Essays on International Financial Markets, Firms' Capital Structure and Exporting Decisions

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Thesis Abstract

International finance studies the dynamics in the areas such as international portfolio diversification, foreign investments, global financial systems, exchange rates, etc. This thesis brings together a set of chapters that summarises and synthesises varied areas of international finance maintaining a balance between the micro- and macro-level studies. This thesis is composed of three main empirical chapters contributing to varied aspects of international finance, mainly the areas of international portfolio diversification and home bias puzzle; development of bond markets and access to external finance; exchange rate uncertainties, output volatility and exports.

Chapter 1 provides an outline and introduction of the thesis. Chapter 2 provides an extensive literature review on home-bias puzzle, explains the evolution and existence of home-bias puzzle, and gives various institutional and behavioural-based explanations which are considered as the main reasons for the existence of this puzzle. It discusses the advantages of international portfolio diversification and also the disadvantages of under-diversification in international portfolios. It gives a detailed empirical literature on the home bias puzzle and the relation between education and portfolio diversification. Further, this chapter empirically analyses a panel of 38 countries over a period of 2001-2010 to study the impact of different levels of education on home bias and international portfolio diversification. The results highlight that education is crucial in reducing equity home bias. After dividing the countries on the basis of their stock market capitalisation the results show that less developed countries with more university graduates have lower equity home bias. Finally, the results show that the benefits of education are larger during the recent financial crisis for the less financially developed economies.

Chapter 3 provides a detailed analysis of the trends in Asian financial markets since the 1990s. It provides the main objectives of the Asian bond market policy initiatives. It also gives a detailed empirical literature of external finance, bond market development across the world and external finance-investment spending nexus. This chapter empirically analyses the impact of policy initiatives co-ordinated by Asian national governments on firms' access to external finance by using a unique firm-level database of eight Asian countries- Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand over the period of 1996-2012. Using difference-in-differences approach and controlling for firm-level and macroeconomic factors the results show a significant impact of policy on firms' access to external finance. After splitting firms into constrained and unconstrained, using several criteria, the results document that unconstrained firms benefited significantly in obtaining external finance as compared to

their constrained counterparts. Finally, the results show that the increase in access to external finance, after the policy initiative, helped firms to raise their investment spending, especially for unconstrained firms.

Chapter 4 focuses on how exporting decision of firms are affected by volatility at the macro and micro levels, using a rich dataset of UK manufacturing firms for the period of 1990-2009. The results show that both types of volatility have an adverse impact on firms' real export sales. After taking into account firm-level heterogeneity, the results show that the negative impact of exchange rate and firm volatility on exports is higher for constrained firms as compared to unconstrained firms. Further, this chapter considers the European Exchange Rate Mechanism (ERM) crisis of early 1990s and the global financial crisis of 2008. The results indicate that during the ERM crisis constrained firms face a significant adverse impact of exchange rate volatility on exports, while the impact of firm-level volatility is mostly insignificant. On the contrary, during the global financial crisis, constrained firms face a significant negative impact of firm-level volatility on exports and an insignificant impact of exchange rate volatility on exports. Finally, Chapter 5 provides the conclusion of the thesis highlighting the contributions, implications and future research avenues of each empirical chapter.

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Dedicated to my grandmother and my parents

Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

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Introduction

The degree of financial integration has increased tremendously around the world during the past decades. The main factor influencing the process of financial integration is the increased globalisation of investments and capital flows across countries for diversification of risk and increasing rate of return. Many countries across the world have encouraged easy access to world capital markets by reducing restrictions and controls on capital outflows and foreign direct investments (FDI). The countries are also focusing on improving the economic environment of their country by announcing various market-oriented reforms and policies. International financial integration helps in the diversification of portfolios which reduces the degree of riskiness of a portfolio. Financial openness of a country also helps in promoting investment and growth by fostering the development of domestic financial markets. Increased depth and breadth of domestic financial markets improve the efficiency of the financial intermediation by lowering costs (Caprio and Honohan, 1999).

The world of finance has also experienced various changes during the past decades with financial institutions becoming less regulated and more international. Financial markets are now less divided and any change in money markets, bond markets, foreign exchange and stock markets are becoming more interconnected. International financial markets are also expanding with developing countries, such as China and India, which are experiencing strong economic growths and are improving financial markets and institutions. Finally, the variety of financial instruments available to investors and borrowers has increased tremendously such as junk bonds and derivative instruments like swaps, futures, options, etc. (Pilbeam, 2005).

Over the last few decades the international debt markets have faced major variations, increasing the role of corporate debtors. Gozzi et al. (2010) stressed that the share of international debt as part of corporate debt has increased significantly over time and is continuing to grow further in both developed and developing countries. Emergence of corporate debt markets has helped firms in increasing their access to international finance, in particular international bonds. Recent studies also show a positive impact of private sector's share of international debt on financial stability and sovereign creditworthiness of a country (Celasun and Harms, 2011). Hallak (2013) highlighted that private sector's share of international debt reduces the cost of debt in a country. Also, corporations that are able to tap the international debt markets face lower credit risk and enjoy greater access to finance (Baker and Riddick, 2012).

Financial openness provides various benefits. Accessing world capital markets helps to expand investors' opportunities for portfolio diversification and helps countries to borrow for smooth consumption in the event of adverse shocks. The potential benefits from financial integration can be categorised as follows: the benefits of international risk sharing for consumption smoothing, significant impact of capital flows on domestic investment and growth, improvement in the efficiency and macroeconomic discipline and greater stability of the financial system of a country (Agénor, 2003).

However, regardless of the potential benefits from financial openness it may also generate substantial costs. Some of the costs of open financial markets comprise of a high degree of capital flows concentration and lack of access to financing for small and developing countries, inadequate allocation of capital flows can result in distortion of growth effects and macroeconomic stability, high degree of volatility of capital flows resulting in contagion effects and risks of foreign bank penetration (Agénor, 2003; Baker and Riddick, 2012). A high degree of international financial integration may also be sensitive to high degree of volatility in capital movements, which can result in large reversals of short-term flows. According to Caballero and Krishnamurthy (2006), large capital inflows and excess liquidity can result in the development of bubbles in the real estate sector.

Volatility of capital flows can also be caused by contagion effects. Financial contagion can occur when a country experiences massive capital outflows due to increased vulnerability of a country's currency or a decline in investors' confidence in a country's economic performance. Changes in nominal exchange rates also played an important role in the transmission of the global financial crisis of 2008 from the United States to the developing countries (Baker and Riddick, 2012).

Bordo (2013) indicated that the global financial market integration has followed a U-shaped pattern, declining in the middle years of the twentieth century from the high levels attained before 1914 to the higher levels present today, and that financial crises were always a part of the scene. These crises are the product of information asymmetries which reflect shocks and unpredictable fundamentals. The U-shaped pattern has been explained by Obstfeld et al. (2005) in terms of the policy trilemma of open capital markets, pegged exchange rates and independent monetary policy. The golden age of financial market integration also consisted of the period of classical gold standard. Dependence on gold standard regime meant that short-term capital movements were stabilising. The gold-standard period was characterised by free capital mobility and unrestricted movement of goods and labour. The golden age ended with the World War I.

After a period of extreme monetary instability in Europe the gold standard system was restored with full capital mobility. The capital flows resumed in the 1920s with the United States succeeding the United Kingdom as principal lender. The Great Depression, caused by the inappropriate US policies in the gold standard regime, also spread among other countries. As a result, some of the countries left the gold standard regime and allowed their currencies to float. By the end of the 1930s capital controls and exchange controls were reinforced during World War II. After the war, the Bretton Woods system of 1944 was introduced which was based on pegged exchange rates with an indirect link to gold, active stabilisation policies and capital controls. By the late 1960s private capital flows resumed which revived the trilemma and massive speculation attacks. The capital controls have been eliminated since then in advanced countries and have been reduced significantly in emerging countries. Floating exchange rate regime has been adopted which is compatible with monetary independence and open capital account (Bordo, 2013).

The international flow of capital, goods and services are the main sources of supply and demand for currencies which are essential to our well-being. A strong currency boosts a country's standard of living, helps citizens to buy more of imported goods and also buy domestically produced goods that are internationally traded. An improvement in the standard of living from a rising currency can be evident when compared between nations. International agencies rank the living standards across different nations which require converting of local currency into a common measure, usually US dollars. Efficient allocations of capital globally also help citizens of a country to enjoy higher returns on their invested capital (Levi, 2010).

Due to increased degree of financial integration across economies in the world events in distant lands also reverberate around the world. Any variations in the price of oil and gold, events in the stock market, election results, outbreak of war, etc. have immediate effects around the globe, resulting in a contagion and highly interdependent financial environment. The close linkage between money and capital makes it futile to concentrate on any one particular part (Levi, 2010).

Financial integration is also likely to affect the level of entrepreneurial activity in a country. The rapid growth of financial integration has a direct impact on the foreign direct investments in a country which can hamper the growth of domestic entrepreneurs. Grossman (1984) showed that international capital flows can result in crowding out of domestic firms from domestic capital markets if foreign firms borrow from the domestic

banks[1]. Further, Emran and Stiglitz (2009) argued that financial liberalisation and competition can have negative effects on the level of entrepreneurial activity. Many researchers have argued that in the presence of pre-existing distortions and weak institutional regulations financial openness result in financial crises and higher volatility, reducing entrepreneurship and innovative efforts in a country (Alfaro and Charlton, 2006).

