ESSAYS IN INTERNATIONAL FINANCE AND BANKING

A thesis submitted for the Degree of Doctor of Philosophy

By

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ABSTRACT

In this thesis financial movements are considered in terms of foreign direct investment (FDI) and a related way to international banking. In Chapter 2 FDI is analysed in terms of the major G7 economies. Then this is further handled in Chapter 3 in terms of bilateral FDI (BFDI) data related to a broader group of economies and a main mode of analysis the Gravity model. Gravity models are then used in Chapter 4 to analyse bilateral cross border lending in a similar way. While the exchange rate effect is handled in terms of volatility and measured using models of conditional variance.

The analysis focused on the bilateral data pays attention to the breakdown of crises across the whole period. With further consideration made of the Euro zone in terms of the study of BFDI and cross border lending.

The initial study looks at the determinants of the inflow and outflow of stocks of FDI in the G7 economies for the period 1980-2011. A number of factors, such as research and development (R&D), openness and relative costs are shown to be important, but the main focus is on the impact of the real and nominal effective exchange rate volatility. Where nominal and real exchange rate volatility are measured using a model of generalised autoregressive conditional heteroscedasticity (GARCH) to explain the variance. Although the impact of volatility is theoretically ambiguous inflows are generally negatively affected by increased volatility, whilst there is some evidence outflows increase when volatility rises.

In Chapter 3, the effect of bilateral exchange rate volatility is analysed using BFDI stocks, from 14 high income countries to all the OECD countries over the period 1995-2012. This is done using annual panel data with a gravity model. The empirical analysis applies the generalised method of moments (GMM) estimator to a gravity model of BFDI stocks. The findings imply that exports, GDP and distance are key variables that follow from the Gravity model. This study considers the East Asian, global financial markets and systemic banking crises have exerted an impact on BFDI. These effects vary by the type and origin of the crisis, but are generally negative. A high degree of exchange rate volatility discourages BFDI.

Chapter 4 considers the determinants of cross-border banking activity from 19 advanced countries to the European Union (EU) over the period 1999-2014. Bilateral country-level stock data on cross-border lending is examined. The data allows us to analyse the effect of financial crises – differentiated by type: systemic banking crises, the global financial crisis, the Euro debt crisis and the Lehman Brothers crisis on the geography of cross-border lending. The problem is analysed using quarterly panel data with a Gravity model. The empirical "Gravity" model conditioned on distance and size measured by GDP is a benchmark in explaining the volume of cross border banking activities. In addition to the investigation of the impact of crises further comparison is made by investigating the impact of European integration on cross-border banking activities between member states. These results are robust to various econometric methodologies, samples, and institutional characteristics.

LIST OF ABBREVIATIONS

BIS	Bank for International Settlements
AIG	American International Group
BIS	Bank for International Settlements
BERD	Research and Development Expenditure in Business
BFDI	Bilateral Foreign Direct Investment
CIS	Commonwealth of Independent States
CDSs	Credit Default Swaps
CU	Currency Union
DPD	Dynamic Panel Data
EqCMs	Equilibrium Correction Models
EC	Error Correction
EA	Euro Area
ECB	European Central Bank
EMU	European Monetary Union
EU	European Union
FE	Fixed Effect
FDI	Foreign Direct Investment
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GMM	Generalised Method of Moments
GDP	Gross Domestic Product
IFS	International Financial Statistics
IMF	International Monetary Fund
LM	Lagrange Multiplier
M&A	Merger & Acquisition
MENA	Middle East and North Africa
MBS	Mortgage Backed Securities
MNCs	Multinational Corporations
MNEs	Multinational Enterprises

OLS	Ordinary Least Squares
OECD	Organization of Economic Cooperation and Development
OLI	Ownership Location Internalization
QE	Quantitative Easing
RE	Random Effects
RLC	Relative Labour Cost
R&D	Research and Development
ROE	Return On Equity
RBC	Royal Bank of Scotland
SUR	Seemingly Unrelated Regression
SYS-GMM	Systems GMM
ULC	Unit Labour Cost
WMA	Weighted Moving Averages
WTO	World Trade Organisation

Dedicated to My Family

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DECLARATION

I hereby declare that this thesis has not previously been accepted for any degree, award, or qualification by any other university or institution of academic learning, and is not concurrently submitted for any degree other than that of the PhD, being studied at Brunel University. I also certify that this thesis has been written by me and it is entirely the result of my own investigations except where otherwise identified by references and that I have not plagiarised another's work.

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CONFERENCE PAPERS

I presented **Chapter 2** titled ‘‘Does Exchange Rate Volatility Affect Foreign Direct Investment? Evidence from the G7 Countries’’ *at* ‘The 2015 Annual Conference of the Royal Economic Society (RES) - The University of Manchester’ ,UK 1st April 2015. *And at* ‘10th BMRC - DEMS Conference on Macro and Financial Economics and Econometrics’, Brunel University, London, May 28-30, 2014.

I presented **Chapter 3** titled ‘‘Exchange Rates and Bilateral FDI: Gravity models of Bilateral FDI in High Income Economies’’ *at’* Inaugural Symposium of Junior Researchers -the Royal Economic Society (RES)’- The University of Manchester , 2-April 2015. *And at* ‘School of Social Science conference presentation’**,** Brunel University, London, May 2014. *And at* ‘Research Seminars Series’, Economics and Finance Department, Brunel University, 04-November 2015. *And at* the European Economics and Finance Society (EEFS) 15th Annual Conference, Amsterdam on 16-19 of June 2016.

I presented **Chapter 4** titled ‘‘EU Cross-Border Banking and Financial Crises: Empirical Evidence using the Gravity model’ *at* ‘11th BMRC-DEMS Conference on Macro and Financial Economics/Econometrics’, Brunel University, London , 18-19th May 2015. *And at* ‘European Integration Group’, College of Business, Arts and Social Sciences, Brunel University, 10-Novemember 2015. *And at* ‘The Annual Conference of British Accounting and Finance Association (BAFA)’, University of Bath 21-23 March 2016. *And at* The 14th INFINITI Conference on International Finance, Dublin, Ireland on 13-14 June 2016.

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Chapter One

Introduction

As international flows enable capital diversity, they reduce the risks faced by capital owners. Global movement of capital limits the impact of Governments following negative policies (Razin and Sadka, 2007). Capital flows are realised in different ways. The main forms are Foreign Direct Investment (FDI), foreign portfolio investment and international banking.

In recent years, FDI has been identified, as a key factor that may help to resolve both the gap in savings and foreign exchange. Therefore, FDI has been identified as an important catalyst for economic growth and development. This has led many countries to try to enhance the business climate to attract FDI.

FDI reflects a long term interest and control by a foreign investor or parent company in one country, in a company in another country. Such investments may help to solve a range of problems by the creation of new job opportunities and by enhancing economic stability. Foreign companies' presence is, as demonstrated by a large body of economic literature on this subject often associated with positive externalities for the host economy. Foreign corporate presence may support technology transfer. In particular, FDI transfers financial resources, technology and managerial know-how from companies in investing countries to those in countries in receipt of FDI and hence boost economic growth. In terms of developments in the the host economy, FDI can assist project development and restructuring, contribute to fuller international trade, enhance business sector competition and support human capital formation. According to common estimates, FDI has a positive effect on macroeconomic performance as it is capable of completing missing domestic resources needed for the implementation of economic reforms and there may be positive secondary effects that follow from the impact of foreign corporations on a hist economy

Furthermore, FDI may also be responsible for enhancing growth potential. In particular, it was suggested by Barrell and Pain in 1997 that this occurs, because it can

act as a conduit for technical knowledge and so improve the capacity of a host economy to benefit from firm specific technological innovation. Moreover, FDI may also generate higher than expected returns in the host country that may help develop a safety net for the poor. While Klein and co authors suggested that this occurs as FDI might reduce the adverse impact of shocks on the poor stemming from financial instability and that it may improve corporate governance.

This area has been an actively studied over the past few decades and more recently there has been a rapid advance in the literature that has increased greatly in the last three decades. Much of this research has examined the drivers of FDI especially how exogenous macroeconomic variables can affect the FDI decision. An important focus at the macro level has been on the impact of exchange rate volatility. This empirical literature built on the early work of Cushman, and Dixit and Aizenman considered the role played by exchange rate volatility in FDI attraction/repulsion in developed countries.

It is important to understand how exchange rate volatility and other factors impact the FDI; as such information might be helpful to policymakers and governments in designing more effective strategies and growth policies.

It is expected that the direction of the effect of exchange rate volatility on FDI is ambiguous. More volatility could expose companies involved in international trade to more uncertainty and therefore would lead to the substitution of FDI for trade flows and thus a positive effect of exchange rate volatility on FDI. On the other hand, a more volatile environment exposes companies to more uncertainty when investing abroad (for example, the size of profits in local currency terms would be more uncertain) and this reduces FDI flows.

The evidence of the link between exchange rate volatility and FDI is quite mixed; this lack of consensus might be because the data and sample periods used in the studies are not the same and this is also a reflection on the complex nature of FDI. Due to this complexity, it may be reasonable to suggest that exchange rate volatility will have an ambiguous impact which is reflected in empirical and theoretical research. At the theoretical level, a lot of ground has been gained. Some of this research focuses on exploration of these complexities. In particular, there are a large number of behavioural assumptions that underlie the motives for FDI. While the nature of the investment

environment, has increased the understanding of the links between FDI and the exchange rate volatility. Alternatively, empirical models could yield mixed results due to problems with the specification in the model and issues with the data.

FDI can be measured either in flow or in stock terms. Earlier studies of FDI often used flow data. While Stein and Daude (2007) suggest the use of stocks rather than flows, because they are interested in the level of activity of multinational enterprises; capital stock being a closer proxy to multilateral activity than investment flows. The stock of FDI is defined as the value of the share of the foreign project capital and reserves (including retained profits) attributable to the parent project plus the net indebtedness of affiliates to the parent enterprise.

In the first empirical chapter, unlike much of the earlier literature, country-specific measures of conditional real and nominal exchange rate volatility are looked at. Furthermore, since the G7 countries are the major source of FDI activity, the initial focus is on FDI stock in and from the G7 countries to all other countries. The sign and magnitude of the effect of exchange rate volatility in the long run can be empirically determined. This is accomplished by constructing measures of exchange rate volatility based on GARCH(1,1) models. To capture the impact of exchange rate volatility on FDI a seemingly unrelated regression (SUR) method is adopted. The impact of exchange rate volatility on FDI in the G7 countries is investigated after controlling for conventional determinants of investment over the period 1980 to 2011. The countries included in this study were Germany, Italy, Canada, France Japan, the United Kingdom and the United States.

This chapter considers FDI in developed countries as compared to developing countries as it is viewed here that pooling developed and developing countries in an empirical study is not appropriate as these behaviours are not the same. Furthermore, this chapter takes into consideration the importance of outward FDI on the economy and this has been largely ignored in the literature. Hence, the outward FDI drivers are analysed in addition to FDI inflows. In contrast to most of the previous research which use firm-level, bilateral FDI data or industry-level data this chapter aims to make a contribution to the empirical literature on the FDI inflows/outflows by using aggregate country level data. The choice of this topic is to consider the nature of these aggregate relations, because this may help derive policy and aid decision making.

This chapter applies traditional time series methods to the aggregate data. Firstly, the order of integration of the aggregate FDI series is of interest as it impacts the way in which these series are to be modelled. Finding that the data is non-stationary or integrated of order one (I(1)) has implications for some of the existing research as it suggests that the analysis is either conducted on data in first differences or that the series normally used to analyse FDI are cointegrated (Engle and Granger, 1987). The first implies that only the short-run can be analysed, and the second that FDI has a short-run dynamic and a long-run static explanation of the data. This investigation seeks to find explanations of inflow and outflow data that depends on either real or nominal exchange rate volatility. As the time series dimension to this data is relatively short, these investigations rely on cointegrating regressions. To identify the long-run the cointegrating regressions are tested sequentially following the method of (Davidson, 1998). This implies from the finding of a single cointegrating relation for each of the country data sets using both inflow and outflow data.

The cointegration results for the inflow models show that openness and relative labour cost (RLC) are always required to find cointegration, while return on equity (ROE) is needed to find cointegration for France, Germany and Italy. For the investigation of the exchange rate, the real and nominal volatility variables were investigated. Real exchange rate volatility is needed for cointegration for Canada, the US and the UK, whilst nominal volatility is needed for the other four countries. For the outflow data for all the countries a series of common cointegration results are found that include openness, RLC, research and development (R&D) and nominal exchange rate volatility. The volatility of the exchange rate was measured using a GARCH(1,1) model for each country in the sample.

These core long run relations are initially found from cointegrating regressions, and these long-run equations embedded in equilibrium correction models (EqCMs). Such models are then estimated using SUR on a balanced panel over the period 1980 to 2011. Seven FDI equations are jointly estimated under the assumptions of the SUR model. In addition, a Wald test is used to further check the model specification (Davidson and MacKinnon, 2004). This allows a test as to whether common coefficients can be imposed across different countries within the panel. Regarding, the Wald test findings for the inflow model, none of these variables can be removed from the panel. The findings for the outflow model show some signs of a systemic pattern for

G7 countries, and same to the inflow model, all variables on this basis appear important in explaining FDI outflow from the G7 countries in the long-run.

Cross-border capital movements play a critical role, as greater capital inflows facilitate growth by completing local resources and bringing new technological know-how. However, capital inflow could suddenly stop and reversal is the partial cause of the financial crises that have hit many economies over the last two decades. Given its importance, there has been a lot of research dealing with the determinants of cross-border capital movements. The earlier research by Calvo et al. in 1996, and Dasgupta and Ratha in 2000 using aggregate country data concentrated on "push" and "pull" factors. The more recent availability of data on a bilateral basis between countries has motivated a large literature attempting to understand the trends and drivers of capital movements between country pairs. Many of the studies using bilateral data apply the Gravity model to different types of international capital movements.

An interesting question that comes up is to what extent the gravity variables affect different forms of capital movements differentially. Especially when including risk factors such as exchange rate volatility in term of financial crises. This issue has not systematically been examined. Therefore, it opened a new field of research in terms of testing how capital movements have been impacted by exchange rate volatility and other determinates during the crises periods. This is the question that is considered in the chapter 3, and chapter 4. Due to data availability, the focus is on cross border FDI, and cross border lending only.

Additionally, Financial crisis is often thought to affect FDI. In principle it is expected that a significant financial crisis affects both the host country and foreign business engaged in FDI. As a result of the turmoil that is caused by the crisis government policies in the host and the doner country are directed to encourage investors in both economies to be more active. Thus it is to be expected that financial crisis will reduce FDI and this suggests why it is important to trace the impact of financial crises on BFDI. Especially were this to enhance our understanding of the mechanism by which financial shocks influence the allocation of FDI.

Interest in the meltdown in FDI following the global financial crisis has arisen as a result of the extent of the impact across different parts of the globe. Before the Asian financial crisis of 1997–1998 and the global financial crisis, foreign investors were

encouraged to relocate their funds to such financial and capital markets as a result of strong economic growth and highly attractive stock returns. While in comparison during crises other forms of capital movements were reduced drastically and sometimes there might be a flight of portfolio investment from crisis economies. The recent global financial crisis led to a collapse in global FDI falling in 2008 by 16% while in 2009 worldwide output contracted and FDI by 40%. So 2009 was the year when the recession became global.

In the second empirical chapter, BFDI stock is analysed over the financial crises using a Gravity Model to which is added the impact of exchange rate volatility and currency union (CU). The effects of financial crises are also looked at in some detail. Specifically, the Asian crisis, global financial markets crisis and systemic banking crises. While FDI is viewed as being based on the long-term linkages between firms, to reflect the permanent benefits that arise from control by foreign investment on investment in another country. The Gravity often used to investigate international stocks of goods and capital is used to analyse BFDI from 14 high income countries to all the OECD countries over the period 1995-2012. Exchange rate volatility is measured for most of the bilateral currencies using the GARCH(1,1) model. The Gravity model is also extended to investigate institutional factors linked to exports, GDP and distance.

Given the persistent nature of the data and the dimensions of the panel the generalised method of moments (GMM) estimator is applied to the problem. The panel method is applied as the time series is short and the approach used can control for heterogeneity. A further issue that links with the persistence found in the previous chapter in relation to the aggregate data is the conventional Gravity equations without dynamics have serially correlated errors and would require at least a lagged dependent variable in the regression to capture this. This further emphasises the need to control for endogeneity in the estimations and so the need to apply a dynamic panel model. Here the two-step GMM estimator is used to extract the non time varying components of the Gravity equations with corrected standard errors (Windmeijer, 2005, and Roodman, 2009).

Understanding the drivers of cross-border asset movements is an important topic of research in financial and international economics. Recently attention has moved to cross-border banking. While the Bank for International Settlements (BIS) has indicated

in the last decade that cross-border banking has increased significantly, especially between international banks and their non-bank customers. With international banks that move abroad becoming one of the most important sources of finance recently. Furthermore, bank lending has also become a major channel for the transmission of the financial crises. This suggests that the determinants of cross-border banking should be considered when analysing how the crises were transmitted and the degree to which most markets were impacted. Understanding the most important variables cross-border banking is also necessary for financial stability in advanced countries, due to the negative way in which financial crises have affected the banks. This has been especially important in the Euro area, where banks have built up core exposure to cross-border activities especially in eastern and central Europe.

The market for financial services has become better integrated in the EU. This cross-border expansion has operated differently, depending on the country, the business and institutions. In the EU, following the introduction of the Euro, cross-border banking created financial linkages with the banks on the periphery getting funding from new sources. While especially following the failure of Lehman Brothers there was a substantial decline in the financial transactions both across the Atlantic and within the Euro zone. It would seem that such cross-border banking activity may have intensified the crisis across Europe. This suggests further investigation of the role of the Euro on cross-border activity in the EU.

The third empirical chapter tries to clarify on top of the usual push and pull factors, the impact of systemic banking crises, the global financial crisis, the Euro debt crisis and the Lehman Brothers crisis. In addition to the gravity factors this study includes variables that are expected to have a significant impact on cross border banking such as European integration. This enables an evaluation of the mechanism by which financial stress is effectively transferred from more advanced economies across the European market economies. This includes lending to all the EUs 29 member states in the European market over the crises periods. It is felt here that the EU is particularly suitable for this purpose since the regulatory system and national banking markets though still heterogeneous are moving together. This investigation covers the period 1999:01 – 2014:04. The impact of the Euro zone is investigated along with the impact of exchange rate volatility.

Chapter Two

Does Exchange Rate Volatility Affect Foreign Direct Investment? Evidence from the G7 Countries

2.1 Introduction

The latest trends in globalisation have led to both increased trade and large increases in foreign direct investment (FDI) around the world. An important impetus to this has been as a result of the liberalisation of the rules governing the flow of investment into and out of the major world economic blocks such as the G7 countries and the World Trade Organisation (WTO) negotiations. In addition, the transformation of the previous centrally planned economies in Eastern and Central Europe and after this the Commonwealth of Independent States (CIS) towards market economics. As companies that are engaged in activities at the global level seek out more cost effective production facilities and profitable overseas markets with associated sales and marketing networks, it is expected that growth in overall FDI will increase.

A common claim in the international economics community is that exchange rate volatility is one of the most important factors in decisions regarding a firm's FDI policies, because a devaluation of a country's currency can give foreign investors an advantage in buying the country's assets. However, the direction of the effect is not clear as increased volatility may have differential impact on cost that will lead some producers locate in overseas markets as this reduces their costs, whilst others may choose to locate at home in order to achieve this objective.

The interest in the effect of the exchange rate and its volatility on international capital flows, for example FDI, is growing among policy makers, as the number of countries that are adopting the floating exchange rate system has increased. Empirical investigation of the relationship between the exchange rate and FDI is critical for the formulation of FDI policies, because FDI brings benefits to both investing and recipient countries.

Recent fluctuations in the exchange rate in developed countries have led to renewed interest in the effect of exchange rate volatility on the economy. A series of papers have analysed the effect of exchange rate volatility on a number of macro variables including trade (Pattichis (2003) and Clark et al. (2004)). Both empirical and anecdotal evidence supports a link between exchange rate volatility and FDI. There has been a significant body of work, for example, Cushman (1985 and 1988), Dixit (1989), Bailey and Tavlas (1991), Sercu and Vanhulle (1992), Goldberg and Kolstad (1995), and Sung and Lapan (2000) that has until now been contradictory as to whether there is a positive or negative effect. Such findings depend on the assumptions employed in relation to the risk preferences of foreign investors, cost reversibility and the timing of entry and production. We can infer from this that findings may not be robust to their conditioning. Much of the existing research suggests that FDI responds differently to macroeconomic fluctuations over the cycle. There is little research to indicate a key contribution from other sources of volatility. To this end, it is not clear whether it is real or nominal exchange rate volatility which matters for FDI activity.

The empirical findings and general predictions of the previous research call for a fresh look at the relationship between exchange rate volatility and FDI. This study looks at country-specific measures of conditional real/nominal exchange rate volatility, unlike much of the early literature. Furthermore, since the G7 countries are the major source of FDI activity, this study only focuses on the G7 inward and outward FDI both from and to the rest of the world, so this chapter takes into consideration the outward FDI importance on the economy, which has been largely ignored in the research. Hence, it analyses the outward FDI drivers in addition to FDI inflows. The sign and magnitude of the effect of exchange rate volatility can be determined empirically. Therefore, the impact of exchange rate volatility on the level of FDI in the G7 countries is investigated after controlling for conventional determinants of investment over the period 1980 to 2011, Openness, relative unit labour cost and return on equity are included in the FDI inflow model. However, replacing return on equity by research and development (R&D) in the case of FDI outflow. The countries included in the study are Germany, Italy, Canada, France Japan, the United Kingdom and the United States. A Seemingly Unrelated Regression (SUR) model is estimated that contains the determinants of FDI in this study. It was found that exchange rate volatility had an effect on the long run behaviour in the dynamic models.

The chapter is organised as follows. Section 2.2 reviews the most recent literature concerning the correlation between the exchange rate volatility and FDI, in addition to the determinants of FDI. Section 2.3 describes the data and model design. Section 2.4 explains the methodology and the results, which looks for cointegrating sets of variables and then embeds them in an equilibrium correction model. Whilst section 2.5 offers the conclusion.

2.2 The Recent Literature

Since the breakdown of the fixed exchange rate system in 1972, both nominal and real exchange rates have fluctuated, in a broad sense. It has been shown that extreme short-term volatility can arise with flexible exchange and this is consistent with the overshooting hypothesis (Dornbusch, 1976) that may also result in episodes of currency misalignments.

The exchange rate level affects FDI in many channels, depending on the destination of the produced goods and this does not depend on whether or not the investor wants to produce for the domestic market. In this situation, the local currency appreciation increases FDI inflows by increasing the purchasing power of local consumers. Meanwhile, a depreciation of the real exchange rate of the host country increases FDI by reducing the capital cost (Benassy-Quere et al., 2001).

The effect of exchange rate volatility has been seen in the case of Merger & Acquisition (M&A) flows as ultimately being an empirical question. On the one hand, if there are fixed costs involved in the acquisition of a firm, standard option theory predicts that firms will delay their acquisitions when faced with higher exchange rate volatility. Meanwhile, depending on how the home currency equivalent of expected future cash flows from the target firm is correlated with other assets in the acquiring firm's portfolio. Hence, high exchange rate volatility may have a positive or negative effect on the investment decision.

There are competing opinions of how exchange rate volatility impacts FDI flows. One strand of the research indicates the effect of risk aversion on foreign investors who want to delay investment decisions (see; Kohlhagen, 1977; Dixit, 1989 and Campa ,1993) who showed that risk neutral investors may also support the evidence that exchange rate volatility made FDI inflow in the US decrease in the 1980s. The effect

was found with industries with high sunk costs in tangible and intangible assets. Another strand indicates the adjustment costs of investment, particularly the difficulty of reversing an investment decision once it is made (see Dixit and Pindyck, 1994). Though delaying investment will eliminate any expected return stream from that investment, the ability to make more profitable options in the future will be retained. Blonigen (1997) and Dunning (1993) among others explain that the probability of deferring investment when faced with change is greater for enterprises where the product has an extended life cycle or a long anticipated lifespan for the firm-specific assets. Esquivel and Larrain (2002) show two channels in the literature linking exchange rate volatility with FDI. First, potential investors will invest in a foreign country as long as the expected returns are high enough to cover currency risk. Therefore, higher exchange rate volatility will lead to lower FDI. Second, changes in the bilateral exchange rates of the G-7 countries could directly impact the amount and direction of FDI through its effect on the real wealth in these countries. This may decrease or increase FDI depending on some factors including the change in the particular currency value, relevance of FDI in addition to its wealth elasticity in the home countries.

The effects of exchange rate volatility on FDI have been discussed in the literature for some time, but there is currently little agreement on the direction of these effects. The existing theoretical literature is mainly focused on the consequences of volatility in the exchange rate on different time horizons in relation to FDI. There are several ways to extract indicators of volatility, and early studies tended to use unconditional estimates where trends had not been extracted, whilst latter studies have tended to use techniques such as generalised autoregressive conditional heteroscedasticity (GARCH) to estimate the conditional, or the component generated by unexpected components in the exchange rate.

2.2.1 Is there a negative link between exchange rate volatility and FDI?

The first approach focuses on the negative impact of the volatility of the exchange rate on FDI. Jeanneret (2006) found a negative and significant relationship on average for exchange rate volatility in a bilateral panel data set of 28 OECD countries over the period 1982-2002 when standard ordinary least squares (OLS) fixed effects and generalised least squares random effects estimators were considered. They also used the

systems generalised method of moments (GMM) dynamic panel data (DPD) estimator to control for endogeneity of the lagged dependent variable in a short panel and found that the corrected average response is smaller and statistically insignificant. Additionally, they show that the negative effect decreases significantly over the period 1990-2002, even becoming positive since the 1990s. Therefore, policies that aim to attract FDI through the stabilisation of the relative exchange rate appears' to be less efficient than might be expected.

Campa (1993) found volatility to be negatively linked with the degree of entry and that this impact is stronger in industries where sunk costs are relatively high. Benassy-Quere et al. (2001), and Urata and Kawai (2000) confirm the negative effect of exchange rate volatility on FDI. While Esquivel and Larrain (2002) show for the G3 countries that exchange rate volatility has a negative impact on FDI flows to sub-Saharan Africa. They go on to indicate that flows to East Asia and the Pacific are not clearly influenced by changes in the currency volatility of the G3, and their empirical evidence on FDI flows to South Asia and Eastern Europe is mixed.

Studies which demonstrate the negative impact of the volatility on FDI inflows include De Vita and Abbott (2007) who examine the effect of the level of real exchange rate volatility on UK FDI inflows from the seven major investing countries for the period 1975-2001. They do this by employing both fixed effects and GMM in a dynamic panel with manufacturing data disaggregated by high and low R&D content of the destination sector. Their findings show that the volatility of the exchange rate has a negative effect on FDI flows into the UK, irrespective of the destination sector of the investment. However, the real exchange rate level is found to have a statistically insignificant impact on FDI after controlling for the endogeneity of the regressors.

Regarding the effect of exchange rate volatility for countries preparing for accession into the European Union (EU), Brzozowski (2006) empirically investigated the relationship between FDI and nominal exchange rate volatility for 19 emerging markets and 13 transition economies during the 1990s. They empirically investigate and discuss theoretically the likely effect on the intensity of FDI inflow from a reduction in exchange rate volatility caused by accession to the European Monetary Union (EMU). Brzozowski employs two methods related to a data set with time-series and cross-section dimensions through estimating models by fixed effects OLS and DPD estimator

of Arellano and Bond (1991). They find that exchange rate volatility and nominal exchange rate uncertainty in particular may negatively influence the decision of where to locate investment. However, they also show that adoption of the euro is likely to influence FDI inflows positively in accession countries.

A further study by MacDermott (2008) used a traditional Gravity model to investigate the impact of changes and volatility of the real exchange rate on FDI. This model predicts that FDI volume between two countries is directly related to the distance between the two countries and their relative gross domestic product (GDP). They apply a fixed impacts variation of the Gravity model to a panel of 55 countries over the period 1980-1997. The results of the model indicate that weak host currencies and greater volatility in the exchange rate discourage FDI flows.

Additionally, Dhakal et al. (2010) use a panel data approach to determine the impact of exchange rate volatility on FDI in China, Malaysia, Indonesia, Thailand, South Korea and the Philippines for 1975-2005. After determining the order of integration of their data they employ a panel cointegration test and develop an error correction model using two sets of data. They find that exchange rate volatility has a negative impact on FDI and the likely cause of this has been the degree of exchange rate volatility these economies have been subject to.

2.2.2 The likely positive relation between the exchange rate volatility and FDI

A number of studies report a significant positive relation between exchange rate volatility and the volume of FDI, but these early papers used unconditional indicators of volatility, and this will have influenced their conclusions. For example, Cushman (1985) studies this association for the US, and Canada, Germany, France, Japan and the UK for 1963-1978, and Cushman (1988) for Canada, Germany, France, Japan and the United Kingdom to the US for the period 1963-1986.

Goldberg and Kolstad (1995) use bilateral quarterly data to study the relation between Japan, Canada and the United Kingdom relative to the United States over the period 1978–1991. In this case, the volatility of the exchange rate is measured by the standard deviation of the real exchange rate over twelve quarters, prior to and inclusive of each period. They find that the capacity share abroad increases when exchange rate volatility rises and this becomes correlated with export demand shocks.

There is also research that indicates that there is no significant link between exchange rate volatility and FDI. For instance, Gorg and Wakelin (2002) examine the effect of the level of the exchange rate, volatility in the exchange rate and expectations of the exchange rate on outward US FDI in the direction of twelve developed countries, and inward FDI from those countries to the US for the period 1983-1995. In their empirical analysis (using measures for volatility and exchange rate expectations) they indicate that there is no evidence for an impact of the variation of the exchange rate on either US outward investment or inward investment into the US. This finding holds for a number of different estimation procedures. In particular, they find that the level of the exchange rate has a positive relation between an appreciation in the host country currency and US outward investment. However, there is a negative relation between an appreciation in the host country currency (the dollar) and US inward investment.

In conclusion, some of the earlier literature, both theoretical and empirical, provides different answers regarding the effect of the exchange rate volatility on FDI. In most of the papers cited above, as mentioned earlier, there is near agreement as to the negative effects of exchange rate volatility on inflows of FDI. The literature on both the theoretical and empirical impacts of the volatility of the exchange rate on FDI has not come up with any coherent conclusions. This may be because FDI serving a host market may be encouraged by volatility, as it reduces uncertainty, whilst FDI that serves an export market may be discouraged by volatility.

2.2.3 The effect of the other variables on the relation between exchange rate volatility and FDI

Although FDI may give companies greater flexibility in production, it may be influenced by the exchange rate regime. To this end, Aizenman (1993) considers the factors determining the effect of exchange rate regimes on the behaviour of FDI and domestic investment, and the link between exchange rate volatility and investment. Aizenman indicates that the link between investment and exchange rate volatility under a flexible exchange rate depends on the nature of the shocks. If the dominant shocks are nominal, a negative correlation will be observed, However if the dominant shocks are real, there will be a positive correlation between the level of investment and exchange rate volatility. The findings for the volatility-investment relation clearly differ across countries, in part, because of differences in the extent to which the exchange rate

moves. The relatively stable exchange rates of some countries leads to them being least affected by a given currency fluctuation. The evidence from panel regressions supports the presence of disparities across countries and over different time periods.

Cavallari and D'Addona (2012) analysed the role of country-specific sources of output and interest rates on the potential for exchange rate volatility to deter FDI. They studied bilateral FDI flows among 24 OECD countries between 1985 and 2007 to find that real and nominal exchange rate volatility strongly impacted FDI. Output and exchange rate volatility seems to matter for the decision to invest in a foreign country and interest rate volatility to affect the amount of foreign investment.

In addition, Crowley and Lee (2003) investigate empirically whether the volatility in the foreign exchange rate hampers capital flows through uncertainty in FDI and increasing risk. They use a GARCH(1,1) model to describe the volatility in the foreign exchange rate. Despite the conventional wisdom, there is weak evidence for the adverse impact of exchange rate volatility on FDI, based on the analysis of data for 18 OECD countries for 1980–1998. Their findings seem to suggest that, while stability in foreign exchange markets would be conducive to capital flows and investment, some degree of exchange rate flexibility, which might generate risks and uncertainty, does not appear to be as important a determinant of foreign investment as economic stability and income growth. In other words, the relation between exchange rate volatility and investment is weak or absent if the exchange rate movements are relatively small, but strong if the exchange rate movements become excessively volatile.

2.2.4 The Determinants of FDI

The factors affecting FDI depend on the reasons for the FDI, in this section FDI types will be discussed, in addition to the empirical evidence of the determinates of FDI.

There is some debate as to the capacity of the various theories of FDI to serve as a self contained general theory to explain all FDI types. The articles by Agarwal (1980), Parry (1985), Itaki (1991), and Herzer (2011) in particular are critical of this position. Taking the investment decision from the perspective of the investing company. Dunning (1993) has been one of the often cited authors who has attempted to describe the main types of FDI based on such motives. Next, a distinction is made between types of FDI:

Firstly, horizontal or market-seeking FDI, the aim of which is to serve foreign and regional markets. This FDI type involves replication of production facilities in the host country. It is motivated by market access and trade frictions avoidance such as transport costs and import protection in the host country. The studies by Markusen (1984), Horstmann and Markusen (1987), and Markusen and Venables (1998) were focussed on horizontal FDI.

Secondly, resource-seeking FDI when companies invest in foreign countries to obtain resources which are not available in the home country, such as raw materials natural resources, or low-cost labour. In particular, in the manufacturing sector, when multinationals invest directly in order to export, factor-costs such as labour cost considerations become critical. In contrast to horizontal FDI, export-oriented or vertical FDI involves relocating parts of the production chain to the host country. Naturally, FDI in the resource sector related to the extraction of oil or natural gas, is attracted to countries which have plentiful natural resource endowments.

Thirdly, strategic asset-seeking FDI, occurs when firms acquire assets which are not available in their home country. An example of this occurs when investors try to gain access internationally to recognised brand names and demotic distribution networks to support their international competitive position. Additionally, Strategic asset-seeking FDI takes place in the form of technology-sourcing FDI when companies try to gain access to foreign technology by purchasing foreign companies or establishing R&D facilities in "foreign centres of excellence". To find models of technology-sourcing FDI, see, Neven and Siotis (1996), Fosfuri and Motta (1999), and Bjorvatn and Eckel (2006).

Lastly, The fourth type of FDI, called efficiency-seeking, takes place when the company can gain from the common governance of geographically sparse activities in the presence of economies of scale and scope. Vertical or efficiency-seeking FDI is driven by differences in international factor prices (Helpman, 1984, and Helpman and Krugman, 1985). It takes place when a company disseminates the production process across different economies to seek out the most efficient production methods so as to obtain production at the least cost. Such relocations decrease local production, at least in the short run (with horizontal FDI). However, in the longer run, the vertical investment could allow the company to import cheaper inputs from foreign affiliates and to produce

a greater volume of goods abroad at lower cost, therefore stimulating exports of goods used by foreign affiliates (see, Herzer, 2008). The new structure of the production chain should be linked to increased efficiency. As a result, the company could be able to improve its competitive position, therefore raising its local productivity over the long run (see, Kokko, 2006). However, if the company is not able to adjust over the longer term to any decrease in local production, because it is not able to increase competitiveness. This may be as a result of labour market rigidities. However, the German economy provides a counter example to this since following the war Germany maintained a competitive advantage that followed from a undervalued exchange rate.[1] Enhanced competition both horizontal and vertical will substitute foreign activities for local activities over the long run, which might lead to a long term reduction in local productivity (see, Bitzer and Görg, 2009).

Together, the factors attracting each type of FDI suggest that the countries with a low labour cost, large market and abundant natural resources, would attract large FDI inflows. FDI would therefore go to countries with favourable initial conditions. However, this study suggests that other factors also matter.

A question that needs to be answered is the importance for a company in investing in a host country? This is where location-specific advantages are in relevant as they relate to why the foreign country is attractive for FDI relative to other countries. For instance, companies may invest in production facilities in foreign countries when transportation costs are high as a substitute for export. This could be directly related to the nature of the good, either being a high bulk item or a service, which needs to be provided on site. While the policy position of the home country relative to the control of imports via tariff rates, access to markets may make the acquisition of productive capacity in the home advantageous. Location advantage also includes other characteristic (economic, political and institutional) such as large local markets, an educated labour force, availability of natural resources, low labour cost, political stability and/or corporate tax rates.

The impact of exchange rate uncertainty on FDI depends on the nature of the associated investment. Vertical FDI that involves the breaking down of the processes of

[1] The only exception relating to the attempt to revalue the Deutch Mark in the exchange rate mechanism at the Birmingham summit of Finance Ministers that was rejected by the UK and French Governments and thie subsequent breakdown in trust between the three key central banks led to Black Wednesday.

production across different countries may be discouraged by exchange rate volatility, because of the need to engage in intra-company trade. While horizontal FDI could even respond positively, because similar projects are undertaken in different locations (Aizenman and Marion, 2004). However, Crowley and Lee (2003) suggest that when FDI involves some form of joint enterprise, reversibility will depend on whether tacit knowledge has been transferred.

The other factor considered to impact investment was R&D. The empirical literature has a clear conclusion that firms that undertake R&D tend to undertake more FDI in order to take firm specific technologies to foreign countries. These technologies could of course be licensed, but this gives the possibility of the knowledge leaking out to other producers in the host country. In much of the literature, it is acknowledged that the major investors in R&D, the US, Japan and Germany, are also the major sources of FDI for other countries (Barrell and Pain, 1997). So it would therefore be expected that outflows will be significantly affected by the level of R&D in the home country.

On the other hand, there are mixed findings in the literature for R&D undertaken by domestic companies and FDI inflow by their multinational rivals. The empirical studies of Kogut and Chang (1991), and Neven and Siotis (1996) on Japanese FDI in the US, and the US and Japanese FDI into the European Union, found that the expected technological progress in the receiving country has a significant role in determining the inflow of FDI. This is demonstrated by the R&D effort undertaken by the domestic industry in the host country. On the other hand, the results in the empirical studies of Driffield and Munday (2000), and Love (2003) were inconclusive in terms of domestic R&D on the inflow of FDI.

Moving to the unit labour cost which researchers consider it as an important determinant of FDI. Baek and Okawab (2001) while focusing on the role of a variety of exchange rates along with labour productivity differential, wage rates and import tariffs, examined the factors determining Japanese FDI on manufacturing in Asia. They show that FDI is attracted by means of relatively cheap labour. Additionally, there is evidence that a higher wage rate or import tariff in the host country significantly decreases Japanese investment.

Furthermore, Lansbury et al. (1996) considered investment by 14 OECD countries into Hungary, Poland, and the Czechoslovakia over the period 1991-1993. They show

that relative labour costs within these so called Visegrad economies have had a greater influenced on the distribution of FDI within those economies when compared with economies in Southern Europe. Similarly, Holland and Pain (1998a), in a panel study of investment in eleven transition economies over the period 1992 - 1996, indicate that wages relative to other transition economies have a significant effect on FDI inflows.

Looking at the basic determinants, the level of local production cost will explain whether the company produces locally to sell locally or whether it supplies the host country by exporting its home-based production (Markusen, 2004). While according to Feenstra (2015), horizontal FDI requires that the returns to producing and selling locally should offset fixed costs. Bedi and Cieslik (2002) found that industries with higher levels of FDI inflow also obtain higher wages and higher wage growth. However, there is some debate as to the impact of FDI drivers on the vertical type. Wheeler and Mody (1992), and Feenstra and Hanson (1997) provide further evidence that labour cost is positively related to FDI. While Culem (1988) finds this impact is negative and for Lucas (1993) insignificant. This would suggest the importance of the investment objective in determining the impact of factor costs. So as expected, Lankes and Venables (1997) found that export-oriented companies place greater importance on production and skilled labour costs.

Unit labour costs are a critical variable in FDI location decisions, especially if the product is mature and competition is based mostly on cost and price. Increases in unit labour costs are expected to affect FDI inflows inversely. Support for the significant effect of unit labour costs on FDI has come from Pain (1993), Bajo-Rubio and Sosvilla-Rivero (1994), Janicki and Wunnava (2004), Biswas (2002), Bevan and Estrin (2004), Yang et al. (2000), and Carstensen and Toubal (2004).

