol. 81 (4), pp. 608–616.

[25] Kiyotaki, N. and J. Moore (1997), "Credit Cycles", Journal of Political Economy, Vol. 105 (2), pp. 211–248.

[26] Levin, A., F. Natalucci and E. Zakrajsek (2004), "The Magnitude and Cyclical Behavior of Financial Market Frictions", Federal Reserve Board, Finance and Economics Discussion Series 2004-70.

[27] Lipsey, R. (2002), "Home and Host Country Effects of FDI", Working Paper 9293, NBER.

[28] Mansi, S. and D. Reeb (2002), "Corporate International Activity and Debt Financing", Journal of International Business Studies, Vol. 33 (1), pp. 129–147.

[29] McConnell, M. and G. Perez-Quiros (2000), "Output Fluctuations in the United States: What has Changed Since the Early 1980's?", American Economic Review, Vol. 90 (5), pp. 1464–1476.

[30] Razin, A. (2002), "FDI Contribution to Capital Flows and Investment in Capacity", Working Paper 9204, NBER.

[31] Rodriguez, F. and Rodrik, D. (2000), "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence". In NBER Macro Annual 2000, ed. by Ben Bernanke and Kenneth Rogoff, National Bureau of Economic Research.

[32] Rodrik, D. (2005), "Trading in Illusions". In International Economics and International Economic Policy, ed. by Philip King and Sharmila King, 4th. Ed., McGraw-Hill.

[33] San Vicente Portes, L (forthcoming), "Aggregate Gains of International Diversification through Foreign Direct Investment: An Inquiry into the Moderation of U.S. Business Cycles", Global Economy Journal.

[34] San Vicente Portes, L. and D. Ozenbas (2007), "On Balance Sheets, Idiosyncratic Risk and Aggregate University", Montclair State University.

[35] Schmukler, S. and E. Vesperoni (2004), "Financial Globalization and Debt Maturity in Emerging Economies", Journal of Development Economics, Vol. 79, pp. 183–207.

[36] Stock, J. and M. Watson (2002), "Has the Business Cycle Changed and Why?", Working Paper 9127, NBER.

[37] _______ (2003), "Understanding Changes in International Business Cycle Dynamics", Working Paper 9859, NBER.

[38] Tornell, A., F. Westermann and L. Martinez (2004), "The Positive Link Between Financial Liberalization, Growth and Crises", Working Paper 10293, NBER.

[39] Townsend, R. (1979), "Optimal Contracts and Competitive Markets with Costly State Verification", Journal of Economic Theory, Vol. 21 (2), pp. 265–293.

[40] Wan, C. (1998), "International Diversification, Industrial Diversification, and Firm Performance of Hong Kong MNCs", Asia Pacific Journal of Management, Vol. 15, pp. 205–217.