On the contrary, availability of foreign resources can help developing countries with less domestic capital to borrow for the purpose of investing and financially constrained entrepreneurs to start new firms. Studies such as Markusen and Venables (1999) and Rodriguez-Clare (1996) have stressed the positive role of knowledge spillovers and innovations on domestic firm activities from foreign firms. Whether financial openness is nurturing or destroying entrepreneurship is a critical question in academics for policy relevance (Alfaro and Charlton, 2006).

Hence, knowledge of international finance can help fund managers to take right financial decisions for their firms by exploiting the positive developments and avoiding the harmful ones. Firms are affected by changes in exchange rates, interest rates, inflation rates and asset values. All these changes are inter-related to each other. Changes in exchange rate can also cause fluctuations in interest rates and firms' asset values. The amount of international exposure and risk depends on the level of integration between exchange rates and other financial prices (Levi, 2010).

This thesis examines the different aspects of international financial markets, firms' capital structure and exporting behaviour of firms in both developed and emerging-market economies. Each empirical chapter is self-contained and aims to contribute to particular questions related to international financial markets with a special emphasis on country and firm-level studies. Chapter 2 examines the relation between different levels of education on home bias and international portfolio diversification. Chapter 3 analyses the impact of policy initiatives coordinated by Asian national governments on access to external finance of Asian firms. Finally, Chapter 4 focuses on how exporting decision of firms are affected by both macro and firm-level volatility with special emphasis to financial constraints and crisis events.

The second chapter reviews the recent literature on equity home bias puzzle and highlights that people have a tendency to overinvest in domestic stocks relative to the theoretically optimal investment portfolio. Several explanations have been offered in the literature for the existence of the home bias puzzle which are mainly related to

[1] Also see Feldstein (2000), Harrison et al. (2004) and Harrison and McMillian (2003).

institutional, geographical, political and behavioural factors. However, the role of education and financial awareness in international portfolio diversification is less researched. This chapter uses a panel dataset of 38 economies over the period of 2001 to 2010 to examine the direct role of education in explaining the equity home bias puzzle. In addition to various country-level and financial factors, this chapter also considers the impact of different levels of education.

The results of Chapter 2 show that university-level graduation, mathematical numeracy and financial skills play an important role in explaining the equity home bias. The results highlight a significant impact of different facets of education in reducing the equity home bias. This chapter also examines the country-level heterogeneity as education is not likely to affect all the economies in a similar way, as every economy has different levels of education. The countries are divided into more and less financially developed countries on the basis of their financial market development. This allows for the fact that countries with different levels of financial market development might have different responses to education. The results show that less financially developed countries tend to benefit more from an increase in the level of education as compared to their more developed counterparts. Finally, this chapter studies how the relationship of education and home bias evolved over time for countries with more and less developed financial markets, focusing on the most recent global financial crisis of 2008. The results demonstrate that less financially developed countries are more sensitive to education during the global financial crisis than the more financially developed economies.

The third chapter explores the pecking order theory of corporate finance and highlights that debt is always prioritised over equity in terms of external finance. This chapter bridges the gap between two relevant literatures of corporate external finance and bond market development in Asia. This chapter analyses the impact of Asian bond market policies such as the Asian Bond Funds (ABF and ABF-2) and the Asian Bond Market Initiative (ABMI) on firms' access to external finance. To tease out the impact of the bond market policy initiatives the difference-in-differences approach is used. The empirical model in this chapter uses an unbalanced panel of 7,436 Asian listed firms for 1996-2012. The treated group includes seven Asian economies namely- Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. While, Taiwan is considered as the control group as it saw similar development in its national bond market and is comparable to the other Asian economies, but it did not participate in the ABF, ABF-2 or ABMI initiatives.

The findings of Chapter 3 using the difference-in-differences method indicate that firms reduced their access to short-term debts and increased their access to long-term

debts after the introduction of the bond market policy initiatives. Next, this chapter exploits the firm-level heterogeneity by classifying firms into financially constrained and unconstrained firms using two main criteria such as firms' profitability and coverage ratio. These characteristics are important as they indicate the financial health of firms which affects the choice of external finance of firms. The results show that the policies helped unconstrained firms to reduce their access to short-term debt and increase their long-term debt financing as compared to the constrained firms.

Further, Chapter 3 builds on the literature of external finance and investment spending of firms by considering the impact of policy initiatives on firms' investment spending in the post-policy period. The results show that firms reduced their investment spending using short-term debt and increased their investment spending using long-term debt in the post-policy period. Finally, on taking into account the financial constraints of firms the results show that unconstrained firms increased their post-policy investment outlay using long-term debt much more as compared to the constrained firms.

The fourth chapter provides a detailed background literature on exchange rate volatility and trade at the country-level, theoretical and empirical evidence on exchange rate exposure at micro-level and the relationship between firm-level uncertainty and trade openness. This chapter tries to empirically link two main literatures on exchange rate volatility and firm-level uncertainty by focusing on the impact of volatility on real export sales of firms. The enormous financial integration across countries has resulted in easy capital flows resulting in an increase in the degree of exchange rate movements, affecting the revenue and cost structures and valuation of firms. This chapter focuses on a unique dataset of UK manufacturing firms which majorly includes unlisted firms over the period of 1990-2009. This provides an interesting setup as these firms are more susceptible to any kind of uncertainty due to their poor financial condition.

The outcomes of Chapter 4 confirm that firms face a negative and significant impact on their export sales from both exchange rate and firm-level volatility. Next, this chapter explores the impact of these volatility measures on real export sales for financially constrained and unconstrained firms. The results show that the adverse impact of exchange and firm volatility on real exports are higher for constrained firms as compared to their unconstrained counterparts. Further, two major crisis events, namely the European Exchange Rate Mechanism (ERM) crisis of early 1990s and the recent financial crisis of 2008 are examined. The results point out that during the ERM crisis, constrained firms face a significant adverse impact of exchange rate volatility on exports, while the impact of firm-level volatility is mostly insignificant. On the other hand, during the global

financial crisis, constrained firms are affected by significant negative impacts of firm-level volatility on exports and insignificant impacts of exchange rate volatility on exports.

The remainder of this thesis is structured as follows. Chapter 2 provides the empirical study of the relation between different levels of education on home bias and international portfolio diversification. Chapter 3 gives the empirical analysis of the Asian bond market policy initiatives co-ordinated by Asian national governments on firms' access to external finance using difference-in-differences method. Chapter 4 empirically focuses on how exporting decision of firms are affected by both macro and firm-level volatility for constrained and unconstrained firms during two major financial crises, namely the ERM crisis of early 1990s and the recent global financial crisis of 2008. Finally, Chapter 5 provides the concluding remarks of this thesis.

In addition, I would like to highlight that most of the estimates presented in Chapter 2 have been published in the *Journal of International Financial Markets, Institutions and Money* (see Bose, MacDonald and Tsoukas, 2015). Another working paper derived from Chapter 3 is available online in the discussion paper series of the Adam Smith Business School, University of Glasgow.

Chapter 2: The Role of Education in the Home Bias Puzzle of International Portfolios during Financial Crisis[2]

2.1 Introduction

Despite the gains from international portfolio diversification, the most striking feature of international portfolio theory is that investors tend to invest heavily in the stocks of their domestic country. This preference is commonly termed as the *'Home bias puzzle'*. French and Poterba (1991) in their seminal work provided surprising data on the domestic ownership of shares in the stock markets of the United States, Japan, the United Kingdom, Germany, and France. They showed that at the end of 1989, investors in Japan had only 1.9% of their equity in foreign stocks, US investors held 6.2% of their equity portfolios abroad. Several justifications have been offered in the literature for the existence of the equity home bias puzzle such as institutional factors (foreign taxes, transactions costs), behavioural biases, information asymmetries, etc. What is less researched, however, is the role of education in determining international portfolio diversification. It is important to understand how education affects international portfolio holdings and can be used to inform policy makers and investors in a better way, particularly in the current economic climate.

There has been a phenomenal growth of financial instruments and products as evidenced by a number of new assets that were developed based on subprime and other mortgages before the 2007-10 global financial crisis. Yet, the ability of investors to make sound financial decisions was challenged in the light of mounting losses observed during this period (see Klapper et al., 2013). This has underlined the need for knowledgeable, educated and more financially aware people for their financial security. There is, in fact, a large and growing set of studies on the determinants of household financial decision-making. This literature considers the importance of formal education in affecting the process of financial decision-making (see Graham et al., 2009 and Cole et al., 2012) and financial participation (see Karlsson and Nordén, 2007; Van Rooij et al., 2011 and Christelis and Georgarakos, 2013).

This chapter tries to fill this gap by bridging the literatures on international portfolio diversification and education. More specifically, the purpose of this chapter is to provide, for the first time, a systematic empirical analysis of the impact of education on equity holdings. This is done by exploring whether education is weighted differently for less and

[2] I am grateful to Lieven De Moor and Rosanne Vanpée for providing the market capitalisation data of equities. I also thank John Burger, Alessio Ciarlone, George Panos and Vikrant Vig for their useful comments.

more financially developed economies, paying special attention to the most recent financial crisis. The motivation for exploring the role of education in international portfolios stems from the fact that education influences financial awareness, knowledge, skills, attitude and the behaviour of investors to make sound financial decisions in order to achieve individual financial well-being. These effects are likely to be stronger for less developed economies as for them access to offshore financial markets may be difficult or prohibitively expensive (Mizen et al., 2012). In addition, the link between different levels of education and portfolio diversification should be more potent during extreme economic events such as the most recent financial crisis, which originated in the US in mid-2007, as it caused a sharp reduction in the asset prices. This, in turn, resulted in a decline in the assets invested abroad and thus an increase in the proportion of equity portfolios which are concentrated in the domestic market of the investor (Milesi-Ferretti and Tille, 2011).