Another factor which the literature on FDI has considered is openness. Charkrabarti (2001) indicates the evidence is mixed for the significance of openness on FDI; where this is generally measured by the ratio of exports plus imports to GDP. The maintained hypothesis is that most investment projects are usually directed towards the tradable sector so a country's degree of openness to international trade could be a relevant variable in this decision. Jordaan (2004) indicates that the impact of openness on FDI depends on the investment type. When FDI are market-seeking, trade restrictions (and hence less openness) may have a positive impact on FDI. The reason

stems from the hypothesis of "tariff jumping", which suggests that foreign companies that seek to serve local markets could set up subsidiaries in the host country if it is difficult to import their products. On the other hand, multinational companies engaged in export-oriented investments may prefer to invest in a more open economy as greater imperfection in competition that accompanies trade protection imply higher transaction costs linked with exporting. Additionally, Singh and Jun (1995) found that export orientation is important in attracting FDI, because trade and FDI flows are gross complements.

The empirical findings in articles by Kravis and Lipsey (1982), Culem (1988) and Edwards (1990) showed a strong positive link between openness and FDI. This compares with Schmitz and Bieri (1972) that indicated this link was weak and positive. Pärletun and Thede (2008) found that trade openness is a positive sign but statistically insignificant. However, as reported by Sun et al. (2002), the degree of openness can also have a negative effect on FDI due to greater competition, making the prevailing effect an empirical question. A lot of surveys suggest a widespread perception that "open" economies boost more FDI.

2.3 Data description and sources

The G7 countries were selected here as they have appeared over the period among the top 10 economies for FDI. FDI can be measured either in flow or in stock terms. FDI flow represents the sum invested in affiliates by foreign firms, which affiliates could spend to accumulate assets, to repay past borrowings, or for other objectives. On the other hand, the advantage of the stock variable is that it reflects the total value of assets related to the foreign investor. Thus, the stock is an indicator of the value of assets engaged in international production (Stephan and Pfaffmann, 2001). So we follow Bitzer and Görg (2009) by using stocks rather than FDI flows, because stocks, due to the accumulation of flows, could be more effectively capture the effects of long-run. The balance of payments measure of direct investment in the reporting countries is used as the FDI stock variable.

As mentioned at the outset of this study, the basic question this research seeks to address is whether exchange rate volatility has had a significant effect on FDI inflow and outflow for the G-7 developed countries over the period 1980 to 2011 and hence

avoid the fixed exchange rate Bretton Woods period. This research is conducted using annual data (32 observations).

The literature has a clear consensus that the main variables to have effects on FDI inflow are openness, relative labour costs (RLC), the return on host country equity and exchange rate volatility. Outflows are thought to be affected by openness, RLC, and exchange rate volatility and also by the scale of R&D taking place in the home country. The theoretical effects of some of these variables are ambiguous so it is hoped that the empirical evidence from this research might establish the significance and the sign of prevailing effects. For instance:

1- If FDI is defined as a capital transfer, it can be interpreted in terms of comparison of expected revenue on other investment decisions. Therefore, both the variability and the level of exchange rates can have an effect on the level of investment. Additionally, exchange rate volatility can complicate the investment decisions of international firms through making the relative profitability unpredictable in the traded, versus the non-traded, sector. The high degree of exchange rate volatility during recent decades has affected firms' decisions as to where to locate production and has also affected their profits. Hence, the volatility of the exchange rate can affect the competitiveness of companies in different countries. In fact, it can probably have either a positive or a negative impact.

The flexible exchange rate system has introduced two aspects into the cross border activities of firms they are uncertainty and flexibility. Although the flexible exchange rate is one of the most important factors to support international financial flows, high volatility in the exchange rate could discourage FDI, because it would be regarded as increasing risk (increased uncertainty) rather than potential flexibility for possible investors. FDI is not normally a pure financial investment and it often incurs large sunk costs. Given the characteristics of FDI, investors prefer low volatility of the exchange rate to high volatility as long as they expect to make profits that are similar between periods of low and high volatility. Corporations can hedge some of this risk, but often this is seen as a low priority activity that may also be difficult to explain to shareholders when the hedge reduces the expected gains when the exchange rate moves in the right direction.

Any conclusion on the sign of the impact of the level of excess volatility may also depend on whether it is the nominal or real measure to be used. The nominal measure would be seen as important when the primary FDI action is seen in terms of financial flows. For this purpose nominal volatility is seen to capture, amongst other things, uncertainty in monetary policy driven by interest rate changes where the overall effect of a rise in interest rate volatility is in principle ambiguous and may well vary depending on the country where it originates.

However, in terms of investment viewed as a real physical activity involved in the creation or acquisition productive capacity then real volatility can be viewed as being most appropriate as it can be seen to represent uncertainty over fluctuations in output or in real profits, amongst other things. This suggests that an increase in output volatility can have a positive or a negative impact on real investment decisions depending on the relative magnitude of their respective income and substitution effects. To see this consider a rise in a source country's output volatility that might reduce FDI outflows via the income channel, but make foreign investments relatively more attractive via the substitution effect.

2- The standard hypothesis that openness motivates FDI (Hufbauer and Elliott, 1994). It may have a positive effect on inward FDI and the multinational enterprises (MNEs) are generally attracted to open economies, because of their intrinsic export potential and more stable economic climate. Moreover, the impact of exchange rate movements is restricted to exports and imports.

In addition to this, openness of a domestic economy is impacted by direct FDI restrictions in addition to trade barriers. FDI restrictions obviously raise barriers to FDI and are possible to affect the choice MNEs make with regards to the location of investment. Fedderke and Romm (2006) suggest two views of the motives for FDI that give contradictory predictions regarding the impacts of trade. The view of trade and FDI being substitutes sees "tariff-jumping" as a motive for FDI, and therefore trade should have a negative impact. If trade is the main motive of the enterprise, then exporting goods is more attractive than FDI as a way to serve a local market. The alternative view shows the motive for FDI follows from MNEs having various affiliates specialising in different local markets according to the locational advantages of the specific host country. This applies, especially to vertical FDI where a liberal trade environment is a

precondition for the international division of labour at the company level.[2] In the research, the ratio of trade to GDP is often used as a proxy of openness of a country and is often interpreted as a measure of restrictions of trade.

3- Return on equity: There are currently two views on the relationship between FDI and equity return. The first view is that FDI has a negative relationship with the development of equity markets (Hausmann and Fernández-Arias, 2000). So that FDI increases in countries that are more risky, financially underdeveloped, and institutionally weak. Therefore, FDI might exist as companies attempt to find alternatives to poor financial markets for both debt and equity. So according to this, FDI should be negatively linked with the development of equity markets. The second view put forth by Classens et al. (2001) is that FDI is positively correlated with the participation of firms in equity markets. They show that FDI goes to countries with well defined and operationally effective institutions. This can be attributed to the idea of matching foreign currency assets to foreign currency liabilities to offset the risk related to the exchange rate. This result from foreign investors' suggestion that they finance part of their investment with external capital or sell equity in capital markets. Given that investors partly invest via purchasing existing equity, the liquidity of the stock markets could rise, increasing the value traded domestically.

4- Labour costs are generally considered to be among the key economic factors in the discussion of the determinants of FDI location decisions of firms (e.g. Havlik, 2005a). The literature on the FDI determinants has been affected by theories of international business. For example the Ownership Location Internalization (OLI) paradigm of Dunning (1988), which suggests that cost-related and market-related factors should be included in any empirical research explaining FDI flows (Fontagn´e and Mayer, 2005).

There are also factors that may mitigate the negative effects of high labour costs on FDI. Public expenditures for an education system or social infrastructure could compensate investors for high labour costs, because well trained and healthy workers are more productive and are seen take sick leave less often. Otherwise labour costs

[2] Trade policies, for example, and, more broadly, trade costs (tariffs, non-tariff barriers, and transportation costs) are generally found to have a significant impact on FDI flows, but in aggregate regressions their sign is ambiguous. This is probably due to the different effect the barriers to trade can be expected to have on horizontal and vertical FDI; they tend to attract horizontal FDI, which aims at penetrating the domestic market, but repel vertical FDI.

could be of minor importance for FDI in immobile services (for example, banking, tourism).

Yet, they clearly play a role in mobile services, such as accounting or call centres. As different indicators used in the empirical research could lead to different conclusions about the role of labour costs as a driver of FDI. Most of the underlying studies find a negative effect for labour costs on FDI. However, the other studies that reveal a positive coefficient use disaggregated data. Boudier-Bensebaa (2005) for example, found a significant positive sign for the unit labour cost variable in his study on a regional FDI in Hungary, stating that "the variable may express not only labour cost effects but also skill effects." Moreover, positive coefficients are found in the study by Benassy-Quere et al. (2005) who examine FDI in eleven OECD countries. They explain this by a similar argument: "unit labour costs are positively related to the quality of labour." However, the effects of this variable depend on which countries are being analysed. For example, the FDI flows to transition or developing countries have been explained widely by the advantage represented by having lower wages, which would be translated into lower labour costs compared to developed countries (Leibrecht and Scharler, 2009; Ranjan, 2011).

In this comparative research unit labour cost are used in both cases for FDI models (inflow and outflow), it is expected that the sign is negative on the coefficient regarding FDI inflows (e.g., countries with higher labour costs would deter FDI). In contrast to FDI outflow where it is expected to be positive as an increase in the labour cost in a specific country relative to the rest of the world would encourage the outflow from this country.

5- R&D[3] or the association between it and FDI is related to the beneficial effects on the host country that can arise from inward investment. It may facilitate the extraction and distribution of raw materials produced in the host nation by improving the network of communication and transport. R&D is widely considered as a way to

[3] An R&D index is constructed for each of the G7 countries represented in BERD (Research and Development Expenditure in Business, using the following formula from Bernstein and Mamuneas (2006):

$$R\ \&\ D stock_{it} = \{R\ \&\ D stock_{it-1}(1 - \text{depreciation rate})\} + R\ \&\ D flow_{it}$$

Gross R&D stock is a measure of the accumulative value of past investment still in existence and net capital stock equals the gross stock less the accumulated depreciation on assets in the gross stock.

spur economic growth. A general overview on the R&D spending in business at level (as % of GDP) draws a first picture of the relative intensity of R&D effort.

The recent theoretical research on company heterogeneity and FDI suggests that the acquisition or establishment of foreign affiliates involves additional costs of overcoming legal, social and cultural barriers, so that only companies above a certain productivity threshold can cope with these fixed costs and therefore engage in outward FDI (see, Helpman et al., 2004; Aw and Lee, 2008). That is, only the most productive companies self-select to invest in foreign countries.

As an increase in aggregate productivity is linked with an increase in firm productivity and, consequently, with an increase in the number of companies reaching the important productivity level for FDI, a macroeconomic conclusion of heterogeneous-company models is that the aggregate amount of outward FDI should increase as factor productivity increases. However, given that factor productivity growth is linked with local output growth, higher demand, and therefore better profit opportunities for local investment, an increase in total factor productivity may lead to a reallocation of funds to more profitable local investment opportunities in place of less profitable outflow investment. Consequently, increased factor productivity could be both the cause of increased and the cause of reduced outward FDI activity.

An important component related to R&D is the measure used to compute depreciation. There is limited empirical evidence on depreciation rates for R&D assets. depreciation rates are often estimated from econometric models relating new to second-hand asset prices (Bernstein and Mamuneas, 2006) or calculated from patent renewals (Pakes and Schankerman, 1979). So R&D capital growth depends on an economic evaluation of the useful life of the asset. If the depreciation rate increases, this means more resources need to be used in order to maintain a constant knowledge outcome. This re-allocation of resources would raise the R&D opportunity cost, and ceteris paribus, reduce the rate of knowledge creation.

Bernstein and Mamuneas (2006) show that depreciation rates are simultaneously calculated with other parameters characterising the overall production structure. The econometric results from Bernstein and Maumuneas (2006) indicate measures of depreciation close to 15% that is the ad hoc assumption usually used as a starting point in empirical analysis. They used gross investment data to generate estimates of the

depreciation rates, in addition to consistent series for the stocks of R&D.

Net R&D stock is based on the method in Guellec and Van Pottelsberghe (2004) to calculate the initial year.[4]

The Table (2.1) below provides definitions of variables we use and categorises their expected sign.

Table (2.1) Definition of the variables, their source and expected signs

Explanatory variables	FDI stock (inflow)	FDI stock (outflow)	Source
OPEN: openness (imports & exports of goods and services/nominal GDP)	?	?	OECD National Accounts
RLC (relative unit labour cost)	-	+	International Financial Statistics
ROE (Return on Equity)	?	Not included	DataStream DS market
Effective Exchange rate volatility(derived from real / nominal exchange rate data)[5]	?	?	Bank for International Settlements (BIS)
R&D (research and development) Stock of BERD as % of nominal GDP	Not included	+	OECD
Real FDI stock (Nominal FDI stock divided by nominal GDP)			United Nations Conference on Trade and Development (UNCTAD)

**Annual data over the period 1980-2011 ** the RLC and R&D variables are expressed in log levels.

While the volatility measures are conditional estimates derived from the GARCH(1,1) exchange rate variance equations.

[4] The following formula is used to measure net R&D stock in the initial year (1980):

$$R\&Dstock_{it} = \frac{R\&Dflow_{it}}{(\text{depreciation rate} + \text{growth rate})}$$

Where the depreciation rate of R&D is set constant over time at 0.15 and the Growth rate at 0.1 as the mean annual rate of growth of R&D flow.

[5] The measure of real exchange rate is Consumer Price Index (CPI).

2.4 Methodology and the Empirical Results

The objective of this research is to show the nature of the relation between exchange rate volatility and FDI inflow and outflow for the G7 countries. The behaviour of a time series can be broken down into long-run and short-run components. To determine the existence of a long-run relation it is important to know the order of integration of the data and to this end the series used are tested to see whether they are difference stationary using an augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979). We measure the volatility of the exchange rate using a GARCH model for each country in our sample. The core long run relations are initially covered using cointegrating regressions, and these are embedded in what have been termed by Sir David Hendry equilibrium correction models (EqCMs).[6] Such models are then estimated using SUR on a balanced panel over the period 1980 to 2011. These models are used to investigate the impact of the volatility of the exchange rate on FDI for each country in the sample.[7]

2.4.1 Measuring Exchange Rate Volatility

The empirical research examining the link between investment and uncertainty has had some interest in decomposing uncertainty into permanent and temporary components. There are a range of different volatility models (Greene, 2011), but Carruth et al. (2000) who survey a range of different conditional volatility models suggest that the findings are scarcely affected by the choice of the approach. For this purpose it is important to find a measure that well approximates these phenomena. Byrne and Davis (2003) in a study of the impact of uncertainty on investment looked at permanent and temporary components of exchange rate volatility in the G7 by applying component GARCH model and they found that it is the transitory component of exchange rate volatility which adversely impacts investment. Byrne and Davis (2004) decomposed inflation uncertainty into temporary and permanent components applying the Markov switching model of Kim (1993). Here the approach of Byrne and Davis (2005) is followed so the volatility of both the real and nominal exchange rate is measured using a GARCH (1,1) model for each country in our sample. We use the conditional variance as its value changes across the sample, because it depends on the

[6] Burke and Hunter (2005) discuss the notion of long-run equilibrium how this relates to non-stationarity and how this is computed in the equilibrium/error correction (EC) and cointegrating regression frameworks.
[7] All estimations were undertaken in Eviews 8.0.

history and any persistence in exchange rate volatility up to that point. Hence, the variance of the exchange rate is conditional on past information.

The conditional variance of the effective exchange rate is derived for each G7 country series in turn using monthly data on the effective exchange rate in nominal and real terms to construct an indicator of volatility within year. The mean equation of each series can be specified as a first order autoregressive (AR(1))[8] model and the dynamic measure of the volatility for country *i* conditioned on the regression errors (u_{it}) is explained by the next equation:

$$\sigma_{it}^2 = \omega_i + \phi_i u_{it-1}^2 + \theta_i \sigma_{it-1}^2 \qquad (2.1)$$

The monthly conditional variances are used to construct an end of year measure of the volatility based on monthly models of the natural logarithm of real and nominal exchange rate.[9] The empirical results are presented for the nominal and real exchange rates in panel A and B of Table 2.2 below for the G-7 countries used in the sample.

Table (2.2 Panel A) Estimation results of the GARCH(1,1) model for the conditional variance of the nominal exchange rate

Country (i)	ϕ_{1i}^*	θ_{1i}^*
Canada	0.028961***	0.971171***
	(0.00801)	(0.009736)
France	0.016017**	0.957577***
	(0.006242)	(0.012993)
Germany	0.206704***	0.830475***
	(0.01659)	(0.011555)
Italy	0.848862***	0.506924***
	(0.050516)	(0.028144)
Japan	0.116467***	0.884285***
	(0.016097)	(0.010172)
UK	0.485377***	0.526292***
	(0.061866)	(0.034606)
USA	0.137219***	0.87713***
	(0.022781)	(0.017696)

NOTE: * *Significant at 10% level.* **Significant at 5% level.* ***Significant at 1% level* and standard errors are in parentheses. The asterisk applied as a superscript to the parameter denotes a Maximum Likelihood Estimate (Davidson and MacKinnon, 2004).

[8] The autoregressive (AR) model is one of a group of linear prediction formulas that attempt to predict an output of a system based on the previous outputs.

[9] It is used here end year measure of the volatility because FDI end year was collected to analyse in this chapter.

Table (2.2 Panel B) Estimation results of GARCH(1,1) model for the conditional variance of the real exchange rate

Country (*i*)	ϕ_{1i}^{*}	θ_{1i}^{*}
Canada	0.057949***	0.943345***
	(0.016048)	(0.016668)
France	0.020644**	0.948525***
	(0.008191)	(0.016679)
Germany	0.135709***	0.729225***
	(0.036552)	(0.07146)
Italy	0.673868***	0.419633***
	(0.044831)	(0.041301)
Japan	0.06497***	0.910337***
	(0.0126)	(0.016114)
UK	0.392687***	0.517032***
	(0.057485)	(0.046292)
USA	0.101652***	0.901197***
	(0.019451)	(0.018515)

NOTE: (See Panel A).

2.4.2 Tests of Stationarity

The ADF test is used to determine the order of integration of the series applied in this study. The test explains whether a series is stationary by testing the significance of the coefficient on the lagged level (γ_i) in the following AR(p) model transformed so under the non-stationary null the dependent variable is stationary (Chapter 2, Burke and Hunter, 2005):

$$\Delta x_{\text{it}} = \pi_{0i} + \gamma_i x_{\text{it-1}} + \sum_{\text{j=1}}^{\text{p-1}} \pi_{ij} \Delta x_{it-j} + \varepsilon_{\text{it}}. \qquad (2.2)$$

If the coefficient on (γ_i) is significantly less than zero then the variable is I(0), otherwise it will be of a higher order of integration, and the test has to be repeated in first difference (for higher order) terms.

It can be observed from Table (2.3.a) that it is not possible to reject the null of non-stationarity for FDI inflow, FDI outflow, OPEN and the natural logarithm (log) RLC for all G7 countries, and Table (2.3.b) investigates first differences and based on these results they appear to be integrated of order one I(1). It is not possible to reject the alternative of stationarity for log R&D, ROE and real exchange rate volatility for most

of our sample of countries at least at the 10% level and so these series would appear more usually to be I(0). Given we predominantly have I(1) series it is possible to test for cointegration using either a cointegrating regression test or error correction model (Davidson and MacKinnon, 2004).

When series are non-stationary, then the likely outcome of any regression model is that the relation is spurious. However, Engle and Granger (1987) first observed that a regression that gives rise to a stationary residual is considered to be cointegrating. Cointegration arises from a regression when a linear combination of series that are I(0). Cointegration defines an alternative to the difference operator as a filter to render series stationary. The primary definition due to Engle and Granger (1987) has been extended to permit further variables that are stationary (Flores and Szafarz, 1996). However, the dependent variable of the regression needs to be I(1) and to be combined with at least one other I(1) series. The cointegrating relations were investigated using two possibilities, combined firstly with real exchange rate volatility and then with nominal exchange rate volatility. The cointegration tests are used sequentially to find a minimum set of cointegrating variables (Davidson, 1998) for each of our countries. The significance of these variables at this stage is not critical to the analysis as we are looking for the underlying structure, and estimate the final model at one pass in an EqC form.

2.4.3 Tests of Cointegration

Intuitively the residuals are taken from an OLS regression and then using the Dickey Fuller model without intercept, these residuals are tested to see whether they are I(0) or I(1) by comparing the t-value of the coefficient on γ from these regressions with the appropriate critical values for stationarity with more than one variable (see Patterson, 2000). The cointegrating regression results are presented with the appropriate stationarity test of the residual in Table (2.4) and Table (2.5).[10] In each case it is not possible to reject the stationary alternative and so consider these relations to cointegrate.

[10] Dummy variables are used to capture outliers and breaks in order to unravel the long run and short run relation among the variables Juselius (2007).

Table (2.3.a)
t-statistics for ADF unit root test with all variables in levels

Countries	FDI inflow	FDI outflow	Open	log(RLC)	log(R&D)	ROE	Nominal exchange rate volatility	Real exchange rate volatility
Canada	0.04774	-0.62307	-1.43277	-1.09219	-5.92649***	-3.12206**	-1.17964	-4.010748***
France	-1.07600	-1.13849	-1.13877	-1.72252	-2.67928*	-2.55869	-1.637936	-2.62892*
Germany	-0.07722	0.07479	0.77699	-1.58838	-2.62105*	-4.49951***	-2.67641*	-3.98025***
Italy	-0.57957	0.56172	-0.81470	-1.16868	-2.72054*	-3.17900**	-3.30480**	-3.38341**
Japan	1.05624	1.66871	-1.03040	-1.81559	-2.98009**	-2.39168	-2.15774	-2.37782
UK	1.38772	-0.31582	-0.99165	-1.81559	-2.24198	-4.81580***	-4.81817***	-4.93966***
USA	-1.25695	-1.41666	-0.07816	-2.47446	-2.97767**	-4.63129***	-2.54341	-2.83503*

NOTE: ** Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.*
The lag length in the unit-root tests was determined by the Schwarz Information Criterion.

Table (2.3.b)
t-statistic for ADF unit root test for the first differenced series

Countries	FDI Inflow	FDI outflow	OPEN	log(RLC)	log(R&D)	ROE	Nominal exchange rate volatility	Real exchange rate volatility
Canada	-9.48746***	-3.19236**	-3.70919***	-4.935711***	-3.42853**	-5.910972***	-3.138893**	-4.138893***
France	-5.66402***	-3.53793**	-5.300298***	-3.214582***	-3.161954**	-4.565265***	-4.197237***	-6.412655***
Germany	-6.47400***	-4.44321***	-4.940651***	-5.175427***	-3.324699**	-5.718138***	-5.959172***	-5.0387***
Italy	-7.25493***	-4.66953***	-5.653517***	-4.584639***	-3.572354**	-3.651878***	-9.47012***	-9.048355***
Japan	-4.30367***	-3.39632**	-4.941959***	-4.452176***	-3.87395***	-5.14674***	-4.915446***	-4.763798***
UK	-6.38729***	-5.92108***	-5.905688***	-4.267049***	-3.783553***	-4.691479***	-5.287174***	-10.74555***
USA	-4.94273***	-5.38852***	-6.137937***	-4.14608***	-3.386669**	-4.710083***	-5.546924***	-6.442254***

NOTE: ** Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.*
The lag length in the unit-root tests was determined by the Schwarz Information Criterion.

For inflows in Table (2.4), openness and log RLC are always required for cointegration, and the return on equity (ROE) is needed for cointegration in France, Germany and Italy. Both exchange rate volatility variables were investigated, and real exchange rate volatility is needed for cointegration for Canada, the US and the UK, whilst nominal volatility is needed for the other four countries. Series that are stationary have controlled variation so they correct the growth path of FDI inflow for movements away from the steady state path. It follows from the unit root test applied to the residual that in the case of Table (2.4) that it is not possible to reject the proposition that the series is stationary at the 5% level.

Table (2.4) OLS results for parameter estimates and residual unit root test statistics for cointegrated regression models of FDI inflow

Country	OPEN	Log(RLC)	Log(ROE)	Real exchange rate volatility	Nominal exchange rate volatility	Residual unit root tests
Canada	0.474414***	0.135203*	--	0.107582***	--	-4.264196**
France	0.669059	-0.22551	-0.00305	--	-0.358416***	-5.433631**
Germany	0.371929***	0.12575***	-0.014819**	--	-0.014819	-4.772635**
Italy	0.221995***	0.13438***	0.00121	--	-0.010102	-5.908518***
Japan	0.131113***	0.01707***	--	--	0.003431***	-4.507709**
UK	0.725907**	0.006092***	--	-0.044087**	--	-4.768013***
USA	1.977917***	0.19617**	--	-0.02601	--	-4.553205**

NOTE: Hannan-Quinn procedure is used for lag selection and robust standard errors use the quadratic spectral kernel with Andrews bandwidth selection. * *Significant at 10% level.* **Significant at 5% level.* ***Significant at 1% level.*

When the long-run coefficients are considered then FDI inflow is affected positively for all countries by OPEN. The RLC variable has a significant positive effect for all the G7 countries with the exception of France where the coefficient is not significant at any conventional level. ROE only has a significant effect on inflow in the case of Germany and in that case the coefficient is negative. While the only other countries where it features in the long-run are France and Italy and although the coefficients are relatively small. Volatility is significant in the case of Canada, France, Japan and the UK with inflow for Canada and the UK being affected by real volatility and for France and Japan by volatility of the nominal exchange rate.

For the outflow results in Table (2.5) we found common cointegrating sets that included openness, log RLC, log R&D and nominal exchange rate volatility for all the countries.

Table (2.5) OLS results for parameter estimates and residual unit root test statistics for cointegrated regression models of FDI outflow

Country	OPEN	Log(RLC)	Log(R&D)	Nominal exchange rate volatility	Residual unit root test
Canada	0.454782***	0.153757***	0.13703***	0.102529***	-4.777629**
France	2.854192***	-0.210567	0.430422***	-0.034574	-5.088101**
Germany	0.695169***	0.140113	0.131827	0.01817	--5.90435***
Italy	0.587975***	0.039262	0.16467***	-0.003255	-4.563804**
Japan	0.437138***	0.039118	0.106545***	0.013282***	-4.954563**
UK	2.771332***	1.290272***	1.301221***	0.010355	-4.496887**
USA	1.557377***	0.045838	0.237897***	0.012597	-5.011386**

NOTE: (see note to table 2.4).

For FDI outflow, the result of openness is positive and significant for all G7 countries, while RLC has a positive effect for all except for France though this appears only to be significant for the UK and Canada. The R&D variable has a significant, positive impact on outflow for all the G-7 countries except Germany. Nominal volatility seems to feature in the long-run relations for outflow for Canada and Japan, but these coefficients are relatively small and insignificant for the other countries in the sample.

Not all variables appear significant at this stage, but they are required to form the minimum cointegrating sets as defined by Davidson (1998). There is evidence in support of the practical benefit of the extended definition or acceptable variables due to Flores and Szafarz (1996) as I(0) variables are needed in these regressions. The presence of a cointegrating relation among the variables assures us that the long-run information can be extracted from the panel. Hence, regression results involving the levels of the variables can proceed without generating spurious results or concern over endogeneity when the series are I(1) as a result of super consistency (see Davidson and MacKinnon, 2004).

If the dependent variable is denoted by *y*, then the cointegrating regression model that in general explains the long-run is represented below while coefficients are set to

zero for the variables excluded in Table (2.4) and (2.5):

FDI inflow model:

$$y_{1t} = a_1 + b_{11}OPEN_t + b_{12}RLC_t + b_{13}ROE_t + b_{14}\sigma_t + e_{1t} \qquad (2.3.a)$$

FDI outflow model:

$$y_{2t} = a_2 + b_{21}OPEN_t + b_{22}RLC_t + b_{23}R\ \&\ D_t + b_{24}\sigma_t + e_{2t} \qquad (2.3.b)$$

Here *y=FDI/GDP,* in the case of outflow σ_t = Nominal exchange rate volatility[11], and the RLC and R&D variables are expressed in log levels.

2.4.4 Model specification

The method in Byrne and Davis (2003a) is adopted here by applying Arnold Zellner's (1962), SUR method. This allows us to test whether common coefficients can be imposed across different countries within our panel. In addition, the SUR method should enhance the robustness of our findings. If the disturbances across countries are correlated so there are worthwhile efficiency gains to be made by applying SUR (Greene, 2011). Here, the SUR method is used to estimate the dynamic equations for both inflow and outflow models of FDI to show the impact of the volatility of the exchange rate for a panel of G7 countries in the long-run.

The long run relations covered in the previous section are re-estimated by embedding the appropriate variables defined in equation (2.4) below. The long-run coefficient exclusions are detailed in Tables (2.4) and (2.5), while the log R&D variable is always absent from the inflow and the ROE variable from the outflow equation. The coefficient on the equilibrium correction term (λ_i) helps to capture the speed of adjustment of the short run deviation from long run equilibrium. The process is captured using the EqCM. The seven FDI equations were jointly estimated under the assumptions of SUR model using the following stacked regression equations:

$$\Delta y_{it} = \lambda_i\{y_{it-1} - \alpha_i - \delta_{2i}OPEN_{it-1} - \delta_{3i}LogR\ LC_{it-1} - \delta_{4i}Log\ R\ \&\ D_{it-1} - \delta_{5i}ROE_{it-1} - \delta_{6i}EXV_{it-1}\} + \varepsilon_{it} \qquad (2.4)$$

[11] According to cointegration regression, nominal exchange rate volatility was included in all outflow equations, and four inflow equations. However, real exchange rate volatility was included in Canada, the UK and the USA equations in case of inflow model.

Where Δ is the first difference operator and the size of λ determines the speed of adjustment. When the EqCM is appropriate, then -1 < λ< 0 and such findings give support the evidence on cointegration.

The initial results for FDI inflow are shown in Table (2.6). When this EqCM is estimated for each of the G7 countries, it is found that the relevant residuals do not suffer from serial correlation, and hence, there is no need to include further dynamic terms. The coefficient on the correction term is negative as required for stability and based on conventional inference significant at the 5% level. As is usual we test for commonalities using a sequence of Wald tests.[12]

Table (2.6) Results for EqCMs Estimated using SUR, for FDI inflow

Country(*i*)	OPEN$(\widehat{\delta}_{2i})$	Log RLC$(\widehat{\delta}_{3i})$	Log ROE$(\widehat{\delta}_{5i})$	NEXV$(\widehat{\delta}_{6i})$	REXV$(\widehat{\delta}_{6i})$	$(\hat{\lambda}_i)$
Canada	0.640687***	0.139042*	--	--	0.101409***	-0.43152***
	(0.117131)	(0.074067)	--	--	(0.023555)	(0.113286)
France	-0.163534	-0.751987	-0.004355	-0.188461	--	-0.335392**
	(1.296633)	(0.538336)	(0.007048)	(0.151282)	--	(0.132418)
Germany	-0.703679***	0.149742***	-0.003265***	-0.04857*	--	-0.385226**
	(0.041867)	(0.050208)	(0.001236)	(0.027308)	--	(0.152982)
Italy	0.194241***	0.107218***	0.001086	-0.015311***	--	-0.390855***
	(0.072093)	(0.034173)	(0.000745)	(0.00457)	--	(0.069641)
Japan	0.077201**	0.012899**	--	0.003911***	--	-0.319576***
	(0.03266)	(0.006245)	--	(0.00142)	--	(0.051789)
UK	0.575951	0.66938***	--	--	-0.035041	-0.307218***
	(0.520133)	(0.155197)	--	--	(0.027668)	(0.100728)
USA	1.743495***	0.01064	--	--	-0.056744	-0.255673**
	(0.526914)	(0.171409)	--	--	(0.03903)	(0.109057)

NOTE: For each independent variable, the first row shows the coefficient and the standard error is reported in the parenthesis. * *Significant at 10% level.* **Significant at 5% level.* ***Significant at 1% level.* The symbol ^ denotes the OLS estimate.

[12] The Wald test is used to further check the model specification (Davidson and MacKinnon, 2004). The size of the Wald test can be approximated by an asymptotic value that follows a chi-squared distribution function with degrees of freedom (*r*).

The Wald test is also applied to measure how close the unrestricted estimates come to satisfying the restrictions under the null hypothesis that they have no effect on the long run outcome. These results are reported in Table (2.6.a), and they are based on the model with all valid restrictions imposed.

Table (2.6.a) Wald Test for FDI inflow model

Common coefficient of	**Countries**	**Chi-square-Test Statistic (r)**	**Probability**	**Null hypothesis**
$OPEN(\hat{\delta}_{2i})$	*all G7 Countries*	46.25603*** (6)	0.0000	$(\delta_{2i} = \delta_{27}$ for i $= 1, \dots, 6)$
	Canada-USA	4.300664(2)	0.0881	$(\delta_{21} = \delta_{27})$
	France - Germany-Italy	5.008958(3)	0.0817	$(\delta_{22} = \delta_{23} = \delta_{24})$
Log $RLC(\hat{\delta}_{3i})$	*all G7 Countries*	33.93677*** (6)	0.0000	$(\delta_{3i} = \delta_{37}$ for i $= 1, \dots, 6)$
	Canada-USA	0.481254(2)	0.4879	$(\delta_{31} = \delta_{37})$
	France - Germany-Italy	2.691431(3)	0.2604	$(\delta_{32} = \delta_{33} = \delta_{34})$
$ROE(\hat{\delta}_{5i})$	*France - Germany-Italy*	12.20572*** (3)	0.0022	$(\delta_{52} = \delta_{53} = \delta_{54})$
REXV$(\hat{\delta}_{6i})$	*Canada-UK-USA*	19.51925*** (3)	0.0001	$(\delta_{61} = \delta_{66} = \delta_{67})$
NEXV$(\hat{\delta}_{6i})$	*France - Germany-Italy-japan*	19.71901*** (4)	0.0002	$(\delta_{62} = \delta_{63} = \delta_{64} = \delta_{65})$
$(\hat{\lambda}_i)$	*all G7 Countries*	2.045918(6)	0.9154	$(\lambda_i = \lambda_7$ for i $= 1, \dots, 6)$
Zero coefficient of	**Countries**	**Chi-square-Test Statistic (r=6)**	**Probability**	**Null hypothesis**
$OPEN(\hat{\delta}_{2i})$	*all G7 Countries*	99.56314***	0.0000	$(\lambda_i = 0$ for i $= 1, \dots, 7)$
Log $RLC(\hat{\delta}_{3i})$	*all G7 Countries*	50.10120***	0.0000	$(\lambda_i = 0$ for i $= 1, \dots, 7)$
$ROE(\hat{\delta}_{5i})$	*France - Germany-Italy*	12.35125***	0.0063	$(\lambda_i = 0$ for i $= 1, \dots, 7)$
EXV$(\hat{\delta}_{6i})$	*all G7 Countries*	41.82346***	0.0000	$(\lambda_i = 0$ for i $= 1, \dots, 7)$

** Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.*

As can be seen from the Table (2.6.a), it is possible to impose a common speed of adjustment to the long run inflow equilibrium. This is not surprising as the adjustment

decisions are made by essentially the same body of firms for these countries, as inflows for each of them are from all other countries in the world. We also find that we can impose common coefficients for the US and Canada and for France, Germany and Italy for both openness and relative costs, but neither the UK nor Japan can be included to complete this group. As can be seen from the tests for a zero restriction at the bottom of the Table (2.6.a), none of the variables can be removed from the panel.

After the SUR estimations are based on the coefficients that satisfy the common restrictions related to the Wald tests reported in Table (2.6.b).

Table (2.6.b) Results for EqCMs estimated using SUR, for FDI inflow (with common coefficients)

Country(i)	OPEN$(\hat{\delta}_{2i})$	Log RLC$(\hat{\delta}_{3i})$	ROE$(\hat{\delta}_{5i})$	NEXV$(\hat{\delta}_{6i})$	REXV$(\hat{\delta}_{6i})$	$(\hat{\lambda}_i)$
Canada	0.7138***	0.069964	--	--	0.122038***	-0.28612***
	(0.14777)	(0.082562)	--	--	(0.036657)	(0.03021)
France	0.300029***	0.078338**	-0.012208	-0.340055***	--	-0.28612***
	(0.042299)	(0.031283)	(0.007579)	(0.129142)	--	(0.03021)
Germany	0.300029***	0.078338**	-0.003423**	-0.060003**	--	-0.28612***
	(0.042299)	(0.031283)	(0.001476)	(0.026275)	--	(0.03021)
Italy	0.300029***	0.078338**	0.000694	-0.01922***	--	-0.28612***
	(0.042299)	(0.031283)	(0.000995)	(0.006045)	--	(0.03021)
Japan	0.064571*	0.012717*	--	0.003717**	--	-0.28612***
	(0.035025)	(0.007226)	--	(0.001708)	--	(0.03021)
UK	0.651502	0.636098***	--	--	-0.028173	-0.28612***
	(0.507218)	(0.139907)	--	--	(0.02684)	(0.03021)
USA	0.7138***	0.069964	--	--	-0.078786**	-0.28612***
	(0.14777)	(0.082562)	--	--	(0.03183)	(0.03021)

NOTE: For each independent variable, the first row shows the coefficient and the standard error is reported in the parenthesis. * *Significant at 10% level.* **Significant at 5% level.* ***Significant at 1% level.* The symbol ^ denotes the OLS estimate.

It was then found from Table (2.6.b) that OPEN has a significant and positive impact on FDI inflow in all G7 countries except Japan and the UK suggesting that an efficient environment with more openness to trade is likely to attract FDI. This result was supported by the findings in Asiedu (2002) and Edwards (1990); consistent with the

idea that a higher degree of openness is seen to create a favourable environment for FDI in export–oriented industries. These results show a positive relation between relative costs and FDI inflow and this would appear to suggest that foreign firms are not moving to cheaper locations, but rather taking firm specific skills to produce, perhaps more cheaply, in higher cost locations, these results are consistent with Boudier-Bensebaa (2005) who stating that "the variable may express not only labour cost effects but also skill effects." The coefficient on ROE is statistically significant and has a negative impact on FDI flows into Germany. This suggests that FDI flows into Germany in periods when equity returns are low, indicating a possibility for higher returns for the investing firm than for the domestic targets.

The focus has in part been on the role of exchange rate volatility, and for inflows, it is not unambiguous as to the sign that might be expected, as FDI might be encouraged by volatility when production is for sale in the host market. However, it is discouraged when it is oriented to exports, or uses a large proportion of imported inputs. The coefficient on exchange rate volatility is negative in five countries, and significant in four of these cases, whilst it is significant and positive for Canada and Japan. More specifically, it is noted that there is a negative effect of nominal exchange rate volatility on FDI inflows for the core European economies in the G7. That is France, Germany and Italy who have had relatively (or completely) fixed exchange rates against each other over the sample period. This is also significant and negative for the US, and negative for the UK. This suggests that FDI in these countries is strongly related to trade, either with significant imports of components or with significant export of products. Real exchange rate volatility in case in Canada and Japan has a strong impact suggesting that production is for the home market**.** We can easily conclude that on average increases in conditional exchange rate volatility reduce the overall level of FDI. It is concluded that openness and RLC encourage FDI inflow while real and nominal exchange rate volatility does not support FDI inflow in the case of the G7 economies themselves.

The results related to FDI outflow are presented in Table (2.7) below. The findings show some signs of a systemic pattern for G7 countries, and once again there is no serial correlation, and no need for further difference terms.

Table (2.7) Results from EqCMs, using SUR for FDI outflow

Country(*i*)	$\mathbf{OPEN}(\widehat{\boldsymbol{\delta}}_{\mathbf{2i}})$	**Log RLC**$(\widehat{\boldsymbol{\delta}}_{\mathbf{3i}})$	**Log R&***D*$(\widehat{\boldsymbol{\delta}}_{\mathbf{4i}})$	$\mathbf{NEXV}(\widehat{\boldsymbol{\delta}}_{\mathbf{6i}})$	$(\hat{\lambda}_i)$
Canada	0.660657***	0.120863***	0.077145**	0.111257***	-0.576828***
	(0.081257)	(0.041509)	(0.031097)	(0.018014)	(0.084222)
France	1.094558	-0.300709	0.688978***	0.011177	-0.443865***
	(0.997792)	(0.489900)	(0.210481)	(0.104698)	(0.133809)
Germany	0.662267***	0.242612**	0.1418380	0.030338	-0.494288***
	(0.088842)	(0.102484)	(0.116677)	(0.036425)	(0.165098)
Italy	0.554212***	0.111573*	0.229216***	0.009331	-0.250964***
	(0.116313)	(0.059687)	(0.042707)	(0.010377)	(0.091670)
Japan	0.510179***	0.042981*	0.111906***	0.016403***	-0.556309***
	(0.094757)	(0.025532)	(0.013911)	(0.003762)	(0.117450)
UK	3.127615***	1.490518*	2.107694***	0.011815	-0.368539***
	(0.471901)	(0.205356)	(0.503420)	(0.024209)	(0.069026)
USA	1.249763***	0.040645	0.33325***	0.01058	-0.910866***
	(0.300634)	(0.055943)	(0.077853)	(0.011684)	(0.208060)

NOTE: For each independent variable, the first row shows the coefficient and the standard error is reported in the parenthesis. * *Significant at 10% level.* **Significant at 5% level.* ***Significant at 1% level.* The symbol ^ denotes the OLS estimate.

All specification, tests applied to consider possible common coefficients for the models of FDI outflow can be found in Table (2.7.a) below.

It can be seen from the results presented in table (2.7.a) that it is possible to apply common coefficients for RLC and openness, and the results are reported in Table (2.7.b).[13] Furthermore, as with the models of FDI inflow a Wald test is applied to see whether sequentially it is possible to omit one variable at a time from the model. As can be seen from the tests for a zero restriction at the bottom of the table (2.7.a) that all variables on this basis appear important in explaining FDI outflow from the G7 countries.

[13] As it was not possible to impose the common coefficient on R&D for European countries and maintain cointegration, this result has not been included.

Table (2.7.a) Wald Tests of restriction for the FDI outflow model

Common coefficient of	**Countries**	**Chi-square-Test Statistic (r)**	**Probability**	**Null hypothesis**
$OPEN(\hat{\delta}_{2i})$	*all G7 Countries*	43.231770****(6)*	0.000000	$(\delta_{2i} = \delta_{27}$ for i = 1, …,6)
	Canada-USA	*3.659798(2)*	*0.0557*	$(\delta_{21} = \delta_{27})$
	France - Germany-Italy	*0.926020(3)*	*0.6294*	$(\delta_{22} = \delta_{23} = \delta_{24})$
Log $RLC(\hat{\delta}_{3i})$	*all G7 Countries*	53.758440****(6)*	0.000000	$(\delta_{3i} = \delta_{37}$ for i = 1, …,6)
	Canada-USA	*1.349156(2)*	*0.2454*	$(\delta_{31} = \delta_{37})$
	France - Germany-Italy	*1.987645(3)*	*0.3702*	$(\delta_{32} = \delta_{33} = \delta_{34})$
Log R&$D(\hat{\delta}_{4i})$	*all G7 Countries*	27.856550****(6)*	0.000100	$(\delta_{4i} = \delta_{47}$ for i = 1, …,6)
	France - Germany-Italy	*5.693210(3)*	*0.0580*	$(\delta_{42} = \delta_{43} = \delta_{44})$
	Canada-USA	*9.627438***(2)*	*0.0019*	$(\delta_{41} = \delta_{47})$
NEXV$(\hat{\delta}_{6i})$	*all G7 Countries*	*31.51407***(6)*	0.0000	$(\delta_{6i} = \delta_{67}$ for i = 1, …,6)
$(\hat{\lambda}_i)$	*all G7 Countries*	97.81136****(6)*	0.000000	$(\lambda_i = \lambda_7$ for i = 1, …,6)
Zero coefficient of	**Countries**	**Chi-square-Test Statistic (*r=6*)**	**Probability**	**Null hypothesis**
$OPEN(\hat{\delta}_{2i})$	*all G7 Countries*	*188.6582****	*0.000000*	$(\lambda_i = 0$ for i = 1, …,7)
Log $RLC(\hat{\delta}_{3i})$	*all G7 Countries*	*70.52430****	*0.000000*	$(\lambda_i = 0$ for i = 1, …,7)
Log R&$D(\hat{\delta}_{4i})$	*all G7 Countries*	*131.1514****	*0.000000*	$(\lambda_i = 0$ for i = 1, …,7)
NEXV$(\hat{\delta}_{6i})$	*all G7 Countries*	*69.86896****	0.000000	$(\lambda_i = 0$ for i = 1, …,7)

** Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.*

The results reported in Table (2.7.b) show in general openness has a significant positive effect on FDI outflows, as would be expected, this result in the line with Kravis and Lipsey (1982), Culem (1988) and Edwards (1990). The impact of relative costs is also positive, but not always significant, and this suggests that outflows may in part be driven by the need to reduce costs, but that these destinations may be outside the G7 group of countries. Wheeler and Mody (1992), and Feenstra and Hanson (1997) provide further evidence that labour cost is positively related to FDI. Interestingly, R&D has a positive effect and is always significant, with the only exception for this being Canada, suggesting that firm specific technology or techniques are being exported, it can be

concluded from R&D results that receiving countries benefit in general or on average from outward FDI due to the increased productivity of the home countries (G7 in our sample). This consistent with the empirical literature which indicates that firms that undertake R&D tend to undertake more FDI in order to take firm specific technologies to foreign countries (Barrell and Pain, 1997). Exchange rate volatility always has a positive effect, with the exception of France, albeit not always significant, indicating that increased volatility might lead to a reduction in production at home.

Table (2.7.b) Results from EqCMs, using SUR for FDI outflow (with common coefficients)

Country(*i*)	$\mathbf{OPEN}(\widehat{\boldsymbol{\delta}}_{\mathbf{2i}})$	$\mathbf{Log\ RLC}(\widehat{\boldsymbol{\delta}}_{\mathbf{3i}})$	$\mathbf{Log\ R\&}\boldsymbol{D}(\widehat{\boldsymbol{\delta}}_{\mathbf{4i}})$	$\mathbf{NEXV}(\widehat{\boldsymbol{\delta}}_{\mathbf{6i}})$	$(\hat{\lambda}_i)$
Canada	0.850609***	0.018843	-0.015904	0.145492***	-0.367893***
	(0.175945)	(0.045932)	(0.061000)	(0.030316)	(0.087790)
France	1.563716**	0.178776***	0.737971***	-0.01574	-0.483529***
	(0.617625)	(0.060824)	(0.153379)	(0.087486)	(0.123939)
Germany	0.662265***	0.178776***	0.175593***	0.035911	-0.627775***
	(0.065491)	(0.060824)	(0.082929)	(0.026519)	(0.153174)
Italy	0.517298***	0.178776***	0.262608***	0.020429	-0.152265**
	(0.187577)	(0.060824)	(0.071697)	(0.014700)	(0.067777)
Japan	0.452275***	0.029333	0.117817***	0.015818***	-0.583102***
	(0.087611)	(0.024354)	(0.013581)	(0.003595)	(0.118213)
UK	3.319244***	1.420715**	1.989182***	0.019547	-0.38526***
	(0.415176)	(0.182188)	(0.440867)	(0.020473)	(0.065673)
USA	0.850609***	0.018843	0.416912***	0.015445	-0.73493***
	(0.175945)	(0.045932)	(0.076699)	(0.012541)	(0.153229)

NOTE: For each independent variable, the first row shows the coefficient and the standard error is reported in the parenthesis. * *Significant at 10% level.* **Significant at 5% level.* ***Significant at 1% level.* The symbol ^ denotes the OLS estimate.

2.5 Concluding Remarks

This contribution adds to the previous literature in a number of ways. Firstly, included in the analysis there are what are now viewed as the most significant economies in the world, the G7 countries. In contrast to some of the earlier studies, the investigated relation between exchange rate volatility and the stock of FDI inflow and outflow is analysed for all the G7 countries to the rest of the world. The study analyses

the extent to which exchange rate volatility impacts on these developed economies over the period 1980-2011. In contrast to most previous research which uses firm-level, bilateral FDI data, or industry-level, this chapter contributes to the empirical literature on the FDI inflows/outflows by using aggregate country level data. Finally, the analysis picks out a more subtle linkage between exchange rate volatility and FDI inflow.

A distinction is made in the models between the FDI inflow and outflow responses to exchange rate volatility and other factors that drive FDI inflow and outflow such as equity return, relative labour cost, R&D, and the openness of the economy. Cointegrating regressions (Engle and Granger, 1987) are adopted to derive minimal long-run relations. The long-run is embedded into dynamic models using a SUR approach. Our results support the hypothesis that exchange rate volatility is an important determinant of FDI for the G7 economies.

In this chapter, it is reported that investors of these developed economies do value exchange rate volatility as an important factor in their decisions to engage in external investments in addition to the other control variables. It is generally found that exchange rate shocks have a stronger impact on the long run behaviour. In particular, we can clearly conclude that exchange rate uncertainty decreases FDI inflow, while for the FDI outflow it seems that it has a positive effect, and exchange rate volatility cannot be excluded from both model regressions. The panel-data results also showed that openness is positively related to FDI in the selected sample suggesting that liberalisation of the trade and investment environment positively affects the choice of forming FDI. It can be concluded that openness is a significant driver of FDI inflow in the G7. Outflow from G7 countries is encouraged by openness and home country R&D with the exception of Canada and by the common coefficients for RLC regarding European economies. This is in addition to the positive effect of nominal exchange rate volatility in the case of Canada and Japan. Moreover, the findings suggest that there is no systemic evidence for an FDI inflow model, because common coefficients are more likely in the case of FDI outflow, because they generally relate to the same group of countries.

Generally, in contrast to the more common view, these results do not always indicate that there is a negative relation. It is the case that an increase in volatility normally encourages FDI outflows, and may be related to an increase in inflows in

some cases. Nonetheless, this result is in line with some of the earlier findings reported in the literature from which it is indicated that volatility in the exchange rate decreases inflows of FDI. However, in certain cases these effects may be reversed such as the cases of Canada and Japan. Our results are also robust to the presence of other conditioning variables often viewed as important determinants of FDI such as openness.

The findings of this chapter contribute to the literature by emphasising the importance of the exchange rate volatility expectations in FDI decision making. This investigation can help to reduce the debates on the empirical evidence, and to reach a better understanding of the relationship between FDI and exchange rate volatility.

Moreover, The findings of the study have valuable implications for policy makers in developed countries 1-) They suggest a positive long-run relationship between exchange rate volatility and FDI outflow, but this effect is not as strong for the core Euro zone countries that have moved relative to each other to a fixed relation over the sample. Implying that policy makers both within the Euro zone and outside need to pay attention to this in terms of policy changes intended to encourage FDI. 2-) They show that FDI complements openness, this suggests that it makes sense to encourage FDI as it encourages economic growth. 3-) They imply that policy makers should pay attention to potential technological advantages and focus on policies that encourage R&D which also encourage FDI outflow.

To further improve the findings of this study, further research should be conducted in certain areas. Additional analysis should seek to explore other FDI forms, as well as, including additional countries. Further insight could be gained by seeing how different financial crises beside those due to exchange rate volatility affect FDI stock, as the time frame includes the period of crises. Another future research could distinguish between the effect of permanent and temporary volatility on FDI.

Chapter Three

Exchange Rates and Bilateral FDI: Gravity models of Bilateral FDI in High Income Economies

3.1 Introduction

As mentioned in chapter 2, FDI has become a critical driver of the World Economy that refers to a type of international investment by which an investor obtains a significant position in the management of a project outside the investor's home country. It has been reported in the 2010 World Investment Report (UNCTAD, 2010) that the inward and outward global stocks of FDI measured as a proportion of GDP were in 2009 valued at 32.3% and 34.5% respectively. Furthermore, government policies across the globe have been modified to boost FDI.

The last two decades brought critical improvements in the investment environment, triggered in part by the recognition of an interest in FDI that has spread quickly across the globe. The financial and economic crises, such as the Asian financial crisis of 1997–1998 and the global financial crisis 2008, have had a large impact on the behaviour of bilateral foreign direct investment (BFDI) and other capital movements. The financial crisis has been detrimental in terms of growth slowdown, rising unemployment, slow export growth and a reduction in international, bilateral capital flows (UNCTAD 2009a).

Mahmoud (2011) indicated that global financial crisis has been found to affect FDI depending on FDI motives. As mentioned in the previous chapter, there are different motives for FDI outflow, widely termed market-seeking, efficiency-seeking and resource-seeking. In the first case, market-seeking, foreign investors are attracted to the local market of the host country. Hence, investment incentives and tariff protection are significant determinants, along with a set of variables such as market size and growth. This Investment form is expected to grow quickly even while there is a financial crisis, the explanation is that this investment form mainly in services which by definition are generally non-tradable. By contrast, efficiency-seeking investments refer

to those that locate in an economy owing to its effectiveness as compared to other locations. The factors that are important here are related to the macroeconomic environment and policy on trade that imply that investment is very likely to be export-oriented. This type of FDI has been expected more recently to grow slowly as a result of the effects of the global financial crisis, especially when concentrated on the automotive, electronics and machine tools industries (Kimura, 2006). However, resource-seeking FDI is expected to be less affected by the global crisis.

Global FDI flows remain a preferred component of external finance during the last decade, although the economic and financial crises witnessed in the global economy (UNCTAD, 2014). In this context, research has been strongly motivated to search for specific determinants to attract FDI, based on the positive impacts of FDI on certain determinants in the host countries (see Kambayashi and Kiyota, 2015). This concern regarding the FDI determinants has resulted from the increasing the FDI importance in the economic development of countries. However, the conclusions as to the fundamental drivers of FDI are no more certain, because the empirical evidence thus far is inconclusive. An investment theory that derives from an economic perspective may call into question why a company is required to operate at a multinational level simply to sell in overseas markets, because at the operational level the products could be exported. On the other hand, there are direct and indirect barriers to trade such as tariffs, transport costs and exchange rate risk. Using a Gravity model Jeanneret (2006) found when they analysed FDI data for Organization of Economic Cooperation and Development (OECD) countries that the finding of a negative relation with exchange rate volatility diminishes with time calling into question the persistence of a negative link. While Görg and Wakelin (2002) also found that the negative impact of volatility on FDI fell over their sample.

The focus of this chapter is on BFDI from 14 high income OECD countries to the OECD countries for a period of 1995-2012. The analysis is applied to the Gravity model and that determines the key factors related to that model. That is the important factors that drive this type of relation such as distance, exports and GDP. Our analysis is not limited to main economic fundamentals, but takes into account other institutional factors that may affect the FDI distribution stocks across the host countries. Despite recent attempts to look at the drivers of FDI, a lot still needs to be said about risk factors such as exchange rate volatility, especially after the decline in FDI. Furthermore, Single

equation estimation of a dynamic panel is derived using what has been called systems-GMM as it not only exploits the time series variation in the data while accounting for unobserved country specific effects, but it also controls for possible correlation between the regressors and the error term. There are three measures of FDI used in research. For example, Bijsterbosch and Kolasa (2010) use gross FDI inflows as a share of value added, while Büthe and Milner (2008) and Singh and Jun (1995) include inward FDI stocks as a percentage of GDP and FDI inflows as a percentage of GDP, respectively. In this study bilateral data on the FDI position is divided by the GDP deflator.

Additionally, Financial crisis is often thought to affect FDI. In principle, it is expected that a significant financial crisis affects both the host country and foreign business engaged in FDI. As a result of the turmoil that is caused by the crisis, government policies in the host and the donor countries are directed to encourage investors in both economices to be more active. Thus, it is to be expected that financial crisis will reduce investment flows and this suggests why it is important to trace the impact of financial crises on FDI. Especially were this enahmce the understanding of the mechanism by which the financial shock influences the allocation of FDI. At the same time, identifying the impact of financial crises on FDI is important for understanding the possible reverse impact of FDI on policy makers response to the crises. This chapter aims to inform the debate by examining the behaviour of BFDI in the context of the 1997–1998 East Asian crisis, the global financial crisis of 2008, and systemic banking crises. Laeven and Valencia (2013) define that a systemic banking crisis occurs when a substantial number of borrowers default or experience repayment difficulties, leading to a sharp increase in non-performing loans for lenders and to an exhaustion of capital for the banking system as a whole.

This chapter will also address an interrelated issue, namely whether a common currency via a currency union (CU) has had any effect on FDI. In addition, it can evidence whether the creation of a CU has created a better environment for firms to make long-term investment decisions. Adopting a single currency so eliminating exchange rate uncertainty within the union can be seen as a highly credible commitment to exchange rate stability. The stability that arises should also reduce transaction costs as in a currency union there is no reason for exchange with transactions within the union. The reduction in transaction costs and a more certain environment certainty should enhance FDI. That suggests the introduction of the Euro will bring about a

higher degree of integration across financial transactions. Bilateral investment constitute a starting point for this analysis, because they possess attributes of both commercial and financial transactions. The debate on the contribution of a common currency to economic development is vital. One main research question regarding euro and FDI is being asked; has the common currency supported FDI for countries that adopted the euro as compared with the rest of OECD countries.

The empirical imperatives of this study can be summarised as follows [1] to analyse the impact of the crises on BFDI to the OECD countries. Using a panel data approach, a significant negative impact of the crises is found on BFDI stock, expressed as a percentage of GDP deflator. [2] After examining the impact of the scale of the recent economic crisis on FDI as compared with previous crises it is concluded that the crisis in 2008 had more of an effect on FDI than the Asian crisis whose primary manifestation was at the country level. [3] The findings indicate that exchange rate risk can be seen as a key factor that may impact FDI and when the data is decomposed at the bilateral basis there is evidence that expected long run exchange rate volatility reduces the BFDI stock. This may give a clear rationale as to why membership of the Euro zone has a reverse effect.

The chapter is organised as follows. First, the literature on bilateral FDI is focused on the Gravity model. Second, this is placed in the context of the impact of crises, the CU, exchange rate volatility and other factors. Thirdly, the data and methodology are discussed followed by the estimations and tests. Finally, conclusions are offered.

3.2 The theoretical framework of the Gravity model in BFDI

This chapter adopts the "Gravity model" for a number of reasons. This model has been considered of use in several areas of economics such as trade flows and FDI. Deardoff (1998) explains that the advantages with the Gravity model are their simple structure and compatibility with a wide range of theoretical frameworks to explain flows. Moreover, the models flexibility allows for both "push" factors originating in home countries and "pull" factors arising from host economies that affect bilateral trade or asset flows.

The Gravity model is derived from the Newtonian principle of gravitational pull applied in an economic context, and developed to explain the movement between countries of information, commodities and investment as a result of the distance between them (Erlander, 1980). The model depends on the interactions of the different factors that determine the extent of this force across borders.[14]

3.2.1 The trade Gravity model

Tinbergen (1962) and Pöyhönen (1963) pioneered the application of the Gravity model to analyse international trade flows. Since then, the Gravity model has been successfully applied to FDI and migration, and more particularly to trade (Martínez-Zarzoso et al., 2009). According to the Gravity model for international trade, the degree of trade between two countries is expected to increase with their size, as measured by their national incomes, and the decrease in transportation costs, as measured by the distance between their capitals or economic centres.

However, the Gravity model has been identified as a highly flexible empirical approach for tackling different applied policy issues. As mentioned above, the most common application of this model has been in the area of international trade especially in terms of goods. For instance, Glick and Rose (2001) and Rose (2002) apply different extensions of the Gravity model to explain goods movements around the world as well as the effect of currency unions and trade agreements and international flows of goods. Head and Mayer (2013) have provided a clear explanation of estimation and the interpretation of gravity equations as applied in relation to bilateral trade relations. The gravity equation is one of the most commonly applied techniques to analyse bilateral trade (see Egger et al, 2012). While Brainard (1997), Braconier et al. (2002), and Egger and Pfaffermayr (2004), apply the approach to the analysis of sales of foreign affiliates of multinational companies. Okawa and van Wincoop (2012) consider portfolio capital flows, and Anderson (2011) migration.

The Gravity model supports both the assumption of increasing returns to scale, and homogenous goods production. This explains why this model has been widely employed to study FDI as can be seen from the empirical applications to be found in the articles by Egger and Pfaffermayr (2004), Bevan and Estrin (2004), Benassy-Quere et

[14] The so called gravity equation has been widely used in the social sciences following William J. Reilly who formulated Reilly‘s Law of Retail Gravitation in 1931.

al. (2007), Stein and Daude (2007) and Kahouli et al. (2014).[15] Similarly, affiliate sales were analysed by Brainard (1997) and Carr et al., (2001). The latter studies appear to provide support for the studies of FDI by Woodward (1992), Barrell and Pain (1999), and Yeaple (2001) that market size is also a critical factor. Whereas investment is expected to flow to countries that are nearer as transport costs decrease with geographic distance.[16]

The choice of traditional explanatory variables to explain FDI has relied on the existing theoretical and empirical research. It is claimed from the nature of the gravity equation that BFDI between any two economies is positively related to the size of the two economies and negatively to distance and population. The size of markets as measured by (GDP, population) and the distance between home and host countries have widely been known to be major drivers of global trade flows. Starting from the international trade literature, many empirical studies have attempted to explain the drivers of FDI using GDP or population to proxy market size, but as is mentioned below different authors have extended the basic model to explain FDI empirically by further factors.

In practice, the Gravity model has been specified according to the specification considered most appropriate to the case at hand with population sometimes excluded and only partner country characteristics taken into account. Not having a clear theoretical basis to these models that is coherent across explanatory variables or even in relation to an explanatory variable may pour doubt on the basis of their use as has been pointed out by Baldwin and Taglioni (2006).

Recent research claims that distance between countries may be much more than a geographic measure. It is associated with history, culture and language, social relations sometimes captured by factors such as transport and transaction costs. Brainard (1997) suggests in the case of trade that it can be imputed that greater distance between home and host country relates to high trade costs, which in turn should be associated with a reduction in trade flow. As most research consider that FDI and trade as substitutes (Helpman, 2006), one would expect a positive effect of distance in FDI[17] (Markusen, 2002). For countries far apart with significant freight costs, high cost trade is expected

[15] Other examples arise in Eaton and Tamura (1994), Graham (1997), Mátyás (1997), and Brenton et al. (1999).
[16] As measured by the distance between their capitals or economic centres.
[17] Unless this is associated with higher search and information costs.

to be replaced by low-cost FDI. However, as "FDI and distance are negatively correlated in the data" (Bergstrand and Egger, 2013), much of the empirical research finds a negative relationship between distance and FDI.[18]

When BFDI are considered then the literature as is suggested above implies a Gravity model, with transactions between countries determined by their national incomes, market size and geographical distance and other frictional variables. In this chapter, a new variable that relates to the crises is included as a key component of the empirical model to examine such phenomena. Moreover, Blonigen and Piger (2014) indicate that the traditional gravity variables distance, common language and a common border are still considered as important determinants of FDI they are also to be included here. Furthermore, exchange rate volatility is included in the gravity equation as is the case with other studies of BFDI. For this purpose, MacDermott (2008) considered the impact of real exchange volatility using a fixed effects variation of the Gravity model for panel data on 55 countries over the period 1980 - 1997. MacDermott found that weak host currencies and greater exchange rate volatility discouraged FDI flows. Here following articles such as Bénassy-Quéré et al. (2005), unit labour cost differential is included as a further variable in the Gravity model.

3.2.2 FDI and Crises:

The Asian Financial Crisis has been seen to have had a significant effect on FDI flows. As a result, of this crises, FDI flows dipped in late 1998 and 1999 in Eastern and South-Eastern Asia and the Middle East and North Africa (MENA) region. Additionally, FDI dropped from a peak in 2000 until 2003 after the crisis related to the dot-com bubble (2000-2001), and then followed by the 9/11 terrorist attacks. This resulted in a dramatic drop in global FDI; FDI inflows fell 41 percent to $576 billion across the world in 2001. In comparison to other regions, South-Eastern Asia, most OECD countries and Eastern Europe recorded the sharpest decline among regions in 2001 (UNCTAD, 2009).

In the period of Global Financial crisis, countries around the world witnessed huge declines in output, trade and employment. The financial crisis began in the USA in 2007 and involved financial institutions across OECD economies and this automatically

[18] Egger and Pfaffermayr (2004), using a Hausman-Taylor approach, found a positive effect of distance on FDI

impacted FDI flows (Dullien et al., 2010). However, in the main multinational corporations (MNCs) have continued to invest in host economies during the Great Recession that followed after the global financial crisis. While FDI flows from overseas parent companies fell, because reinvested earnings and intercompany debt fell (see Contessi and Li, 2012).

Given that the global crisis started in western economies and economic growth is an important determinant of FDI, it comes as no surprise that FDI inflows and outflows from developed countries have thus far fallen most. The decline has had a particularly strong effect on banks in developed economies and their financial institutions especially in America and Europe. Fabuš and Kohuťár (2010) show that the turbulence in the global economy and the financial markets fell gradually and this influenced what happened to total flows of FDI in 2008 and in the first half of 2009. After an uninterrupted growth of FDI over the period 2003-2007, the worldwide inflow fell by 14% in 2008 to $1.697 billion from $1.979 billion in 2007.

According to research by UNCTAD, the fall in global FDI in 2008–2009 is the result of two main factors affecting domestic as well as international investment. First, the capability of transnational companies to invest has been reduced as access to credit has tightened and corporate balance sheets have deteriorated. Second, the propensity to invest has been negatively affected by economic prospects, especially in developed countries hit by the sharp recession (UNCTAD, 2011). Beyond this, FDI could cause social costs. For example, these investments can affect unemployment, because of transfers of the work force to companies under foreign ownership or by pushing out companies at the domestic level that are more susceptible to local economic and financial conditions as they have less access to global funds and markets (Grgic, 2008).

Theoretically, systemic banking crises could affect FDI through two channels. Firstly, banking crises are widely accompanied by demands shocks, such as the downturn of world GDP, which is highly correlated with FDI. Secondly, credit supply is a difficult constraint on FDI. Companies purposed to prospect foreign markets face entry costs barriers in the fixed and information costs form. Financing these sunk costs for FDI is not an easy task for a number of reasons such as the lag between initial investments and sales, and production or the complexity to forecast foreign returns.

Moreover, financial constraints may impact new endeavours of transnational firms in addition to established subsidiaries.

Furthermore, banking crises could impact both the amount invested and the number of investments across borders. As a response to the demand or credit shortening, companies' responses can be either through FDIs' extensive margin, reducing investment abroad, or through FDIs' intensive margin, reducing the financial scale of the prospective projects. For German firms, Buch et al. (2010) found that financial constraints seem to be decisive for the decision to engage in FDI, but less so for the aggregate magnitude of sales of foreign affiliates.

3.3 Recent Literature on FDI:

3.3.1 FDI and financial crises:

The extent of the impact of the financial crises on FDI has been questioned in the literature. A few studies have analysed the relation between FDI and the recent crisis to global financial markets that then impacted the world economy. For example see the study by Mahmoud (2011) who examined the impact of financial crises on BFDI. His study addresses the effect of global financial crisis and Asian crisis on BFDI using a panel for the period 1985-2008 with the six largest countries by FDI outflow representing home economies relative to a further 42 host countries. The systems GMM estimator was applied to a Gravity model of BFDI flows, as it provides a remedy to endogeneity bias, simultaneity and spatial characteristics of the data (see Madariaga and Poncet, 2007). A key result of Mahmoud' study is that global financial crisis has a negative and significant effect on BFDI, Asian crisis has a negative but not significant effect on BFDI. The extent of the negative shock related to the effect of financial crises on FDI appears to change in response to their origin and their nature.

Additionally, Dornean and Oanea (2012) analysed the link between post crisis FDI and economic growth for the European Union taking into account that financial crisis had a strong impact on the EU countries. Using the least squares method based on an unbalanced panel over the period 1990-2011, the study found that the effect of the financial crisis has a significant negative impact on FDI.

The recent interest by researchers who have approached this topic has been to measure the effect of global financial crisis on the FDI level. More specifically, the empirical study conducted by Ucal et al. (2010) revealed that the financial crisis had a significant effect on FDI. After recording an upturn before and during the crisis, the level of FDI was reduced in following years. Poulsen and Hufbauer (2011) compared the current FDI recession with the response on FDI to past crises and found that the financial crisis of 2008 could be seen as the most extreme in recent memory. While, the global impact of the recent crisis meant that it had had a greater effect on FDI.

Also, Sachs (2009) showed that the effect of the recent crisis was different from one region to another, highlighting that Asia experienced a quicker recovery, because of the stimulus packages. In addition to the recent global financial crisis, there were some articles that were interested in the Asian crisis, all these studies indicating the post-crisis evolution of FDI. In this sense, the empirical research done by Park et al. (2009) indicated that the FDI level fell in six Asian host countries for more than a decade after the crisis. Going deeper into the problem, Moon et al. (2011) compared the FDI evolution after the Asian crisis with the level recorded before the crisis. Their results showed that countries with a higher FDI level before the Asian crisis will experience a milder recession and a more gradual recovery.

Even though there are studies that analyse the different crises, there is little research regarding the relation between the systemic banking crises and FDI. The impact of financial and banking constraints on FDI has caught the attention of a number of articles. Ma and Cheng (2005) found that FDI falls in response to banking crises. Contessi and De Pace (2012) examined the impact of the subprime crisis on the inflows of FDI into the USA over the period 2006-2010 and found that U.S. industries with more financial vulnerability experience significant variations in the debt and equity components of FDI inflow in response to the capital cost changes that occurred in the home countries during the crisis period. Similar subprime crisis in the financial channels on FDI have been identified in the western economies, for example Germany and Belgium (Düwel et al., 2011; and De Maeseneire and Claeys, 2012).

In their recent study, Gil-Pareja et al., (2013) estimate the impact of the systemic banking crises on FDI using the Gravity model on a sample of 161 Countries for the period 2003-2010, they show that systemic banking crises may impact FDI in two ways

via their impact on aggregate monetary flows and individual project counts. Their results indicate the unprecedented number of systemic banking crises since 2007 a period known as the Great Recession, through credit constraints on markets, have had a significant negative impact on the investment decision, but not on the quantities invested.

3.3.2 FDI and the introduction of the Euro

It is generally thought that by adopting the Euro the countries in the Euro zone have become more highly integrated. Increased trade is without any doubt one of the gains from a currency union by eliminating exchange rate volatility and reducing transactions costs of member countries; as a result of this trade is expected to increase. The nature of the Euro zone trade effects has also spilt over into other EU economies which have not joined yet, as well as the member countries.

Gravity models as applied in the international trade literature have been widely examined to investigate the effect on trade of a common currency following the seminal paper by Rose (2000), where currency unions were found to increase trade by more than 200%.[19] Following this there has been much debate in particular from Persson (2001), Barr et al. (2003), Frankel (2005, 2010), Flam and Nordström (2006, 2007), Bun and Klaassen (2007), Berger and Nitsch (2008), and Santos Silva and Tenreyro (2010). Herwartz and Weber (2010), and Camaero et al. (2012) proposed a Gravity model estimated using a panel-based cointegration approach, which allows for cross-sectional dependence by common factors. The literature appears to demonstrate that currency unions have a large positive effect on trade among within the common currency zone.

The empirical research has grown rapidly and was constructed to some extent to follow the impact of the Euro on intra-Eurozone trade. In anticipation of the positive impacts on trade volume a common currency could bring to its members, a foreign firm has a stronger incentive to expand its production (or set up new facilities to start a production activity) in the host country in order to benefit form a boost in trade. Therefore, the creation of a CU tends to enhance FDI flows into the Euro zone. However, there has been, with some recent exceptions, a lack of attention to the CU's

[19] The size of the effect has had some effect on the increase in the literature as can be seen from by Glick and Rose (2002), Alesina et al. (2002), Micco et al. (2003), de Nardis and Vicarelli (2003), Anderson and Van Wincoop (2004) and de Nardis et al. (2008).

effect on FDI flows. Theoretical research on the effect of CUs on FDI seems to be emerging slowly (Neary, 2007). On the other hand, empirical research has recently emerged and has focused mostly on the effect of the euro on FDI flows into the Euro zone. The Gravity model has been used the most in this literature, for example see Buch et al. (2003), Aristotelous (2005), de Sousa and Lochard (2006,2011), Petroulas (2007), Schiavo (2007), Brouwer et al. (2008) and Jienwatcharamongkhol (2010) that all show that there is a positive and significant effect of the Euro on FDI. This seems to be a plausible finding since a currency union may promote trade among members via FDI flows. On the other hand, Flam and Nordström (2007), Dinga and Dingová (2011), Folfas (2012) and Kyrkilis et al. (2013), found that the Euro zone had no significant impact on FDI across the EU member countries.

However, few papers studied whether exchange rate volatility affects BFDI. In this context, CU has potential to affect FDI inflows through transformation of the volatility of the exchange rate and reduced transaction costs (Dinga and Dingová, 2011, 2012). The impacts of exchange rate risk on FDI are mixed. Firstly, Cushman (1988) and then Markusen (1995) found a positive link between exchange rate volatility and FDI. Whereas Zis (1989), Tavlas (2004), Dixit and Pindyck (1994), Wei and Choi (2002), Servén (2003), De Sousa and Lochard (2009), Petroulas (2007) and Schiavo (2007) found the link to be negative. So it is not clear as to whether reduced exchange rate volatility will impact FDI positively with the formation of the Euro zone. However, elimination of exchange rate risk and reducing the cost of the currency conversion by CU decreases transaction costs and leads to cost saving and this affects returns positively (Dinga and Dingová, 2011). So it is expected that CU affects FDI positively by decreasing transaction costs.

Following, these lines of research, Schiavo (2007) uses a Gravity model on a sample of OECD countries to analyse the effect of EMU on FDI flows over the period 1980-2001. Schiavo argues that the higher exchange rate volatility, the higher the probability that an investment opportunity be delayed. He suggests that the elimination of volatility stemming from a currency union "gives a non-negative impulse to cross-border investment". Moreover, adopting the same currency appears to do more than merely eliminate exchange rate volatility. Schiavo's OLS and Tobit estimation results indicate that EMU has resulted in larger FDI flows with the rest of the world. However, some care should be taken in interpreting these results due to the very short length of

time (1999-2001) for which the data on EMU is part of the sample.

Since the formation of the EMU analysis of the role of exchange rate uncertainty on FDI flows is supplemented by a formal CU and its effect on investment flows. The literature studying the link between the Euro and FDI finds a significant positive effect of the Euro on FDI. However, there is no agreement regarding the size of the effect. Therefore, the exact magnitude of the size of the impact of the Euro effect on FDI remains unclear.

Altogether, it can give an indication of whether CU creates a better environment for companies making long-term investment. One concern against floating currencies is that higher exchange rate variability creates uncertainty that discourages FDI so that fixing the exchange rate eliminates this risk. Thus encouraging FDI, as well as making companies cost calculations and pricing decisions easier. In the next section the link between exchange rate volatility and FDI will be considered further.

3.3.3 Financial variables and macroeconomic variables related to the FDI decision

This study aims to analyse the factors which affect FDI. An empirical study on FDI can be divided into two approaches. When asking why countries or sectors within a country receive more investment from abroad than others, some economists relate FDI variations over time to changes in macroeconomic factors that show a high degree of uncertainly, in particular exchange rates (Froot and Stein, 1991; and Blonigen, 1997). Moreover, there is a possible connection between FDI and exchange rate volatility, earlier studies often use industry-level (or even country level) data to test these hypotheses, while more recent research has had firm- and plant-level data available to match more appropriately the firm-level theory. Others explain FDI by using primary characteristics like factor-price differences, market size, and trade costs (Eaton and Tamura, 1994; Graham, 1997; Brainard, 1997). They apply a cross-section approach, although a few studies use panel data for their estimations (see, for example, Eaton and Tamura, 1994; Egger and Pfaffermayr, 2004).

3.3.3.1 Exchange rate volatility and FDI

Theoretically, the impact of exchange-rate volatility causes is ambiguous as to the impact on FDI. A decrease in the volatility of the exchange rate could favour vertical FDI insofar as companies fragment their production and locate their activities in various countries depending on international differences in factor prices. On the other hand, if foreign investment is a way to serve foreign markets, a decrease in exchange rate volatility could reduce horizontal FDI and increase trade as a substitute.

As we mentioned in the previous chapter in more detail, the evidence of the link between exchange rate volatility and FDI is quite mixed, this lack of consensus might be because the data and sample periods used in these studies are not the same and also a reflection on the complex nature of FDI. Due to this complexity, it may be reasonable to suggest that exchange rate volatility will have an ambiguous impact which is reflected in empirical and theoretical research. Alternatively, empirical models could yield mixed results due to model specification and data issues.

3.3.3.2 Other determinants of FDI

The question of the key roles financial variables and the macro-economy play in the FDI decision of companies is answered in this section. There is a considerable literature on the determinants of FDI which include both traditional and policy factors as the drivers. Traditional factors include market size, distance, factor proportions and political and economic stability. Policy and institutional factors include openness, product-market regulation and labour market arrangements. Demekas et al. (2005) found that gravity factors explain a large part of FDI inflows in the case of transition economies, including South Eastern European countries, but the policy environment also matters. Janicki and Wunnava (2004) showed that international trade could be the most important factor for explaining FDI in this region. Eaton and Tamura (1994) explained bilateral trade and FDI flows using a simple Gravity model and their results suggest for both the U.S. and Japan, that there is a large positive relationship between outward FDI and openness alike.

Political and economic instability are expected to drive FDI since they create uncertainty and Barrell et al. (2004) observe that this increases the risk related to FDI returns. Generally, it might be expected that FDI will possibly flow from home countries into host economies that are politically stable and have access to large

regional markets. Furthermore, the recent literature affirms that the policy environment does matter for FDI (Demekas et al., 2005 and 2007; Lipschitz et al., 2002; and Witkowska, 2007). A predictable policy environment that enhances macroeconomic stability, guarantees the rule of law and the enforcement of contracts, supports competitiveness, minimises distortions, and spurs private sector development, can be expected to encourage private, including foreign investment. Solomon (2011) analysed the impacts in attracting FDI of economic development, human capital, the quality of the economic and political environments and financial development in host countries. The system GMM method is applied to a panel of 111 countries over the period 1981-2005. The findings show that the level of these factors, significantly affect the relationship between growth and inward FDI. Pourshahabi et al. (2011) analysed the relationship between FDI, economic freedom and growth in OECD economies and it was indicated that market size, inflation and political stability positively affect FDI inflow while economic freedom had an insignificant positive effect on FDI inflow.

Regarding competitiveness indicator in the FDI Gravity model, as mentioned in Chapter 2, the relationship between labour cost and investment is clearer than other determinants, because this expresses a burden that investors have in terms of the legal obligations they have with respect to their employees. Bevan et al. (2004) and Agiomirgianakis et al. (2006) as has been common in the literature found a negative effect for labour cost on FDI. However, for example, Javorcik and Spatareanu (2005) found a positive and statistically significant impact, arguing that it may reflect the purchasing power of the population as measured by the wages for each country. The link between unit labour cost (ULC) and FDI has been explained in some detail in the previous chapter.

The issue of whether labour costs affect the investment decision in relation to the OECD countries is seen as a critical one and the subject of some debate. Konings and Janssens (1996), and Savary (1997) found labour costs to be a critical factor in the investment location decision especially for the OECD. Labour cost advantages were shown to be among the most important factors determining FDI along with overall profitability, stability and local market access.

Bellak et al. (2008) examine the determinants of net BFDI across selected Central and Eastern European Countries for the period of 1995–2003 focusing on labour costs.

They propose a labour cost measure, which is related to the location decisions of multinational firms. Using panel estimates of a Gravity model to empirically assess the effect of market-related and cost-related location factors, their findings suggest that higher ULC as well as higher total labour costs impact FDI negatively, whereas higher labour productivity affects FDI positively. While Mateev (2009) using panel data analysis have found that both gravity factors (distance, population and GDP) and non-gravity factors (labour costs, risk and corruption) can explain the FDI flows in transition economies for Central and South Eastern Europe. Mateev finds that with an increase in overall labour cost leading to a lower incentive for FDI in the host country.

Considerable attention has been paid to the FDI level in OECD economies, based on the widespread assumption that foreign investments are critical for economic restructuring and development of these countries. As a result, attracting FDI has become a prominent item on the government policy agenda, and research on the drivers of FDI has been expanding rapidly. This section presents a summary of the main results of this research.

Blonigen and Piger (2014) used Bayesian statistical techniques to choose from a large set of candidates those variables likely to be FDI determinants. The variables are traditional gravity variables: parent-country per capita GDP, cultural distance factors, relative labour cost, and regional trade agreements. Variables with little support for inclusion are openness, costs of the host country business, recipient country infrastructure (including credit markets), and recipient country institutions.

Cavallari and D'Addona (2012) analysed the role of country-specific sources of exchange rate or interest rate volatility in driving FDI activities. Depending on a dataset for BFDI flows between 24 OECD countries over the period 1985-2007, they found that nominal and real volatility has a significant impact on foreign investments. Output and volatility of the exchange rate matter in particular for the FDI decision and as to whether it relates to outflow in the first place. Interest rate volatility mainly affects the extent of foreign investment.