The value addition of this chapter is threefold. First, a direct role of education in influencing equity home bias is considered. In addition to the country-specific and financial indicators previously considered, this study also considers the impact of different measures of education. This approach adds to the existing empirical literature on international portfolio holdings (see Chan et al., 2005; Fidora et al., 2007; De Moor and Vanpée, 2013), which highlight the effect of different institutional factors, geographical, political and behavioural effects on home bias in international portfolios.

Second, using comparable multi-country panel data, this chapter tries to identify which countries are more likely to benefit from a higher level of education. It is well accepted that economic literacy and education differs widely across countries and tends to be rather limited in poorer demographic groups (Jappelli, 2010). Countries with higher levels of education tend to benefit much more from financial liberalisation (Bekaert et al., 2001) and also tend to experience higher growth (Barro and Sala-iMartin, 1995). This chapter tests whether there is a differential effect of education on international diversification for economies with more and less developed financial markets.

Finally, this chapter examines whether education-home bias nexus has changed over time for both more and less financially developed economies. Gerardi et al. (2010) show that limited financial literacy (numerical ability) played an important role in the recent subprime mortgage crisis in the US. Klapper et al. (2013) make similar arguments for Russian households during the crisis. Thus, the link between education and equity home bias is likely to be more potent during the financial crisis as it might help in resolving information asymmetries in the economy and improve investors' cognitive ability.

The chapter is divided into ten sections. Section two describes the merits of international portfolio diversification and section three explains the costs of international portfolio under-diversification. Section four analyses the theoretical framework explaining the concept of home bias puzzle. Section five provides an extensive literature review on home bias puzzle and education. Further, section six gives a detailed description of the empirical modelling implementation and section seven describes the data used in the empirical analysis along with the summary statistics. Section eight refers to the econometric results and section nine checks the robustness of these empirical results. Finally, section ten gives the concluding remarks of the chapter.

2.2 Merits of international portfolio diversification

International portfolio diversification can help to reduce the risk in terms of variability of returns. The total risk of the portfolio depends not only on the number of securities included in the portfolio, but also on the riskiness of each individual security in the portfolio. As diversification increases, the degree of riskiness of a portfolio decreases but not proportionally. By adding an extra security to the portfolio, marginal reduction in variability decreases substantially. Several authors such as Grubel (1968), Levy and Sarnat (1970) and Solnik (1973) showed that movements in stock prices are uncorrelated in different countries. Thus, the risk can be substantially reduced by diversification of portfolio internationally.

To examine the advantages of international diversification for a US investor, Grubel (1968) used a simple macroeconomic model of government bonds traded between two countries over a period of January 1959 to December 1966. He concluded that the potential gains from international diversification are extensive. Levy and Sarnat (1970) used annual data from 1951 to 1967 to calculate the Markowitz efficient frontier for a set of 28 country indices. Their findings were similar to those of Grubel (1968).

Agmon (1972) criticised Grubel's approach, and proposed that country indices are an incomplete measure of potential benefits of international diversification. As each market has many assets and a composite market index does not measure all the possibilities of diversification within a local market. Solnik (1973) further pointed out the problems with Grubel (1968) and Levy and Sarnat (1970) and stated that the indices used in these studies were not representative and suffered from small sample bias. Solnik calculated Markowitz efficient frontier for a sample of market indices of nine European countries, Japan and the US and found results matching with the earlier studies.

Thus, it is evident from the above that international portfolio diversification is a reasonable method to reduce risk in an investment portfolio.

2.3 Costs of international portfolio under-diversification

The costs of under-diversification can be explained using different approaches namely: mean-variance approach, consumption-based approach and individual portfolio holdings data.

Mean-variance approach: French and Poterba (1991), Glassman and Riddick (2001) and Jeske (2001) computed implied expected returns from the following equation:

$$(\mu - 1r) = \gamma \Omega x^{act},$$

where x^{act} is the vector of actual portfolio shares, $(\mu - 1r)$ is the vector of expected excess returns, γ denotes the coefficient of relative risk aversion (CRRA), and Ω is the covariance matrix of risky asset returns.

Jeske (2001) calculated shadow costs of foreign investment for a sample of 11 countries for the time period from 1991 to 2000 assuming the level of relative risk aversion of 3. However, measuring the cost of foreign investments by making a comparison between implied expected returns and historical mean returns was difficult for many reasons. First, results were dependent on a debatable value of the relative risk aversion. Second, methodology did not take into account omitted assets like long-term bonds, exchange rate risks, etc.

Cooper and Kaplanis (1994) gave an extension of the international CAPM model used by Adler and Dumas (1983) and Sercu (1980). Cooper and Kaplanis (1994) took into account both domestic inflation risk and deadweight costs of foreign investments. Cooper and Kaplanis (1994) calculated implicit costs of foreign investment using different levels of relative risk aversion but still the model had a few drawbacks. In particular, it did not take into account non-traded assets, the deadweight cost estimates were just point estimates and depended on hypothetical values of relative risk aversion and the model did not account for time-varying returns and variances. Further, Sercu and Vanpée (2007a) simplified the Cooper and Kaplanis (1994) model with new portfolio holdings data and tried to address the drawbacks of the original model.

Sercu and Vanpée (2007a) applied a regression technique so that confidence intervals could be computed for average implicit investment costs and the risk aversion. The deadweight costs were also estimated and the instruments were divided into six categories of information asymmetries, explicit frictions, measures of financial development, measures of economic development, measures of political risk and corporate governance, and the skewness in equity returns. Finally, De Moor et al. (2010) applied the time-varying model of Bekaert and Harvey (1997) to take into account time-varying and asymmetric volatilities. The final results reported by Sercu and Vanpée (2007a) were

lower and more reliable as compared to the results of Cooper and Kaplanis (1994), but still was imperfect for not considering non-traded assets like human capital.

Errunza et al. (1999) showed empirically that the calculations of estimated costs of under-diversification by traditional mean-variance approach were overstated. Their study was carried out mainly from the viewpoint of US investors and they found that though the average gains from foreign asset-based diversification were insignificant, there were some periods when international markets provided a meaningful diversification that could not be repeated at home.

Consumption-based approach: Another approach that can be used to calculate the costs of under-diversification is consumption-based approach. It considers production process as exogenously given, and determines how optimal risk-sharing is likely to affect the consumption pattern of investors. Lewis (2000) calculated the gains of international diversification for a US investor using data from 1969 to 1993 and made a comparative analysis between mean-variance approach and consumption-based approach. Lewis (2000) compared the estimated welfare gains with the gains from diversification estimated under consumption-based approach. He clarified that the reason for the difference between the estimated costs of under-diversification from an equity-based mean-variance approach and consumption-based approach was due to the high variability of stock returns and low variability of consumption growth rates. The gains from international diversification are derived from the benefits of reducing variation in marginal utility over time. In equity-based approach, marginal utility depends on stock returns and in consumption-based approach, marginal utility is derived from consumption. According to Campbell and Cochrane (2000) and Gordon and Samson (2002), the main drawback of consumption-based approach is that in practice it works poorly, even worse than the CAPM. Another drawback with consumption-based approach is that data does not fit in well and it also leads to unbelievably high levels of risk aversion.

Individual portfolio holdings data: Goetzmann and Kumar (2003) calculated the costs of under-diversification by dividing portfolios into groups based on the degree of diversification. They used a large sample of individual portfolio holdings over a period of 1991 to 1996. They showed that the degree of diversification is affected by the factors related to specific investor characteristics and not due to the differences in transaction costs or turnover.

Overall, it shows that international diversification can give substantial gains to investors, hence existence of the home bias in international portfolios in this context is puzzling.

2.4 Theoretical background of the home bias puzzle

Following Chan et al. (2005), the theoretical framework of the model is taken from Cooper and Kaplanis (1986). Cooper and Kaplanis (1986) gave a theoretical framework which is useful in explaining the concept of home bias. The model assumes that for a given level of variance, each investor in country $\mathcal{i}$ is likely to maximize the expected returns of the wealth.

$$Max(\mathcal{Y}_i'\mathcal{R} - \mathcal{Y}_i'\mathcal{C}_i) \quad (1)$$

subject to

$$\mathcal{Y}_i'V\mathcal{Y}_i = \mathcal{v}$$

$$\mathcal{Y}_i'I = 1$$

where

$\mathcal{Y}_i$ is a column vector of the portfolio weights, the *j*th element of which is $\mathcal{Y}_{ij}$,

$\mathcal{Y}_{ij}$ is the proportion of individual $\mathcal{i}'s$ total wealth invested in the risky securities of country *J*,

$\mathcal{R}$ is a column vector of pre-tax expected returns,

$\mathcal{C}_i$ is a column vector, the *j*th element of which is $\mathcal{C}_{ij}$,

$\mathcal{C}_{ij}$ is the deadweight cost to investor $\mathcal{i}$ of holding securities in country *j*,

$\mathcal{v}$ is a constant variance,

V is the variance/covariance matrix of the gross (pre-cost, pre-tax) returns of the risky securities,

I is a unity column vector.