Katsaitis and Doulos (2009) analysed the FDI inflow determinants in EU–15, using a panel analysis over the period 1970–2005. Their results indicate that market size, agglomeration effects, GDP growth, unit labour cost, macroeconomic stability and level of institutional quality appear to be the main drivers of FDI inflows.

Using a Gravity model, De Sousa and Lochard (2006) tested the impact of the common currency on FDI flows and stocks. The estimated model controls for market size, transactions and production costs, the exchange rate, exchange rate volatility, skilled-labour endowments, and merger and acquisition drivers, using data from 22 OECD countries for the period 1982-2002. The main result is that common currency spurs on Euro and non-members FDI stocks inside the Euro zone. While De Sousa and Lochard (2011) analysed the impact of EMU on BFDI and using a Gravity model they found that EMU has increased BFDI stocks intra-EMU by about 30% since the launch of the single currency. Simiarity, Kilic et al. (2014) tested the effects of the EMU on inward FDI to the Euro zone from 16, G20 countries by analysing the relationship between real FDI inflows and real GDP growth rate, real GDP, inflation volatility, exchange rate volatility, distance, exchange rates of selected G20 countries in terms of euro over the period 1999-2012. They found that real GDP, the GDP growth rate and the exchange rate affected real FDI inflows positively. While FDI is negatively affected by inflation volatility, exchange rate volatility, distance affects real FDI inflows. So EMU and the EU contribute to the inflows of FDI by reducing exchange rate volatility, inflation volatility, distance and encouraging economic growth.

There appears to be little research on BFDI drivers after crises especially for the OECD. This chapter confirms that gravity factors predominate and outlines the other key determinants explaining BFDI stocks into the OECD.

3.4 Data description and sources

3.4.1 Dependent variable

A panel has been collected that considers BFDI from 14 high income OECD countries to 31 OECD countries (.see Appendix A3) with yearly data spanning the period 1995 to 2012.[20]

The dependent variable used here is the stock of BFDI divided by the GDP deflator home, which is among the most used measures of FDI in the literature. Some articles use the outward stocks of FDI as the dependent variable (e.g. Egger and Merlo,

[20] However, some observations are missing on the dependent and explanatory variables leaving a complete sample of 5820 country-year observations.

2007; Baltagi et al., 2007 and 2008; Stein and Daude, 2007; Cardamone and Scoppola, 2015).

Earlier studies of FDI often used flow data. While Stein and Daude (2007) suggest the use of stocks rather than flows, because they are interested in the level of activity of multinational enterprises; capital stock being a closer proxy to multilateral activity than investment flows. This compares with Head and Ries (2008), and Blonigen and Piger (2014) who pool inward and outward stocks of FDI in their analysis.

The FDI stock data will be the benchmark measure of FDI used in this chapter. A number of studies, for example, Carr et al. (2001), and Bergstrand and Egger (2007) have suggested the use of affiliate sales as the most suitable measure of actual multinational firm activity in a host country. This is due to FDI stock data being significantly affected by financial transactions of a firm not related to current productive activity. Unfortunately, affiliate sales data are not as widely available as FDI stock data.[21]

In the FDI literature this kind of analysis is usually conducted on bilateral data, but here to extend the sample one-way FDI stocks will be used for each country pair in the empirical specification. These are defined as outflows of FDI stocks, where an investment from country *i* to country *j* (FDI_{ij}) is seen as an outflow from the perspective of country *i*.

Egger (2001), Egger and Winner (2006), Baltagi et al. (2007), Egger and Merlo (2007), and Egger (2008) all specify the model in natural logarithms.[22] For this reason, Rose (2000) excluded observations when the dependent variable is zero. Although a simple correction to the ill-defined dependent variable, may lead to a serious selection bias, because the zero observations may convey critical information especially were zeros more prevalent with countries that are far apart.

In the trade literature, Eichengreen and Irwin (1995) deal with zero values by adding a unit value to the dependent variable. Adjusting the dependent variable using a fixed constant is a straightforward transformation to apply (McDonald, 2008 and

[21] Braconier et al. (2005) have graciously allowed us to use their most extensive database of cross-country affiliate sales.

[22] The data set used here includes a number of observations where the FDI stock is zero. However, a log stock specification is used extensively in the empirical trade literature, reduces the weight of very large country pairs and simplifies the interpretation of coefficients as elasticities.

Osborne, 2002) and the coefficients following the log transformation are still likely to represent elasticities. So $\log(1+FDI_{ij})$ well approximates $\log(FDI_{ij})$ as the transformed variable passes from a linear scale at small absolute values to a logarithmic scale as the dependent variable increase in value. Following Dinga and Dingová (2011), the dependent variable applied to FDI stocks is log(1+(FDI/GDP)) in equation (3.2).

3.4.2 Source and Measurements of Independent Variables

The empirical results are mixed and contentious debate in the literature persists over the factors determining FDI. In this section both the data sources and the measurement of the driving variables are considered.

Adopting Gravity models developed from the literature, the key determinants in the Gravity model of BFDI stock are market size, distance.

1-) The first determinant based on the Gravity model is the market size of home and host countries most commonly measured by real GDP. Charkrabarti (2001) indicates that a large market may be needed for efficient utilization of resources and exploitation of economies of scale so as the market grows FDI will increase with further expansion. A variable representing the market size has been used in nearly all empirical studies of FDI. So a large home country in terms of GDP will generate large FDI and more FDI should be received into a large host country market as measured by GDP. Therefore, for both variables we expect a positively signed coefficient. Buch et al. (2003) and Limao and Venables (2001) indicate that FDI targeting the domestic service market (market-seeking FDI) would be affected positively by real GDP.

2-) The next critical Gravity variable is bilateral distance between capital cities of home and host countries. This is a primary measure used by Portes and Rey (2005), Stone and Jeon (1999), and Egger and Pfaffermayr (2004a, 2004b) to help explain Gravity as it is seen to act as a straightforward proxy for transportation and information costs.

However, the expected sign of this variable crucially hinges on the motive for FDI that is market or efficiency-seeking. In the former case, FDI substitutes for exports and so a larger bilateral distance is expected to increase FDI. In the latter case, efficiency-seeking FDI is seen as generating exports from the host to the home country and a negative relationship is likely to arise.

The market-seeking also occurs when geographically separated countries are institutionally and culturally distant as this relates distance to increased investment and monitoring costs. For example Buch et al. (2004, 2005), and Buch and Lipponer (2004) suggest it discourages FDI due to the lack of market know-how, higher information and communication costs and differences in culture and institutions. Moreover, Kleinert and Toubal (2010) suggest that market-seeking foreign affiliations are frequently based on the import of intermediary goods by the parent company. So not only is sign of the coefficient on distance ambiguous a priori (Carr et al., 2001), but it may not possible to conclude from the sign an underlying motive for FDI.

For this reason as a part of the Gravity specification, further dummy variables are applied. The first is based on language similarities between the home and host countries in the sample (based on the fact that two countries share a common official language). The other dummy variable examines the common border between both countries.

3-) A bilateral trade proxy is included even though as Brainard (1997), and Grosse and Trevino (1996) suggest the effect of trade on FDI flow in the existing research is inconclusive. However, a number of authors, Altomonte (1998), Bevan and Estrin (2004), Bos and De Laar (2004), and Carstensen and Toubal (2004) have indicated that trade limitations have had significant effect on the size of FDI. Therefore, the bilateral export variable is used to capture whether trade complements FDI activity and in this case the coefficient on trade will be expected to be positive. However, Resmini (2000) has suggested trade should be expected to have a positive relation to FDI flows, as the greater openness of the economy provides greater support for foreign investment.

Again the sign of the measure of trade may be ambiguous as it relates to the purpose. So investment for local production and exporting is expected to be positive and Pain (1993), Ferris and Thompson (1994), Wong (2005), Addison and Heshmati (2003), Janicki and Wunnava (2004) and Ramirez (2006) show that the more open the economy, the larger the FDI inflows. While when trade is a substitute for FDI activity, then the coefficient is expected to be negative.

4-) The investment climate is incorporated in the model by the free economics indexes of home and host countries. The 'Free economics index'[23] is a measure by which the quality of the economic environment is proxied. The index broadly captures the quality of the economic environment. It is derived from the six governance indicators that include measures of government size, taxes, trade openness, legal structure and protection of property rights, the growth of money supply, inflation as well as regulations on the credit market, labour market and business. It takes values in the range 0 to 100, with 100 being the highest level of economic freedom. This has been one of the FDI determinants identified by Beach and Kane (2008), and Beheshtitabar and Irgaliyev (2008). It is argued that countries that enjoy higher levels of economic freedom have greater factor efficiency and higher rates of growth. Moreover, free economies are supposed to attract more investment (Gwartney et al., 2008). As British Petrolium (BP) found with investing in Russia expatriation of funds can often with fraught with complications when the system is not transparent and prone to political interference. Bengoa and Sanchez-Robles (2003), Ferragina and Pastore (2006), Pourshahabi et al. (2011), Pearson et al. (2012), and Ajide and Eregha (2014) have established a positive connection.

5-) Global Financial Crisis and Asian Crisis are constructed here as dummy variables that measure the presence of the crisis at time t, when the dummy variable takes the value 1 for the crisis in a year t and 0 otherwise. Additionally, a systemic banking crisis; dummy variable that equals 1 when host country suffers from systemic banking crisis in a year t and 0 otherwise; is included.

The impact of systemic failure in banking is collected using the Laeven and Valencia (2013) financial crises database. To test for the impact of systemic banking crises on cross-border FDI stocks, we use Laeven and Valencia's (2013) identification of the timing and scale of systemic banking crises. Laeven and Valencia (2013) explain that not all banking crises are systemic to the same degree. In particular, 24 countries in our sample experienced borderline systemic banking crises (see Appendix B3).

[23] Economic freedom has been defined as 'the absence of government coercion or constraint on the production, distribution, or consumption of goods and services beyond the extent necessary for citizens to protect and maintain liberty itself'. This index is an indicator of the quality of the economic environment. It not only captures the economic policy of the government, but also the legal soundness of the economy and macroeconomic stability.

6-) The single currency is measured by a dummy that takes the value zero when a home country or host country is not in the Euro zone and 1 when the both countries enter the Euro zone. It is expected that this variable has a positive effect on FDI. This study tries to contribute to the debate as to whether the introduction of the Euro has led to greater integration in terms of financial trade. Bilateral investments constitute a starting point for this analysis because they possess attributes of both commercial and financial transactions. Hence, introducing a measure of exchange rate uncertainty in the gravity equation may allow us to distinguish between the impacts of the common currency. This compares with the often stated opinion that common currency just captures the removal of exchange rate risk as compared with a reduction in transaction costs.

7-) Nominal exchange rate volatility is computed by experimentation with measures of volatility based on estimation of a model of the variance. Nominal volatility in this case is expected to capture the role of country-specific currency risk. As before, exchange rate volatility can affect FDI in opposing directions depending whether it originates in the multinational's native or host country.

There is no consensus as to which measure of volatility is most appropriate. When the investment decision is real then it is anticipated that this ought to relate to the impact of the real exchange rate as nominal effects are often discounted. However, volatility derives from the behaviour of prices (Engle, 1982) and this suggests nominal exchange rate volatility may also be appropriate. It may be felt that this may follow from shocks or movements in monetary policy driven by interest rate changes. However, jump behaviour in the nominal exchange rate arises in Dornbusch (1976) as a result of price stickiness relative to fast moving asset prices.

8-) A variety of location variables have been considered in empirical research elaborating on the drivers of FDI. To cope with the claim that our findings may be driven by an omitted variable bias, we include an additional variable that appears to be an important determinant of FDI stocks. As a measure of competition, unit labour cost is seen by many authors to be the most relevant measure for location related decision for FDI.

ULC is defined here as the costs of the labour input that is needed to produce one unit of output. They are calculated either in nominal terms or in real terms and are expressed either in domestic currency or in a common currency. Given this definition, one has to choose carefully the appropriate type of unit labour costs. For our objective, which is explaining the location choice of foreign investment between different host countries, it is demonstrated that the following criteria are critical in the choice of the appropriate ULC definition. First, since the location choice is international rather than on a national level (e.g. between regions of the same country), ULC should be expressed in a common currency. Here the US Dollar is the common currency. Second, expressing ULC in a common currency in real terms relates to the actual location choice of a foreign investor to compare labour costs of two locations. For real value added, the comparison needs to be made in a common currency, as the investor compares the absolute amount of employee wage costs. Hence, assuming two locations, even if location 1 has lower ULC than location 2, when expressed in local currencies, this could look different when transferred to a common currency. Currency appreciations (and vice versa for depreciations) may thus increase (decrease) ULC. It is important to note that the decision of the foreign investor on the basis of ULC relates to both, the efficiency-related FDI (also vertical) and the market-related FDI (also horizontal). If ULC is lower in a given location (country 1) where the market is, then the market will be predominantly supported by domestic production. When there is another location (country 2) with lower ULC in a common currency, country 1 is likely to receive exports from country 2.

The impact of bilateral unit labour costs on BFDI is also considered by adding to the Gravity model. Unit labour costs are taken from the OECD, following Bénassy-Quéré et al. (2005), bilateral unit labour costs is derived as the natural logarithm difference between labour cost in host country and labour cost in home country. If foreign investors are seeking low labour costs, the availability of cheap labour will be a critical factor affecting FDI. Thus, it is expected to observe a negative coefficient for the ULC (e.g., countries with lower labour costs would attract more FDI), since an increase in this indicator means a decrease in profitability and hence a less attractive determinant for investors.

All of the above factors must be taken into account when investigating the BFDI determinants in the OECD countries. To summarise the discussion of the variables, Table (3.1) below displays the variables that are considered here and their definitions.

Table (3.1) Variables definitions and data sources.

Variables	Unit	Source
$y_{i,j,t}$ =Log ($FDI_{i,j,t}$/ GDP $Deflator_{i,t}$)	is the stock measure of bilateral outflow from the home country (i) to the host country (j) in year t, with FDI in current in US$ deflated using the home country's GDP deflator.	(OECD)
$EXV_{i,j,t}$	A measure of exchange rate volatility predicted using equations (3.1) and (3.1a) below, and derived from daily percentage changes in the nominal bilateral exchange rate.	IMF, International Financial Statistics
$EXP_{i,j,t}$	Bilateral exports of goods are just used (As exports of service data are not available for most of the countries in the sample).	(OECD)
Real $GDP_{i,t}$, Real $GDP_{j,t}$	At constant 2005 prices and converted to US$s.	(OECD)
$DIS_{i,j,t}$	Measure in geographical distance in kilometres to proxy transportation costs	www.cepii.fr
$Free_{i,t}$. $Free_{j,t}$	An index of economic freedom that refers as to whether there is any restriction on trade in a country (Busse and Hefeker, 2007).	Heritage Foundation 2015 www.heritage.org
FC_t	Dummy variable for Global Financial Crisis (2008)[24] and Asian crisis (1997-1998) that equals 1 during crisis years and 0 otherwise.	
$SYS_{j,t}$	Dummy variable that equals 1 when host country suffers from systemic banking crisis in year T, otherwise 0	(see Appendix B3)
$CU_{i,j,t}$	Dummy variable that equals 1 if countries i and j use the same currency (euro) at time t and 0 otherwise.	(see Appendix C3)
$ULC_{j,i,t}$	labour costs in the host country relative to the home country, Exchange Rate Adjusted ULC, Index OECD base year (2010=100)	(OECD)
$Lang_{i,j}$	Dummy variable that equals 1 when both countries share a common official language	www.cepii.fr
$Land_{i,j}$	Dummy variable that equals 1 when both countries share a common land border	World Factbook
The dependent variable, real BFDI stock, is real FDI outflows from 14 High income OECD to all the OECD countries. The nominal FDI outflows to the OECD are converted to real value by dividing GDP deflator.		

**Annual data over the period 1995-2012

[24] Complex financial crises such as arose in 2008 may not be easy to capture through a single variable, but the financial crisis that started with the failure or Lehman Brothers in the US was amplified across the World so it had a powerful negative effect on the OECD countries.

3.5 Methodology

An important objective of this research is to show the nature of the relation between exchange rate volatility and BFDI stock from 14 high income OECD countries to all the OECD countries. A static Gravity model is applied to a panel to show the impact of the volatility of the exchange rate on BFDI, based on a number of regression specifications. This regression is shown to have serially correlated errors, and hence, we would almost certainly need to include at least a lagged dependent variable in the regression to capture this. As there are fewer than 30 time series observations, the autoregressive coefficient is likely to be biased downwards when OLS is used (Nickell, 1981). Hence, we need to use a procedure that allows us to estimate unbiased coefficients whilst retaining long run information. In addition to overcome possible endogeneity in the regressors, the model is estimated using what has been termed a systems GMM method (Greene, 2011). Once volatility is observed, then it makes little sense to assume that the variance or standard deviation remain fixed over the sample. A range of possible methods arise, updating a simple variance estimate on an annual basis, exponentially weighted moving averages (WMA) and the various models that arise from the ARCH family of models and is discussed for the purposes of computing time varying risk in Hull (2014). As the view is that volatility is time varying then the latter two approaches are followed in this Chapter.[25]

3.5.1 Measuring Exchange Rate Volatility

The effects of exchange rate volatility on FDI have been discussed in the literature for some time, but there is currently little agreement on the direction of these effects. The existing theoretical literature is mainly focused on the consequences of volatility in the exchange rate on different time horizons in relation to FDI. There are several ways to extract indicators of volatility, and early studies tended to use unconditional estimates, whilst later studies have tended to use techniques such as GARCH to estimate the conditional variance or unexpected component in exchange rate changes. The volatility measure of the nominal exchange rate is constructed by first taking the log difference of daily exchange rates calculated from data taken from the IFS

[25] All estimations were undertaken in STATA 13.0

database.[26]

Byrne and Davis (2003) model volatility by means of a GARCH model and find that it is the transitory rather than the permanent component of exchange rate uncertainty which adversely affects investment. Here the intention is to find a coherent measure of volatility that is intended to capture uncertainty in a similar manner for the different economies and to capture this key feature of the exchange rate. Carruth et al. (2000) survey different volatility specifications and suggest that these results are not greatly affected by the particular choice of the scholar. So in this study we use the same specification as in the previous chapter with the dynamic measure of the volatility (σ_{it}) conditioned on the regression errors (u_{it}) as explained by the GARCH(1,1) process:

$$\sigma_{it}^2 = \omega_i + \alpha_i u_{it-1}^2 + \beta_i \sigma_{it-1}^2. \qquad (3.1)$$

Firstly, the daily conditional variances are used to construct an indicator of annual volatility**.** A simple weighted moving average model (3.1a) is used as the variance estimate when it is not possible to identify the ARCH/GARCH specification:

$$\sigma_{it}^2 = \sum_{j=1}^{p} u_{it-j}^2 \qquad (3.1a)$$

These are based on blocks of p=20 past observations on the past errors to create a rolling moving average. The details as to the methods applied to estimate the volatility for each bilateral pair of currencies are given below in Table (3.2) for all of the bilateral nominal GARCH and the moving averages. In 20 out of 420 cases the WMA process is used, and in a relatively small number of cases the GARCH(1,2) specification is applied, but when not otherwise stated the model of variance is GARCH(1,1).

[26] Calculation of the exchange rate for Euro area countries: firstly, due to differences in national conventions for rounding up the data all conversions between the national currencies had to be carried out using data that impoeses a binding cross arbitrage condition via the Euro that implies a simple specification for the underlying exchange rates specifications as following random walks (Smith and Hunter, 1985). Secondly, the original conversion rates were determined by the Council of the European Union based on a recommendation from the European Commission to apply market rates as of the 31st December 1998 (see Appendix D3).

Table (3.2) Measure of Bilateral Exchange rate volatility

	Austria	Belgium	Canada	France	Germany	Italy	Japan	Korea, Rep.	Netherlands	Spain	Sweden	Switzerland	United Kingdom	United States
Australia	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Austria	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	**WMA**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Belgium	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Canada	G (1.1)	G (1.1)	-	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Czech Republic	G (1.1)	**WMA**	G (1.1)	**G(1.2)**	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	**G(1.2)**	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Denmark	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Estonia	G (1.1)	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	**WMA**	G (1.1)	**WMA**	G (1.1)
Finland	G (1.1)	G (1.1)	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
France	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Germany	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Greece	G (1.1)	**WMA**	**WMA**	**WMA**	G (1.1)	G (1.1)	**WMA**	G (1.1)	**WMA**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Hungary	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Ireland	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Israel	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Italy	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	**WMA**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Japan	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Korea, Rep.	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Mexico	**WMA**	**WMA**	**G(1.2)**	**WMA**	G (1.1)	**G(1.2)**	**G(1.2)**	G (1.1)	**G(1.2)**	**WMA**	**WMA**	**WMA**	**WMA**	G (1.1)
Netherlands	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
New Zealand	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	**G(1.2)**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Norway	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Poland	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Portugal	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Slovak Republic	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Slovenia	G (1.1)	G (1.1)	**WMA**	G (1.1)	G (1.1)	G (1.1)	**WMA**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Spain	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)	G (1.1)
Sweden	G (1.1)	**WMA**	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)	G (1.1)
Switzerland	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	**G(1.2)**	G (1.1)	G (1.1)	-	G (1.1)	G (1.1)
Turkey	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)
United Kingdom	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-	G (1.1)
United States	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	G (1.1)	-

NOTE : G(1.1): GARCH(1.1), G(1.2): GARCH (1.2), WMA: Weighted Moving Average

3.5.2 The standard Gravity model on BFDI stocks

We start by discussing a simple gravity equation which is an empirical model that originated in the trade literature. It has also been used recently to estimate the determinants of BFDI stocks and flows (see, for example, Stein and Daude, 2007; Talamo, 2007; Abbott and De Vita, 2008; Mahmoud, 2011; Paniagua, 2013; among others). Its main implication is that the gross flow of trade (in this chapter BFDI stocks) between two countries should depend inversely on the distance between both countries and depend positively on their economic size where the latter is generally measured by the two countries' real GDP. All econometric work will follow from the following specification for models using data observed at the annual frequency:

$$y_{i,j,t} = a + b_1 \ln EXP_{i,j,t} + b_2 \ln GDP_{j,t} + b_3 \ln GDP_{i,t} + b_4 \ln DIS_{i,j,t} + b_5 EXV_{i,j,t} + b_6 EcoFree_{i,t} + b_7 EcoFree_{j,t} + b_8 \ln ULC_{j,i,t} + \varepsilon_{i,j,t}. \quad (3.2)$$

Where $y_{i,j,t}$ in logarithms is the stock measure of bilateral outflow from the home country (i) to the host country (j) in year t, with FDI in current dollars deflated using the home country's GDP deflator (to deal with missing data we use the log of one plus the ratio of FDI to GDP deflator). $EXV_{i,j,t}$ is the measure of exchange rate volatility derived from a GARCH model with the exception of the 20 cases pointed out in the Table (3.2). $GDP_{i,t}$ is real GDP for the home country and $GDP_{j,t}$ real GDP for the host country, $EXP_{i,j,t}$ is bilateral exports from the home to host country. $EcoFree_{i,t}$ is free economic index for the home country and $EcoFree_{j,t}$ for the host country and $DIS_{i,j,t}$ is the log of geographic distance. $ULC_{j,i,t}$ is labour costs in the host country relative to the home country. The errors in (3.2) $\varepsilon_{i,j,t}$ are usually assumed to be identically and independently distributed (IID) mean zero and constant variance $\sigma^2_{i,j,t}$.

A number of factors commonly used in the literature are used to capture aspects of common culture and stronger ties through language, as well as a number of other possible determinants of bilateral stock patterns. In order to identify the parameters affecting the BFDI stock over the crises, Gil-Pareja et al. (2013) is followed by adding dummy variables to capture the impact of financial distress:

$$y_{i,j,t} = a + b_1 \ln EXP_{i,j,t} + b_2 \ln GDP_{j,t} + b_3 \ln GDP_{i,t} + b_4 \ln DIS_{i,j,t} + b_5 EXV_{i,j,t} + b_6 EcoFree_{i,t} + b_7 EcoFree_{j,t} + b_8 \ln ULC_{j,i,t} + b_9 Lang_{i,j} + b_{10} CU_{i,j,t} + b_{11} land_{i,j} + b_{12} FC_t + b_{13} SYS_{j,t} + \varepsilon_{i,j,t}. \quad (3.3)$$

The dummy variables to capture these further factors are: $Lang_{i,j}$ defined as the effect of a common official language, $Land_{i,j}$ a common land border, $CU_{i,j,t}$ the country specific impact of the introduction of the Euro (Dummy variable that equals 1 if countries i and j use the Euro currency) and $SYS_{j,t}$ systemic banking crisis expressed as a dummy variable when the host country suffers from a systemic banking crisis in year T. We also introduce financial crisis dummies that distinguish between the global crisis, and Asian crisis (FC_t).

Acceding to the assumption that the country's specific fixed effect is a random variable which is not correlated with other independent variables, random effects estimates are consistent and effective. So in this study the gravity equation is estimated using panel data by estimating a "random-effects" (RE) model to capture any heterogeneity not captured in the specification of the model. The RE approach can also accommodate a country-pair of fixed effect, while also allowing for some time-invariant regressors. However, RE estimates are typically more efficient as they take into account, the cross time and the cross-transversal dimensions of the data; treating intercepts as random variables through common member countries. In this case, it can provide efficient estimates, particularly when there is little variation in the time series since they use information both "between" and "within" the panels. The consistency of the OLS estimator crucially relies on the individual random effects and any of the indicators and/or regressors not being correlated with the disturbances (Greene, 2011).

On the other hand, the fixed effect (FE) model suffers from three shortcomings. First, it reduces the degrees of freedom, therefore, decreasing the power of statistical testing. Second, variables that present little or no variation, within groups cannot be estimated. Third, The FE approaches are not sufficient to determine invariant variables in time, such as distance that is a key component of the Gravity model (Cheng and Wall, 2005). The choice between the two formulations can be decided empirically (FE or RE) using the test devised by Hausman (1978), the null hypothesis for Hausman test is that the preferred model is the random effects formulation versus the fixed effects specification (see Greene, 2011, chapter 9). It tests whether the unique errors ($\varepsilon_{i,j,t}$) are

correlated with the regressors, the null hypothesis is they are not.[27]

3.5.3 Econometric specification for the equations

The discussion above concerns the static version of the model that is in widespread use, although some of the issues also apply to dynamic equations. It is highly probable that past bilateral stocks of FDI impact current bilateral FDI stocks. Therefore, a dynamic extension to equation (3.3) will be used that incorporates a lagged dependent variable.

In general, there is a well known bias problem in the estimation of an AR(1) term from a regression estimator. This bias is removed as the sample size increases, but here T=18 and N=420 or there is little capacity for T to increase at the same rate as N. The differenced regression defines a first order approximation to a linear equation so when the model is well formulated and the estimates consistent the betas from this equation should resemble those of the form in levels. However, the differencing may remove some of the time invariant effects that may be considered important for the Gravity model.

As the panel includes a lot of countries of varied characteristics, there is the need to control for the unobserved country specific terms as they could be correlated with any of the explanatory variables leading to biased estimates. When the instruments are well defined, GMM should capture the impact of the endogeneity that may arise, due to concerns with of country-specific characteristics, reverse causation, omitted variable and measurement error.

The Systems GMM (SYS-GMM) estimator of Blundell and Bond (1998) is particularly useful for panel data with a short time series dimension, especially when they are persistent as is common with many datasets used in relation to FDI data. FDI is primarily a financial transaction, but as is observed from the discussion of Mergers and Acquisitions (M&A) in the review of the literature is used to purchase physical assets.

[27] Unfortunately, in this case, a Hausman specification test may not be particularly helpful. Many time-invariant factors are significant and one cannot distinguish whether the observed fixed-effects correlation with the error term of the within estimator is due to factors omitted in the within estimation. More specifically, distance, common official language, etc. This is compared with possible random-effects or other truly unobserved factors. As the study is drawn to explain the high income countries behaviour the sample is not drawn at random from a larger population so there may be a sample selection problem and this could call into question the application of the random-effects estimations. Alternatively, selecting such countries may form an appropriate grouping for pooling the data. For further discussion of these issues see Baltagi (2001) and Wooldridge (2002)

The irreversible form of much of this investment explains why the time series is likely to be persistent over time. Physical investment is best seen as a real asset and unlike stock prices that aggregate to the market valuation of the same investment in M&A form of FDI are observably a less volatile form of foreign capital flows.[28] This may also help to explain the persistence and smooth nature of these series as significant physical investment in plant and machinery has a relatively high sunk cost. Kahouli and Maktouf (2015) suggest that customers of the home country become used to the product that comes from this investment generating 'the formation of the habits'. Eichengreen and Irwin (1998) saw that it was very likely that the bilateral commercial flows between home and host countries are likely to trend upwards over time at the aggregate level and by the positive feedback of past FDI onto current FDI.

As proposed by Arellano and Bond (1991), the moment restrictions exploited by the standard linear first-differenced GMM estimator entails the use of lagged instruments for the equations in first-differences. This yields a consistent estimator of the parameters when N approaches infinity and T is fixed. However, there are shortcomings with the first-differenced estimator. While Blundell and Bond (1998), Alonso-Borrego and Arellano (1999) and Blundell et al. (2001) indicate that if the series are highly persistent or if the variance of the individual specific impact is largely relevant to the residual variance of the error term, then the lagged levels may make weak instruments for the regression equation in differences.[29] Instrument weakness, in turn, impacts the asymptotic and small-sample performance of the first-differenced GMM estimator. Asymptotically, the variance of the coefficients increases while, in small samples, instrument weakness could produce biased estimates (Wooldridge, 2002). To overcome the imprecision and potential bias associated with the standard GMM estimator, the SYS-GMM model of Arellano and Bover (1995) and Blundell and Bond (1998) is estimated.

The fundamental idea behind the systems GMM estimator is to simultaneously estimate a system of two equations: one in levels and the other one in first-differences (Greene, 2011). Accordingly, the lagged levels are used to instrument first-differenced

[28] For instance, Sarno and Taylor (1999) find that FDI is less volatile than portfolio investment flows; Levchenko and Mauro (2007) indicate that FDI is the most stable form of cross-border finance.

[29] Weak instruments are uncorrelated with the error term but only weakly correlated with the endogenous variable. The weak instrument problem in the case of the first differenced GMM estimator usually occurs when time series are persistent so the AR(1) coefficient is close to one, and/or the relative variance of the fixed effects increases with the sample.

equation, while the lagged first-differenced values are used to instrument the equation in levels. Once the instrument matrix is constructed, the two-step estimator is calculated. The two-step GMM estimator is asymptotically more efficient than the one-step estimator and relaxes the assumption of homoscedasticity in the error terms (Arellano and Bond, 1991; and Blundell and Bond, 1998). However, because of its dependence on the estimated residuals, the two-step GMM estimator could impose a sharp downward bias on the estimated standard errors, specifically in small samples (see Bond, 2002; Windmeijer, 2005).[30]

Two conditions need to be met to ensure the validity of the SYS-GMM estimator (Roodman, 2009). First, based on the validity of the levels specification of the model, the first-differenced residuals should exhibit negative and significant first-order autocorrelation as this model will normally be over-differenced, but there should be no second order autocorrelation. So it is important to test for evidence of first and second order serial correlation in the error using the statistic developed by Arellano and Bond (1991) as an extension to the usual LM test. Failure to reject the null hypothesis of no serial correlation in the first-differenced disturbances at an order greater than one indicates that the disturbances are serially correlated, which renders the GMM estimator inconsistent (Arellano and Bond, 1991; and Roodman, 2009).

Second, the instruments should be uncorrelated with the error term. This condition can be tested using the Hansen (1982) J-test of over-identifying restrictions, which evaluates the joint validity of the instruments. This test statistic is robust to problems of heteroskedasticity and autocorrelation when compared with test used to determine instrument validity by Sargan (1964).[31] Under the null hypothesis that the instruments and further moment conditions are valid, there is no correlation between the instruments and the error term. With further instruments as often occurs automatically with GMM, then any further instrument conditions should not inflate the test statistic and as a result, the additional instruments/moment conditions are valid. In terms of instrument validity for these extra variables, they ought not to be correlated with the error term. An issue of concern in the GMM literature is the extent to which instruments proliferate.

[30] The standard errors presented are robust to heteroscedasticity and first order serial correlation. However, The literature on whether it is necessary in generated regressors to correct standard error biases induced by generated variables is not conclusive (see for example Liang and Zeger (1986); Hu and Lachin (2001); Souleles (2004) and Hunter and Wu (2014)).

[31] The J-statistic, which is the minimized value of the two-step GMM criterion function, has an asymptotic $\chi 2$ distribution (Arellano and Bond, 1991; and Greene, 2011) where the number of degrees of freedom equals the number of over-identifying restrictions. If there as many moment conditions as endogenous variables then the IV/GMM criterion is zero and the coefficients of the model are exactly identified.

The random effects formulation is not acceptable when the specification is not valid as a result of serial correlation, for this reason, the test for autocorrelation in random-effect models derived by Wooldridge (2002)[32] is applied, this test can be applied under general conditions and is easier to implement. Furthermore, Drukker (2003) based on Monte Carlo simulation finds that the Wooldridge' test has good size and power properties in reasonably large samples.

3.6 Empirical Findings

3.6.1 The standard Gravity model

The empirical results related to the Gravity model are summarised in Table (3.3). The Gravity model is viewed as an important and effective tool for explaining bivariate trade and FDI relations. The use of this model often involves a huge number of observations as even with a relatively small number of countries there may be a substantial number of country pairs and this is likely to imply more robust results (Kahouli et al., 2014). Robust inference should follow from the application of standard errors that arise from Huber/White variance-covariance matrix.

The statistical results from the Gravity model are derived from the random effects panel data estimator to explain the behaviour of BFDI stock from 14 high income OECD countries to host countries drawn from all the OECD countries. To this end, several model specifications are developed, with and without financial crises dummies, capturing the impact of exchange rate volatility and the timing of the crises.

The estimates of six models are summarised in Table (3.3). First of all the traditional Gravity model is presented in column (1), and then to that model are added the crises dummy variables, in column (2) for systemic banking crisis. In column (3, 4 and 5), the dummies for the Asian and global crisis are added, and lastly both crises (global and Asian) dummies in column (6). As systemic banking crisis and global crisis are often related or overlapping, the global crisis dummy is excluded from the model in column (2) to show the effect of the systemic banking crisis. If these results have some meaning, then all the banking crisis variables have a negative impact on BFDI for the twenty-four countries across the panel.

[32] The test for serial correlation in the idiosyncratic errors of a linear panel-data model is formed under the null of no serial.

Table (3.3) Results for Gravity models Estimated using RE, for BFDI outflow.

Independent Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)
$LnGDP_{i,t}$	0.8525***	0.8532***	0.8113***	0.8122***	0.8502***	0.8069***
	(0.0984)	(0.0984)	(0.0972)	(0.0971)	(0.0986)	(0.0971)
$LnGDP_{j,t}$	0.8407***	0.8349***	0.8155***	0.8164***	0.8343***	0.8075***
	(0.0987)	(0.0981)	(0.0977)	(0.0976)	(0.0985)	(0.0972)
$LnEXP_{i,j,t}$	0.5471***	0.5524***	0.5564***	0.5557***	0.5598***	0.5690***
	(0.0785)	(0.0776)	(0.0781)	(0.0781)	(0.0788)	(0.0784)
$EXV_{i,j,t}$	-4.4018**	-3.8035**	-4.1928**	-4.1805**	-4.1955**	-3.9967**
	(1.8760)	(1.9269)	(1.8226)	(1.8276)	(1.8235)	(1.7740)
$Free_{i,t}$	0.0282***	0.0292***	0.0242***	0.0242***	0.0295***	0.0256***
	(0.0067)	(0.0067)	(0.0069)	(0.0069)	(0.0067)	(0.0069)
$Free_{j,t}$	0.0297***	0.0304***	0.0271***	0.0272***	0.0300***	0.0275***
	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)
$LnDIS_{i,j}$	-0.7821***	-0.7822***	-0.7590***	-0.7599***	-0.7778***	-0.7537***
	(0.1061)	(0.1057)	(0.1055)	(0.1055)	(0.1062)	(0.1055)
$Land_{i,j}$	-0.9611***	-0.9620***	-0.9420***	-0.9421***	-0.9735***	-0.9514***
	(0.2253)	(0.2252)	(0.2212)	(0.2212)	(0.2261)	(0.2215)
$Lang_{i,j}$	0.8402***	0.8322***	0.8709***	0.8704***	0.8305***	0.8608***
	(0.1935)	(0.1936)	(0.1912)	(0.1912)	(0.1944)	(0.1917)
$CU_{i,j,t}$	0.1707*	0.1750*	0.1321	0.1321	0.1662*	0.1284
	(0.0890)	(0.0895)	(0.0915)	(0.0915)	(0.0894)	(0.0918)
$LnUCL_{j,i,t}$	-0.2430*	-0.2648**	-0.2396*	-0.2399*	-0.2489*	-0.2456*
	(0.1304)	(0.1293)	(0.1307)	(0.1307)	(0.1307)	(0.1310)
$SYS_{j,t}$		-0.1980***				
		(0.0373)				
FC_{1997}			-0.1816***			-0.1797***
			(0.0400)			(0.0400)
FC_{1998}			-0.1202***			-0.1187***
			(0.0347)			(0.0347)
$FC_{1997/1998}$				-0.1502***		
				(0.0341)		
FC_{2008}					-0.0965***	-0.0928***
					(0.0247)	(0.0246)
Constant	-39.0232***	-39.1169***	-37.1166***	-37.1513***	-39.2099***	-37.2160***
	(3.2026)	(3.2016)	(3.1228)	(3.1226)	(3.1996)	(3.1058)
Observation Number	5671	5671	5671	5671	5671	5671
Country pairs	397	397	397	397	397	397
R^2	0.6715	0.6726	0.6717	0.6717	0.6721	0.6725
R^2 -within	0.4903	0.4928	0.4920	0.4918	0.4913	0.4928
R^2 - between	0.6854	0.6863	0.6854	0.6854	0.6859	0.6861
F(1, 394)	137.888	138.446	136.899	137.094	134.279	133.276
(p-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

NOTE::For each independent variable, the first row shows the coefficient and the second row the robust standard error.
White-type robust standard errors are given in parenthesis. F(1,394) is the Wooldridge (2002) test for autocorrelation in panel data.
***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.

In terms of the literature, most of the estimated parameters have their expected signs with a sensible economic interpretation. Assuming the standard errors are valid, they are also significant and do not seem to be sensitive to changes in the model specifications. In this chapter the interest is on the impact of exchange rate volatility on BFDI and this coefficient is negative and not subject to great variation. All in all, the results are quite consistent with the findings of the literature that market size, bilateral export and macroeconomic stability are important determinants of BFDI outflow.

The Wooldridge test for first order serial correlation is significant at the 1% for all of the models presented in Table (3.3) implying that it is not possible to reject this hypothesis so serial correlation derives from the equation error or the idiosyncratic component and showing the error is not well behaved. This also implies that these results cannot be relied on to provide a short-run explanation of BFDI. The only possible interpretation supposing the coefficient estimates are super consistent would follow from cointegration. However, any conclusions must be made with care as this does not apply to stationary variables that are endogenous and it is usual when there is a considerable cross section dimension in the panel case to suggest an IV approach even in the context of cointegration (Greene, 2011).

A further conclusion that might be drawn from the scale of the Wooldridge test statistic is that there is a lot of inertia in the stock data, and that at the very least a lagged dependent variable is required to correct for this. Once a lagged dependent variable is included, then the conventional interpretation of the OLS results is called into question. This emphasises the requirement to control for endogeneity in the estimation that is best undertaken applying GMM to a dynamic panel model as the time frame is short. Estimating a short-run model by random effects would produce biased estimates (see, for example, Nickell, 1981), because of the correlation between the autoregressive term and the estimated residuals.

3.6.2 Empirical findings for models estimated by GMM

As mentioned above, with a relatively small sample when the model is dynamic and there are some persistent explanatory variables, estimation is likely to be inefficient and biased. Since OLS and random-effects estimators yield biased and inconsistent estimates with a dynamic panel specification, the Arellano and Bond (1991) estimator may be employed. However, The gravity equations only employing the differenced

instruments (Arellano and Bond, 1991) is likely not to perform well as evidenced for BFDI by Egger (2001), Egger and Merlo (2012), and Egger et al. (2009) among others. To make equation (3.3) dynamic, we propose adding a lagged endogenous variable. The simplest explanation of this when the dynamic is persistent implies there is hysteresis in the FDI. Based on the discussion above it makes sense to estimate the dynamic model using the SYS-GMM estimator of Blundell and Bond (1998) and this computes estimates from which both the differenced and the levels variable coefficients can be extracted. This is appropriate when the FDI model follows from a theoretical explanation that is similar to that of conventional panel models of investment that derive from euler equations solved for expectations. Otherwise, to be used as a comparison to try to select empirically the most appropriate models. The Blundell and Bond method has been adopted previously to BFDI data by Abbott and De Vita (2011).

$$\begin{aligned}\ln(BFDI_{i,j,t}) = a + \lambda \ln(BFDI_{i,j,t-1}) + \beta_1 \ln(\mathrm{EXP}_{i,j,t}) + \beta_2 \ln(\mathrm{GDP}_{j,t}) + \beta_3 \ln(\mathrm{GDP}_{i,t}) \\ + \beta_4 \ln(\mathrm{DIS}_{i,j,t}) + \beta_5 \mathrm{EXV}_{i,j,t} + \beta_6 \mathrm{EcoFree}_{i,t} + \beta_7 \mathrm{EcoFree}_{j,t} + \beta_8 \ln UCL_{j,i,t} \\ + \beta_9 \mathrm{Lang}_{i,j} + \beta_{10} \mathrm{CU}_{i,j,t} + \beta_{11} \mathrm{land}_{i,j} + \beta_{12} \mathrm{FC}_t + \beta_{13} SYS_{j,t} + \varepsilon_{i,j,t}. \qquad (3.4)\end{aligned}$$

Where λ is the adjustment coefficient in the dynamic model.

The preferred results from the two-step system GMM estimator are presented in Table (3.4), The dynamic specification seems to work well based on the diagnostic tests for the definition of the instruments (Hansen, 1982) and the absence of up to 2nd order error autocorrelation. Across all specifications, the result for the serial correlation test is an expected. The null hypothesis of no serial correlation at order one is rejected while it is not possible to reject the null for the case of second order serial correlation. This suggests that the key criteria related to the moment conditions are met.

The tests of autocorrelation in the residuals demonstrate that there is a negative and significant first order serial correlation but an insignificant second order serial in the first differences in the residuals in all models. These findings are coherent with the notion that the models do not relate to a backward-forward specification with expectations. The first order serial correlation relates to the expectational explanation as compared with models that are derived from pure costs of adjustment or hysteresis explanations of the data. Otherwise, the finding of serial correlation might imply that the models are not well formulated and there is some other specification that includes variables not currently included in the model.

Table (3.4) Results for dynamic panel-data estimation using two-step SYS-GMM

Independent Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)
$LnBFDI_{i,j,t-1}$	0.2363***	0.2351***	0.2638***	0.2463***	0.2468***	0.2602***
	(0.0367)	(0.0364)	(0.0374)	(0.0375)	(0.0386)	(0.0374)
$LnGDP_{i,t}$	0.4159***	0.3419**	0.3874***	0.4170***	0.3265**	0.3522***
	(0.1378)	(0.1347)	(0.1304)	(0.1335)	(0.1323)	(0.1307)
$LnGDP_{j,t}$	0.7801***	0.7013***	0.6084***	0.6830***	0.7713***	0.5414***
	(0.1116)	(0.1085)	(0.1156)	(0.1199)	(0.1187)	(0.1174)
$LnEXP_{i.j.t}$	0.1910***	0.2729***	0.2759***	0.2442***	0.2206***	0.3360***
	(0.0721)	(0.0710)	(0.0773)	(0.0783)	(0.0769)	(0.0811)
$EXV_{i.j.t}$	-1.8848**	-1.4594**	-1.5458**	-1.6835**	-1.6548**	-1.2545**
	(0.7408)	(0.6457)	(0.6625)	(0.6956)	(0.7065)	(0.6184)
$Free_{i.t}$	0.0399***	0.0410***	0.0383***	0.0387***	0.0400***	0.0390***
	(0.0063)	(0.0062)	(0.0059)	(0.0060)	(0.0064)	(0.0059)
$Free_{j,t}$	0.0400***	0.0390***	0.0380***	0.0388***	0.0378***	0.0381***
	(0.0064)	(0.0062)	(0.0063)	(0.0065)	(0.0064)	(0.0063)
$LnDIS_{i.j}$	-0.6198***	-0.5707***	-0.5385***	-0.5732***	-0.5785***	-0.4940***
	(0.0929)	(0.0875)	(0.0940)	(0.0953)	(0.0912)	(0.0950)
$Land_{i.j}$	-0.3429*	-0.3689*	-0.3197*	-0.3249*	-0.3719*	-0.3285*
	(0.2081)	(0.1980)	(0.1858)	(0.1938)	(0.2132)	(0.1841)
$Lang_{i,j}$	0.5462***	0.5770***	0.5015***	0.5554***	0.5569***	0.4776***
	(0.1919)	(0.1910)	(0.1782)	(0.1853)	(0.1972)	(0.1775)
$CU_{i.j.t}$	0.1444	0.1364	0.0989	0.1048	0.1397	0.0992
	(0.1121)	(0.1086)	(0.1068)	(0.1119)	(0.1137)	(0.1003)
$LnUCL_{j.i.t}$	-0.0415	-0.0828	-0.1557	-0.1378	0.0633	-0.1882
	(0.1217)	(0.1235)	(0.1375)	(0.1390)	(0.1718)	(0.1426)
$SYS_{j.t}$		-0.2530***				
		(0.0498)				
FC_{1997}			-0.1074**			-0.1094**
			(0.0478)			(0.0478)
FC_{1998}			-0.0231			-0.0246
			(0.0414)			(0.0417)
$FC_{1997/1998}$				-0.0725*		
				(0.0419)		
FC_{2008}					-0.1016***	-0.1228***
					(0.0216)	(0.0254)
Constant	-24.3267***	-22.3003***	-21.6314***	-23.2669***	-22.6060***	-20.4966***
	(3.4244)	(3.2141)	(3.2374)	(3.3605)	(3.4075)	(3.2406)
Observation Number	5282	5282	5282	5282	5282	5282
AR(1) test	-5.79***	-5.71***	-5.90***	-5.82***	-5.54***	-5.62***
AR(2) test	-0.55	-0.59	-0.24	-0.34	-0.57	-0.36
J-test~χ2(425)	377.65	375.07	378.93	376.07	372.70	377.58
J-test: p-value	0.952	0.961	0.947	0.958	0.968	0.949

Notes: All regressions are estimated over the period 1995–2012 using a dynamic two-step system GMM estimator proposed by Blundell and Bond (1998) with Windmeijer (2005) finite sample correction. Huber–White robust standard errors are reported in the parenthesis. ***, **, and * coefficients are statistically significant at 1%, 5%, and 10%, respectively. The Hansen (1982), J-test statistic with p-values for over-identifying restrictions. AR(1) and AR(2) are tests for 1st and 2nd order serial correlation.

The SYS-GMM estimations yield an adjustment coefficient that relates to the lagged FDI variable that is positive and statistically significant suggesting the dynamic model estimated through the GMM estimator can be considered appropriate. This result supports the studies of Kinoshita and Campus (2004), Walsh and Yu (2010), Gedik (2013), and Blonigen and Piger (2014), who suggest that FDI in the previous year has a positive impact on prospective foreign investor decisions. The result indicates that a lagged dependent variable impacts the behaviour of FDI. This also relates to hysteresis when FDI is highly persistent, but such persistence might be a number of factors. One explanation that is popular is costs of adjustment and as the lagged dependent variable is highly significant this is confirmation that the FDI Gravity model should be estimated using a dynamic specification (Bhavan et al., 2011; Mina, 2012). The presence of sunk costs incurred by investors to set up distribution networks and services in foreign markets generates persistent FDI to a country which invests in another country for a given year and tends to continue to do so the following year. According to the results, the coefficient of the lagged FDI δ in column 1 is about 0.24, implying a partial adjustment coefficient of 0.76. This means that net investment in one year is 76 percent of the difference between the steady-state level and the current value of FDI. If the steady-state level of the FDI stock does not change, it will take about 1.32 years (16 months) for the gap between the equilibrium and the current FDI stock to close. The partial adjustment coefficient ranges in size from .23 to .26 in remaining columns in Table (3.4) which report the other GMM specifications. A slower speed of adjustment indicates more persistence in the pattern of FDI in these OECD economies. The significance of the lagged dependent variable confirms that the GMM estimator is again appropriate.

The results related to the control variables in Table (3.4) are also of interest with real GDP of the host country and home country having a positive sign and being statistically significant in all the models. The results demonstrate support for the following hypothesis: real GDP is likely to exert a stronger effect on FDI depending on the form of the latter, especially when FDI outflow is seeking a domestic service market (market-seeking FDI). The result suggests that the income investment partners and host countries strongly influence FDI stocks (Hejazi, 2009; Martinez et al., 2012; Cuong, 2013). These findings are also consistent with the standard gravity theory prediction and previous empirical findings (Culem, 1988; Billington, 1999; Chakrabarti, 2001). This

signals the importance of an expanding market for producers' goods in the supply of FDI. The impacts from host country GDP are almost twice as large as for home country GDP, suggesting that market effects dominate the gravity part of the relationship.

In the same way, the positive link between foreign investments and export performance may indicate that those foreign investments have contributed to the export performance, or the increasing export performance has been a good signal regarding competitiveness for foreign investors to favour those destinations. The coefficient of trade (which is expressed as bilateral export) is positive and statistically significant 1% level. So this variable appears to be complementary in terms of the relation with BFDI stocks and this support the findings of Brenton et al. (1999), Kinoshita and Campus (2004), Bhavan et al. (2011) and Mina (2012).

These findings again confirm the importance of exchange rate volatility, which is significant at the 5% level and still has a negative effect on outward BFDI in all the specifications in the Table (3.4), this result is consistent with other studies, for example Jeanneret (2006) found a negative and significant link on average for exchange rate volatility in a bilateral panel data set of 28 OECD countries by applying Gravity model.

The results for the financial crises variables imply that the shock related to the crises has spread as a result of the negative coefficient, which means the risk that follows from a crisis reduces BFDI. The effect of financial crises for all the models is coherent as these coefficients are as expected negative and statistically significant. Specifically, the coefficients of the global crisis dummy variables were found highly significant, indicating the presence of an impact of the global financial crises on the BFDI stocks in the selected panel. The results for the estimates of the crises dummy coefficients reveal a significant decrease in FDI during the Asian crisis in year 1997, with a slightly more negative coefficient during the systemic banking crisis. The results of global financial crisis are in line with the UNCTAD report 2009, which state that; global FDI inflows fell by 39% from US$1.7 trillion in 2008 to US$1.0 trillion in 2009. It can be seen Table (3.4), columns (3) and (6) that the Asian crisis in 1998 has a negative but not significant effect. To the extent past FDI patterns can provide relevant insights to the current FDI slump. Interestingly, the global financial crisis has higher coefficient and significance comparative to Asian crisis as can be seen in column (6). The occurrence of this crisis causes the FDI stock from home to a host country to drop

by 12% in year 2008. These results are consistent with Mahmoud (2011) research on BFDI; his finding shows that global financial crisis has negative and significant effect on BFDI, in contrast to Asian crisis (1997-1998) which has negative but not significant effect on BFDI.

When the host country suffers from a systemic banking crisis, BFDI to that country reduces and such results are consistent with Gil-Pareja et al. (2013) who found that systemic banking crisis has the expected sign and is statistically significant. So financial constraints impact on the decision to engage in new FDI, expressed through FDI's extensive margin.

As for institutional variables, the economic freedom index of home country and host country is positive and highly significant presenting evidence that the OECD countries with good institutions managed to attract more FDI. This indicates that there is no implicit restriction on trade for these countries so this should increase BFDI. A system of law enforcement signals that investors' rights will more likely be protected. These results are in line with Bengoa and Sanchez-Robles (2003) who suggest that the countries in which the institutional framework is sounder and better regulated were regarded as more attractive by foreign investors.

Turning to the estimation results for the Euro dummy variable, when both countries (host and donor) are in the Euro zone there is not significant effect for all the specifications in Table (4.3), suggesting that this is not merely capturing goods market integration. These results are consistent with Kreinin and Plummer (2008*).*

Additionally, it is found that distance and language dummies have significantly negative and positive impacts, which is in the line with other studies. For example, Tekin-Koru and Waldkirch (2010) show distance has a significant negative effect on FDI, while common language exerts a positive impact. In particular, cultural proximity would seem to be proxied by a common language as the effect is statistically significant and positive. This is consistent with the notion that transaction costs as a result of a what may be common cultural ties or values are reduced and this encourages BFDI. Görg and Wakelin (2002), and De Vita and Abbott (2007) find a similar impact for a common language on US and UK FDI respectively. This findings confirm that home and host countries sharing the same language invest more with each other than a pair that does not use the same language as information costs are lower (see Buch et al.,

2003; Bergstrand and Egger, 2007; Desbordes and Vicard and, 2009; and Mohan and Watson, 2012).

More particularly, the distance between home and host countries has a negative and significant impact on BFDI. The coefficient suggests that when the distance increases by 1%, the bilateral stock of FDI falls by about 0.49%-0.62%. This is also consistent with previous studies as evidenced by Buch et al. (2004, 2005), and Buch and Lipponer (2004). This suggests that companies are found to prefer investing in closer countries rather than those farther away, while the impact of a common border is negative but not significant in all specifications in Table (3.4). This fits with the trade literature where the coefficient is positive, because proximity reduces the need for FDI in horizontally integrated industries. These results show that sharing the same land border has no impact on the stocks of the FDI (Mitze et al., 2008; Cuong, 2013).

It appears that unit labour costs are not important as they are not significant for any specification of the model. The insignificance of labour cost differentials could be associated with the endogeneity of this variable or that it may not be well instrumented. This finding is consistent with Holland and Pain (1998), Devereux and Griffith (1998) also found unit labour costs differentials to be a non-significant driver of the location choices of US multinationals in the EU. They explain this result by their data not being disaggregated enough a measure of productivity so not reflecting the firm's heterogeneity within each industry.

The main message conveyed by Table (3.4) is not so different from that related to the OLS results in Table (3.3). Apart from the ULC coefficient that in some specifications is negative and not significant for all specifications. The currency union dummy is estimated at lower impact than the figures obtained from the OLS regressions models, it is positive but not significant in all specifications in Table (3.4), so the inclusion of exchange rate volatility measures seems to capture the impact of using the same currency.

For SYS- GMM all coefficients across all specification are significant at the 5% level, except common currency, unit labour cost differentials and common land border which are not considered as critical variables for BFDI. As expected, higher GDPs, lower distance, common language, lower exchange rate volatilities all have a positive impact on BFDI stocks. Moreover, countries with good institutions, more trade

openness, and fewer restrictions on FDI are likely to receive more FDI. We consistently find that exchange rate volatility plays an important role in driving FDI.

The long-run coefficients are easily computed[33] and are reported in addition to the Wald test of these coefficients in Table (3.4a); the results suggest the use of the complete model represented by equation (3.4) except again for unit labour cost that it seems possible to exclude from the model. The test is not linear as the long-run is based on a ratio of the linear regression coefficient.

Table (3.4a) SYS-GMM long-run estimates with Wald Tests of restriction

Independent Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)
$LnGDP_{i.t}$	0.5446	0.4470	0.5261	0.5532	0.4334	0.4760
Wald test ~$\chi^2(1)$	9.21***	6.41**	8.88***	9.83***	6.16**	7.34***
$LnGDP_{j.t}$	1.0215	0.9168	0.8264	0.9061	1.0240	0.7318
Wald test ~$\chi^2(1)$	56.42***	47.35***	32.37***	38.53***	46.34***	24.56***
$LnEXP_{i.j.t}$	0.2501	0.3567	0.3747	0.3240	0.2928	0.4542
Wald test ~$\chi^2(1)$	7.24***	15.67***	12.90***	9.80***	8.68***	17.18***
$EXV_{i.j.t}$	-2.4680	-1.9079	-2.0997	-2.2336	-2.1971	-1.6956
Wald test ~$\chi^2(1)$	6.41**	5.06**	5.43**	5.86**	5.46**	4.14**
$Free_{i.t}$	0.05221	0.0535	0.0520	0.05129	0.0531	0.0527
Wald test ~$\chi^2(1)$	42.99***	46.19***	45.62***	45.04***	41.89***	47.19***
$Free_{j.t}$	0.05232	0.0509	0.05166	0.0515	0.0501	0.0514
Wald test ~$\chi^2(1)$	41.16***	40.86***	38.77***	38.19***	37.37***	39.24***
$LnDIS_{i.j}$	-0.8115	-0.7461	-0.7315	-0.7604	-0.7681	-0.6676
Wald test ~$\chi^2(1)$	50.00***	47.08***	37.87***	41.6***	44.02***	31.14***
$Land_{i.j}$	-0.4490	-0.4822	-0.4342	-0.4311	-0.4938	-0.4440
Wald test ~$\chi^2(1)$	2.77*	3.54*	3.06*	2.90*	3.09*	3.28*
$Lang_{i.j}$	0.7151	0.7543	0.6812	0.7369	0.7394	0.6456
Wald test ~$\chi^2(1)$	8.39***	9.62***	8.36***	9.50***	8.22***	7.59***
$CU_{i.j}$	0.1891	0.1783	0.1343	0.139	0.1854	0.1341
Wald test ~$\chi^2(1)$	1.68	1.59	0.87	0.89	1.52	0.99
$LnUCL_{j.i.t}$	-0.0543	-0.1082	-0.2114	-0.1828	0.084	-0.2543
Wald test ~$\chi^2(1)$	0.12	0.45	1.26	0.97	0.14	1.7

Note: the table shows the long-run estimates derived from an underlying short-run dynamic model using the two step systems GMM. A Wald test is reported in the second row for each coefficient. Denoted ***, **, and * then the coefficients are statistically significant at 1%, 5%, and 10%, respectively.

A further question is as to whether exchange rate volatility enhances the explanatory power of the regression equation. As can be seen from Table (3.4a), the exchange rate volatility parameter confirms its importance in the long-run as it has

[33] If the AR(1) parameter is termed γ and the i^{th} coefficient relates to the i^{th} non deterministic regressor, the long-run multiplier $\pi_i=\beta_i/(1-\gamma_i)$. The more general case of this type of dynamic model appears in Gregoriou et al. (2009) and the article includes some discussion of the application of the same type of Wald test constructed from the unrestricted parameters.

increased for all specifications, and it is also significant based on a Wald test of the coefficients. FDI reacts more strongly to exchange rate volatility in the long run. These findings reflect an easier and less expensive possibility for companies to insure against the risk of short term volatility by foreign exchange market instruments. Meanwhile, the long run exchange rate misalignment are costly and unavoidable unless as part of an exchange rate union. Therefore, they deter FDI. As can be noticed from Table (3.4a) the variables of interest are important in the long run with the exception of the labour cost and euro dummy variables, which are also not critical in the short run as reported in Table (3.4). These results are consistent with Dinga and Dingová (2011) who test the effect of the transition to the Euro on international FDI with a panel of 35 OECD countries for the period 1997-2008. Their finding indicates that the Euro currency does not have a significant effect on FDI, while long-term exchange rate volatility hinders FDI. The results reported in Table (3.4a) suggest that variables not significant in the short run may also be insignificant in the long run. Moreover, the significance level of the variables appears stable, but the long-run effect by the dynamic adjustment that follows from the impact of the partial adjustment to the steady state in the long run.

Moreover, Table (3.4b) below shows the elasticity which provides information on the % contribution of each variable to BFDI

Table (3.4b) SYS-GMM elasticity of the independent variables

Independent Variables	**Column (1)**	**Column (2)**	**Column (3)**	**Column (4)**	**Column (5)**	**Column (6)**
$LnBFDI_{i,j,t-1}$	0.2348692	0.2335282	0.2622296	0.2447229	0.2453328	0.2586377
$LnGDP_{i.t}$	0.6733037	0.553378	0.6272196	0.6749451	0.5285817	0.5703377
$LnGDP_{j.t}$	1.218261	1.094821	0.9503241	1.066331	1.204592	0.8457247
$LnEXP_{i.j.t}$	0.2433762	0.347461	0.3515399	0.3110351	0.2810226	0.4281954
$EXV_{i.j.t}$	-0.0008341	-0.0006456	-0.0006842	-0.0007449	-0.0007324	-0.0005553
$Free_{i.t}$	0.164733	0.1692073	0.1584514	0.1596669	0.1652877	0.1611388
$Free_{j.t}$	0.1611982	0.1571285	0.1534559	0.1565535	0.1524394	0.153592
$LnDIS_{i.j}$	-0.2823703	-0.2599219	-0.2453919	-0.2610749	-0.2636154	-0.2250985
$Land_{i.j}$	-0.0021564	-0.0023189	-0.0020105	-0.0020428	-0.0023391	-0.0020663
$Lang_{i.j}$	0.0034405	0.0036334	0.0031598	0.0034979	0.0035086	0.0030094
$CU_{i.j}$	0.0013328	0.0012583	0.0009127	0.0009667	0.0012891	0 .0009161
$LnUCL_{j.i.t}$	-0.0000914	-0.0001824	-0.000343	-0.0003035	0.0001395	-0.0004146
$SYS_{j.t}$		-0.0006545				
FC_{1997}			-0.0003157			-0.0003219
FC_{1998}			-0.0000691			-0.0000735
$FC_{1997/1998}$				-0.0004292		
FC_{2008}					-0.0003915	-0.0004733

3.7 Concluding Remarks

One aim was to establish the impact of the volatility of the exchange rate on bilateral FDI stock outflow from 14 high income OECD countries to all other OECD countries over the period 1995 to 2012. In addition to the volatility of the exchange rate the Gravity model controls for several FDI determinants including traditional factors and institutional factors such as bilateral exports, real GDP, distance, unit labour cost differentials, the free economic index, and other common instructional characteristics, in addition to the effect on BFDI of financial crises.

A static gravity equation is estimated using a "random-effects" panel data model based on a number of regression specifications. However, estimating a short-run model by random effects would produce biased estimates (Nickell, 1981), because of the correlation between the autoregressive term and the estimated residuals.

Given the nature of the data, there is very likely significant serial correlation and this may further be compounded by the series being non-stationary. In time series the relations may be cointegrating, but this is more complicated to deal with here than was the case in the previous chapter.

Given the time series dimension and the further complications that may arise as a result of the impact of the large cross section dimension it is felt best to tackle the issue of serial correlation directly by the inclusion of a lagged dependent variable. However, the estimations may not consistent (Greene, 2011) when there is serial correlation so there needs to be some consideration of endogeneity as a result of likely heterogeneity and the likely interaction with the lagged dependent variable. So SYS-GMM is applied to a Gravity model of BFDI stocks.

The results obtained in this chapter confirm that a dynamic model is more appropriate to explain the stocks of high income countries outward BFDI. As for the control variables, our results are generally in line with previous studies and confirm that Gravity models are critical in explaining BFDI. Based on a panel data analysis it was found here that BFDI stocks are significantly influenced by both gravity factors (distance, gross domestic product (GDP)) and non-gravity factors (risk as measured by exchange rate volatility and the economic freedom index). While high GDP, distance between the countries, positively affects BFDI, and long term exchange rate volatility

hinders BFDI stocks. The results also support the hypothesis that exchange rate volatility is a determinant of BFDI decisions and this appears to confirm the relatively common view that this relation is negative. Whereas, the Euro does not have a significant effect on BFDI, but it is observed that BFDI increases.

Examining patterns of global economic crises, the study of how BFDI stocks responded to the different types of crises across the period. The bottom line is that financial shocks reduce bilateral FDI. These results show that past FDI patterns can provide relevant insights into the current FDI slump. Interestingly, the global financial crisis has had a larger effect than the Asian crisis that is also significant. The findings enhance the previous literature by examining the behaviour of FDI outflow from high income countries during the 1997–1998 East Asian crisis, the financial markets crisis of 2008, and systemic banking crises.

The findings of this chapter have serious implications for International business. 1-) Identifying the financial crises impact on FDI is crucial for understanding the possible reverse effect of FDI on the government's response. 2-) This chapter was aimed at identifying and filling the gaps in the literature on this topic by analysing the impact of Long run exchange rate volatility on FDI with panel data.

Furthermore, the results provide some useful policy implications for policy-makers as the finding accords with the theoretical predictions of models stressing sunk costs relevance in the decision as to whether to invest abroad. Moreover, countries with better institutions, more trade openness, and fewer restrictions on FDI are likely to receive more FDI. It is consistently found that exchange rate volatility plays an important role in driving FDI. Furthermore, the past level of outward FDI stock provides incentives for domestic companies to invest abroad.

Finally, It may help to confirm this analysis using different samples to determine whether there are some special characteristics of selected countries (the OECD in this study), which could affect these findings on the impact of the financial crises on BFDI. So the direction for further study could be to replicate the analysis to determine how financial crises affects BFDI by region (for example, Euro zone), sector, in addition to the link between exchange rate volatility and FDI.

Appendix (A3) Table offers a list of the countries included in the sample.[34]

Home countries (14)	**Host Countries-OECD Countries (31)**
Austria	Australia
Belgium	Austria
Canada	Belgium
France	Canada
Germany	Czech Republic
Italy	Denmark
Japan	Estonia
Korea, Rep.	Finland
Netherlands	France
Spain	Germany
Sweden	Greece
Switzerland	Hungary
United Kingdom	Ireland
United States	Israel
	Italy
	Japan
	Korea, Rep.
	Mexico
	Netherlands
	New Zealand
	Norway
	Poland
	Portugal
	Slovak Republic
	Slovenia
	Spain
	Sweden
	Switzerland
	Turkey
	United Kingdom
	United States

[34] As classified by the World Bank

Appendix (B3) Countries in the sample experienced borderline systemic banking crises.[35]

Host Country	**Year**
Australia	-
Austria	2008
Belgium	2008
Canada	-
Czech Republic	1996
Denmark	2008
Estonia	-
Finland	1999
France	2008
Germany	2008
Greece	2008
Hungary	2008
Ireland	2008
Israel	-
Italy	2008
Japan	1997
Korea, Rep.	1997
Mexico	1995
Netherlands	2008
New Zealand	-
Norway	-
Poland	-
Portugal	2008
Slovak Republic	1998
Slovenia	2008
Spain	2008
Sweden	2008
Switzerland	2008
Turkey	2000
United Kingdom	2007
United States	2007

[35] Laeven and Valencia (2013)

Appendix (C3) Accession into the Euro zone

Euro zone countries	**Adopted in year**
Austria	1999
Belgium	1999
Estonia	2011
Finland	1999
France	1999
Germany	1999
Greece	2001
Ireland	1999
Italy	1999
Netherlands	1999
Portugal	1999
Slovak Republic	2009
Slovenia	2007
Spain	1999

Appendix (D3) Conversion rates of exchange rates for entry into the Euro[36]

Country	Currency	Code	Fixed rate	Fixed on	Yielded
Austria	Austrian schilling	ATS	13.7603	31/12/1998	01/01/1999
Belgium	Belgian franc	BEF	40.3399	31/12/1998	01/01/1999
Estonia	Estonian kroon	EEK	15.6466	13/07/2010	01/01/2011
Finland	Finnish markka	FIM	5.94573	31/12/1998	01/01/1999
France	French franc	FRF	6.55957	31/12/1998	01/01/1999
Germany	German mark	DEM	1.95583	31/12/1998	01/01/1999
Greece	Greek drachma	GRD	340.75	19/06/2000	01/01/2001
Ireland	Irish pound	IEP	0.78756	31/12/1998	01/01/1999
Italy	Italian lira	ITL	1,936.27	31/12/1998	01/01/1999
Netherlands	Dutch guilder	NLG	2.20371	31/12/1998	01/01/1999
Portugal	Portuguese escudo	PTE	200.482	31/12/1998	01/01/1999
Slovak Republic	Slovak koruna	SKK	30.126	08/07/2008	01/01/2009
Slovenia	Slovenian tolar	SIT	239.64	11/07/2006	01/01/2007
Spain	Spanish peseta	ESP	166.386	31/12/1998	01/01/1999

[36] Preceding national currencies of the Euro zone http://www.ecb.Europa.eu/

Chapter Four

EU Cross-Border Banking and Financial Crises: Empirical Evidence using the Gravity model

4.1 Introduction

Understanding the drivers of cross-border asset movements has become an important topic of research in financial and international economics. Previously the focus has been more on foreign direct investment (FDI), but more recently attention has been centred on cross-border international bank lending. Some consensus has emerged that portfolio flows are most volatile (Sarno and Taylor, 1999; Calvo and Mendoza, 2000). However, FDI is the most stable form of cross-border finance (Levchenko and Mauro, 2007).

It has been indicated by the Bank for International Settlements (BIS) that in the last decade cross-border banking has increased significantly. In particular, this has occurred between international banks and their non-bank customers. More specifically, it was reported in BIS (2011) that in the expansionary phase of the global economy, "cross-border lending to the cross-border and nonbanks components classified by residential banks" had tended to rise at a faster rate than the equivalent flow of credit.

International banks that move abroad have been one of the main sources of finance in recent years. It is thus that financial linkages and more specifically bank lending ties have been seen as one of the major channels of transmission of the financial crisis from advanced countries (IMF, 2009a). Thus, the determinants of cross-border banking should be considered when analysing how the crisis was transmitted and why most markets were differently impacted. Understanding the major variables driving cross-border banking is also necessary for financial stability in advanced countries, due to the negative way in which financial crisis has affected the banks in advanced economies. This has been the case in the Euro area, where banks have built up core exposure to cross-border activities especially in Eastern and Central Europe.

Shin (2012) has shown that cross-border banking has had a critical role in the build-up of the global crisis, with European banks operating as a major financial intermediary for the US, competing in terms of size with the local financial sector. While, in the Euro Area, cross-border banking has been a leading factor in the build-up of the housing bubbles and credit booms in countries such as Ireland and Spain (BIS, 2011). To understand better the Financial crisis, there has been a recent focus on cross-border banking at a gross and not a net level (Shin, 2012; Borio and Disyatat, 2011). This has arisen as a result of the increase in cross-border lending over the past 18 years with differential effects on the global economy and financial sector. Navaretti et al. (2010) over the period 2007 to 2009 indicated that retail and corporate bank lending of foreign affiliates has risen across Europe. De Haas and van Lelyveld (2010) found at a global level that that foreign multinational banks, in contrast to domestic banks, may not have to cut lending, because they have access to the international capital markets.

The financial crisis has evidenced some challenges specific to cross-border banking. Facilities are often exposed to legislation and regulation both in the lender and borrower countries. This increases the complexity and operations costs. Furthermore, this introduces the possibility for conflicts between the lender and borrower countries in areas such as maximising the banking organizations efficiency and resolving liquidity or solvency problems.

4.2 Cross-border banking in the European Union (EU)

In the case of the European Union, the market trend towards cross-border banking has been enhanced by a number of EU policies trying to reduce legal barriers to achieving a single market for financial services.

Generally, market integration was one of the primary purposes for the foundation of the EU. From the inception of the EU the idea of joining the internal markets ties in with economic and political integration. The EU single market for financial services has progressed at a slower pace when compared with other markets. This was a reason for the pursuit of an EU policy action to foster financial market integration in the last decade. This policy has translated into a number of regulatory initiatives aiming at overcoming legal barriers to cross-border banking activity among EU financial

institutions. Furthermore, market integration should enhance competition, which should improve the terms and conditions for corporate and consumer credit.

The achievement of a functioning single financial market would facilitate the full exploitation of the EU market, a better allocation of resources and a better response to the needs of what is still a heterogeneous market in terms of size and structure. More competition should reduce costs and increase market choice. One can distinguish the effects of further development and efficiency of the local financial system, on the access to financial services by firms and households, and on the stability of the local financial system and the overall economy. Studies on the effect of cross-border banking on efficiency and development, access to financial services and stability find effects that are largely beneficial, although there are some question marks over financial stability.

4.2.1 Cross-Border Banking and Financial Stability

The formation of a single banking market and the enhancement of competition in the EU may necessitate a high degree of cross-border activity. The European Central Bank (ECB) has commented on financial integration in Europe as follows: 'Cross-border banks play an important role in the process of banking integration. They enhance competition in the Euro area banking markets. In this fashion, they promote convergence towards more efficient, lower-cost banking practices.' (ECB, 2007, p. 33).

To understand the overall effect of cross-border banking on financial stability, it is useful to disentangle the costs and benefits of cross-border banking. Theoretical research into modelling different aspects of the costs and benefits of cross-border banking (see Dasgupta, 2004; Goldstein and Pauzner, 2004; Wagner, 2010) indicates that some degree of integration is beneficial, but an extreme degree may not be.

4.2.2 Benefits of Cross-Border Banking

An advantage of cross-border banking is due to the potential for risk diversification (Markowitz, 1952), because cross-border banks assets will be less sensitive to country-specific shocks and, in theory, the probability of collapse. By spreading its activities across different countries, banks are less exposed to a domestic or foreign shock; this could reduce lending volatility. Widely speaking, cross-border banking facilitates international risk sharing (e.g. van Wincoop, 1999). The existence of

cross-border banking can also increase competition for domestic banks, and an important strand of the literature has shown that more competition is beneficial to stability (e.g. Boyd and De Nicoló, 2005).

As well as diversification gains that arise because cross-border banking reduces the bank risk and stabilises lending, cross-border banking could contribute to sharing an economy's risks with other countries. The cross-border banking repercussions for the synchronisation of real economic variables, such as investment, consumption and national income can be shown theoretically using the international version of real business cycle model (see Baxter and Crucini, 1994; Neumeyer and Perri, 2005).

4.2.3 Costs of Cross-Border Banking

It has been suggested that cross-border banking may bring various important benefits to financial stability. On the other hand, as can be observed from the impact of the crisis on the UK there are potential dangers for financial stability that can arise from the extent to which the home economy is open to cross-border banking.

When international financial markets are highly volatile, then economies that are open to cross-border banking will be sensitive to foreign capital flows. Foreign capital is likely to be more mobile than domestic capital. Hence, in a crisis, foreign banks could decide to 'pull back and run'. Domestic banks may be constrained in their capacity to redeploy capital quickly outside the country. The extent to which foreign capital is more sensitive than domestic capital crucially depends on which form cross-border banking takes. Specifically, foreign banks are less likely to cut and run when their investment is significant as a result of sunk costs. This is indicated by studies showing that lending by subsidiaries is more stable than direct cross-border lending (see Peek and Rosengren, 2000; de Haas and van Lelyveld, 2006; McCauley et al., 2010; Schnabl, 2012).

Another factor that affects financial stability is contagion[37] that may have a similar effect on cross-border banking by limiting the exposure of the local financial system to local shocks. Even so, the creation of cross-border banking will induce increases in complexity and size of financial institutions. Thus, cross-border banks are relevant to systemic risk. Their collapse could impose a larger cost on economies than the meltdown of a purely local bank. Moreover, substantial international diversification

[37] The survey by Babus et al. (2009) explains the various channels that relate to what may be called contagion.

by local banks will make them more sensitive to the global market for funds. Hence, in terms of operations and culture, it may be difficult to distinguish the behaviour of local and international banks. This may increase the systemic component of any crisis even were such diversification to reduce the likelihood of isolated bank meltdowns. Another important cost comes in the form of contagion; cross-border banking may transmit shocks among countries. A credit shock to one country, for example, can be propagated easily to the other country when both are financially integrated, as shown again by the international version of the Royal Bank of Scotland (RBC) literature (see Kalemli-Ozcan et al., 2013).

The paradigm of "cross-border banking" is used with both banks and banking customers. While several studies on cross-border banking focus either on banks customers (international) or interbank relations, here the focus is on the large customer countries side and their capacity to borrow abroad during the financial crises. This chapter examines bilateral country-level data available from the BIS on cross-border lending. Here the lending from 19 advanced countries[38] as directed towards European countries is investigated using quarterly data for the period 1999-2014. The extent of this data gives us the capacity to analyse how the geography of cross-border banking is impacted by the financial crises in terms of the systemic component, the global financial crisis, the Euro debt crisis and the Lehman Brothers' crisis. Additionally, the application of the Gravity model enhances the capacity to consider whether EU has resulted in significantly more cross border banking with the countries that are party to the EU. Additionally, the effect of monetary integration on cross-border banking is studied as increasing monetary integration leading to a common currency could influence cross-border lending positively through a number of channels. Finally, given the importance of financial crises on cross border banking this chapter considers their role in the euro area following the spread of crises. During the introduction of the Euro, banks from Euro area countries set strong financial linkages with the circumferential banks by providing them with large amounts of funding.

A broad range of determinants of cross border lending were considered in order to be able to isolate the behaviour of cross-border lending stocks by taking account of the recent financial crises and its aftermath on international lending. This in particular is

[38] The only available countries in the database.

associated with the global financial crisis, the Lehman Brothers collapse and the Euro crisis starting in 2011, and that is in addition to any borrower country specific systemic banking crises. A larger set of observable macroeconomic indicators are adopted than in the earlier literature, and the distinction is made between expected and unexpected macroeconomic developments. Iacoviello and Minetti (2006) studied cross-border lending, but focused on productivity. Goldberg (2002, 2007) used interest rates and GDP growth as explanatory variables. This work is developed in the context of the Gravity model approach discussed below. To the best knowledge, one study examined the effect of bilateral exchange rate volatility on cross border banking. Herrmann and Mihaljek (2013) examined cross border banking from OECD countries to emerging countries over the period (1993-2008). Here, the effect of exchange rate volatility has been studied on cross border lending to the European market.

The following key findings emerged. 1) The empirical "gravity" model is the benchmark in explaining the volume of international lending activities. 2) Conditioned on standard gravity variables (distance, GDP), well-functioning institutions is a key driving force for cross border lending stocks. 3) Furthermore, our results suggest that European Market Integration has a large effect on cross border lending. 4) There is strong evidence indicating that financial crises have a significant effect on cross border lending from more developed markets to European Markets. Specifically, the Euro debt crisis has had a strong long negative impact on cross border lending. 5) Furthermore, these results confirm that EU integration has the required effect regarding our sample by offsetting the benefit from the single currency among Euro zone countries and eliminating bilateral exchange rate volatility.

4.3 Cross-border banking and the Gravity model

As mentioned in the introduction, cross-border banking is likely to be affected by some measure of economic and financial distance. Proximity, especially within Europe may facilitate lending and borrowing activities. This may also be a function of the order of the activities decreasing as the network expands. For this reason, the study turns to the Gravity model.

Empirical Gravity models have already been employed in the international banking literature. However, there has been limited theoretical motivation for why

international banking should depend on a Gravity model. More recently, such models have considered financial frictions, asset types and the asset studied.

4.3.1 Gravity models for International Bank Assets

Based on different panel methodologies the findings of such models indicate that geography, institutions and politics are core drivers of international banking activities. The success of the “gravity” equation in the empirical trade literature in modelling asset flows as a function of the distance between the source and recipient countries and their "size" appears to be a powerful benchmark for analysing cross-border banking flows.

In the international trade literature, distance is seen to be a proxy for transportation costs. While for international banking; geographic distance between two countries can be used to proxy informational frictions and/or monitoring costs (Brüggemann et al., 2012; Okawa and van Wincoop, 2012).

As such, it can be shown that the Newtonian inspiration for the gravity variables, economic size and distance can be used to explain cross-border banking and finance (Berger et al., 2004; Focarelli and Pozzolo, 2005; Portes and Rey, 2005; Buch, 2005; Buch and Lipponer, 2007; Claessens and van Horen, 2013; and Aviat and Coeurdacier, 2007). To this end, it seems that distance and size also matter for financial markets. As distance is expected to reflect higher cost for cross-border asset trades negative findings may be explained by transactional and informational frictions.

Brüggemann et al. (2012) provide a theoretical motivation for an empirical Gravity model of bank international assets. They develop a model in which they consider a company (*g*) located in country (*i*), looking for a bank loan with specific maturity, volume, interest rates, or other contractual features. This search is undertaken in a number of countries (*n*), including the home country. The company selects a bank (*k*) in a specific country (*j*). The bank is seeking to obtain the best rate of return relative to risk on its loans subject to cost and the extent to which the loan offer is attractive to the customer. The following equation (4.1) is used to explain the lowest cost at which a bank can supply a loan:

$$C_{i,g,j,k} = \delta_1 r_j + \delta_2 \pi_{i,j} + \delta_3 a_j + \varepsilon_{i,g,j,k}. \qquad (4.1)$$

Where this cost depends on factors such as geographic distance, which affects the cost of monitoring (π_{ij}). As Banks differ total costs are measured by the average interest rate in a specific country (r_j), average bank characteristics (a_j) and a residual term capturing any unobservable cost and bank-company-specific traits ($\varepsilon_{i,g,j,k}$). The company compares the offers of banks located in different countries and chooses a specific bank that depends on the characteristics of the country pair. It is to be expected that other elements in the trade/FDI Gravity model literature also matter. For a given distance, we would expect that larger lender countries would offer more bank loans and larger borrower countries would require more loans, and hence both countries should have influence based on the size of their economies in the model.