The Lagrangean of the above maximization problem can be represented as follows:

$$L = (\mathcal{Y}_i'\mathcal{R} - \mathcal{Y}_i'\mathcal{C}_i) - \left(\frac{\hbar}{2}\right)(\mathcal{Y}_i'V\mathcal{Y}_i - \mathcal{v}) - k_i(\mathcal{Y}_i'I - 1), \quad (2)$$

where $\hbar$ and k_i are Langrange multipliers. Setting the derivative of the objective function with respect to $\mathcal{Y}_i$ to zero, it gives

$$\mathcal{R} - \mathcal{C}_i - \hbar V\mathcal{Y}_i - k_iI = 0 \quad (3)$$

Therefore, the optimal portfolio for investor $\mathcal{i}$ is

$$\mathcal{Y}_i = \left(\frac{V^{-1}}{\hbar}\right)(\mathcal{R} - \mathcal{C}_i - k_i I), \tag{4}$$

where $k_i = \frac{[I'V^{-1}\mathcal{R} - I'V^{-1}\mathcal{C}_i - \hbar]}{I'V^{-1}I}$.

Given the individual portfolio holdings, it can be aggregated to get the world capital market equilibrium. The market clearing condition is

$$\Sigma \mathcal{D}_i \mathcal{Y}_i = \mathcal{Y}^* \tag{5}$$

where

$\mathcal{D}_i$ is the proportion of wealth owned by country i,

$\mathcal{Y}^*$ is a column vector, the *i*th element of which is $\mathcal{Y}_i^*$,

$\mathcal{Y}_i^*$ is the proportion of world market capitalisation in country $i's$ market.

Using equations (4) and (5) and defining $\mathcal{Z}$ which the global minimum-variance portfolio as $\mathcal{Z} = V^{-1}I/(I'V^{-1}I)$, the following can be obtained

$$\hbar V(\mathcal{Y}_i - \mathcal{Y}^*) = (\Sigma \mathcal{D}_i \mathcal{C}_i - \mathcal{C}_i) - \mathcal{Z}'(\Sigma \mathcal{D}_i \mathcal{C}_i - \mathcal{C}_i) I. \tag{6}$$

The deadweight costs ($\mathcal{C}_{ij}$) are equal to zero for all i and j, if there is no barrier to access the domestic markets for an investor, and hence each investor holds the world market portfolio as the right-hand side of equation (6) is zero.

However, if the deadweight costs are not equal to zero, the portfolio holdings of the investor will deviate from the world market portfolio. To examine the effect of this a simple case is considered where the covariance matrix *V* is diagonal with all the variances equal to $\mathcal{S}^2$. The deviations of the portfolio weight of investor i in country j from the world market portfolio are given by:

$$\hbar \mathcal{S}^2(\mathcal{Y}_{ii} - \mathcal{Y}_i^*) = -\mathcal{C}_{ii} + \mathcal{b}_i + a_i - d, \quad i = j \tag{7}$$

$$\hbar \mathcal{S}^2(\mathcal{Y}_{ij} - \mathcal{Y}_j^*) = -\mathcal{C}_{ij} + \mathcal{b}_j + a_i - d, \quad i \neq j \tag{8}$$

where

$$a_i = \mathcal{Z}'\mathcal{C}_i ,$$

$$\mathcal{b}_j = \Sigma \mathcal{D}_k \mathcal{C}_{kj} ,$$

$$d = \mathcal{Z}'\Sigma \mathcal{D}_i \mathcal{C}_i .$$

The value a_i can be interpreted as the weighted average marginal deadweight cost for investor i, b_j as the weighted average marginal deadweight cost for investors investing in country j, and d as the world-weighted average marginal deadweight cost. Equation (7) measures the extent to which the equity portfolio holdings of investor i in the domestic market would deviate from those of the world market portfolio. Whereas, equation (8) measures the extent to which the equity portfolio holdings of investor i in foreign market j would deviate from those of the world market portfolio.

Equation (7) gives the equity home bias in a country with respect to the world. If the deadweight cost of investor i investing in his own country i (C_{ii}) is significantly less than the weighted average deadweight cost for world investors (b_i), he would overweight in domestic securities relative to the market. Investor i would also like to overweight in his domestic country if the weighted average deadweight cost faced by him (a_i) is large enough to discourage him from investing in foreign countries. Further, a country would not face any home bias if the deadweight costs for domestic (C_{ii}) and foreign investors (b_i) investing in country i are symmetric, that is, if transaction costs are symmetric to domestic and foreign investors in both markets, then the degree of home bias is not expected to differ between the two countries.

2.5 Extensive empirical literature

This section gives an extensive literature on home bias puzzle using recent and earlier portfolio holdings data. It also provides various explanations for the existence of home bias in international portfolios.

2.5.1 Home bias puzzle

For a number of years after World War II most countries had strong barriers to foreign investments as most currencies could not be converted, and thus investing abroad required access to scanty foreign currencies. Many countries also had restrictions to foreign investments by their own citizens or ownership of domestic stocks by foreign investors. Due to the existence of these restrictions on international investments, one is expected to hold more of domestic stocks than predicted by the world CAPM.

Over the last thirty years there has been a huge decline in the international barriers to investments. However, among the emerging markets, sovereign risk still remains a significant barrier for international investments. Warnock (2002) illustrated that though the US holdings of domestic equities had declined over the past two decades, it still remains high. According to Thomas et al. (2004), by the end of 2003 US investors held only 14% of foreign stocks in their equity portfolios, while such stocks accounted for 54%

of world market capitalisation. Other surprising observations include that larger home bias results are found in small and medium sized countries, while they are supposed to be gaining the most from international diversification. Cooper and Kaplanis (1994) concluded that domestic equity investment as a fraction of total portfolio equity ranged from 65% in France to 100% in Sweden. According to Baele et al. (2007), the home bias had reduced over the years especially in European Union member states since the European integration. Such results have further motivated other studies to find explanations for the existence of the home bias phenomenon.

There has always been a challenge for the economists to explain the behaviour of the home bias puzzle in international portfolios. The various explanations given for the home bias puzzle includes barriers to international investment and higher transaction costs, information asymmetries, hedging demand for stocks which have smaller positive correlation with domestic variables like inflation risk and sovereign risk (Campbell and Kraussl, 2005). The factors can be broadly categorised into five main groups:

Hedging domestic risk: The first possible explanation for the home bias is that domestic assets help in hedging risks that are specific to the home-country such as inflation risk, domestic consumption risk, real exchange rate risk and risk from non-tradable wealth components (i.e., human capital and non-financial income), as the performance of domestic assets depend on the overall performance of the domestic market.

Returns on the equities are different for both domestic and foreign investors if purchasing power parity (PPP) does not hold. It is possible to hedge inflation risk if there is a positive correlation between the domestic stock returns and inflation rates. According to Adler and Dumas (1983), because of this uncertainty about the future inflation rates investors hold portfolios which differ by a component designed to hedge inflation risk. However, Adler and Dumas (1983) and Sercu and Vanpée (2007a) empirically show that a positive correlation between stock returns and inflation rates is weak.

Further, Cooper and Kaplanis (1994) tested whether the home bias in equity portfolios is due to the investors' tendency to hedge purchasing power parity (PPP) deviations. They developed a model of international portfolio choice and equity market equilibrium that integrated PPP deviation and deadweight costs. This model is used to estimate the costs required to generate the home bias in portfolios. These costs are consistent with other costs such as withholding taxes only if investors have low levels of risk aversion. They concluded that the home bias could be explained by either inflation hedging or costs of international investment. They found that in order to explain the equity home bias in favour of hedging domestic inflation risk, there must be a positive correlation between the equity returns and inflation.

Sorensen et al. (2005) showed that the home bias in international bonds and equities have declined during the late 1990s, while the international risk sharing has increased. Hence, countries holding larger share of foreign asset holdings experience better consumption smoothing.

Chue (2007) suggested an Euler equation to measure the extent to which foreign securities could help in hedging domestic consumption risks. Chue (2007) concluded that foreign equities had a weak ability in hedging domestic consumption risk and thus the study did not provide any substantial result which could show that hedging domestic consumption risk can explain the home bias in equity portfolios.

Fidora et al. (2007) focused on the role of real exchange rate risk in explaining the home bias in equities and bonds. They presented Markowitz-type international capital assets pricing model (CAPM) in which real exchange rate volatility induced a bias towards domestic financial assets and towards assets with low local currency volatility. The rationale was that the home bias should be higher for bonds than for equities as returns on equities were more volatile than bonds. They tested the hypothesis for 40 investor countries including industrialised and emerging market economies and concluded that a reduction in monthly real exchange rate volatility can help in reducing the bond home bias by 60 percent while the equity home bias by only 20 percent.

Further, Mishra (2011) contributed to the literature by investigating Australia's equity home bias. Mishra (2011) used a Markowitz type mean variance portfolio model and empirically established that the home bias increased with an increase in exchange rate volatility. If the change in real exchange rate volatility equalled the inflation differential, i.e., if the relative purchasing power parity is true, the home bias is zero. Conversely, the home bias is equal to one, if exchange rate volatility increases to infinity.

De Moor and Vanpée (2013) discovered differences between the equity and bond home bias for a large sample of data on OECD countries for the period of 2001-2010. They found that exchange rate volatility played an important role for the bond home bias rather than the equity home bias. Also, they explored that the level of financial development of a country plays an important role in attracting foreign bond and equity investors. Further, corporate governance matters more for international equity portfolios than for bond portfolios.