Brüggemann et al. (2012) use their model to test aggregate credit relations between banks and firms which are located in countries *i* and *j*. This is a function of the average interest rate in the host country, the number of banks active in the foreign market, any observable bilateral monitoring costs such as geographic distance, and the size of the foreign banking market. Additionally, they include time-varying measures of multilateral resistance. The multilateral resistance measure indicates the average financial barriers for any country vis-à-vis other countries (Anderson and van Wincoop, 2003; Baldwin and Taglioni, 2006).

The empirical literature related to the Gravity model of cross border banking has used two types of factors to control for transaction costs. Firstly, the geographical characteristics of country pairs, such as distance, remoteness and adjacency used to capture transportation costs. Secondly, related to cultural and historical ties between the countries, such as common language and past colonial links. Cultural similarities are frequently used in order to account for other factors that could affect the cost of cross-border banking. However, these variables do not capture the transaction costs that are related to the need for frequent interaction in real time between the parties, because physical distance does not always fully capture this. Therefore, the time zone can have an impact, because agents may not be able to function fully when their markets and support services are not operating even given easy to use and low-cost communications; in this way the effective may not be the same for East-West as compared with North-South transactions. The transactions cost associated to the time zone difference should be important in activities that require an interaction deal in real time. This is why it is

believed that cross border banking offers a perfect setting in which to show the effect of differences in time zones.

There are a number of recent findings on the determinants of cross-border banking based on a Gravity model for example Buch (2005) analysis of banks' foreign asset holdings. While Buch and Lipponer (2007) examine German banks and their international strategies via foreign direct investment (FDI) and a cross-border condition term for banking services. Other articles show the core role of distance in explaining global banking. Heuchemer et al. (2009) examine cross-border retail lending for the Euro zone using a Gravity model. They also suggest that physical distance may have an effect because of cultural distance.

4.3.2 Crises, International Bank Assets and Gravity models

The theoretical rationale for the Gravity model especially the formulation associated with equation (4.1) would appear to be well adapted to investigate the effect of crises on cross border banking. Due to its relative success in explaining goods flows, recent applications of these models have also been used to analyse asset flows. Portes and Rey (2002 and 2005), Razin (2002) and Lane and Milesi-Ferretti (2008) are seminal papers that make use of Gravity models to analyse cross-border equity flows and FDI, respectively. While Martin and Rey (2004), and Okawa and van Wincoop (2012) use the Gravity model to analyse portfolio capital flows.[39]

4.4 Cross-border banking and financial crises

We focus mainly here on the role of cross-border banking in the propagation of the credit crisis from the US. We will first make some general points, then discuss how cross-border institutions responded during the global financial crisis, Lehman Brothers' crisis, Euro debt crisis and systemic banking crises.

The crisis was intensified on market liquidity failures which are comparable to a bank run on a liquid market that changes liquid securities to illiquid loans, following a shock that makes traders and asset holders uncertain regarding the underlying assets value (Davis, 2008). Furthermore, Adrian and Shin (2008) indicate that market liquidity

[39] Coeurdacier and Rey (2011) provide an extensive survey of literature on international asset portfolios.

failure reflects contagion through market price changes, so financial institutions managed balance sheets in response to measured risk and price changes.

Barrell and Davis (2008) indicate that when balance sheets are strong, banks see leverage as low and seek to extend balance sheets through increased lending and short-term liabilities incurrence. This is seen as an enhance liquidity across the whole, as was available to lend to sub-prime borrowers in the run-up to 2007. Then, when there is a market prices shock, financial institutions that mark to market find their leverage high and seek to reduce their balance sheets which required ceasing to lend in the interbank market.

One important source of financial instability has resulted from exposure to bad financial debt that has arisen from real estate bubbles. It is argued that the global crisis arose from the bubble in real estate prices in the US. Financial fragility led to what became an over-expansion in housebuilding in other countries, such as Spain and Ireland. The subsequent impact on the banks in these countries had further implications for their capacity to respond to the crisis in the Euro zone. The over valuation of house prices and subsequent fall impacted financial institutions leading to bank failure in the US, UK and Ireland that then affected the real economy, and both the retail and then the commercial construction industries. In the US, this was compounded by failure in the securitised mortgage markets and markets for assets such as mortgaged backed securities (MBS). Such securities were then held by European banks either by purchase of the derivative assets or of financial institutions that held them and this meant that the crisis spread quickly from the US to Europe. Honohan (2008) indicates that half of the assets backed by sub-prime loans had been offloaded, especially on European banks. Greenlaw et al. (2008) demonstrate that there had also been a big amount of recapitalisation from sovereign wealth funds in the early months of the crisis.

The way the dynamics of the global crisis of 2008-2009 worked out has been greatly affected by cross-border banking. European banks were exposed to US securities such as mortgage backed securities (MBS) and credit default swaps (CDSs) as a result of global banks operating on either the selling or buying side. Furthermore, the nature of this failure in credit and collapse in asset markets was fully global, feeding across borders as a result of complex linkages through the global ownership of financial assets. Further compounded, because the system was not transparent due to feed through with

cross-border counterparties and ownership not helped by the failure of central banks and regulatory authorities to get to grips with the complexity of the problem.While, the nature of the crisis caused a severe short-fall in liquidity so European banks were short of US dollars. This situation had to be resolved so a solution was finally found for the shortage through a currency swap initiative by the major central banks.

Banks were affected by the market liquidity failure for securitised loans because of mark-to-market pricing, so price decrease impacted solvency. This was different banking crises in the past where loans have been held at known cost with no specific price. Finally, although the fiscal easing operating in the US and to a lesser extent in the UK did manage to restrict the crisis as it was not supported by other European economies, fiscal policy was not a solution to distressed banks in terms of their cross-border activities. So the european economy did not recover in the same way as the US, rather fiscal consolidation on the content may well have helped counteract these policies especially in the case of the UK. These set of features led on to the emergence of historically large premia in the local interbank markets in the UK, US and EU. Banks attempted to reduce balance sheet lending, at the same time that borrowers were made cautious by house price falls, leading to unprecedented falls in mortgage lending. Central banks offered huge volumes of liquidity to supply banks and seek to restart the interbank funding markets (Barrell and Davis, 2008).

The effect of financial crisis on cross-border banking can occur in the lender country, in the borrower country or both countries at the same time. This depends on the nature of the crisis. The existing studies have mainly emphasised the importance of banks that directly experience a crisis in the lending country. It is documented in the literature that banks decrease their local lending (Ivashina and Scharfstein, 2010) and their cross-border lending (Cetorelli and Goldberg, 2011; Milesi-Ferretti and Tille, 2011; Takats, 2010, and Herrmann and Mihaljek, 2010). This also occurs with local lending by foreign offices (Peek and Rosengren, 2000; Popov and Udell, 2010; Cetorelli and Goldberg, 2011). However, the reduction in cross-border lending is limited to banks which are geographically closer to the borrower and that have a domestic office or strong historical ties to the domestic banks (De Haas et al., 2011).

Regarding the overall impact of cuts to foreign and domestic lending by banks' loan portfolios, Giannetti and Laeven (2012) argue that there is a 'flight home effect'. This means that during the global financial crisis there may have been an increased propensity for banks to display lending bias in the disposition of their loan portfolios in the corporate syndicated loan market (Degryse et al., 2015). This is consistent with much of the research that suggests that the financial crisis limited international banking and cross-country flow of funds (i.e., Milne, 2009).

4.4.1 Episodes of Financial Crises

Crises can be categorised into distinct phases.

Firstly, the Global crisis arose as the second phase of what starts with the US housing market collapse as core banks faced the consequences of the crisis and as a result, local authorities forcefully intervened. The associated global recession led to co-ordinated monetary and fiscal efforts primarily in the US and the UK. EU governments and the ECB that has only lately engaged in Quantitative Easing (QE) were reticent to support fiscal expansions in EU countries or engage in what were viewed as lax monetary policies. However, many countries and their national banks did commit financial support directly in their local economies to overcome the effects of the financial crisis on banks, financial institutions and corporations.

Secondly, the Lehman Brothers Crisis occurred with the failure of a single institution on the 15th of September 2008. The extent to which financial markets not just in the US, but also across the globe were impacted by this failure caught the authorities unprepared.[40] In addition, the US Government not only had to intervene over American International Group (AIG), but also had to extend asset purchase from credit easing of March 2008 into what became the programme of QE in November 2008. Monetary policy had also eased in the US as the Federal Reserve reduced interest rates and the US Government instituted a fiscal expansion. The collapse in stock prices especially for financial assets affected the credit position of financial institutions influencing gearing and their capacity to lend even with unprecedentedly low interest rates.

[40] It would seem unlikely that neither the US or UK governments were not aware that Lehman Brothers was in trouble during 2008. In particular, there had been rumours of a cross border acquisition earlier in the year and eventually Barclays acquired the trading arm of Lehman Brothers seemingly with the tacit approval of the US authorities and presumably based on due diligence undertaken some time in advance. It has also been documented that prior to failure, the then Chancellor of the Exchequer, Alistair Darling had pleaded with the US Treasury to intervene.

After Lehman Brothers filed for bankruptcy, cross-border lending reduced deeply as banks were obliged to reduce their exposure to risk. According to Dealogic Loan Analytics syndicated cross-border lending fell by 58% in the year following the Lehman Brothers meltdown in 2008, this reduction varied noticeably between recipient countries, because the direct impact in the economic activity and liquidity was initially felt most heavily in the UK and the US. However, the supply of cross-border lending was caused and may well have been a contributing cause of this. While international banks needed to cut their lending abroad, they were required to increase new credit to customers in the home market (Giannetti and Laeven, 2012) to reduce the impact of the crisis on domestic borrowers.

The equity market, which had been affected by the crisis, started to fall sharply. This reflected low confidence in banks that were dependent on wholesale funding, because markets for these funds proved to be totally closed to such institutions after Lehman's failure. Cross-border lending was more sharply reduced than local, showing the known instability of the international interbank market (as indicated earlier by Bernard and Bisignano (2000)). Money market funds underwent losses when Lehman's meltdown, and this led to breaking the dollar and need support from the Federal Reserve.

Thirdly, banking crises will lead to more loans when credit reduction at home is more intensive than the impact of informational asymmetries. However, once cross-border lending increases, it is possible that the impact is reduced when customers and banks have invested in overcoming informational inequity. If we take the market discipline argument, then crises periods provide a special time to study this (see Martinez Peria and Schmuckler, 2001), especially when considering where investors put their funds. Therefore, depositors are able to withdraw their deposits from their local banks and move them abroad. In particular, it is expected at the beginning and early on in the process that banking crises will have a powerful effect on cross-border lending. Whether banking crises have an influence on cross-border banking before and after the crisis depends on the nature of the crisis.

Fourthly, the Euro crisis is viewed as starting with the Greek debt scandal and a shift in economic policy from fiscal support to consolidation. With the introduction of the Euro, cross-border banking for the Euro area countries (core banks) provided countries on the periphery and their banking systems (circumferential banks) with

increasing amounts of funding. The peripheral countries absorbed huge amounts of net liabilities from the existing member states banks, because this was expected to be transitory. The peripheral countries banks' net foreign asset position vis-a-vis the core became increasingly negative between 2001 and 2008. Furthermore, there became a significant imbalance with the rest of the world. Although the crisis is often seen to be the preserve of countries such as Greece who were required to reschedule their debt, the Euro zone crisis may also reside in what seemed quite a relaxed attitude by the ECB and some of the leading Euro zone economies as the Lehman Brothers crisis developed. Financial institutions in Ireland, Portugal and Spain already in trouble from the over expansion of their property markets, when policy in countries such as the UK shifted gear were in further trouble.

It is also important to realise that there has been and still is a risk of a sovereign debt crisis related to the Euro. As documented by Cecchetti et al. (2012), with the effect of the crisis late in the last decade, the intra-EA financial linkages were quickly undone, because of the smooth structure of the Euro system. The policy actions by the public sector at large (ECB, Country Government's and the International Monetary Fund (IMF)) in addition to supporting neighbour banks, sovereign bonds also led core banks to completely unravel positions.

Although it may be useful to break down the crises into events related to banking, economy and financial system it is also important to consider that these are not completely separable. Between the great moderation and the failure of Lehman Brothers the incapacity to find returns or the reversal of fortunes in serene times especially in the housing markets in the US and the EU were heralded the first complete crisis since the inter war years. What links property values to liquidity is the failure of and the difficulty with the valuation of risk along with the incapacity to compute this for what are highly complex assets in less moderate times. To this may be added the problem of what is an appropriate monetary policy in terms of interest rate setting, open market operations and macroeconomic policy co-ordination. To this might be added the extent and impact of contagion and to this the spatial dimension of banking flows.

4.5 Further Literature

This chapter is related to previous comprehensive empirical studies on determinants of cross border lending. Though some similarity to research on foreign direct investment (FDI) does exist, the number of significant research explicitly focusing on cross-border lending (and its uncertainty due to episodes of Crises) is still small.

Further to the earlier discussion of the Gravity model, the work presented here draws on to two main strands of research. The first considers the determinants of cross-border/the classical push and pull factors, which affect cross border banking. The second links International Bank Activity to the crises.

Jeanneau and Micu (2002) were first to analyse the determinants of cross-border bank lending. Focusing on the macroeconomic endowment over the period 1985-2000, their panel data analysis includes seven OECD lending countries and large markets and shows that economic cycles in lending countries have a pro-cyclical effect on international bank lending. Additionally, they find that fixed and intermediate exchange rate arrangements could enhance foreign bank lending flows while floating rate agreements inhibit them.

Papaioannou (2009) employed data on 40 lending countries and 140 recipient countries for the period 1984-2002 to investigate further the nexus between businesses in borrowing countries and capital inflows. The search shows that under-performing businesses in customer countries could be a major obstacle to foreign bank lending to emerging markets as a result of legal inefficiencies, weak property rights or a high risk of expropriation. In contrast to this, the author advises that political liberalisation, privatisation, and other structural policies could enable local economies to support considerably more foreign bank capital. Similarly, focusing on international bank flows from 26 lending countries to 120 borrowing countries for the period 1996 -2007, Houston et al. (2011) provided evidence that the ability of banks to avoid regulations by shifting some of their business to less regulated markets could positively impact international bank flows between developed and developing countries. Moreover, the study indicated that recipient countries may encourage the inflow of capital by imposing stronger property and lender rights.

Uhde and Mueller (2013) analysed data on foreign bank claims for thirteen OECD countries on fifty-one markets over the period 1993 and 2007. They consider the characteristics of the banking markets in the OECD and view lending banks as key drivers of cross-border lending. Using a number of specifications of the Gravity model, they define the attributes that may describe further important determinants of cross-border lending.

The second strand relates to studies that examine the interplay of financial crises and international bank lending based on data provided by the BIS over periods of financial stress to show how international bank shocks feed across borders using either bilateral country-level or bank-level data. Research that uses bilateral country-level data includes the studies by McGuire and Tarashev (2008), Cetorelli and Goldberg (2011), Buch et al. (2010), and Herrmann and Mihaljek (2010). While the impact of crisis has been analysed by Popov and Udell (2010), de Haas and van Horen (2012) and Schnabl (2012) using bank-level data.

To the best knowledge, the first paper to combine pull and push factors with financial stress indicators was Van Rijckeghem and Weder (2003). It was reported by the World Bank (2008) that during the global crisis that bank loans had grown less as a result of tensions in the global interbank market. While McGuire and Tarashev (2008) confirmed that cross-border loans were related to measures of bank health in borrower countries. Buch et al. (2009) found in their investigation of the relation between macroeconomic shocks and international banks' foreign assets that bank responses were linked to overshooting followed by readjustment over the following quarters.

The key research here is in Kleimeier et al. (2013) who analysed how financial crises impact cross-border banking stock. They did this by considering cross-border lending and depositing, separately from the borrower side and found that cross-border deposits and loans respond differently to different financial crises types. Their results show that financial crises before 2007/08 have had a significant positive and long-lasting impact on cross-border banking, because crisis-affected borrowers shift their business to foreign banking markets. Overall, their findings confirm that in a truly global crisis, what they call a globalisation enhancing impact driven by non-affected borrowers can counteract the globalisation-reducing impacts driven by crisis-affected

banks, and this should be taken into account when assessing the overall impact of crises on international banking.

Cetorelli and Goldberg (2011) indicated that banks reduced their international activities in the fourth quarter of 2008 and the first quarter of 2009 as a result of a short fall in international liquidity. In addition to the decline in the flows of funds across the global economy, a significant amount of derivative trades had been unwound and many banks capacity to lend in many of the world' developed economies was significantly constrained. The study found that banking sectors that relied more on short-term US dollar funding experienced a larger decline in cross-border lending. More specifically, McGuire and von Peter (2012) examined the extent to which dollar funding shortages have explained the decline in cross-border banking flows over the financial crisis period.

Much of the recent literature appears to show a general 'pull back' over this period. However the banking system and bank's behaviours varied noticeably and this appears to relate to the behaviour of foreign subsidiaries, the health in funding of local subsidiaries, and the distance between the lender and the borrower countries. Cull and Peria (2013) argue that in Eastern Europe, growth of loans by foreign banks contracted more than that of local private banks over the crisis period, but, in Latin America foreign banks did not reduce their loans at least in the early stage of the crisis. Moreover, Claessens and van Horen (2013) show that foreign banks cut credit by a greater extent than local banks in countries which were less important, but this was not true when the funds were locally sourced.

Other studies have also used Gravity models for international bank lending. Buch et al. (2010) have shown that the growth rate of world energy prices has had a significant impact on banks' foreign assets. Meanwhile, Herrmann and Mihaljek (2010) examined the drivers of cross-border ending based on panel data from seventeen advanced and twenty-eight less developed economies over the period 1993 to 2008. Using a Gravity model of financial flows, they found that the decline in cross-border lending during the global crisis period was mostly due to global rather than country-specific risk factors. While eastern and central Europe were less heavily impacted by this fall than other emerging market regions, because of the strength of the financial and monetary ties with lender countries and a relatively sound banking systems. Their

results show that cross-border bank flows are impacted by country specific risk factors, and they detect that the increases in expected global financial market volatility, fiscal deficits and a deterioration in bank sector performance reduce cross-border banking flows in emerging markets. This is further effect when financial and monetary linkages are not well defined between lender and borrower countries.

Finally, Düwel et al. (2011) focus on the German banking sector, employing data on long-terms loans issued by 69 German banking groups towards 66 countries between 2002 and 2010. They provide evidence that risk characteristics may become more relevant when loans are distributed by banks' affiliates located abroad. Moreover, they provide evidence that rising risk aversion among banks may have restricted cross-border lending during the subprime mortgage crisis that was further compounded by the collapse of Lehman Brothers.

In comparison with the studies considered above that look at more highly aggregated flow data some micro information has been collected by the BIS on loans raised among international banking syndications. When it is possible to obtain such proprietary data, it is possible to control for individual customer and bank characteristics.

Regarding the Euro zone, Erce (2014) examined the linkages between cross-border banks and sovereigns over the different crises. After discussing the evidence from previous crises, they focused on the Euro zone and found that banks from the core Euro zone economies played an important role in transferring the US mortgage crisis to the Euro zone. Cerutti and Claessens (2013) have argued that in recent years, international banks have sharply reduced direct foreign lending to domestic affiliated subsidiaries. This was especially important over the period when Lehman Brothers failed (2008Q2-2009Q2) and during the early part of the Euro crisis (2011Q3-2011Q4).

Using a large panel of bilateral bank flow data, Papaioannou (2005) evaluated how institutions and the political environment might have affected international bank flows from banks in 19 developed countries to 51 recipient economies. They exploit an empirical Gravity model including factors such as distance, GDP and population as a benchmark to explain the volume of international banking activity. They find that the European integration process has encouraged cross-border banking activity between member states. While EU membership has increased cross-border banking among

member-states and they suggest that the likely conduit for this has been changes in banking law and the elimination of exchange rate risk.

Existing empirical research findings suggested the source of bank lending, and recipient countries' macroeconomic and institutional (regulatory) determinants could be considered as major push and pull factors of cross-border bank lending (e.g. Ferrucci et al., 2004; Kim, 2000; Bohn and Tesar, 1996; Fernandez- Arias, 1996; Hernandez and Rudolph, 1997). Prior to 2008–2009 a strand of the literature found that international banks have a stabilising impact on aggregate lending during periods of financial turmoil for the host country as can be seen for the case of Eastern Europe (de Haas and van Lelyveld, 2006) and a broader set countries (de Haas and van Lelyveld, 2010).

In this Chapter, European markets are studied following recently undertaken empirical studies on international bank lending. This has developed on growing research showing that foreign banks were affected by the global propagation of the recent crises and especially as to how the crises affected cross-border bank lending.

Next, the nature of the data is considered along with the modelling strategy.

4.6 Empirical design and the Data

4.6.1 Defining cross border lending

The dependent variable used for estimation was a bilateral loan by each lender country to each of the borrower countries. This measure is retrieved for 19 advanced economies banking market lending to European recipient countries from the Consolidated Banking Statistics provided by the BIS.

Cross-border banking occurs in a specific country when a loan is made to a borrower in another country. The dependent variable is consolidated international bank claims of BIS reporting countries. The BIS's, International Banking Statistics are divided into the Consolidated and the Locational accounts.[41] Consolidated banking statistics are appropriate to an investigation of country lending determinants since they allow us to look at the exposure pattern by lenders and borrowers nationality (Herrmann

[41] The BIS Locational Banking Statistics benefit from their long time horizon, broad country coverage, and dis-aggregation into assets (i.e. loans) and liabilities (i.e. deposits) vis-à-vis different customer groups. However, the Locational Banking Statistics are either disaggregated by reporting unit (bank) or country customer.

and Mihaljek, 2013). This information is not available from other databases such as the IMF or the World Bank. Interestingly, consolidated statistics are based on the nationality and not residence. The "foreign claims" data are drawn from the consolidated banking statistics.[42] The consolidated cross-border claims are available on either an immediate borrower, or an ultimate risk basis. Like other research in the literature, the data on an immediate risk basis is used as they cover a longer time horizon that enables data collection for each country pair.[43]

For example, Cetorelli and Goldberg (2011), Cerutti and Claessens (2013) and Uhde and Mueller (2013) use the Consolidated International Banking Statistics database to examine bilateral lending between advanced and emerging economies over the period of the financial crisis. However, Bruno and Shin (2014) use the Locational International Banking Statistics data to analysis aggregate banking to emerging and advanced economies. The data collected here measure on a quarterly basis, bilateral cross-border lending stock over the period 1999 Q1 to 2014 Q4 for European countries. The sample covers a large geographic range, which extends to 19 individual countries and 29 individual borrower countries, see Appendix A4.

Here Consolidated Banking Loans data collected by the BIS are used as compared with the studies by McGuire and Tarashev (2008), Herrmann and Mihaljeck (2010), and Cetorelli and Golberg (2011) who have all used the BIS, aggregate country-level data on foreign bank and cross-border bank Claims. While De Haas and van Horen (2012, 2013), and Giannetti and Laeven (2012) have obtained syndicated loan market data to show how cross-border lending was impacted by the crisis.[44]

Following Cerutti (2013) and Kleimeier et al. (2013), the analysis takes into account exchange rate variations. These corrections are critical to achieve a representation of the evolution of banks claims. This type of correction is important for appropriate analysis and interpretation, because they can make larger difference comparisons to the original series. The large impacts of the sharp change in the

[42] Foreign claims comprise cross-border claims of domestic banks and their foreign offices (in domestic and foreign currency), as well as local claims of reporting banks' foreign offices in domestic and foreign currency (BIS, 2003).
[43] One disadvantage of the consolidated BIS data is that they also contain local claims that are denominated in a foreign currency. However, at least for the larger countries in the EU, this issue should be less important.
[44] For other papers analysing the determinants of aggregate cross-border banking using the BIS: see Van Rijckeghem and Weder (2003), Herrmann and Mihaljek (2013), Cerutti and Claessens (2013), Cerutti et al. (2014), and Bruno and Shin (2014).

dollar/euro exchange rate over the period 2008-09 was an important source of stock variation during the period under study, but it comes from exchange rate movements and not from bank caused underlying position changes. To eliminate the impact of exchange rate valuation, quarterly exchange rate-adjusted stocks are calculated. Firstly, the original nominal stock is taken for the second quarter of 1999 and successively the BIS quarterly exchange rate adjusted changes are added. The BIS reports all stocks and flows in the US$ independent of the currency in which the initial cross-border loan transactions are denominated. To calculate exchange rate adjusted changes (changes in stocks that are free of exchange rate valuation effects), the stocks are converted at both the previous quarter (T_0) and the current quarter (T_1) into their local currency by applying the US$ exchange rates. Next to reconvert their changes from their local currency terms into the US$ using period average exchange rates (see BIS, 2003).[45]

4.6.2 Explanatory variables

The analysis depends on a set of variables from those described in the previous empirical research consulted, to show the relationship between cross-border banking and other 'push and pull' factors,[46] which have been assembled theoretically to drive cross-border banking.

There are three primary factors that relate to the size dimension or the mass of the relative economies, then exports and finally distance; these all relate to the Gravity model.

Firstly, economic size is measured by the product of the GDPs of lender countries and borrower countries. Generally, Gravity models stipulate that a positive coefficient for the size of both lender and borrower countries. This variable can be considered to be an important factor determining the amount of loans demanded by the trading nations of the European market. However, banks in a lender country with a larger lender market

[45] Some recent papers created flow data from the BIS original stock data by taking first differences; this could be very misleading, since devaluation at the "lender" or at the "borrower" country might cause either a sharp increase or decrease in total assets, even if no capital movements have taken place. Not all countries receive foreign bank credit in all quarters, and so the BIS dataset includes some zeros. As discussed in the previous Chapter, when the log transformation has been applied the data has one added to it prior to the log transformation (1 plus the amount of cross-border lending to borrower countries).

[46] Following Lee (1966) "push factors are not preferable aspects of the area that one lives in, however pull factors are elements which attract one to another area". For the purpose of this chapter, push factors refer to home (lender) and pull factors to host (borrower) country conditions, and these push or pull country factor that then increase or reduce the cross-border activity.

are less dependent on business in foreign markets. Therefore home GDP could reduce cross border activity. Similarly, smaller borrower markets could attract more cross-border loans than larger ones, so the size of borrower GDP could be negative. The sign of GDP coefficients thus has to be empirically determined.

Secondly, bilateral exports, based on Obstfeld and Rogoff (2000) who provide both theoretical and empirical evidence to show that information gathered from trading across goods markets should encourage transactions in financial assets. Rose and Spiegel (2004) indicates that an increase in the expected bilateral trade volume with a given country is associated with an increase in borrowing in that country. If these arguments are valid, then higher bilateral exports encourage financial inflows into the borrower countries.

Thirdly, bilateral geographical distance can also be seen as a proxy for informational asymmetries and transaction costs between lender and borrower countries (de Haas and Van Horen, 2013). They show the greater the distance between the lender and borrower countries, the larger the cut in bank claims, and that distance is statistically significant. While, Mian (2006) shows that lending over larger distances could increase, but this is limited as a result of transaction and enforcement costs. Banks find it is difficult to recover debts when a defaulting borrower is further away. Suggesting why banks could cut lending more to firms in more distant countries when they make these allocation decisions across countries in more challenging times. Additionally, cross-border lending is expected to be negatively related to information asymmetries, transaction costs and investment risk (Ahearne et al., 2004).

Buch (2004) and Buch et al. (2010) indicate the cross-country differences that could play a role in determining banks' cross-border activity are differences in language, culture and legal system. So in addition, to more direct calculation of distance in terms of other forms of proximity in a more generic sense may also be accounted for by a common official language, a common land border and in part by a dummy that accounts for membership of the Euro zone. In terms of potential misspecification these variables are useful to reduce variable omission as they are proxies for both financial, informational and other frictions between lender country and the borrower. Linguistic ties could diminish informational frictions for two reasons; the existence of a common language may reduce costs of communication during credit negotiations and language

may serve as a proxy for cultural proximity as sharing a common language often coincides with common historical and cultural influences. This is consistent with the notion that transaction costs with a local presence are less, and cross border lending from the lender may be more feasible with the borrower from abroad who shares a language. The extent of trading activity and implicit historical linkages may also be observed relative to quarterly bilateral exports for lending and borrowing countries. There is evidence here that distance adversely affects cross-border lending stability. However, cross-border lending could also be impaired by a cultural or a land border. To control for the fact that during a crisis banks are more likely to continue lending to a country that is "close" (De Haas and Van Horen, 2012), a bilateral variable for proximity is included.

However, none of these variables captures the transaction costs related to the need for frequent interaction in real time between the parties. In particular, distance does not fully capture this effect as telephone, e-mail and teleconference communication are close substitutes for face-to-face interaction. So lateral distance is more disruptive of trade and as a result the time zone differential between the capital cities of the lender and borrower countries is used as a variable in this research using a variable that varies from zero to 12.[47] According to the best knowledge, this study is the first to include this variable to the research in cross banking.

Fourthly, as a measure of the efficiency of the banking sector, the rate of return is measured using the differential in lending rates between the lender and the borrower countries. These are available as quarter averages of monthly data on three-month nominal interest rates in each lender country and borrower country. The nominal interest rate is used as banks compute all expected profit and loss using nominal rates and relative to the lender country this is not affected by deducting a single country inflation rate from both terms implying that the institution either considers the return relative to the local cost of borrowing at an internal rate or relative to the lender rate. This variable is predicted to be positively related to cross-border banking, as an increase in a country's interest rate increases its income from lending. The higher interest rates in the borrower country or, conversely, lower interest rates in the lender countries should lead to an increase in lending in the borrower economies. Furthermore, the aim to

[47] The variable is constructed based on standard time zones, abstracting from the issue of daylight savings.

include this variable is to control for the presence of a risk-taking channel of monetary policy, as low interest rates over an extended period of time may push banks to take on more risk and increase the supply of lending.

Fifthly, the Financial Freedom Index[48] is another risk factor to determine whether the extent to which relative country risk affects the lenders viewpoint. This is a measure in the range 0-100 and used in relation to the lender country and borrower country. How this affects cross border lending would appear to be an empirical question with an index for the lender economies that is likely to be less important as they are more homogenous than the borrowers.

Sixthly, a variable to control for the various forms of crisis as this has been found to be important in affecting cross border banking. That is a dummy variable that takes the value 1 for specific quarters, to capture possible economic and financial changes that are common across our sample and zero otherwise. A dummy is included for quarter 4 in 2008 and first three quarters in 2009 to pick up the effect of the global financial crisis and the Lehman Brothers collapse. A dummy variable to capture the effect of the systemic crisis, and five dummy variables starting from 2011q4 till 2012q4 to capture Euro debt crisis. It is important to differentiate between the effects of the global crisis, systemic banking crises, the Lehman Brothers crisis and euro debt crisis on cross-border banking. To do so, the borrower countries are classified as having suffered a systemic banking crisis. In particular, 17 countries in our sample experienced systemic banking crises (see Appendix B4).

Finally, another indicator is developed to consider the lending stock for a member of EU. This can be viewed as an indirect test of 'deep integration' as sharing the same legal tender not only eliminates exchange rate volatility, but constitutes a cut of the transactional and informational barriers that apparently play a major role in shaping international banking decisions.[49] A major concern regarding most empirical analyses on institutions is if the estimated effect is driven by the substantial variability between countries. This also enables us to assess the effect of the ongoing European integration

[48] Financial freedom is a measure of banking efficiency and the independence from government control and interference in the financial sector. This indicator is considered to assess an economy's total level of financial freedom that guarantees easy and effective access to financing opportunities for businesses in the country. An overall score on a scale of 0 to 100 is given to a country's financial freedom through deductions from the ideal score of 100.

[49] Micco et al. (2003) use the variable EU to test for trade diversion that implies that it is possible an increase in trade among EU members comes at the expense of a deterioration of commercial links with non-member countries. The same reasoning applies here with respect to bank funds.

in cross-border banking activities. The EU Single Market Act and the subsequent Financial Service Action Plan purposed to remove both barriers in cross-border movements of capital by harmonising banking law and financial services' regulation.

Data definitions and sources can be found in Table (4.1) below.

Table (4.1)

The variables and their sources are summarised as following

Variable	Variable description	Data sources
$L_{i,j,t}$	the log of the quarter, the exchange-rate adjusted stocks of cross-border loans in millions of US dollar from the lender to the borrower country.	BIS
$GDP_{i,t}$, $GDP_{j,t}$	Millions of US dollars, volume estimates, fixed purchasing power parities, OECD reference year 2005, quarterly levels, seasonally adjusted.	OECD
$BEXP_{i,j,t}$	bilateral quarter exports from the lender to borrower country.	DataStream (Thomson-Reuters)
$DIS_{i,j}$	The geographical distance measured in kilometres.	CEPII Distance Database (www.cepii.fr)
$TimDiff_{i,j,t}$	Variable accounting for the time differential in between the capital cities of the lender and borrower countries.	Britanica atlas, Encycopedia Britanica Inc. 1994
$RateDiff_{j,I,t}$	The spread of lending interest rates between the borrower and the lender country, available as quarter averages of monthly data on three-month nominal interest rates in each lender country and borrower country.	International Financial Statistics
$FinFreedom_{i,t}$, $FinFreedom_{j,t}$	An index of financial freedom.	Heritage Foundation 2015 www.heritage.org
$Border_{i,j}$	Dummy variable that equals 1 when both countries share a common land border	World Factbook
$Lang_{i,j}$	Dummy variable that equals 1 when both countries share a common official language	www.cepii.fr
$SYS_{j,t}$	Dummy variable that equals 1 when borrower country experiences a systemic banking crisis in quarter T, otherwise 0	(see Appendix B4)
FC_t	Dummy variable equal to one in the quarter 4 in year 2008 and first three quarters in year 2009 otherwise 0, to pick up the effect of the global financial crisis and the Lehman Brothers collapse. And equal to one in the quarter 4 in year 2011 and all quarters in year 2012, to capture the effect Euro debt crisis, otherwise 0.	
$EU_{i,j,t}$	Dummy variable that equals 1 if countries i and j are EU members at time t and 0 otherwise.	(see Appendix A4)

**Quarterly data over the period 1999 Q1 to 2014 Q4

4.7 Econometric methodology

Here the intention is to clarify the determinants of cross-border lending by the application of a Gravity model to which have been added further factors including variables to capture the spread of crises from the advanced economies to the European market economies. In addition to the push and pull factors considered in the previous literature, indicators to capture country specific financial efficiency are important determinants of cross-border lending. This chapter develops further a recent literature linking the determinants of cross-border banking and financial stress indicators (see Buch et al., 2010; McGuire and Tarashev, 2008; and World Bank, 2008).

4.7.1 Applying the gravity approach

Building on the existing empirical literature, our analysis depends on a Gravity model to study cross border lending stock determinants, especially in periods of financial crises. These are issues not yet studied in the literature in detail.

Underlying the model there is a set of country specific variables that capture the gravitational effects related to equation (4.1). Several of the variables are dummies that operate like classic fixed effects when the data are pooled across country transactions. A single model specification with the addition of such variables would capture country specific heterogeneity in this way, but were this not to be complete then the model would be misspecified and estimation would be biased or inconsistent. An alternative to the fixed effects specification is the random effects estimator that captures heterogenity in the structure of the error.

The modelling strategy is to adopt the static Gravity model without financial crises dummies. The second step to consider the impact of a set of crises variable on cross-border lending. The estimation of the Gravity model is undertaken using a random effects panel data model. We then show that the results are robust to alternative panel methodologies. This is a benchmark relative to the existing literature. The primary Gravity model specification is presented in equation (4.2.) below.

$$\begin{aligned}\mathrm{Log(L)_{i,j,t}} = {} & \mathrm{a_{i,j}} + \mathrm{b_1 LogGDP_{i.t}} + \mathrm{b_2 LogGDP_{j.t}} + \mathrm{b_3 LogBEXP_{i,j.t}} + \mathrm{b_4 LogDIS_{i,j}} \\ & + \mathrm{b_5 RateDiff_{j.i.t}} + \mathrm{b_6 finfreedom_{i.t}} + \mathrm{b_7 finfreedom_{j.t}} + \mathrm{b_8 border_{i,j}} \\ & + \mathrm{b_9 Lang_{i,j}} + \mathrm{b_{10} EU_{i,j.t}} + \mathrm{b_{11} TimDiff_{i,j.t}} \\ & + \varepsilon_{\mathrm{i,j,t}}. \end{aligned} \quad (4.2)$$

In terms of right-hand side variables in equation (4.2), the fundamental drivers of cross border lending are accounted by the lender (push) and borrower (pull) factors that figure in the previous section. Where (*i*) and (*j*) indicate the "lender" and "borrower" country respectively and *t* denotes the time dimension of the sample in quarters. The log denotes the natural logarithm and the dependent variable $L_{i,j,t}$ is the exchange rate-adjusted stocks of cross-border loans in quarter *t* from banks in lender country (*i*) to the borrower country (*j);* that is bank and non-bank sectors of borrower EU markets, respectively. *GDP* appears in equation (4.2) separately for country (*i*) and (*j*) to determine the relative effect of the size of a country market. The variable, $BEXP_{i,j.t}$ measures bilateral exports from the lender to borrower country and $DIS_{i,j}$ is the geographic distance. The following dummy variables take values 0 or 1: $Lang_{i,j}$ captures whether both countries have a common official language, $border_{i,j}$ a common land border and $EU_{i,j,t}$ for membership of the EU. The variable $RateDiff_{j,i.t}$ is the spread between the lending interest rate in the borrower country relative to the lender country. While $TimDiff_{i,j}$ captures time zone differential between the countries and *finfreedom* is the Financial Freedom Index entered as a variable for lender country (*i*) and for borrower country (*j*). The errors $\varepsilon_{\mathrm{i.j.t}}$ are assumed to be identically and independently distributed (IID) random error terms that are mean zero with variance $\sigma^2_{i,j.t}$.

The Gravity model can be extended to incorporate variables that may better capture cross-border lending stocks. In particular, by considering the mechanism via which financial crises have affected lending stocks, equation (4.3) is developed to include additional sets of variables that represent possible channels of crisis movement. As we are interested in the impact of financial crises, we introduce financial crisis dummies that distinguish between global crisis, Euro crisis and Lehman Brothers crises denoted by the variable FC_t and investigate the impacts for several quarters during and after the beginning of the crises.

$$\begin{aligned}\mathrm{Log(L)_{i,j,t}} = {} & \mathrm{a_{i,j}} + \mathrm{b_1 LogGDP_{i,t}} + \mathrm{b_2 LogGDP_{j,t}} + \mathrm{b_3 LogBEXP_{i,j,t}} + \mathrm{b_4 LogDIS_{i,j}} \\ & + \mathrm{b_5 RateDiff_{j.i.t}} + \mathrm{b_6 finfreedom}_{i.t} + \mathrm{b_7 finfreedom_{j,t}} + \mathrm{b_8 border_{i,j}} \\ & + \mathrm{b_9 Lang_{i,j}} + \mathrm{b_{10} EU_{i,j,t}} + \mathrm{b_{11} TimDiff_{i,j.t}} + \mathrm{b_{12}} FC_t + \mathrm{b_{13} SYS_{j,t}} \\ & + \varepsilon_{\mathrm{i,j,t}}. \qquad (4.3)\end{aligned}$$

Where $\mathrm{SYS_{j,t}}$ is a systemic banking crisis, dummy variable related to borrower country experiencing a crisis in quarter *t*.

Equations (4.2) and (4.3) are estimated by applying the "random effects" model to the panel of cross-country lending data. The random effects panel data specification captures heterogeneity not explained by the specification of the model. The model specifications (4.2) and (4.3) already incorporate fixed effects in terms of the dummy variables that capture aspects of the latent gravity relation and in the case of (4.3) the crises effects. The models not incorporating fixed and/or random effects are likely to be misspecified as they exclude lending country specific characteristics that underline any heterogeneity. This implies that these panel estimators ought to generate better predictions, and may generate micro-foundations that may help in any aggregate data analysis. The random-effects estimators are typically more efficient, since they use information both "between" and "within" the panel. Their consistency, however, crucially relies on individual effects not being correlated with the disturbances.[50]

As is mentioned by Wooldridge (2002) and Egger (2000, 2002), estimating the model with random effects is a logical strategy when the unit being pooled is relevant. This having been considered valid, then what is observed may be viewed as a sample as compared with a population.

In this light, the fixed effects models are often seen as more appropriate when the data is not sampled, but is seen to cover the population. While random effects models are more suitable when the purpose of inference relates to (an estimate of the)

[50] As has been mentioned in the previous Chapter, the Hausman test may not be so helpful in comparing specifications. Baltagi (2001), Wooldridge (2002) and Greene (2011) consider the specification issues related to different forms of panel estimation. In this chapter the time series dimension is relatively large leading to the use of more usual panel procedures. However, there are still a number of time-invariant factors that appear to be significant and this means that one cannot distinguish whether any potential correlation of fixed-effects with the error term of the within estimator is due to omitted factors in the within estimation (distance, common official language , etc), but that may be included in the random-effects. As may occur in all estimations there may other truly unobserved factors. A further issue is sample selection bias. It may be that the estimation would be improved were the countries selected are at random. However, given that for the countries used there are already some zero observations, then it may be that the data used is relatively complete. While the lenders represent the largest economies that cover most of the loan market.

population mean so that units are viewed as sampled from a total population. Subject to the comment above the latter may be seen as the case for a sample of lender and borrower country-pairs. Thus, the interest is in inference on typical financial stocks between a randomly drawn sample of countries rather than between a predetermined selection of nations. Moreover, employing the random-effects model is a reasonable strategy for our study since most of the variation should be observed over time while the random effects estimator still allows for the inclusion of a number of time-invariant variables among the regressors especially those important to the specification of the gravity model.

While from an econometric point of view for consistency of the estimator, the errors need to be independent of the regressors. This is a critical factor to distinguish between random and fixed effects methods. As the fixed effects approach is only impacted by correlation between the exogenous measures and the individual effect through collinearity that only affects efficiency of the estimator. However, random effects estimation assumes that the individual specific effect is uncorrelated with the independent variables.

Finally, consideration in computing the standard errors is given to controlling for clustering[51] and thus account for cross-sectional dependence. Even were random effects estimation adequate to control for clustering at the country-pair level, Wooldridge (2013) and Arellano (2003) discuss robust and cluster–robust VCE estimators for the random-effects estimations. When borrower-country clustering is controlled for, in most cases higher standard errors are obtained. In some cases, this leads to insignificance in the size and currency union proxies. This occurs as there is a trade-off with calculation of more robust standard errors to reduce bias with a loss of precision and as they tend to be larger, then it is decided to adjust the error at the country-pair level. Reporting such statistics is common in the recent empirical research using panel data on Banks.[52] Furthermore, according to (Nickell, 1981) there is no problem with biases in the

[51] Clustering, in the context of panel data involves computing standard errors and test statistics that are robust to any form of serial correlation and heteroscedasticity (Wooldridge.2012). Additionally, Arellano (1987) proposed that clustering with a panel country pair produces an estimator that is robust to cross-sectional heteroscedasticity and within-panel (serial) correlation.

[52] The following authors amongst others have investigated this: Blank et al.(2009),Victoria and Scharfstein (2010), Acharya et al. (2010), Düwel et al.(2011), Kleimeier et al. (2013), Cerutti and Claessens (2013), De Hass and Van Horen (2013), Buch et al.(2014), Uhde and Mueller (2013), Bologna and Caccavaio (2014), Cerutti (2013), Reinhardt and Riddiough (2015), Degryse et al. (2015), Papi et al. (2015) and Acharya et al. (2015).

estimates, as this study includes more than 30 time series observations (T=64). In the contrast to the previous chapter, so there is no need to add lagged dependent variables.

Furthermore, the lagrange multiplier (LM) test due to Breusch and Pagan (1980) is employed to test for the appropriateness of our model specification to compare between a random effect specification and OLS. In pooling the model both intercept and the coefficients on the explanatory variables are seen to be the same for each of the cross-sectional units. The null hypothesis of the LM test is that there is zero co-variation across the cross sectional entities. When the null is accepted, then there is no significant behaviour in any of the error components across such units.

The Breusch and Pagan LM test for random coefficient variation was first developed by Breusch and Pagan (1980) and modified by Baltagi and Li (1990). In this study, the test can be used to determine whether individual (or time) specific variance components are significant. An LM statistic is under the null of correct specification of the model and follows a chi-squared distribution with one degree of freedom when the simple form of the test is conducted. If the null hypothesis cannot be accepted, then it is possible to conclude that random effects are appropriate in the panel specification.

4.8 Empirical Findings

First the results are presented for the full sample of European countries. A range of different panel estimation procedures will be reported using random effects specifications. Moreover, our primary focus is on the direct effect of the factors affecting the stocks of cross border lending to European Markets from advanced economies.[53]

The results summarised in Table (4.2) initially relate to the conventional Gravity model (4.2) above and these regression results are presented in columns 1, 2 and 3. The next regressions relate to equation (4.3) and these are estimated including a set of dummy variables to explain the crises: global financial crisis, systemic banking crisis, Lehman Brothers collapse and Euro Debt Crisis (column: 4, 5, 6, 7, 8). In columns 9 and 10 are added dummy variables for the Euro debt crisis as a permanent effect.

According to the LM results presented here, the null hypothesis cannot be

[53] All estimations were undertaken in STATA 13.0

accepted and the random effects model yields a superior specification. This implies evidence of significant differences across countries.

Altogether, most of the estimated parameters have the expected signs, are statistically highly significant and the results are robust with respect to different model specifications. The gravity equations show that both push and pull factors had an impact on cross border lending during the period of study. For all the regressions, the size variable for both the lender and borrower is a positive and significant determinant of cross-border lending indicating that economies that have prospered in both sides of the bilateral trade benefit. This is coherent with the previous empirical studies by Papaioannou (2009), Alfaro et al. (2008) and Tornell and Velasco (1992). It is noticeable that economic size for the lender country is more important than that of the borrower country for cross-border lending for all the empirical results in Table (4.2). This suggests that the market size of the lender countries may be a stronger determinant in explaining cross-border lending from advanced economies to European markets.

The results for the lending interest rate differential variable in the case of cross-border lending was positive, but not significant. The insignificant interest rate differential on cross-border lending indicates that changes in the monetary policy stances in the lender and borrower countries do not appear to affect cross-border lending by these countries. It is also likely that this effect has been impacted by official interest rates during and after the global financial crisis of 2008–2009 almost falling to zero. Our result supports a common finding in empirical studies that showed that interest rates and interest rate differentials do not play as important a role as economic theory suggests in terms of cross border lending. For instance, Cetorelli and Goldberg (2011) found that international lending in the case of global US banks was insulated from monetary policy changes in the US. Kleimeier et al. (2013) found that interest rate differentials are not important when they studied cross border lending from 23 countries to 165 countries. Pontines and Siregar (2014) found similar results when lending from European countries to six Asian countries is considered.

With respect to the other factors, the regression results show bilateral exports have a positive and statistically significant effect on cross-border banking between lending and borrowing countries. The positive correlation between exports and lending can be explained, as exports have traditionally been a key avenue for the international

expansion of bank lending. Further, a strong export relationship between two economies may help enhance information flow between lenders and borrowers, which should enhance lending (see Rose and Spiegel, 2004).

Financial freedom, seen as a proxy for banking efficiency in lender and borrower financial systems was positively related to cross border lending; this could operate through stimulating consumption, investment and trade. The positive coefficients for lending countries suggest that banks in these countries place great importance on overall financial freedom (governance quality) and they are better disposed to increase their lending to better governed European markets.

The measures that capture proximity are commonly used to explain bilateral patterns in cross-border lending. This bilateral distance coefficient is negative and significant at the 1% level across all regressions indicating a decrease in the volume of lending with geographical distance between lender and borrower countries. This is consistent with the cross-border financial flow research as can be observed from the findings in Portes and Rey (2005), and Buch (2005). While similar findings arose with the empirical results in Degryse and Ongena (2005) suggesting distance makes it more difficult to monitor lenders increasing transaction costs.

In the second column of Table (4.2), the time zone differential is included in the regression from which it can be concluded that increases in the differential cause bilateral lending stocks to decline by 19 percent for each extra hour of time difference. This impact is both statistically significant and economically important. Moreover, after controlling for the time zone differential, the coefficient on distance is reduced. This reveals that in the case of international lending an important component of distance is the relative time zone over which transactions occur, there being an impact from the real-time interaction. Portes and Rey (2005) show that when other factors that more directly capture information costs, here the time zone differential variable, that the coefficient of distance decreases substantially. It must be said that here the distance effect is still negative and significant.[54]

Moving to the Friction variables, in all the regression in Table (4.2) except for column (1) and (2), an alternative distance measures (culture proxy and land border) are

[54] The time zone differential is not added to the other regressions in table (4.2) as it is expected that the other variable coefficients will not change in response to this inclusion as they are orthogonal.

added to the gravity specification. It seems clear that geographical distance is a very robust determinant of lending activity as the culture proxy and land border measures leave this measure strongly related to lending stability. However, the coefficient becomes less important. Culture as measured by the common language has the expected positive effect and is significant at the 1% level. So that a common language encourages cross border lending from advanced countries to the European markets, this result is in line with the previous empirical studies of Buch (2005), Papaioannou (2009), Stulz and Williamson (2003), and Herrero and Pería (2007).

However, the conventional gravity variable that does not enter with a positive coefficient relates to a common border. The insignificant effect of a common border may not be a surprise since adjacency might be seen as more important for trade in goods (Papaioannou, 2005). This suggests that cross border banking may depend more significantly on the other more usual determinants of the Gravity model especially such as culture, time zone and distance. When a similar analysis is applied to foreign direct investment (FDI), these findings are almost identical to the coefficients presented in Table (4.2). However, the negative effect of a common land border in relation to bilateral bank lending would appear to be insignificant as it may not be relevant to loans that are not related to these borders. Additionally, the insignificance and negative coefficient of the common border may relate to the common language variable, which is statistically significant and has a positive impact on for foreign loans. Thus, these effects may in the main just cancel out.

Corresponding to the results on geographical distance it suggests that banks seek external outlets of lending which are either culturally or geographically closer to their home markets.

Regarding EU membership, the estimated regressions including the dummy for EU membership in Columns (3) to (10), it is found that joint EU membership has a large impact. The EU coefficient estimate is economically and statistically highly significant; this implies that cross border banking between member states increases. It has been suggested that there is substantial integration in terms of equity and debt markets would seem to also be true for the banking sector. Thus, integration in the banking sector would appear to have taken the form of increased cross-border lending and borrowing rather than through acquisitions and mergers as in the USA.

Table (4.2) Determinants of cross border lending stocks from advanced to EU countries

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)	Column (7)	Column (8)	Column (9)	Column (10)
$LogGDP_{i,t}$	1.3748***	1.4284***	1.4830***	1.4690***	1.4475***	1.5069***	1.4912***	1.4591***	1.6420***	1.6211***
	(0.1625)	(0.1721)	(0.1774)	(0.1757)	(0.1780)	(0.1731)	(0.1710)	(0.1722)	(0.1734)	(0.1707)
$LogGDP_{j,t}$	1.3227***	1.3206***	1.3208***	1.3183***	1.2583***	1.3327***	1.3290***	1.2650***	1.3747***	1.3695***
	(0.1270)	(0.1270)	(0.1271)	(0.1264)	(0.1274)	(0.1263)	(0.1255)	(0.1262)	(0.1282)	(0.1272)
$LogBEXP_{i,j,t}$	0.2243***	0.2219***	0.2190***	0.2183***	0.2306***	0.2217***	0.2210***	0.2329***	0.2295***	0.2290***
	(0.0532)	(0.0531)	(0.0530)	(0.0529)	(0.0543)	(0.0532)	(0.0531)	(0.0544)	(0.0542)	(0.0541)
$LogDIS_{i,j}$	-1.2928***	-0.8526***	-0.5960***	-0.6006***	-0.6096***	-0.5839***	-0.5888***	-0.6010***	-0.5407**	-0.5464**
	(0.1328)	(0.1924)	(0.2061)	(0.2053)	(0.2009)	(0.2076)	(0.2067)	(0.2014)	(0.2161)	(0.2148)
$RateDiff_{i,j,t}$	0.0087	0.0088	0.0089	0.0087	0.0061	0.0089	0.0086	0.0060	0.0082	0.0080
	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)
$FinFreedom_{i,t}$	0.0103***	0.0104***	0.0104***	0.0102***	0.0090***	0.0105***	0.0104***	0.0091***	0.0107***	0.0106***
	(0.0031)	(0.0031)	(0.0032)	(0.0031)	(0.0031)	(0.0032)	(0.0032)	(0.0031)	(0.0031)	(0.0031)
$FinFreedom_{j,t}$	0.0012**	0.0012**	0.0012**	0.0011**	0.0005**	0.0010**	0.0009**	0.0004**	0.0002**	0.0001**
	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0025)	(0.0025)	(0.0024)	(0.0025)	(0.0025)
$Border_{i,j}$			-0.6103*	-0.6043*	-0.5740	-0.6330*	-0.6250*	-0.5859*	-0.7376*	-0.7259*
			(0.3614)	(0.3599)	(0.3510)	(0.3650)	(0.3631)	(0.3525)	(0.3848)	(0.3821)
$Lang_{i,j}$			1.5795***	1.5755***	1.5493***	1.5864***	1.5818***	1.5527***	1.6246***	1.6183***
			(0.3862)	(0.3854)	(0.3729)	(0.3894)	(0.3884)	(0.3747)	(0.4026)	(0.4009)
$EU_{i,j,t}$			2.2128***	2.1808***	2.1081***	2.2752***	2.2391***	2.1424***	2.5806***	2.5343***
			(0.5768)	(0.5738)	(0.5705)	(0.5740)	(0.5703)	(0.5641)	(0.5903)	(0.5853)
$TimDiff_{i,j,t}$		-0.1929**								
		(0.0789)								
$SYS_{i,t}$				0.3277***			0.3166***			0.2742***
				(0.0416)			(0.0405)			(0.0397)
$FC_{2008,q4}$					0.2941***			0.2852***		
					(0.0358)			(0.0341)		
$FC_{2009,q1}$					0.3961***			0.3882***		
					(0.0349)			(0.0341)		
$FC_{2009,q2}$					0.4387***			0.4307***		
					(0.0340)			(0.0333)		

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)	Column (7)	Column (8)	Column (9)	Column (10)
$FC_{2009,q3}$					0.4471***			0.4391***		
					(0.0339)			(0.0331)		
$FC_{2011,q4}$						-0.1508***	-0.1459***	-0.1134***		
						(0.0395)	(0.0394)	(0.0392)		
$FC_{2012,q1}$						-0.0812**	-0.0764*	-0.0448		
						(0.0405)	(0.0405)	(0.0403)		
$FC_{2012,q2}$						-0.1060***	-0.1013**	-0.0698*		
						(0.0410)	(0.0409)	(0.0404)		
$FC_{2012,q3}$						-0.1071**	-0.1025**	-0.0700*		
						(0.0421)	(0.0420)	(0.0415)		
$FC_{2012,q4}$						-0.0943**	-0.0897**	-0.0584		
						(0.0426)	(0.0425)	(0.0420)		
$FC_{2011,q4,long}$									-0.2003***	-0.1946***
									(0.0465)	(0.0465)
Constant	-22.9251***	-26.5157***	-31.3085***	-31.0009***	-29.9874***	-31.9556***	-31.6057***	-30.3558***	-34.9162***	-34.4734***
	(1.9131)	(2.6535)	(3.3063)	(3.2866)	(3.2809)	(3.2429)	(3.2184)	(3.1903)	(3.3146)	(3.2810)
Observations Number	27407	27407	27407	27407	27407	27407	27407	27407	27407	27407
Cluster country pairs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country pairs	513	513	513	513	513	513	513	513	513	513
R^2	0.5142	0.5160	0.5132	0.5137	0.5182	0.5125	0.5131	0.5178	0.5089	0.5097
R^2 -within	0.2244	0.2257	0.2246	0.2258	0.2351	0.2261	0.2271	0.2358	0.2332	0.2339
R^2 - between	0.5555	0.5563	0.5654	0.5658	0.5696	0.5649	0.5653	0.5693	0.5621	0.5627
LM test ~$\chi^2(1)$	4500***	4500***	4400***	4500***	4500***	4500***	4500***	4500***	4500***	4500***

Note: The dependent variable is the log of the quarter, the exchange-rate adjusted volume of cross-border loans in millions of US dollar between the lender - borrower country. For each independent variable, the first row shows the coefficient and the second row shows the standard error, which is heteroskedasticity robust and clustered by pair country. LM test for random effect.
***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.

Moving to the main variables of interest and beginning with the crises dummies. The results on systemic banking crises are shown in Table (4.2) - column 4, 7 and 10. The measures of systemic banking crisis are statistically significant with positive sign. The presence of systemic crises in the borrower country seems to lead to an increase in cross border lending. As systemic banking crisis and financial crisis are often related or overlapping, the global crisis dummy is excluded to focus on the effect of systemic banking crisis. The same also applies to the regressions in column (5) and column (8) to support the view that the global crisis was different. During other systemic banking crises, lenders look for safe havens abroad only after the crisis becomes obvious. An increase in cross-border loans during crisis times suggests that borrower demand outweighs the effect of informational asymmetry on bank loans. Specifically, borrowers whose banking systems respond to the direct effect of a crisis may feel the impact of overall credit restrictions early (Kleimeier et al., 2013). From the results in column 5 that include the quarterly dummy variables, it is seen that this pattern is largely affected by the global crisis and Lehman brothers crisis. Financial crises provide a particularly strong push towards cross-border loans stocks. While in the quarter after the global crisis started, cross-border loans stock remained high.

Further as the global financial crisis, systemic crises, and Lehman crisis, hit Europe in 2008-2009, according to Dornean and Sandu (2012), the global financial crisis had a strong effect on the EU countries. Almost all countries started to feel the impacts of the financial crisis in September 2008 mainly following the filing for bankruptcy by Lehman Brothers, but for the EU countries the peak impact was recorded in 2009, when they experienced dramatic falls in the GDP.[55] At the same time, further turmoil arises through a large increase in public debt and budget deficits. Overall, all EU member states were faced with the economic crises. In a crisis period GDP can fall in both lender and borrower countries, and this will cause a fall in cross border banking that is larger than the fall in GDP according to our these coefficients in Table (4.2) for which 1.4% is the average response for the lender country and 1.3% on average for the borrower countries in response to a 1% fall. Hence, the results are consistent with the widespread belief that cross border banking falls in crises.

[55] Dornean and Oanea (2012) explain that in 2009, the level of average GDP growth at EU level reached the minimum of -5.77%, compared to the level in 2008 of 1.32%.

It is also important to reconcile these results with those of Cetorelli and Goldberg (2011), and Navaretti et al. (2010), who find that total outstanding loans by foreign affiliates in Central and Eastern Europe did not decrease in the early stages of the crisis. Given that these studies look at total loans outstanding (stock), the evidence presented here would seem to accept the results regarding the Global and Lehman Brothers crisis. The two sets of findings can be reconciled by the different nature of stocks and flows as a decline in new loans does not necessarily imply a decline in total loans outstanding when the unused component of credit lines and overdraft facilities are used. The evidence indicates that this occurred in the early stages of the crisis in the U.S., as has been argued by Cohen-Cole et al. (2008) in response to Chari et al. (2008), while new bank credit declined dramatically after the collapse of Lehman Brothers, there was little change in total credit outstanding, because firms had to draw on their existing lines of credit lines.

Regarding the Euro debt crisis, what can be noticed from results in columns 6,7 and 8 in Table (4.2) is that the effect of this crisis, which started in quarter 4 in 2011 had a strong adverse effect on cross border banking in European markets, but this then became less significant from the first quarter of 2012. The Euro Crisis had much more impact on cross border banking than previous crises as it brought to the fore the necessity for the lender country specific regulation of banks, and therefore reduced the incentive to undertake foreign banking. Finally, in column (8) when the dummy variables for the period of Lehman Brothers crisis and global financial crisis are included with the Euro debt crisis, then the initial Euro crisis effect is robust to this. However, the extent of the impact of the Euro debt crisis is reduced as the dummies that relate to 2012 are no longer significant when the Lehman Brothers and global financial crises variables are introduced.

However, it can be seen that the Euro debt crisis may have a more permanent effect by including a further dummy variable that captures this, as can be noticed by the significance of this composite variable in columns (9 and 10) in Table (4.2). These findings indicate that the Euro debt crisis has a longer term effect over the time horizon since the crisis starts in q4 2011. Though this effect is reduced when the effect of the systemic banking crisis variable is included in column 10.

To conclude, during the financial crises international banks did not reduce their cross-border lending stocks in an indiscriminate manner; there was no run for the exit. Instead, the proximity of bank-borrowers was strongly related to the flexibility of cross-border credit. While banks continued to lend more to borrower countries that are geographically close, especially where they were integrated into a network of local co-lenders, and where they had more lending experience. These results indicate that deep financial integration is associated with stable cross-border credit during a crisis. The findings suggest that this pattern largely driven by financial crises depends on the nature of the crisis.

4.9 Robustness and Sensitivity Analysis

In this section some robustness checks are considered to check for potential omitted variables and sub-samples.

4.9.1 Adding control variables:

In addition to the variables in equation (4.3) the time-invariant factors related to the geographic component in Gravity model are included. In particular, by the addition of a new variable to literature related to European markets a control is made for other factors that are simultaneously influencing cross border banking, including exchange rate volatility and currency union controls (Butler and Fauver, 2006).

Although the dependent variable is adjusted for exchange rate valuations, the adjustment in the published series does not control totally for the valuation effect. Therefore, a bilateral nominal exchange rate volatility variable ($EXV_{i,j,t}$)[56] is added as an additional control variable in the new estimations. Volatility in bilateral exchange rates affects all capital movements and vice versa. An appreciating currency increases the expected rate of return measured in the lender's currency and this makes it easier for borrowers to repay their external loans, and this should induce additional inflows. So exchange rate volatility is included as a robustness check.

However, as cross-border lending is only one part of total capital movements, and this is only one of many factors impacting exchange rates. In terms of the measures used to capture volatility, potential endogeneity between cross-border banking and

[56] As the exchange rates expected return is calculated according to nominal interest rate and nominal values.

nominal exchange rates should not be a problem (see Herrmann and Mihaljek, 2013). The volatility in the bilateral exchange rate is an indicator of financial instability and exchange rate risk and this has been represented in the estimation work by an average of the end of quarter variance of daily bilateral exchange rates.

4.9.1.2 Measuring Exchange Rate Volatility

The effect of exchange rate volatility on cross border banking has been discussed in the literature for emerging countries, but there is currently little agreement on the direction of these effects regarding developed economies. In this chapter as in Chapter 3 the GARCH(1,1) method is predominantly used to construct a measure of volatility. The volatility measure of the nominal exchange rate is constructed by first taking the log difference of daily exchange rates calculated from data taken from the IFS database.[57] The dynamic measure of the volatility (σ_{it}) conditioned on the regression errors (u_{it}) explained by the GARCH(1,1) process is:

$$\sigma_{it}^2 = \omega_i + \alpha_i u_{it-1}^2 + \beta_i \sigma_{it-1}^2. \qquad (4.4)$$

Daily conditional variances are used to construct an indicator of quarterly volatility**.** A simple weighted moving average model (4.4a) is used as the variance estimate when it is not possible to identify the ARCH/GARCH specification:

$$\sigma_{it}^2 = \sum_{j=1}^{p} u_{it-j}^2 \qquad (4.4a)$$

These are based on blocks of p=20 past observations on the past errors to create a rolling moving average. The details as to the methods applied to estimate the volatility for each bilateral pair of currencies are given in Table (4.3) for all of the bilateral nominal GARCH and the moving average models. In 20 out of 536 cases the WMA process is used, and in one case the GARCH(1,2) specification is applied, but otherwise the model of variance is the GARCH(1,1) model.

[57] Calculation of the exchange rate for euro area countries depends on differences in national conventions for rounding up the data, then all conversions between the national currencies had to be carried out using cross arbitrage via the Euro. See Smith and Hunter (1985) for a discussion of the impact of cross arbitrage on exchange rate specification. Secondly, the original conversion rates were determined by the Council of the European Union based on a recommendation from the European Commission using market rates as of the 31st December 1998 (see Appendix D4).

Table (4.3) Measure of Bilateral Exchange rate volatility

	AU	AT	BE	CA	CH	DE	DK	ES	FI	FR	GB	GR	IE	IT	JP	NL	PT	SE	US
AT	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
BE	**WMA**	**WMA**	-	**WMA**	**WMA**	**WMA**	**WMA**	**WMA**	**WMA**	**WMA**	**WMA**	G(1.1)	**WMA**	**WMA**	**WMA**	**WMA**	**WMA**	**WMA**	**WMA**
BG	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
HR	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
CY	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
CZ	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
DK	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
EE	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
FI	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
FR	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
DE	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
GR	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
HU	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
IE	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	**WMA**	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
IT	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
LV	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
LT	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	**WMA**	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
LU	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	**G(1.2)**	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
MT	G(1.1)	**WMA**	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
NL	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)
PL	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
PT	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)
RO	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
SK	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
SI	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
ES	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
SE	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)
CH	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)
GB	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	-	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)	G(1.1)

Note: G(1.1): GARCH(1.1), G(1.2): GARCH (1.2), WMA: Weighted Moving Average - for the countries and currencies code (see Appendix D4).

Additionally, this study contributes to the research by examining the effect of currency union $CU_{i,j,t}$ [58] (the group of countries that adopt the Euro currency as their national currency) on cross border banking in the context of the EU. Moreover, the single currency has eliminated exchange rate risk for transactions within the Euro zone. It is possible that the Euro area will attract extra-EU lending since a single currency allows for complete penetration by multinational corporations into the most important part of the central European market.[59]

The results in Table (4.4) indicate that exchange rate volatility has not had a significant effect on cross border lending to European countries. This may occur as most of the sample is in the Euro zone that is 18 out of 29 countries and the results suggest that there is no risk associated with exchange rate volatility. These results are in the line with Düwel and Lipponer (2011) who study German bank foreign lending. This chapter noted that the extent to which EU favours lower exchange rate volatility, it is beneficial to cross border lending.

However, the Euro dummy variable is statistically positive, but not significant across all the results in Table (4.4). This suggests that currency union in these groups did not significantly affect the stock of cross border lending. In contrast, the EU dummy is positive and statistically significant suggesting that regional integration may have removed key barriers to cross border lending among European countries. This suggests that the EU offsets or causes the insignificant finding on the Euro currency zone. They are both positive though the EU dummy coefficient becomes less important with the currency union dummy variable.

Altogether, this finding squares with the fact that the EU dummy captures not just the elimination of exchange rate volatility, but also the additional benefits of a single currency outlined earlier. Aristotelous and Fountas (2012) found similar results when they studied the effect of exchange rate volatility on FDI inflow into the Euro zone. The coefficients of all the variables across the regressions in Table (4.4) appear stable in terms of sign and significance.

[58] Dummy variable that equals 1 if countries i and j use the same currency at time t and 0 otherwise, see Appendix C4

[59] The idea is that a single currency would boost trade along the lines of Rose (2000). Hence, locating in one member country will grant access to the market of all other participants to the currency union. This in turn increases the extent of the market served by the foreign affiliate and makes cross border lending potentially more profitable.

Table (4.4) Determinants of cross border lending stocks from advanced to EU countries -including exchange rate volatility and Euro dummy

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)	Column (7)	Column (8)	Column (9)	Column (10)
$LogGDP_{i,t}$	1.3802***	1.4309***	1.4848***	1.4708***	1.4490***	1.5098***	1.4941***	1.4612***	1.6511***	1.6303***
	(0.1626)	(0.1722)	(0.1776)	(0.1758)	(0.1781)	(0.1730)	(0.1710)	(0.1719)	(0.1729)	(0.1703)
$LogGDP_{j,t}$	1.3085***	1.3071***	1.3077***	1.3053***	1.2478***	1.3186***	1.3151***	1.2538***	1.3562***	1.3514***
	(0.1295)	(0.1294)	(0.1296)	(0.1289)	(0.1297)	(0.1288)	(0.1279)	(0.1284)	(0.1304)	(0.1295)
$LogBEXP_{i,j,t}$	0.2196***	0.2176***	0.2149***	0.2142***	0.2274***	0.2172***	0.2165***	0.2293***	0.2234***	0.2229***
	(0.0523)	(0.0522)	(0.0521)	(0.0520)	(0.0535)	(0.0522)	(0.0521)	(0.0536)	(0.0531)	(0.0530)
$LogDIS_{i,j}$	-1.2896***	-0.8707***	-0.6160***	-0.6205***	-0.6251***	-0.6060***	-0.6108***	-0.6181***	-0.5704***	-0.5758***
	(0.1327)	(0.1934)	(0.2078)	(0.2070)	(0.2029)	(0.2092)	(0.2083)	(0.2034)	(0.2174)	(0.2161)
$RateDiff_{j.i,t}$	0.0089	0.0089	0.0091	0.0088	0.0062	0.0090	0.0087	0.0061	0.0084	0.0081
	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0076)	(0.0076)
$FinFreedom_{i,t}$	0.0101***	0.0101***	0.0101***	0.0100***	0.0088***	0.0102***	0.0101***	0.0089***	0.0103***	0.0101***
	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0031)	(0.0032)	(0.0032)	(0.0031)	(0.0032)	(0.0031)
$FinFreedom_{j,t}$	0.0015**	0.0015**	0.0014**	0.0013**	0.0006**	0.0013**	0.0012**	0.0006**	0.0005**	0.0005**
	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)
$CU_{i,j,t}$	0.1110	0.1054	0.1023	0.1021	0.0788	0.1160	0.1153	0.0889	0.1647	0.1631
	(0.1499)	(0.1506)	(0.1508)	(0.1505)	(0.1489)	(0.1503)	(0.1499)	(0.1484)	(0.1504)	(0.1500)
$EXV_{i,j,t}$	-0.1761	-0.1764	-0.1743	-0.1858	-0.2422*	-0.1766	-0.1876	-0.2423*	-0.1972	-0.2063
	(0.1286)	(0.1290)	(0.1296)	(0.1285)	(0.1194)	(0.1298)	(0.1288)	(0.1200)	(0.1282)	(0.1278)
$Border_{i,j}$			-0.6276*	-0.6213*	-0.5858*	-0.6537*	-0.6456*	-0.6002*	-0.7713**	-0.7594**
			(0.3609)	(0.3594)	(0.3511)	(0.3644)	(0.3626)	(0.3524)	(0.3844)	(0.3817)
$Lang_{i,j}$			1.5739***	1.5699***	1.5444***	1.5806***	1.5759***	1.5474***	1.6179***	1.6118***
			(0.3838)	(0.3831)	(0.3713)	(0.3868)	(0.3858)	(0.3729)	(0.3992)	(0.3975)
$EU_{i,j,t}$			2.1459***	2.1139***	2.0564***	2.2017***	2.1662***	2.0856***	2.4876***	2.4426***
			(0.5901)	(0.5871)	(0.5837)	(0.5875)	(0.5840)	(0.5775)	(0.6031)	(0.5982)
$TimDiff_{i,j,t}$		-0.1836**								
		(0.0807)								
$SYS_{j.t}$				0.3279***			0.3164***			0.2720***
				(0.0416)			(0.0405)			(0.0396)
$FC_{2008,q4}$					0.2955***			0.2862***		
					(0.0358)			(0.0341)		

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)	Column (7)	Column (8)	Column (9)	Column (10)
$FC_{2009,q1}$					0.3948***			0.3862***		
					(0.0350)			(0.0341)		
$FC_{2009,q2}$					0.4367***			0.4280***		
					(0.0340)			(0.0332)		
$FC_{2009,q3}$					0.4456***			0.4368***		
					(0.0339)			(0.0330)		
$FC_{2011,q4}$						-0.1548***	-0.1499***	-0.1167***		
						(0.0390)	(0.0390)	(0.0387)		
$FC_{2012,q1}$						-0.0854**	-0.0806**	-0.0482		
						(0.0401)	(0.0400)	(0.0398)		
$FC_{2012,q2}$						-0.1103***	-0.1056***	-0.0733*		
						(0.0405)	(0.0403)	(0.0398)		
$FC_{2012,q3}$						-0.1112***	-0.1065**	-0.0731*		
						(0.0415)	(0.0414)	(0.0409)		
$FC_{2012,q4}$						-0.0985**	-0.0939**	-0.0617		
						(0.0422)	(0.0420)	(0.0415)		
$FC_{2011,q4,long}$									-0.2082***	-0.2026***
									(0.0463)	(0.0463)
Constant	-22.7885***	-26.2114***	-30.9161***	-30.6087***	-29.6784***	-31.5373***	-31.1914***	-30.0259***	-34.4322***	-34.0001***
	(1.9155)	(2.6887)	(3.3641)	(3.3444)	(3.3382)	(3.3043)	(3.2803)	(3.2507)	(3.3679)	(3.3352)
Observations Number	27406	27406	27406	27406	27406	27406	27406	27406	27406	27406
Cluster country pairs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country pairs	513	513	513	513	513	513	513	513	513	513
R^2	0.5154	0.5168	0.5144	0.5149	0.5190	0.5137	0.5144	0.5187	0.5103	0.5111
R^2 -within	0.2246	0.2257	0.2248	0.2260	0.2352	0.2263	0.2273	0.2360	0.2338	0.2344
R^2 - between	0.5569	0.5572	0.5665	0.5669	0.5704	0.5660	0.5665	0.5702	0.5634	0.5640
LM test $\sim\chi^2(1)$	4500***	4500***	4500***	4500***	4500***	4500***	4500***	4500***	4500***	4500***

NOTE: This table provides robustness checks for Table (4.2), by including bilateral exchange rate volatility and common currency dummy variables.
The dependent variable is the log of the quarter, the exchange-rate adjusted volume of cross-border loans in millions of US dollar between the lender - borrower country. For each independent variable, the first row shows the coefficient and the second row shows the standard error, which is heteroskedasticity robust and clustered by pair country. LM test for random effect.
***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.

4.9.2 Financial Centre effects

For the financial services sector, internationalisation played a critical role in the recent crises, increasing challenges for firms, regulators and investors. International financial centres are increasingly discussed (see Park and Essayyad, 1989). As these centres must have unique features, which benefit international banking in general and the borrower country in particular. For instance, financial centres develop the international allocation of financial resources by enhancing the local capital markets integration with global markets. They spur the multinational banks growth by providing a preferable fiscal and regulatory climate. Therefore, increasing financial globalisation is possible to continue sustaining growth in financial centres.

From the point of view of multinational banks, establishing a presence in financial centres is "going where the business is" (Tschoegl, 2000) to meet other banks through subsidiaries and/or branches to develop specific business lines and that is inter-bank activities or trading in the wholesale financial market. Furthermore, financial centres provide agglomeration economies, which benefit banks' revenues, reduce their costs and encourage innovation.

In the banking research literature, there are just two papers, which focus on bank efficiency in financial centres; Kwan (2006) and Rime et al. (2003). The first analyses cost efficiency of commercial banks in Hong Kong by applying a standard multiproduct translog cost function and their results indicate that banks move closer to the frontier over time. Moreover, large banks were less efficient, but the size effect seems to be related to portfolios differences. Rime et al. (2003) analyse the performance of Swiss banks applying a distribution-free approach.

As financial centres provide a platform where international banks meet via their subsidiaries and/or branches, the likely favourable nature of the organisational form needs to be tested. Additionally, the difference between lending and borrowing country characteristics needs to be taken into account to measure performance properly.

As here consolidated banking statistics (which are based on the nationality) are applied to a Gravity model, this avoids problems caused when some exposure is related to financial centres as some account is made for locational banking (see Herrmann and

Mihaljek, 2010).[60] Even given the special nature of the dataset used, the robustness of these results is checked by including a dummy variable for countries hosting a financial centre (see Table 4.5). In the first instance include variables among the country dummies in equation (4.3) are variables meant to account for countries classified as international financial centres by IMF such as the United Kingdom, Luxemburg and Switzerland.

The results including the financial centres dummy are shown in Table (4.5). As is seen from the regressions in Table (4.5), the UK and Switzerland dummies have no impact on cross border lending, while the Luxemburg dummy has a significant positive effect. This can be interpreted as evidence that lower regulatory barriers or lower information costs increase the volume of international bank activity. Recently, Luxembourg developed as a centre for private banking and currently it is the largest European centre for the domicile of investment funds (IMF, 2009). Growth may have been enhanced by tax and regulatory advantages in addition to Luxembourg's swift implementation of EU directives (OECD, 2008, 2010).

Additionally, estimates of other parameters in Table (4.5) across all regressions are comparable with the results presented in Table (4.2). This confirms that the inclusion of country specific dummy variables to capture financial centres does not impact the results. Financial friction is less important across all our specifications, and the time zone differential has a higher coefficient, whilst the coefficient for the distance variable in the same regression in column (2) is lower than the coefficient in Table (4.2) further confirming that results that include time zone differential will reduce the distance coefficient.

In addition, with the introduction of financial centres, the EU coefficients have increased and so this may provide a further indication that integration across EU countries has increased as can be viewed from the results in Table (4.5). This might suggest that financial centres may help to reduce the barriers between lenders and borrowers countries.

[60] The use of the locational banking statistics in a Gravity model might pose a problem when some exposure is booked to financial centres.

Table (4.5) Determinants of cross border lending stocks from advanced to EU countries - adding host financial centres effect

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)	Column (7)	Column (8)	Column (9)	Column (10)
$LogGDP_{i.t}$	1.3451***	1.4107***	1.4669***	1.4553***	1.4330***	1.4894***	1.4764***	1.4433***	1.6205***	1.6038***
	(0.1583)	(0.1682)	(0.1740)	(0.1733)	(0.1746)	(0.1696)	(0.1686)	(0.1686)	(0.1700)	(0.1685)
$LogGDP_{j,t}$	1.3315***	1.3281***	1.3296***	1.3284***	1.2661***	1.3420***	1.3397***	1.2732***	1.3856***	1.3821***
	(0.1291)	(0.1292)	(0.1295)	(0.1291)	(0.1298)	(0.1287)	(0.1283)	(0.1286)	(0.1307)	(0.1301)
$LogBEXP_{i.j,t}$	0.2269***	0.2241***	0.2211***	0.2201***	0.2327***	0.2239***	0.2230***	0.2351***	0.2318***	0.2309***
	(0.0532)	(0.0531)	(0.0530)	(0.0529)	(0.0543)	(0.0531)	(0.0530)	(0.0544)	(0.0541)	(0.0540)
$LogDIS_{i.j}$	-1.2347***	-0.7124***	-0.4917**	-0.4965**	-0.5047**	-0.4792**	-0.4843**	-0.4959**	-0.4347**	-0.4404**
	(0.1303)	(0.1937)	(0.2067)	(0.2062)	(0.2016)	(0.2082)	(0.2076)	(0.2021)	(0.2167)	(0.2157)
$RateDiff_{j.i,t}$	0.0091	0.0091	0.0093	0.0090	0.0064	0.0092	0.0089	0.0064	0.0086	0.0084
	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)
$FinFreedom_{i,t}$	0.0103***	0.0104***	0.0104***	0.0102***	0.0090***	0.0105***	0.0104***	0.0091***	0.0107***	0.0105***
	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0032)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
$FinFreedom_{j,t}$	0.0011**	0.0011**	0.0011**	0.0010**	0.0004**	0.0009**	0.0008**	0.0003**	0.0001**	0.0000**
	(0.0025)	(0.0025)	(0.0024)	(0.0024)	(0.0024)	(0.0025)	(0.0025)	(0.0024)	(0.0025)	(0.0025)
$Border_{i,j}$			-0.4403	-0.4365	-0.4001	-0.4630	-0.4576	-0.4120	-0.5666	-0.5583
			(0.3610)	(0.3599)	(0.3509)	(0.3645)	(0.3632)	(0.3524)	(0.3840)	(0.3820)
$Lang_{i,j}$			1.2403***	1.2383***	1.2104***	1.2452***	1.2427***	1.2124***	1.2744***	1.2708***
			(0.4010)	(0.4007)	(0.3887)	(0.4036)	(0.4031)	(0.3902)	(0.4140)	(0.4131)
$EU_{i,j,t}$			2.3672***	2.3392***	2.2659***	2.4277***	2.3965***	2.2985***	2.7288***	2.6901***
			(0.5710)	(0.5695)	(0.5647)	(0.5680)	(0.5659)	(0.5580)	(0.5842)	(0.5811)
Luxemburg	2.5149***	2.6808***	2.5395***	2.5318***	2.4538***	2.5719***	2.5623***	2.4739***	2.6894***	2.6775***
	(0.8018)	(0.8101)	(0.8234)	(0.8217)	(0.8199)	(0.8255)	(0.8237)	(0.8204)	(0.8423)	(0.8399)
Switzerland	0.2140	0.2784	0.0951	0.0942	0.1222	0.0904	0.0898	0.1187	0.0824	0.0820
	(0.2595)	(0.2748)	(0.3071)	(0.3058)	(0.3038)	(0.3090)	(0.3075)	(0.3045)	(0.3229)	(0.3208)
UK	0.1054	0.3751	0.1787	0.1806	0.3097	0.1472	0.1513	0.2896	0.0521	0.0585
	(0.4137)	(0.4400)	(0.4325)	(0.4307)	(0.4274)	(0.4332)	(0.4310)	(0.4257)	(0.4519)	(0.4489)
$SYS_{j.t}$				0.3273***			0.3162***			0.2736***
				(0.0415)			(0.0405)			(0.0396)
$TimDiff_{i,j,t}$		-0.2272***								
		(0.0782)								

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)	Column (7)	Column (8)	Column (9)	Column (10)
$FC_{2008,q4}$					0.2934***			0.2844***		
					(0.0358)			(0.0341)		
$FC_{2009,q1}$					0.3958***			0.3878***		
					(0.0349)			(0.0340)		
$FC_{2009,q2}$					0.4383***			0.4303***		
					(0.0340)			(0.0333)		
$FC_{2009,q3}$					0.4467***			0.4385***		
					(0.0339)			(0.0331)		
$FC_{2011,q4}$						-0.1517***	-0.1471***	-0.1143***		
						(0.0395)	(0.0394)	(0.0392)		
$FC_{2012,q1}$						-0.0818**	-0.0772*	-0.0454		
						(0.0405)	(0.0404)	(0.0402)		
$FC_{2012,q2}$						-0.1067***	-0.1022**	-0.0704*		
						(0.0410)	(0.0408)	(0.0404)		
$FC_{2012,q3}$						-0.1077**	-0.1032**	-0.0705*		
						(0.0421)	(0.0420)	(0.0415)		
$FC_{2012,q4}$						-0.0949**	-0.0905**	-0.0590		
						(0.0426)	(0.0425)	(0.0420)		
$FC_{2011,q4,long}$									-0.2009***	-0.1956***
									(0.0465)	(0.0465)
Constant	-23.2143***	-27.5094***	-32.2277***	-31.9625***	-30.9249***	-32.8643***	-32.5646***	-31.2831***	-35.7975***	-35.4299***
	(1.8902)	(2.6109)	(3.2679)	(3.2592)	(3.2420)	(3.2036)	(3.1904)	(3.1501)	(3.2739)	(3.2532)
Observations Number	27407	27407	27407	27407	27407	27407	27407	27407	27407	27407
Cluster country pairs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country pairs	513	513	513	513	513	513	513	513	513	513
R^2	0.5234	0.5273	0.5212	0.5216	0.5268	0.5203	0.5208	0.5264	0.5163	0.5170
R^2 -within	0.2244	0.2257	0.2246	0.2258	0.2351	0.2260	0.2271	0.2358	0.2331	0.2338
R^2 - between	0.5686	0.5716	0.5773	0.5775	0.5822	0.5766	0.5769	0.5818	0.5733	0.5739
LM test ~$\chi^2(1)$	4400***	4400***	4400***	4400***	4400***	4400***	4400***	4400***	4400***	4400***

NOTE: This table provides robustness checks for Table (4.2), by including host financial centres dummy variables.
The dependent variable is the log of the quarter, the exchange-rate adjusted volume of cross-border loans in millions of US dollar between the lender - borrower country. For each independent variable, the first row shows the coefficient and the second row shows the standard error, which is heteroskedasticity robust and clustered by pair country. LM test for random effect.
***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.