More recent literature also focuses on relative price of tradable and hedging risk from non-tradable wealth such as non-financial wealth. Obstfeld and Rogoff (2000) argued that trade cost helped to solve the equity home bias puzzle. However, the model presented by Coeurdacier (2009) and Coeurdacier and Rey (2013) showed the opposite results for most of the parameter values.

Eldor and Pines (1988) explored the issue of the home bias in a general equilibrium framework. The model integrated non-traded goods, non-unitary income and price elasticities and return on securities which were not perfectly positively correlated with the price of consumption good. The results showed that hedging motive was neither sufficient nor necessary for home asset preference, but was an outcome of a desire to gamble in real income which surpassed the relative measure of risk aversion and price-elastic demand for non-traded goods.

While comparing the developed and developing countries, Driessen and Laeven (2004) investigated a sample of 52 countries which included 23 developed and 29 developing markets to show how the benefits of international portfolio diversification differed across different countries. The results showed that the benefits of international portfolio diversification are larger for the developing countries as compared to the developed economies. Country risk is a good factor for diversification benefits and hence countries with higher risk are likely to gain more from global diversification.

Massa and Simonov (2006) demonstrated that non-financial income was uncorrelated with market portfolio of financial assets. They concluded that investors deliberately decided not to hedge these risks by tilting their investments in such a way that there is a positive correlation with non-financial income. Thus, hedging risk of non-financial income failed to explain the home bias in equity portfolios. Baxter and Jermann (1997) found a positive correlation between returns on human capital and domestic equities and thereby suggesting that investors should reduce their investments in domestic assets to hedge their non-financial income risks. While on the contrary, Bottazzi et al. (1996) and Julliard (2003) found a negative correlation between returns on human capital and domestic equities. Julliard (2003) argued that the results of Baxter and Jermann (1997) were due to some econometric misspecifications as the correlation between returns to human capital and local equity were overstated. This was because they assumed that improvement in capital and labour incomes are independent across countries.

Hnatkovska (2010) presented a two-country, two-sector general equilibrium model. This shows that low diversification occurred as disparities in relative prices increased the riskiness of holding foreign assets and facilitated risk-sharing across countries. Hence, volatile capital flows occurred in response to international risk-premia differentials which arose due to movements in terms of trade. Overall, the studies are not so useful in explaining the home bias puzzle in international portfolios.

Higher costs and barriers to international investments: Many studies focused on transaction costs and barriers to international investments as the main explanations for the home bias. Some of the earlier studies include Stulz (1981) and Errunza and Losq (1985).

At that time for many investors investing abroad was very difficult due to restrictions imposed by their countries on foreign investments and on access to foreign currency. However, since early nineties the restrictions started to decline as the financial markets in many countries liberalised and thus in the present scenario almost all the countries are open to trade in foreign investments. Hence, barriers to international investments fail to explain the home bias in today's scenario.

Another set of explanations include the explicit market frictions such as transaction costs. Mann and Meade (2002) concentrated on the equity markets and global portfolio behaviour of US and European investors and found that transaction costs helped in explaining the actual US portfolio allocations. Using the 1997 US Survey Benchmark data they proved that European firms had a home bias towards their holdings of European equities. However, with the start of EMU convergence period in 1997 the home bias of European firms reduced as their holding of US equities started rising. Martin and Rey (2004) developed a two-country model with incomplete asset markets. Demand for foreign assets decreased with transaction costs which included banking commissions and variable fees, exchange rate transaction costs and information gathering costs. They proved, theoretically, that transaction costs could affect the equity home bias severely.

Chan et al. (2009) empirically examined the effects of the home bias on the cost of capital and firm valuation, via Tobin's Q at both country and firm-levels. They used 31 countries across the world including both developed and 10 emerging market economies over a period of 1999 to 2004. Results claimed that the divergences of home and foreign equity allocations from the standard international asset allocation models had an impact on the market value of a company or aggregate market value of a country.

However, empirically transaction costs did not seem to play a greater role in explaining the home bias in equity portfolios. Tesar and Werner (1995) used long-term international investment models with respect to Canada, Germany, Japan, the UK and the USA during the period of 1970-1990. The study included data on investment in corporate equities, government and corporate bonds. Their results showed a strong evidence of the home bias in domestic portfolios of countries and also concluded that high transaction costs associated with trading of foreign securities could not be the only reason for the equity and bond home bias. Ahearne et al. (2004) also proved that transaction costs failed to explain the home bias puzzle. Goetzmann and Kumar (2008) showed that under-diversification of portfolios in US exists among investors who are young, less educated and have low income. They proved that transaction costs have a little role to play in explaining this under-diversification as most investors under-diversify due to information disadvantage. Thus, direct costs fail to explain the equity and bond home biases.

Information asymmetries: Another popular explanation for the home bias puzzle is the existence of information asymmetries between domestic and foreign investors. There are explanations that deal with the fact that investors are better informed about their domestic stocks as compared to foreign stocks. Kang and Stulz (1997) showed that foreign investors in Japan held more stocks of large companies as compared to small companies as information advantage of foreign investors was higher for large stocks. Dahlquist and Robertson (2001) also got same results as Kang and Stulz (1997) for Swedish stocks.

Ahearne et al. (2004) provided a picture of the home bias phenomena by analysing the determinants of US holdings of equity across different countries. They analysed the role of information asymmetries that arose from differences in accounting standards, disclosure requirements and regulatory environment across countries. They suggested cross-listing of securities on US stock exchanges. The regression framework used was:

$$BIAS_i = a + \beta X_i + \epsilon_i$$

where $BIAS$ was the degree of U.S. investors' home bias against country i and X was a vector of independent variables that included information costs, trade, transactions costs, capital controls and historical risk-adjusted returns. They concluded that to be listed on US exchanges the companies should follow strict rules of reconciling their financial statements compiled with SEC disclosure requirements. This helped in reducing the information cost to US investors.

Brennan et al. (2005) developed a noisy expectations model where investors received public and private information signals. They confirmed the results of Brennan and Cao (1997) that foreign purchases by US investors were positively correlated to lagged returns from the foreign market. They further proved that there was a link between information disadvantages and expectations for market.

Ivkovic and Weisbenner (2007) used data of investments by 78,000 US retail investors made through a discount broker from 1991 to 1996 and found that households had a strong preference for domestic investments. They found that the average household generated an additional annual income of 3.2% from its local holdings compared to non-local holdings. This implies that local investors had the ability to exploit local knowledge or asymmetric information.

Guidolin (2005) developed a two-country overlapping generations (OLG) model with Bayesian learning to study the effects of asymmetries in the initial informational endowment of investors located in different countries. Guidolin (2005) concluded that it was difficult to explain the home bias using quantitative data for information asymmetry. Hence, it would be helpful to study dynamic equilibrium model involving learning and differential estimation risk and also to concentrate on quality of informational flows.

Barron and Ni (2008) tried to analyse the effect of asymmetric information on the equity home bias puzzle using a rational expectations model in a two-country framework where the portfolio managers had different levels of portfolio size and information attainment was endogenous. They showed that there was a direct linkage between the portfolio size, the acquisition of information cost and degree of home bias in portfolios across each country. Their finding was in line with Gehrig (1993) that well informed portfolio managers demand more foreign assets. Gehrig (1993) derived an optimal portfolio where foreign investors had less information and this led to overweighting of domestic assets.

Many studies like Chan et al. (2005), Berkel (2004), Lane and Milesi-Ferretti (2004, 2005) and Faruqee et al. (2004) regressed actual portfolio holdings on variables that proxy informational asymmetries such as regional and cultural factors. Proximity of foreign market is an important proxy to capture the effects of information asymmetries. Coval and Moskowitz (1999) analysed that investors had a preference for geographically proximate investments and found that the US fund managers invested in companies that were 9-11% closer to them. Also, local equity preference was related to firm size, leverage and output tradability as small, highly levered firms whose products were consumed would expect local investors to have easy access to information. They concluded that geographic proximity played an important role in determining investor portfolio choice from the point of view of domestic scenario.

Kilka and Weber (2000) provided evidence that investors felt more secured and optimistic about their home equity market and thus, invested in familiar companies. Familiarity with one's own domestic companies led to a simple way of understanding the sub-optimal international asset allocation. However, Pastor (2000) concluded that uncertainty did not provide a good explanation for the puzzle. While analysing the geographic distribution of shareholders of US Regional Bell Operating Companies, Huberman (2001) showed that investors were more likely to hold shares with their local providers. Grinblatt and Keloharju (2001) analysed that investors in Finland were keener to invest in the companies which were geographically located closer to them. These explanations indicated that people favoured stocks to which they were more familiar as it provided an informational advantage to the investors. However, there could be a possibility of a myth that the investors had superior information about the companies which were situated closer to their home.

Chan et al. (2005) studied as to how mutual funds are allocated between the markets of domestic and foreign equity and the factors that affect asset allocations in the world. They used a dataset of 26 countries which included both developed and developing

countries and found that a larger proportion of investments were made in the domestic stocks. The results showed that stock market development and familiarity variables play an important role in explaining the domestic bias. Lane (2006) found out that EMU had an important role to play in global bond portfolios. Cross-investment among Euro-members has been substantially higher compared to any other country pairs. Giofre (2008) found that in terms of equity portfolios there has been a shift from the equity home bias to the equity Euro-bias due to informational advantage.