4.9.3 Euro zone sample

Does the financial crises effect vary across Euro Area (EA) members? To address this question and to assess regional differences in the determinants of cross-border lending stocks, the sample was restricted. Then regressions for six models were estimated for the Euro zone; both lender and borrower countries in the Euro Area. To study the effect of financial crises on the Euro zone, an analysis was undertaken using the random effects estimator on the same set of variables including a dummy for the countries, which participated in the Euro zone after 1999 (see Appendix C4).

The results of the sub- sample are presented in Table (4.6). They are similar in that in the first set of regressions this relates negatively to the cutbacks in cross-border loans, but it is not statistically significant for all specifications. This pattern likely reflects in part the fact that the crises were now centred on the Euro zone, It is of note that the coefficient on GDP for lender and borrower countries (these push and pull factors) and bilateral exports has remained significant and positive. However, in the case of GDP it is less important for the Euro zone whereas exports are important for this sub-sample. First, both coefficient values of the lender and borrower country's GDP turn out to be less in regressions on Euro zone as compared to the primary regression for the whole sample in table (4.2) Second, our results reveal that coefficient values of the borrower country's GDP are systematically higher in the subsample for the Euro zone regressions as compared to the lender country's GDP. Whereas the opposite is true for all regressions within the original sample suggesting that wealthier borrowing countries may find it easier to attract foreign bank lending from lending countries. These findings suggest that bank lending to the Euro zone is more highly dependent on the level of national incomes in the borrower Euro countries (pull factor) while an increase in the basic markets' GDPs more strongly fosters the provision of loans from the lender euro countries (push factor).

The effect of bilateral exports on cross border lending is also positive and significant; the estimated coefficient is on average 0.45, with a robust standard error of 0.09, implying a t-statistic in excess of 5. This means that an increase in bilateral exports leads to rise in cross border loans on average for our sub-sample, a comparable impact to that found by Rose and Spiegel (2004) for developing and developed countries.

Regarding, the bilateral friction variables (the language and border dummies) it was found that they are now less important determinants of cross border lending within the Euro zone, as they have led to a consolidated market with one currency, The language dummy which is thought to proxy the culture tie exhibits lower values in regressions for the Euro area market. The language variable does not appear to have high impact on cross border lending, at least not when the full sample of countries is considered. Furthermore, most countries in the Euro zone do not have one official language. While the negative coefficient on distance turns out to be higher across the regressions in Table (4.6). A negative and significant coefficient estimate of −0.6 for the distance variable implies that financial institutions among Euro zone economies have tended to favour lending to countries, which are located closer to each other as in the Euro zone. It is also interesting to note that the range of the distance coefficient [−0.7, −0.6] is very close to the range [−0.8, −0.6] reported in Papaioannou (2005).

The lending rate differential and common border variable estimates remain statistically and economically insignificant for the sub- sample. Interestingly, it was noticed from Table (4.6) that there is no effect linked to the participation of countries, in the Euro zone after the launch on cross border lending among Euro zone.

Regarding the banking efficiency of the lender and the borrower Euro zone countries, proxied by the financial freedom index, have a significant and positive effect on cross border lending across this subsample. Its positive coefficient indicates that countries with effective governments attract more bank lending.

It is seen when accounting for the different measures of the Euro debt crisis quarter dummies presented in column (2) and (6) of Table (4.6) have a statistically significant effect in explaining cross-border loans. For Q4-2011 till Q2-2012, the coefficients are negative, which could reflect the idea that the systems that had expanded fast before the crisis, had over-reported their profits and capital adequacy. It can be noticed from column (3), that the Euro debt crisis continues to have a negative and significant impact regarding loans across the Euro zone in quarter 3 and quarter 4 of 2012. These results confirm that the debt crisis has a persistent effect that is also highly significant as can be observed from the coefficients in column (4) and column (5) for the Euro debt crisis that starts in quarter 4 in 2011.

Table (4.6) Determinants of cross border lending stocks among Euro zone- Random effects estimator

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)
$LogGDP_{i,t}$	0.9481***	0.9539***	0.9535***	0.9186***	0.9070***	0.9369***
	(0.2446)	(0.2387)	(0.2385)	(0.2451)	(0.2375)	(0.2307)
$LogGDP_{j,t}$	0.9787***	0.9715***	0.9809***	1.0212***	0.9971***	0.9471***
	(0.1603)	(0.1573)	(0.1575)	(0.1639)	(0.1595)	(0.1525)
$LogBEXP_{i,j,t}$	0.4561***	0.4645***	0.4660***	0.5207***	0.5228***	0.4674***
	(0.0919)	(0.0915)	(0.0914)	(0.0925)	(0.0923)	(0.0914)
$LogDIS_{i,j}$	-0.6767***	-0.6653***	-0.6632***	-0.6072**	-0.6036**	-0.6611***
	(0.2498)	(0.2490)	(0.2503)	(0.2605)	(0.2565)	(0.2452)
$RateDiff_{j.i,t}$	0.0086	0.0078	0.0067	0.0019	0.0018	0.0075
	(0.0184)	(0.0182)	(0.0182)	(0.0179)	(0.0179)	(0.0182)
$FinFreedom_{i,t}$	0.0149***	0.0156***	0.0160***	0.0178***	0.0177***	0.0154***
	(0.0057)	(0.0057)	(0.0058)	(0.0057)	(0.0057)	(0.0057)
$FinFreedom_{j,t}$	0.0053**	0.0052**	0.0051**	0.0039**	0.0039**	0.0052**
	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0038)
$Border_{i,j}$	-0.8319*	-0.8421*	-0.8598*	-1.0266**	-0.9858**	-0.7998*
	(0.4551)	(0.4503)	(0.4517)	(0.4735)	(0.4646)	(0.4413)
$Lang_{i,j}$	1.0672**	1.0687**	1.0725**	1.1079*	1.0945*	1.0539**
	(0.5275)	(0.5275)	(0.5318)	(0.5719)	(0.5627)	(0.5189)
$Greece_{2001}$	-0.0298	-0.0258	-0.0253	0.0028	0.0020	-0.0261
	(0.2400)	(0.2403)	(0.2406)	(0.2437)	(0.2432)	(0.2397)
$Slovenia_{2007}$	0.5755	0.5875	0.5950	0.6628*	0.6577*	0.5800
	(0.3791)	(0.3794)	(0.3791)	(0.3778)	(0.3776)	(0.3790)
$Cyprs_{2008}$	0.7165	0.7031	0.6870	0.5003	0.5128	0.7146
	(0.4717)	(0.4725)	(0.4731)	(0.4792)	(0.4786)	(0.4717)
$Malta_{2008}$	-0.2633	-0.2343	-0.2191	-0.1680	-0.1548	-0.2197
	(0.2462)	(0.2457)	(0.2462)	(0.2472)	(0.2460)	(0.2444)
$Slovakia_{2009}$	0.4361	0.4563	0.4689	0.5670	0.5694	0.4597
	(0.3717)	(0.3715)	(0.3712)	(0.3711)	(0.3710)	(0.3713)
$Estonia_{2011}$	-0.6007	-0.5609	-0.5306	-0.2991	-0.2999	-0.5594
	(0.3683)	(0.3692)	(0.3699)	(0.3751)	(0.3747)	(0.3685)
$Latavia_{2014}$	-0.3658	-0.3870	-0.4055	-0.0846	-0.0838	-0.3826
	(0.3457)	(0.3459)	(0.3467)	(0.3475)	(0.3471)	(0.3455)
$FC_{2011,q4}$		-0.2384***	-0.2536***			-0.2326***
		(0.0599)	(0.0627)			(0.0602)
$FC_{2012,q1}$		-0.1799***	-0.1953***			-0.1744***
		(0.0629)	(0.0661)			(0.0630)
$FC_{2012,q2}$		-0.2397***	-0.2550***			-0.2343***
		(0.0621)	(0.0659)			(0.0618)
$FC_{2012,q3}$			-0.2220***			
			(0.0707)			
$FC_{2012,q4}$			-0.2605***			
			(0.0730)			
$FC_{2011,q4,long}$				-0.4424***	-0.4373***	
				(0.0774)	(0.0775)	
$SYS_{i.t}$					0.2029***	0.3116***
					(0.0648)	(0.0667)
Constant	-22.36587***	-22.6274***	-22.79318***	-24.22527***	-23.85783***	-22.19728***
	(3.6985)	(3.6194)	(3.6215)	(3.7424)	(3.6366)	(3.5079)
Observations	10101	10101	10101	10101	10101	10101

Variables	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes
Country pairs	186	186	186	186	186	186
R^2	0.5574	0.5586	0.5582	0.5560	0.5583	0.5610
R^2 -within	0.2357	0.2385	0.2408	0.2683	0.2684	0.2392
R^2 - between	0.5842	0.5856	0.5849	0.5797	0.5822	0.5881
LM test ~$\chi^2(1)$	1400***	1400***	1400***	1400***	1400***	1400***

Note: The dependent variable is the log of the quarter, the exchange-rate adjusted volume of cross-border loans in millions of US dollar between the lender - borrower country. For each independent variable, the first row shows the coefficient and the second row shows the standard error, which is heteroskedasticity robust and clustered by pair country. LM test for random effect.
***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.

By extending the time horizon for the post-crisis quarters, it was found here that the Euro debt crisis had a longer-term effect. Across all the results, it seems clear that the start of the crisis has an effect and this would seem to support the idea that borrowers in 2011 felt credit constrained early in the crisis. While difficulties in obtaining domestic credit only appeared to manifest itself later in other crises.

The systemic crisis variable remains statistically significant, but becomes less important when compared with the findings for the original sample, as can be seen from the findings in column (5) that include the dummy that captures the long term effect of the debt crisis. By comparison with the regression in column (4), the effect of the systemic banking crisis in column (5) has a reduced effect of the Euro debt crisis for the Euro zone countries in terms of cross border lending. On the other hand, as can be seen from Table (4.6), the effect of the Euro debt crisis is higher now than that found for the larger sample used in Table (4.2).

4.10 Conclusion

Given the importance, there is a lack of studies on the effect of cross-border activity on the EU banking markets. Especially after financial crises, and none has investigated the impact of exchange rate volatility and the impact of the spread of crises on cross border banking in the EU markets which is a fundamental issue, as cross-border activity is expected to exert an impact on efficiency via competition.

In addition to the push and pull factors considered in the literature, this chapter looks at the financial crises – differentiated by type: systemic banking, the global financial crisis, the Euro debt crisis and the Lehman Brothers' crisis. The geography of cross-border lending stock is also considered. This study is motivated by recent

theoretical work justifying a gravity model in banking, which proposed taking into account variables to proxy for informational asymmetries in gravity models for international asset holdings as a measure of financial frictions. Work by Brüggemann et al. (2012) and Niepmann (2013) shows a direct motivation for international bank loans, while most other models concentrate on international equity investments. In addition to the gravity factors (country size and distance), this study includes several additional explanatory variables that are expected to have a significant impact on cross border lending such as bilateral exports, the free financial index and time zone differential to capture country differences from both the perspective of the lender and the borrower country. Such transactions also have a geographical dimension that is well suited to handle information required to explain the mechanism by which the global and then the Euro zone crises have developed and spread. In addition to the investigation of the impact of crisis, further comparison arises from investigating the impact of European integration on cross-border banking activities between member states. The Gravity model was estimated using a random effects panel data model. It was then shown that the results were robust to alternative panel methods.

The specific transaction data used is on an immediate risk basis to study bilateral foreign asset transactions of reporting countries vis-a-vis borrowers in foreign countries over the period 1999-Q1 to 2014-Q4. The analysis relates to lending across Europe from 19 lenders to 29 borrower countries and such "foreign claims" data readily permits the investigation of lending at the country level. Quarterly exchange rate-adjusted stocks are used to help capture a crucial correction for exchange rate variations especially the sharp change in the dollar/euro exchange rate over the period 2008-09.

Following such correction, cross border lending stocks clearly depend on standard gravity variables, with the exception of the common border variable. The impact of market size as represented by GDP is generally large and positive while distance clearly reduces lending. In line with previous studies such as Kleimeier et al. (2013), the results indicate that financial crises increase cross border lending stocks to the EU as it is seen that the crisis is in the latter stage. This is in addition to banks lending to foreign customers as domestic banks balance sheets weaken. However, the Euro debt crisis from 2011 onwards was associated with a clear reduction in the intensity of European financial integration as risks of cross border activity rose significantly. It appears from these results that the reaction of cross-border loans to

financial crises depends on the nature of the crisis. It is found that the Euro debt crisis has had a significant and often long-lasting effect on cross-border lending to the EU. Moreover, EU membership has a large effect that suggests that banking integration has taken the form of increased cross-border lending across EU members. The findings suggest that EU membership has led to a substantial expansion of banking activities across EU members. It was found that the time zone differential between the lender and the borrower has the effect of mitigating the direct distance effect between countries.

These results are robust to the inclusion of a range of variables such as exchange rate volatility and the Euro currency effect, and this is in addition to the primary factors. It is found that membership of the EU has been a spur by reducing the impact of exchange rate volatility, and reducing the effect of common currency. Additionally, host country characteristics may drive bank efficiency as a result of the impact of recognised financial centres, but of these only Luxembourg amongst other countries such as Switzerland and the UK have a significant effect. This might be as a result of Luxembourg maintaining a favourable regulatory and fiscal environment to attract foreign banks (IMF, 2009).

Finally, the specifications are estimated over sub-samples involving Euro zone membership that is with both lender and borrowers in the Euro area. It is found that the effect of the Euro debt crisis has turned out to have a stronger effect than the primary regressions for EU members. The results confirm the importance of variables used in the primary models.

This study contributes to the understanding of the crisis in international banking and this chapter goes beyond the identification of statistically significant drivers of cross-border lending stocks on the economic significance of the estimated parameters. Specifically, the analysis quantifies the impact of global and country factors on observed cross-border stocks. Therefore, enabling an evaluation as to how financial stress is effectively transferred from more advanced economies across the European market economies. According to the best knowledge, the study in this chapter is one of the earliest to consider the lending to all the EUs 29 member states in the European Union during the crises. The EU is particularly suitable and interesting for this investigation since the regulation and structure of national banking markets is still heterogeneous despite national and European legal systems gradually becoming

intertwined, but with the primacy of EU law.

These findings suggest a need for further research. Further work is required to empirically evaluate how politics and institutions impact the capital movement behaviour such as portfolio investment. Or attempt to model a nonlinear relation with distance by including some other variables which capture the real transaction cost such as internet effect.

Appendix (A4) The table offers a list of the countries included in the sample.

Lender Countries (19)	**Borrower Countries- EU Countries**[61]
AU: Australia	AT: Austria
AT: Austria	BE: Belgium
BE: Belgium	BG: Bulgaria
CA: Canada	HR: Croatia
CH: Switzerland	CY: Cyprus
DE: Germany	CZ: Czech Republic
DK: Denmark	DK: Denmark
ES: Spain	EE: Estonia
FI: Finland	FI: Finland
FR: France	FR: France
GB: United Kingdom	DE: Germany
GR: Greece	GR: Greece
IE: Ireland	HU: Hungary
IT: Italy	IE: Ireland
JP: Japan	IT: Italy
NL: Netherlands	LV: Latvia
PT: Portugal	LT: Lithuania
SE: Sweden	LU: Luxembourg
US: United States	MT: Malta
	NL: Netherlands
	PL: Poland
	PT: Portugal
	RO: Romania
	SK: Slovakia
	SI: Slovenia
	ES: Spain
	SE: Sweden
	CH: Switzerland
	GB: United Kingdom

[61] As classified by the World Bank

Appendix (B4) Countries in the sample experienced borderline systemic banking crises[62]

Borrower Country	**Year-Quarter**
AT: Austria	2008-Q4
BE: Belgium	2008-Q4
BG: Bulgaria	-
HR: Croatia	-
CY: Cyprus	-
CZ: Czech Republic	-
DK: Denmark	2008-Q4
EE: Estonia	-
FI: Finland	-
FR: France	2008-Q4
DE: Germany	2008-Q4
GR: Greece	2008-Q4
HU: Hungary	2008-Q4
IE: Ireland	2008-Q4
IT: Italy	2008-Q4
LV: Latvia	-
LT: Lithuania	-
LU: Luxembourg	2008-Q4
MT: Malta	-
NL: Netherlands	2008-Q4
PL: Poland	-
PT: Portugal	2008-Q4
RO: Romania	-
SK: Slovakia	-
SI: Slovenia	2008-Q4
ES: Spain	2008-Q4
SE: Sweden	2008-Q4
CH: Switzerland	2008-Q4
GB: United Kingdom	2007-Q4

[62] Laeven and Valencia (2013) and Drehmann and Juselius (2014).

Appendix (C4) Accession into the Euro zone

Euro zone countries	**Adopted in year**
Austria	1999
Belgium	1999
Cyprus	2008
Estonia	2011
Finland	1999
France	1999
Germany	1999
Greece	2001
Ireland	1999
Latvia	2014
Luxembourg	1999
Italy	1999
Malta	2008
Netherlands	1999
Portugal	1999
Slovak Republic	2009
Slovenia	2007
Spain	1999

Appendix (D4) Conversion rates of exchange rates for entry into the Euro[63]

Country	Currency	Code	Fixed rate	Fixed on	Yielded
Austria	Austrian schilling	ATS	13.7603	31/12/1998	01/01/1999
Belgium	Belgian franc	BEF	40.3399	31/12/1998	01/01/1999
Cyprus	Cypriot pound	CYP	0.58527	10/07/2007	01/01/2008
Estonia	Estonian kroon	EEK	15.6466	13/07/2010	01/01/2011
Finland	Finnish markka	FIM	5.94573	31/12/1998	01/01/1999
France	French franc	FRF	6.55957	31/12/1998	01/01/1999
Germany	German mark	DEM	1.95583	31/12/1998	01/01/1999
Greece	Greek drachma	GRD	340.75	19/06/2000	01/01/2001
Ireland	Irish pound	IEP	0.78756	31/12/1998	01/01/1999
Latvia	Latvian lats	LVL	0.7028	09/07/2013	01/01/2014
Luxembourg	Luxembourgish franc	LUF	40.3399	31/12/1998	01/01/1999
Italy	Italian lira	ITL	1,936.27	31/12/1998	01/01/1999
Malta	Maltese lira	MTL	0.4293	10/07/2007	01/01/2008
Netherlands	Dutch guilder	NLG	2.20371	31/12/1998	01/01/1999
Portugal	Portuguese escudo	PTE	200.482	31/12/1998	01/01/1999
Slovak Republic	Slovak koruna	SKK	30.126	08/07/2008	01/01/2009
Slovenia	Slovenian tolar	SIT	239.64	11/07/2006	01/01/2007
Spain	Spanish peseta	ESP	166.386	31/12/1998	01/01/1999

[63] Preceding national currencies of the Euro zone http://www.ecb.Europa.eu/

Chapter Five

Conclusion

This Chapter summarises the major findings of the thesis, policy implications and possible future research areas. The central research topics are divided into three research chapters.

The thesis adds to the previous literature on FDI in a number of ways. Chapter 2 considers what are now viewed as the most significant economies in the world, the G7 countries. In contrast to some of the earlier studies the relation between exchange rate volatility and FDI inflow and outflow is handled for all the G7 countries to study the extent to which exchange rate volatility impacts developed economies. Secondly, this study analyses the period from 1980 to 2011 that includes the financial markets crisis.

A further aim of this thesis was to establish in Chapter 3, the impact of the volatility in the exchange rate on bilateral FDI outflow stock from 14 high income countries to all the OECD countries for the period 1995 to 2012. The conventional gravity model also controls for bilateral exports, real GDP, distance, free economic index, unit labour cost differential, and other common characteristics. As mentioned above another feature of this analysis is the further study of crises.

In addition to capturing exchange rate volatility, the gravity model is used in Chapter 4 to explain cross border lending from the advanced country to European Union over the period 1999:01 – 2014:04. An important feature is that it can be augmented by a wide set of cross border characteristics such as bilateral exports, GDP, distance and the free financial index to capture country differences from both the perspective of the lender and the borrower country. These transactions have a geographical dimension well suited to handle information required to explain the mechanism by which the global and then the Euro zone crises have developed and spread.

Then, once it is observed that the aggregate FDI inflow and outflow series are non-stationary a key objective of **Chapter 2** was explain their long-run behaviour. In

particular, in terms of an explanation of inflow or outflows of FDI stock in terms of either nominal or real exchange rate volatility. This analysis is undertaken from the G7 countries to the rest of the world. As this analysis spanned the years 1980 to 2011, beside exchange rate volatility the further influences of other economic and political factors on the FDI inflow and outflow needed to be considered. The key variables required for a long-run explanation were equity return, relative unit labour cost, R&D, and the openness of the economy.

As the sample, although using annual data is relatively small the analysis is handled by cointegrating regressions (Engle and Granger, 1987) and error correction models. The approach in terms of cointegration having found at least one I(1) series to combine with FDI, is based on finding stationary linear combination that produce minimal long-run relations (Davidson, 1998). The definition of cointegration is extended by Szafarz and Flores (1996) to allow for the further inclusion of stationary series in the long-run model and these variables especially when the sample is small are likely to enhance this explanation. Once cointegration is found the long-run form is embedded into a dynamic model estimated using SUR. The results support the hypothesis that exchange rate volatility is an important determinant of FDI for the G7 economies.

In terms of the inflow models, following the SUR estimations the coefficients indicate that there is a negative effect of nominal exchange rate volatility on FDI inflows for the European countries (France, Germany and Italy). These economies were among the original six that formed the Iron and Steel community after the Second World War and then entered the crawling peg alignment of exchange rates via the EMS in the 1980s. They then entered the Euro Zone in 1999 so these exchange rates were relatively (or completely) fixed against each other over most of the sample period. These coefficients also had the same sign for the US and the UK. This suggests that FDI in all these countries is strongly related to trade, either as a result of the secondary import of components or aligned with the direct export of products. There is a strong effect of real exchange rate volatility in the case of both Canada and Japan, suggesting that production there is for the home market. Moving on to the more conventional variables applied in the literature, it was found that trade openness has had a significant and positive impact on FDI inflow for all the G7 countries except Japan and the UK suggesting that an efficient environment with more openness to trade is likely to attract

FDI. This result is consistent with the idea that a h*ig*her degree of openness is seen to create a favourable environment for FDI in export oriented industries. A further finding is a positive relation between relative costs and FDI inflow and this would appear to suggest that foreign firms are not moving to cheaper locations, but rather taking firm specific skills to produce, perhaps more cheaply, in higher cost locations. The coefficient on return on equity is statistically significant and has a negative impact on FDI into Germany that suggests that this occurs when equity returns are low in the home market so that firms investing into the home market might be finding bargains.

In terms of FDI outflows, openness has a significant positive effect, as would be expected. The impact of relative costs is also positive, but this coefficient is not always significant. This suggests that such outflows are directed to low cost economies and these are likely to be the destinations that lie outside the G7 block. Interestingly, R&D has a positive effect on FDI and is predominantly significant, with the only exception Canada, suggesting that firm specific technology or techniques are being exported. While in terms of outflow, nominal exchange rate volatility always has a positive effect, with the exception of France. This may be bought at the cost of a reduction in production at home, though this coefficient is not always significant.

Focusing on the role of exchange rate volatility it is important to distinguish between the impact of volatility in terms of inflow where the relationship is predominantly negative and outflow where it is positive. These findings support some of the earlier results in the literature that indicated that volatility in the exchange rate decreases inflows of FDI. However, here these effects may be reversed in countries such as Canada and Japan. The results are also robust to the presence of other conditioning variables such as openness. Moreover, the findings for the outflow model show some signs of a systemic pattern for the G7 countries as an increase in volatility normally encourages FDI outflows.

This chapter has investigated the determinants of the outward and inward stock of FDI for developed countries. In this respect, there has been little empirical research in the literature. Furthermore, this study is one of the first to consider the impact of exchange rate volatility on FDI with regard to all the G7. So this chapter complements much of the recent research by focusing on developed countries and investigating aggregate inward and outward FDI stocks data both from and to the rest of the world.

By comparison much of the empirical research on developed countries has employed firm and industry level data or they have adopted bilateral FDI data.

This study contributes to the literature by emphasising the importance of exchange rate volatility expectations on FDI decision making and to further our understanding of the relationship between FDI and exchange rate volatility. The results based on SUR, provided strong evidence that FDI inflow has been influenced by exchange rate volatility in the long-run and more, that it seems to have a positive effect on FDI outflow. The SUR results also showed that openness is positively related to FDI in the selected sample, meaning a liberalisation of the trade and investment environment positively affects the FDI decision and trade openness in the host country attracts FDI inflows.

These findings have valuable implications for policy makers in developed countries as: Firstly predominantly for the G7 economies any policy that helps reduce volatility will help improve FDI inflow. While less volatility may also help stem the outflow of investment funds from a G7 economy. It is also of interest to note that although the outflow effect is still positive for the G7 economies, then this effect is reduced and this may reflect the extent to which these economies have effectively had a fixed rate for a substantial part of the sample used here. So outflow will not be so stimulated relative to three core EU economies. Secondly, for all the G7 economies any strategy that enhances openness will also enhance FDI inflow and this ought to enhance growth. While, policies that enhance R&D will have the side effect of increasing FDI outflow.

This study would have benefitted from a more extensive set of data both in terms of the time period and the countries analysed. Further data would enhance the statistical findings and lead to the adoption of more advanced methods to estimate the long-run behaviour. Further insight might then be gained by being able to better analyse the different financial crises in addition to the impact of exchange rate volatility.

An important objective of **chapter 3** was to further investigate the nature of the relation between exchange rate volatility and FDI by analysing BFDI stock from 14 high income countries to all the OECD economies. The analysis is conducted on data collected over the period 1995-2012. The persistent nature of aggregate FDI data observed in the previous Chapter called into question the application of static models,

but given the time series dimension it seemed less appropriate to directly investigate the long-run. The very nature of the BFDI data does suggest the use of the Gravity equation and in the first instance this is estimated to provide a benchmark comparison to much to the existing literature. Were the time series longer, then it may have made sense to analyse the long-run, but here the focus has been on estimating the Gravity equation using a dynamic panel data approach.

Consistency of the panel equations estimated by a regression estimator depends crucially on individual random effects so any of the indicators and/or regressors not being correlated with the disturbances (Greene, 2011). The problem is less acute were the model static, but as mentioned previously this is not relevant with FDI data as either they require differencing to make them stationary or they require cointegration. Dynamic panel data models (Arellano and Bond, 1991) provide a mechanism by which these issues can be accounted for by estimating the model in first differences. Unfortunately when the levels specification is correct, then time invariant regressors are removed by this transformation. This leads to the SYS-GMM estimator of Blundell and Bond (1998) that applies the same procedure to remove the fixed effects as Arrelano and Bond, while still allowing the parameters of time invariant variables to be backed out of the system. Few studies have obtained descent findings from the application of dynamic panel models to BFDI data and there has been even less research that has successfully applied the SYS-GMM approach.

In this chapter, it is shown that past behaviours in FDI can provide relevant insights to the current FDI slump, and interestingly the impact of the global financial crisis is more significant than the Asian crisis. Furthermore, when the host country suffers from a systemic crisis, BFDI to that country reduces and so systemic banking crisis have a significant impact on BFDI. So constraints to finance impact on the decision to engage in new FDI, expressed through the extensive margin.

While it needs to be stressed that exchange rate volatility is a significant and negative factor for all specifications of the Gravity model in a short run and a long run sense. While the effect of the dynamic is that the short-run effect is further compounded in the long run so that the short-run impact feeds through more strongly in the long-run.

The focus is on SYS-GMM in terms of the reliability of the coefficient estimations and all specifications are composed of significant variables at the 5% level, except in terms of the common currency and unit labour cost differentials. These variables are not considered critical to explain BFDI. As expected, the key factors still make sense for this form of the Gravity model, because higher GDP, higher openness, lower distance, a common language, economic freedom and lower exchange rate volatility all have a positive impact on BFDI stocks. Moreover, countries with good institutions, more trade openness, and fewer restrictions on FDI are likely to receive more FDI. While, it is observed that exchange rate volatility consistently plays an important role in driving BFDI stocks and it seems to capture the impact of using the same currency.

The results obtained in Chapter 3 have serious implications for international business by identifying the financial crises impact on FDI is crucial for understanding the possible reverse effect of FDI on governments' responses. This chapter has identified a gap in the literature that long-run exchange rate volatility impacts FDI in this panel country bilateral stock data study. While there is a fairly large body of literature addressing the relationship between exchange rate volatility and FDI, there is very little research on the relationship for the OECD countries, especially as the crises spread.

Several policy implications can be derived from this study. The results of Chapter 3, suggest a major change from the policy recommendations made in previous studies. These findings can provide an analytical foundation for the evaluation of country policies and institutions aimed at making OECD countries more attractive to foreign investors. In line with the finding made here, the study provides guidance on which major macroeconomic and institutional determinants of FDI might be most important for policymakers in these countries. As has been seen in previous studies GDP has a powerful effect, but also as mentioned in the last chapter exchange rate volatility along with the impact of labour costs, and improving the overall infrastructure. Moreover, there are significant effects for the economic freedom measure, indicating that efforts to improve governance and combat corruption and bureaucracy will have a direct impact on FDI in these countries.

It also needs to be understood that there is some inertia in terms of the significant impact of the past level of outward FDI stock that provide incentives for domestic companies to invest abroad.

Nevertheless, there is still more work to be done in future research. This Chapter opens up a new line of research, which could benefit from further empirical effort. Further benefit can arise from using more detailed data in order to evaluate the overall impact of the crises on the FDI stocks by region, sector and mode of entry. It is expected that the results will be very useful if there is a pattern for different categories of countries such as those in the Euro area regarding the main effect of the financial crises and the link between exchange rate volatility and FDI. Another direction for further study will be to analyse and compare results for two sub periods, that of before and after the crisis.

Chapter 4 considers the consolidated international bank lending data collected by the BIS. The transaction data adopted is on an immediate risk basis appropriate to study bilateral foreign asset transactions of reporting countries vis-a-vis customers in foreign countries. Firstly, it was intended that this research be used to clarify the determinants of cross-border lending stock. This is done by the application of a Gravity model to which have been added further factors including variables to capture the spread of crises. In addition to other variables such as GDP, distance, bilateral exports, the financial freedom index for lender and borrower countries, interest rate differential between both countries, the differential in time zone and variable capturing the EU membership. The study focuses on the period 1999-Q1 to 2014-Q4 for lending from the 19 advanced economies to the 29 European market economies. In addition to analysing the push and pull factors, this chapter extends the recent literature (Buch et al., 2010, McGuire and Tarashev, 2008, and the World Bank, 2008) by linking the determinants of cross-border banking with financial stress indicators. These issues have not been addressed in detail by the existing literature. The Gravity model was estimated using a random effects panel data model. It was then shown that the results were robust to alternative panel methodologies.

The analysis takes into account exchange rate variations. This was critical to achieve a representation of the evolution of bank claims across Europe. The large impact of the sharp change in the dollar/euro exchange rate over the period 2008-09 was

an important source of stock variation during the period under study, but it comes from exchange rate movements and not from changes in the underlying position of banks. To eliminate the impact of exchange rate valuation, quarterly exchange rate-adjusted stocks are calculated.

From the application of a panel study, it is possible to find that the variables of the standard Gravity model were significant drivers of the cross border lending stock. Therefore, lending is reduced as the distance increases between lender and borrower countries while cross-border loans to the EU markets increased significantly from the markets of larger lenders. While larger markets related to borrowers increased the size of cross-border lending stocks. Cross-border stocks were also impacted by the transmission of financial stress, and the analysis revealed that the size of the financial freedom index increased transactions in lender as well as borrower countries.

The variables for which the strongest effects are found relate to the presence of bilateral trade agreements. Furthermore, financial frictions are proxied by gravity-type variables like distance, common language and time zone differential that appear to matter for international banking. The time zone differential which directly captures information costs had a negative and significant effect. This reveals that in the case of international lending an important component of distance is the relative time zone over which transactions occur, there being an impact from the real-time interaction.

Moreover, this chapter indicates that during the financial crises international banks did not reduce their cross-border lending stocks in an indiscriminate manner; there was no run for the exit. Instead, the proximity of bank-customers was strongly related to the flexibility of cross-border credit. While banks continued to lend more to borrower countries that are geographically close, especially where they were integrated into a network of local co-lenders, and where they had more lending experience. Further explanation, as the global financial crisis, systemic crises, and Lehman Brothers crisis, hit Europe in 2008-2009 and according to Dornean and Sandu (2012), the global financial crisis had a strong effect on the EU economies. Almost all countries started to feel the impacts of the financial crisis in September 2008 mainly following the filing for bankruptcy by Lehman Brothers, but for the EU countries the peak impact was recorded in 2009, when they experienced dramatic falls in the GDP. On the other hand, the Euro Debt Crisis had much more impact on cross border banking than previous events as it

brought to the fore the necessity for lender country specific regulation of banks, and hence reduced the incentive to undertake foreign banking.

In this study it is found that cross border lending stocks clearly depend on standard gravity variables, with the exception of a common land border. The impact of GDP is generally large and positive, while increases in distance reduce lending. On top of the application of and extensions to the Gravity model mentioned above another key reason to extend the analysis was to discover how cross-border loans responded to different types of financial crises. It is shown in this chapter that the global financial crisis, Lehman Brothers crisis, and systemic banking crisis have had a significant positive effect on cross border lending stock. While, the Euro debt crises has been seen to have a long-lasting negative impact on cross-border banking. While, membership of the EU as may be expected is found to have had a positive and significant effect on cross border lending among member states. On top of that when a sub-sample is run for the Euro zone, it was observed that the Euro debt crisis has had a stronger effect when compared to the original results. While financial friction turns out to have less of an impact except for the distance variable, which becomes more important.

Studying different forms of financial shock are an important part of the analysis conducted here. With financial crises per se causing an increase in cross border lending as banks lend to foreign customers when domestic banks weaken and this is in line with previous studies. However, the Euro zone crisis from 2011 onward was associated with a clear reduction in the intensity of European financial integration as the risk of cross border activity rose significantly. It is shown here that the reaction of cross-border loans to financial crises depends on the nature of the crisis.

Policy making is conducted in the EU at both a country and a system level. For this reason it is important to understand the lending behaviour of international banks to unearth the possible determinants of international banking stocks. From a policy perspective the evidence indicates that improving the efficiency of the bureaucratic process and enhancing legal system competence are likely to attract cross border lending.

Here the "random-effects" specification was applied and it was found that Governments that pursue policies to enhance political liberalisation, EU integration and financial freedom, enhance cross border lending. While, European integration has had a

double effect, because it eliminated exchange rate risk and reduced the impact of the Euro zone currency countries. In addition, it had spurred on cross-border bank lending activities within the EU. In particular, we found evidence that advanced economies adjusted the loan stock of cross-border banking to the European markets in response to a reassessment of financial crises and this is in line with the findings of Kleimeier et al. (2013). Additionally, stronger financial and monetary linkages between the lender and borrower countries encouraged stability in cross-border stocks even in times of financial stress.

These results suggest a need for additional research. Further study is required to empirically evaluate how politics and institutions affect the behaviour of capital movements such as portfolio investment. The theoretical literature on international capital movements needs to devise a model that features the mechanisms by which institutions affect the investment decision.

A key focus in this thesis has been on the impact of exchange rate volatility on FDI and other types of capital transactions. However, for cross border loans the coefficient has been relatively robust to different types of crisis relative to the findings on FDI. This evidence has gone some way towards enhancing our understanding of the contributions not only FDI but also bank lending has had on economic growth in receiving economies.

It would be a great benefit to the analysis thus far undertaken were the time series available, longer. Unfortunately, the study of FDI is limited by the data being annual even though all of the analysis considered is capable of study by panel methods.

The measure of volatility adopted here is intended to capture the behaviour of the underlying series as compared with being a structural specification of risk. Originally ARCH was devised by Engle (1982) as a test of specification as compared with a coherent model of dynamic variance. Here, the appropriateness of the measure of volatility in terms of the study of the G7 countries data is in terms of the capacity to represent the behaviour of the underlying series and with no prior knowledge as to how the variance is specified, the GARCH(1,1) model may be as good as any other. In terms of the analysis of Chapter 3 and 4, the many specifications are not the key purpose of the study so these measures of variance are secondary to the main goal of these studies and this is the reason to adopt the GARCH family of models. However, for Chapter 2,

the G7 study as there are fewer combinations, further consideration of these specifications may enhance this study. While the cointegration method adopted may also benefit from the panel extension to the single equation tests that seem best suited to this.

In the main the samples have been selected following the existing literature and this may not have been done for adequate statistical reasons. The selection of a panel assumes it is appropriate to pool the selected data. When this is not the case, then mechanisms to capture heterogeneity are not likely to be adequate. There has been some discussion of the nature of the panel selected, but it may make sense to better consider the samples selected. For this reason and also based on the method adopted in Chapter 3, the study of BFDI may benefit from further analysis of the nature of the samples selected. This will help determine whether there are some special characteristics of the selected countries, which could affect the findings on the impact of the financial crises on BFDI. One direction for further study could be to analyse how financial crises affects BFDI among Euro member states.

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