Aviat and Coeurdacier (2007) used the gravity equations framework to cross-border equity flows and found that distance, which is a proxy for information asymmetries, was a big barrier to cross-border asset trade. They provided different endogenous variables for both the variables namely bilateral trade in goods and bilateral asset holdings. They found out that if the bilateral trade increased by 10%, then it increased the bilateral asset holdings by 6% to 7%. The reverse causality was also true and on controlling for trade, the impact of distance on asset holdings reduced substantially.

Further, Rose and Spiegel (2009) explained the fact that countries which were farther from the major international financial centres were likely to be more volatile. This was in connection with the joint hypothesis that firstly, countries which were closer to major financial centres were more financially united and secondly, financial integration helped in reducing macroeconomic volatility. They found that financial remoteness which was measured by the distance from major international financial centres increased volatility in macroeconomic activities. By constructing different alternative measures for both financial remoteness and volatility, they showed a positive correlation. They concluded that costs of intermediation increased with distance and hence with the increase in the cost of risk-sharing, the macroeconomic volatility also increased.

Hamberg et al. (2013) examined the effect of mandatory European adoption of International Financial Reporting Standards (IFRS) on foreign ownership of Swedish firms. IFRS is likely to make financial reporting more uniform which would help investors' to judge and correctly compare the performances of the firms across different countries. This should help in reducing the home bias as investors can easily find foreign investment opportunities in foreign equity markets.

Earlier papers like Bushman and Piotroski (2006) and Covrig et al. (2007) examined that the adoption of IFRS was related to economic consequences like stock liquidity, quality of earnings, and investor ownership. Hamberg et al. (2013) tried to focus on Sweden which was known for its strict legal enforcement as described by La Porta et al. (1998) and identified a setting in which accounting quality remained constant. On an aggregate level the results showed that in Sweden adoption of IFRS did not affect the total

foreign ownership, measured as capital rights and percentage of foreign owners. However, when the foreign owners were decomposed into different groups the results showed that European Union investors increased their foreign ownership. But foreign ownership in the countries which did not adopt IFRS were not affected. Overall, it showed that there was a decline in the home bias of foreign investors in European Union countries, thus raising greater risk. These results were consistent with Brochet et al. (2012) and Eichler (2012) who showed that investors had less equity home bias with widespread financial statement disclosure. The results showed that investors had less equity home bias towards firms adopting IFRS.

Also, cultural differences such as speaking different languages or having different religions can also affect international portfolio holdings. According to Grinblatt and Keloharju (2001), information costs occurred in the form of translations and adaption to different religious habits. Faruqee et al. (2004) applied the Coordinated Portfolio Investment Survey (CPIS) dataset to test the validity of the explanations of the literature of cross-border equity holdings. They used consumption based asset pricing model to accommodate transaction costs and found that the factors like market-size, information costs and transaction efficiency variables explained about 80 percent of the disparity in cross-border equity holdings. Chan et al. (2005) and Sercu and Vanpée (2007a) also showed that size bias played an important role in explaining the equity home bias as (log) GDP or number of publicly listed companies influenced decisions related to international portfolios. Sarkissian and Schill (2004) highlighted that industrial (economic) proximity was also an important factor as overseas decisions of listing firms reflected investment decisions of investors.

However, there are certain drawbacks of having information asymmetry as an explanation for the home bias. If investors have more information about their domestic assets they face a lower variance of returns from domestic equity and also their expected returns differ from foreign investors. Another problem is that there are many index vehicles which help in reducing information disadvantage relative to foreign investors. Errunza et al. (1999) empirically showed that the benefits from international diversification could be obtained fully by combining domestically traded multinational, ADRs and closed-end country funds together. Further, Brealey et al. (1999) explained that holding country index funds or index futures combined with cash helped to avoid institutional disadvantages of holding foreign equities. Another drawback is related to the assumption of information immobility, while asymmetric information usually exists when information is mobile.

Hau (2001) with German data, Dvorak (2005) with Indonesian data, and Choe et al. (2005) with Korean data concluded that foreign investors had an informational disadvantage compared to domestic investors as domestic investors enjoyed higher profits than foreign investors. On the contrary, Grinblatt and Keloharju (2000) used Finnish data and Huang and Shiu (2006) showed that foreign investors outperform domestic investors.

Corporate governance and transparency: Recent studies have brought corporate governance and transparency at the firm-level and political risk at the country level into limelight as important explanations for the home bias puzzle. La Porta et al. (1999) showed that company ownership was more internationally dispersed in countries with good legal protection of minority shareholders. Dahlquist et al. (2003) illustrated that the home bias could be explained by taking into consideration the differences between corporate governance across countries. Further, Gelos and Wei (2005) showed a positive relation between both government and corporate governance and international investments in a country. Also, Giannetti and Simonov (2006) showed that foreign investors preferred to invest in companies with good corporate governance. Thus, quality of corporate governance played an important role in attracting foreign investments.

Pinkowitz et al. (2001) showed that the home bias is linked to corporate governance. The results showed that controlling for barriers to international trade did not help in removing the home bias. However, the home bias declined significantly when the extent to which shares held by shareholders across the world was taken into consideration. Hence, to reduce the home bias it is important to improve the investor rights across countries, especially where large shareholders control the major part of the firms.

Further, Stulz (2005) highlighted that the home bias was caused by twin agency problem, that is, agency problem of corporate-insider discretion and agency problem of state-owner discretion. Agency problem of corporate-insider discretion meant that inside investors could extract substantial private benefits at the cost of outside investors. Agency problem of state ruler discretion meant that state rulers could expropriate investors by regulations and taxes which were meant for the benefit of the state rulers.

Stulz (2005) showed, both empirically and theoretically, that in countries with poor investor protection and high risk of state expropriation the concentration of share ownership was more. He gave three main ways by which agency problems affected international portfolio decisions. First, foreign investors invested less in countries with poor governance as insiders had a larger ownership share in such countries. Second, foreign investors owned larger fraction of wealth in smaller countries while portfolio investors living in small countries with smaller share of world market portfolio invested

more abroad. Third, foreign investors owned a lower fraction of wealth in countries with high risk of state expropriation. Therefore, to reduce the home bias it was important to develop institutions that supported decentralised ownership in the countries with poor public governance.

Behavioural-based explanations: All possible explanations of the home bias puzzle are generally based on institutional factors. However, psychologists and experimental economists have found that people tend to suffer from wishful-thinking bias and self-control problems. To understand this researchers made behavioural models in which domestic investors are risk-averse and consider foreign markets as more risky.

Fellner and Maciejovsky (2003) considered behavioural explanations to shed some light on the home bias as focusing on institutional explanations alone was insufficient in explaining the home bias puzzle. These behavioural explanations included familiarity towards one's domestic companies, optimism about domestic equity market, asymmetric expectations due to individual probability judgements and social identity. In this experiment pairs of subjects were randomly assigned to firms where three firms were a subset of one out of two diverse production groups. While in the social identity treatment group affiliation was implemented by labelling two groups separately. Results showed that social identity factor explained the home bias equally well as asymmetric information and thus social factors played an important role in explaining the home bias along with institutional factors.

Strong and Xu (2003) contributed to the investor behaviour description of the home bias by analysing monthly fund manager surveys of 4 main geographical domains i.e. the US, the UK, Europe and Japan covering 61 month period from October 1995 to October 2000. The results of their study proved that the managers had confidence in their domestic equity market. This implied a bias towards domestic equities and relative bias against foreign equities. Lutje and Menkhoff (2007) examined the home bias puzzle using data in the form of questionnaire survey conducted in 2003 amongst 234 German equity and bond managers. Results showed that fund manager showed a preference towards their domestic assets due to information advantage and expectation of higher returns.

Kilka and Weber (2000) showed that German investors felt more confident in judging their domestic stocks compared to the US stocks. This influenced peoples' expectations as expressed by subjective probability distribution. They concluded that investors were more optimistic about the domestic stocks as compared to the foreign stocks. On the contrary, Dorn and Huberman (2005) examined questionnaire data of Germany from January 1995 to May 2000 and did not find any convincing evidence for overconfidence towards

domestic stocks. Morse and Shive (2011) studied a sample of 53 countries and highlighted that patriotism towards one's own country also leads the equity home bias, even after controlling for capital controls, diversification benefits, information advantages and familiarity.

Also, numerous investor characteristics affect international investment decisions. According to Grinblatt and Keloharju (2001), Goetzmann and Kumar (2003) and Karlsson and Norden (2007), investors with less experience were more home biased as compared to sophisticated investors. Also, Goetzmann and Kumar (2003) underlined that there was a positive relation between age and diversification and income and diversification.

Gender and age are also considered as substantial factors which affect the attitude of investors. It has been verified that female investors are more conventional and do not like to take risk when compared to male investors. Barber and Odean (2001) found that young male investors are inclined to trade more as compared to older female investors. Also, they argued that male investors tend to trade more than female investors as male investors are over-confident. On the contrary, Graham et al. (2009) concluded that more trading by male investors are due to their high competence. Glaser and Weber (2003) demonstrated that overconfidence in the form of miscalibration, illusion of control scores, etc. was not affected by investor demographics like age, gender and portfolio size. Also, Biais et al. (2005) and Deaves et al. (2004) proved that miscalibration was not associated with gender.

The main problem with the behavioural explanations is that psychological constructs are difficult to measure and distinguish. Unobservable psychological attribute, such as overconfidence, are difficult to measure and is, therefore, proxied by age and gender. Another method to deal with behavioural explanations is by conducting questionnaires or experiments. However, two problems can arise: first, if multiple proxies are suggested to measure the same proxy then sometimes individuals' responses are poorly correlated across proxies. Second, it is difficult to extend the questionnaire-based studies to other populations as explained by Dorn and Huberman (2005).

Nowadays as other explanations seem to fail in clarifying the home bias puzzle empirically, information asymmetries, governance issues and behavioural biases are the most popular explanations. However, there is still a debate going on regarding institutional explanations and behavioural explanations. Ke et al. (2010) tried to explain foreign investment decisions based on information-based explanation and familiarity. As they did not find any evidence in favour of information-based explanation, they concluded that foreign investments were affected by familiarity issues. Bekaert and Wang (2009) also concluded that information and familiarity variables and degree of capital market

openness played an important role in explaining both home and foreign biases. On the other hand, DeMarzo et al. (2004) concluded that foreign investment was driven by availability of information and familiarity was just a substitute for better information.

Some other explanations: Prices of consumption good and human capital play an important role as these can lead to differences in portfolio choice. Krugman (1981) and Stulz (1983) proved that investors preferred to hold bonds rather than stocks to hedge against relative good prices as the price of foreign bonds in domestic currency was correlated with relative price of foreign goods.

Campbell et al. (2001) developed a model which was able to optimise investor's portfolio of risky assets by maximising mean-downside risk portfolio. Campbell and Kraussl (2005) focused on downside risk as an explanation in resolving the puzzle as risk in foreign investment had increased resulting in a decline in benefit from international diversification. They used a downside risk portfolio model and data on international equity markets to determine the extent of risk-return trade-off in international financial markets. They showed that due to greater downside risk there was a higher risk-return trade-off in international equity portfolios. The model included additional risk involved in investing in foreign equity and helped to understand the bias for home equity.

Salehizadeh (2003) empirically analysed the return relationships between the US and other international indices, using daily data from January 31, 1995, through May 31, 2001. To examine the behaviour of global stock market indices and its relationship with a portfolio of the US MNCs, tests were conducted based on correlation measures. The empirical results showed that the US investors expanded their domestic stock portfolios by including foreign-traded stocks from both developed and emerging market economies. However, the equity home bias still persists as the US MNCs fail to substitute for international returns.

Michaelides (2003) gave an explanation for the home bias in domestic equity by certain investors by using basic ingredients of undiversifiable labour income risk and liquidity constraints in his model. He extended the approach of Heaton and Lucas (1997) to solve models regarding domestic portfolio choice from international perspective and found that investors held very small amount of internationally diversified portfolio even when the investment amount was very small. Positive correlation between domestic and foreign stock markets reduced foreign market participation but portfolio remained balanced internationally. The model predicted that as long as the equity wealth was held largely by small savers, chances of the equity home bias were more.

Hurst and Stafford (2004) demonstrated that in a permanent income model with exogenous liquidity constraints and mortgage behaviour, the households were likely to refinance. Households found their home as a financial buffer. Households facing unemployment shocks and low levels of liquid assets were 25% more likely to refinance than other households. Hence, households refinance in periods of low interest rates to receive a lower stream of mortgage payments and thus increased the financial wealth. Also, they would refinance to access accumulated home equity for the purpose of consumption smoothing.

Berkel (2004) observed that despite large potential gains, international equity investment was less diversified across countries than predicted by the traditional capital asset pricing model (ICAPM). Using a sample of 38 countries over a time period of 1997 and 2001 the results showed a very strong effect of indirect capital market frictions on international equity holdings. Thus, explained the equity home bias.

Zalewska (2005) analysed the role of the home bias in stock market development and used the Polish experience as the case study. Zalewska (2005) concluded that in emerging markets domestic-biased investments had a negative impact on the investors and the local stock market development. Since, the portfolios of pension funds were not diversified, they were more risky, and hence suffered from low returns.

Brown et al. (2007) provided evidence that causal relationship exists between the average stock market participation decisions of one's own community and an individual's decision of owning the stock. They instrumented for average ownership of an individual's community with lagged average ownership of the states in which one's non-native neighbours were born. The results were stronger in more sociable communities and suggested that a 10 percentage-point increase in stock ownership of one's community increased the probability of individual's owning that stock by 4 percentage-points.

Ivkovich and Weisbenner (2007) studied the relation between households' stock purchases and the stock purchases by their neighbours. They covered the investments by 36,000 households over a six-year period of 1991 to 1996 including common stocks, mutual funds and other securities. They found that there was a very strong evidence of information diffusion which suggested that a 10 percentage-point increase in purchase of stocks from an industry made by a household's neighbour resulted in 2 percentage-point increase in the household's own purchase of stocks from that industry. The effect was significantly larger for local stocks and among households in more social states. Controlling for area sociability, households' and neighbours' investment style preferences and the industry composition of local firms, they suggested that word-of-mouth communication attributed 21-56% of the overall information diffusion.

Foad (2008) examined the impact of the introduction of a monetary union like Euro in 1999 on the equity home bias puzzle. The results showed that the equity home bias has reduced in the entire world for this period and the sharpest fall has been for intra-EA equity holdings with the home bias reducing from 68% to 29% between pre- and post-Euro periods. The most important reason for this drop was the reduction of information asymmetries. Further, Schoenmaker and Bosch (2008) showed that the decline in the equity and bond home bias in Europe due to the arrival of Euro is a permanent phenomenon and this decline is stronger in EMU countries than in non-EMU countries.

Hanushek and Woessman (2008) reviewed the role of cognitive skills in promoting economic well-being and concluded that cognitive skills of population rather than school attainment played a more important role in individual earnings, distribution of income and economic growth. Empirical results showed the important relevance of both minimal and high-level skills, complementarity of skills and also quality of economic institutions. Further, international comparisons of cognitive skills revealed that there were larger skill deficits in developing countries than resulting from school attainment and enrolment.

Foad (2008a) evaluated the relationship between immigration and the equity home bias and found that inward migration was positively correlated to increased foreign equity home bias and reduced equity home bias. Outward migration reduced the home bias in rich countries while it increased the home bias if migration happened from or to developing countries. Hence, migration leads to the benefit of increased information flows for developed countries, but not for developing countries.

Coeurdacier and Gourinchas (2011) described short positions in domestic currency bonds for G7 countries and also showed significant levels of home bias for the US, Japan and Canada. Their findings had crucial empirical implications. First, they confirmed the results of VanWincoop and Warnock (2006) and also highlighted the limitatio that equity positions are not driven by exchange rate risk. Further, domestic equities help in providing a good hedge against non-financial income risk, conditional on bond returns.

Further, Coeurdacier et al. (2010) showed that regardless of liberalisation of capital flows, there is a big amount of the equity home bias that still exists among the OECD countries. The model took domestic stocks in order to hedge fluctuations in local wage income and the terms of trade risk was hedged using bonds. They used a two good/two country RBC model with smooth international trade in equities and bonds.

Mondria and Wu (2010) presented a rational expectations model of asset prices with rationally inattentive investors. They tested the model on a panel data set of 19 developed countries in the time period of 1988 to 2004 using degree of information capacity, degree of information advantage and financial openness of each country. Information capacity

was measured by the average circulation of number of newspapers published at least 4 times in a week, number of mobile telephone subscribers to a public mobile telephone service using cellular technology and the number of people using internet. Financial openness was calculated using both de facto and de jure measures. The estimation results proved that at least 46.8% of the home bias could be explained by the model. Also, they showed that the home bias decreased with an increase in financial openness and information capacity.

Coeurdacier and Guibaud (2011) used aggregate data on bilateral cross country equity holdings and found that there was a strong impact of diversification motive on source countries with a higher level of home bias. Investors like to increase investment in foreign equity holdings within countries which offer superior diversification opportunities.

2.5.2 Education and portfolio diversification

An increase in the number of financial instruments and products has augmented the need for education and financial awareness among citizens, educators, community groups, businesses, policymakers and government agencies for their own financial security. Knowledgeable, educated and more financially aware people are able to manage their finances well by making good and profitable decisions for their economic security and well-being. Financially secure individuals are able to contribute to the economic development of their communities and nations. Thus, education and financial awareness play an important role in influencing investment decisions (Hilgert et al., 2003).

Bernheim (1995, 1998) was the first to point out that most individuals lack basic financial knowledge and numeracy. Numerous surveys have emphasised that US population or specific sub-groups steadily have very low levels of economic and financial literacy. Mandell (2004) also confirmed, using the JumpStart coalition for personal financial literacy survey, that US high school students have very low levels of basic literacy. Hilgert et al. (2003) examined data from 2001 survey of consumers, covering knowledge about credit, savings patterns and mortgages and found that there is a widespread illiteracy among the whole population. Similar results were also found by other authors like Agnew and Szykman (2005) and Moore (2003) using smaller samples or specific groups of population.

Some studies confirm the positive relation between financial knowledge and financial decision-making among households. Hilgert et al. (2003) confirmed a positive link between financial knowledge and financial behaviour. Van Rooij et al. (2011) argued that financially aware households are more likely to participate in stock market investments. Further, Stango and Zinman (2007) indicated that individuals, who are not able to

calculate the interest rates correctly out of a stream of payments, are likely to borrow more and collect lower amounts of wealth. Agarwal et al. (2009) showed that financial errors in investments are more dominant among the young and elderly people who have less financial knowledge and cognitive ability.

Campbell (2006) pointed out that educated households in Sweden diversify their portfolios more proficiently. Bucks and Pence (2006) stressed that households with adjustable rate mortgages, which are more complex than the fixed-rate mortgages, are unaware about the terms and conditions of their contracts. Individuals with less knowledge of mortgages have low levels of education and low income. These results are similar to the results found by Campbell (2006) in which he showed that many households fail to refinance their mortgages during the period of declining interest rates as they have low education and low income levels. Further, Moore (2003) showed that households engaged in difficult mortgages are less probable to be knowledgeable and financially skilled.

Van Rooij et al. (2011) designed two modules of measuring the relationship between financial literacy and stock market participation for De Nederlandsche Bank (DNB) household survey. They found that most of the respondents had basic financial knowledge and were familiar with the concepts of inflation, interest compounding and time value of money. However, very few people knew the basic concepts about bonds and stocks and the relation between bond prices and interest rates. Thus, they concluded that lack of literacy along with lack of understanding of economics and finance prevent households from participating in the stock market. Gollwitzer (1996, 1999) argued that people who are able to develop concrete plans are more likely to invest in profitable channels and achieve their goals. Even a little bit of planning generates higher wealth.

Cole et al. (2011) examined the theory of low demand for financial services in emerging market economies along with survey evidence from Indonesia and India in a field experiment. They found a strong correlation between financial literacy and financial behaviour among emerging market economies. Also, the results showed that the demand for financial education is quite high. However, experimental results showed that programme on financial education is not an effective method for the promotion of use of bank accounts. Their final results indicated that reducing the price of financial services is a better option for financial deepening, for example, by encouraging low-cost technological solutions like mobile banking, etc.

Cole et al. (2012) explored why education affects financial behaviour. They estimated results using the following equation:

$$y_{it} = \alpha_1 knowledge_i + \alpha_2 ability_i + \beta education_{it} + \delta X_{it} + \mathcal{S}\mathcal{G}_i + e_{it}$$

where $ability_i$ is a measure of innate ability, $knowledge_i$ is a measure of acquired knowledge, $education_{it}$ is the highest grade obtained by individual i by year t. X_{it} includes age, gender, race and survey year effects and finally, $\mathcal{S}\mathcal{G}_i$ are sibling-group fixed effects.

Cole et al. (2012) found that education affects confidence, borrowing decisions, the probability of a person having pension, occupational choices, financial market participation and decision-making. Following Lochner and Moretti (2004), they also considered the changes in schooling requirements between 1914 and 1978 to measure the effect of education on confined rates. The results showed that an additional year of education can increase financial market participation by 3.54%. They also showed that one standard deviation increase in knowledge and education increased the market participation margin by 3.4 or 1.8 percentage points. Thus, education has significant and positive effects on market participation. They argued that education, knowledge and ability achieved at the school level can increase financial market participation.

Education also affects financial behaviour through beliefs and attitudes. Puri and Robinson (2007) showed that individuals, who are optimistic, invest a larger part of their portfolios in equities as compared to other financial instruments. Graham et al. (2009) found that educated investors show higher levels of confidence and invest more in foreign portfolios as stronger educational background and other demographics help investors to feel more competent in understanding the financial information. A more competent investor is keen to invest in foreign securities. Since he is knowledgeable, he understands the benefits and risks involved in financial assets. The empirical results showed that education increases investor's competence and investor's with better education are more likely to invest in foreign assets. Heath and Tversky (1991) highlighted that competence helps a person to invest in foreign stocks. An US investor may be unfamiliar with different foreign languages but at the same time may feel competent to invest in foreign markets.

Lusardi and Mitchell (2007) introduced the Rand American Life Panel (ALP) which offered several features for analysing financial literacy and retirement planning. The dataset helps in evaluating financial knowledge of the workers when they are in their prime earning years and are making crucial financial decisions like buying a home and

other savings. The results are similar to the analysis of Lusardi and Mitchell (2006, 2007a). They concluded that financial literacy is an important determinant in retirement planning and respondent's literacy is higher when they are exposed to subjects like economics in schools and to other company-based financial education programmes. Lusardi and Mitchell (2007a) explained that individuals with higher income and more education such as in ALP sample are better planners. It further confirms that older, educated and male respondents are better planners due to higher levels of financial knowledge.

Christelis and Georgarakos (2013) constructed a flexible multivariate probit model which helped investors to understand different participation hurdles in order to invest in domestic and foreign markets. The results showed that households face trouble in investing in foreign markets which are different from the obstacles of investing in domestic markets and hence requires financial sophistication and economic resources to overcome these hurdles. These results point towards the significance of financial literacy as awareness can help in improving the portfolio performance of households who participate in stock markets.

Further, Magi (2009) tried to numerically solve a simple model of international portfolio choice using different behavioural patterns and preferences of economic agents. The results show that only investors, who are correctly able to analyse information derived from the stock markets, are able to gain from diversification opportunities. In case of Italy the results show that people with a higher degree of education like graduates are likely to invest more in foreign equities as compared to people with a lower level of education.

Lusardi and Tufano (2009) examined a national sample of Americans with respect to their debt literacy and financial experiences about their indebtedness. They measured debt literacy through a set of questions related to respondents' knowledge of fundamental concepts related to debt. It showed that debt literacy was low and that about a third of the credit card fees and charges are paid by the individuals with low literacy and lack of knowledge, even after controlling for disparities in income, wealth, family status, etc.

Bernheim et al. (2001) and Bernheim and Garrett (2003) proved that people who are exposed to financial education at the school level are able to make better decisions regarding savings. Calvet et al. (2009) created an index for measuring financial sophistication using the data from Sweden based on the actions of investors. The results showed that poor, less educated and immigrant households lack financial knowledge and

hence are likely to make maximum mistakes regarding financial decision-making. Moore (2003) further explained that respondents with lower financial literacy are likely to run into costly mortgages.

Jappelli (2010) used panel data of 55 countries from 1995 to 2008 to show extensive heterogeneity of financial and economic competence between countries and tried to relate economic literacy to human capital indicators, technological infrastructure, financial and economic development. He merged the indicators of financial literacy with a large group of macroeconomic and institutional variables. The results showed that literacy rate varies drastically across countries and improves with human capital and financial sector reforms. While literacy variability factor depends on educational attainment, social interactions and savings in the form of social security.

Lusardi and Mitchell (2010) tried to find out if there were people with economic decision-making skills. They created a questionnaire on financial literacy and retirement planning for the respondents in American Life Panel (ALP). This helped in measuring financial literacy in a better way. They identified the causal relation between financial literacy and retirement planning through information about financial knowledge acquired at the school level. They established that people who have a higher level of knowledge in economics are likely to make better financial decisions. Moreover, they found that financially literate adults are likely to do better planning for their retirement.

Further, Kimball and Shumway (2010) developed an index of investor sophistication using the data from April 2005 Survey of Consumers based on a questionnaire of 14 questions. They correlated the measure of sophistication with the holdings of international investments, measures of diversification and holding of employer's stock. They tried to correlate three different puzzles, that is, home bias puzzle, employer stock puzzle and participation puzzle with investor sophistication and finally, correlated sophistication with financial education. The results showed that financial education variable has significant explanatory power for the home bias and market participation variable, while income and pension variables have explanatory power for participation variables. Thus, participation, home bias, diversification and employer stock puzzles are significantly related to each other and to investor sophistication.

According to Atkinson and Messy (2011), OECD International Network on Financial Education developed a questionnaire to compare the levels of financial literacy at the international level. The questionnaire takes into account different attributes like education, behaviour and attitude related to personal finances. This facilitates in finding out

similarities and differences in the level of financial literacy among different countries of the world.

Abreu et al. (2011) examined that investors initially invest in their country securities and then after sometime enter the foreign market. Analysing the time period they concluded that investors who invest more frequently in the domestic market are likely to be the first to invest in the foreign market as compared to others. The experience they gain from trading in the domestic market helps them to make better investment decisions in the foreign market. However, investors who are educated and have financial knowledge can enter the foreign investment market without prior experience of trading in the domestic market.

Giofre (2012) explored the role of financial education and investor protection in explaining the lack of international diversification of portfolios. Giofre (2012) showed that investor's financial education helps in increasing international investment and stronger minority investor protection attracts inward investment.

Klapper et al. (2013) used a panel dataset of consumer loans of Russia from 2003 to 2008 to examine the effect of financial literacy on human behaviour. They found that only 41 percent of the respondents could answer questions related to interest compounding. So, they concluded that financial literacy has a positive relation with financial market participation and a negative relation with informal sources of borrowing.

Education helps people to take proper decisions regarding borrowing and investing wealth which induces growth and stability in the overall economy. From the asset side, education and financial literacy are important because of the increasing complicacy of financial products. Since the end of 1980s there has been more deregulation and financial innovation resulting in more availability of financial investment options in equities and bonds. Many researchers have found that lack of knowledge leads to poor risk diversification, inefficient portfolio allocations and low savings rate. Banks and Oldfield (2007) analysed the numerical ability and other scopes of cognitive ability using a sample of older adults in England. They found that numeracy levels are strongly correlated with understanding of pension arrangements, perceived financial security, retirement saving measures and investment portfolios. Further, Christelis et al. (2010) considered the relation between cognitive abilities and stockholding based on the Survey of Health, Assets, Retirement, and Expectations (SHARE) and concluded that the propensity to invest is associated with numerical ability, verbal fluency and recall skills.

Guiso and Jappelli (2005) documented that a significant proportion of households were not even aware of the existence of many financial instruments, as per the 1995 and 1998 Bank of Italy Surveys of Household Income and Wealth (SHIW). They found that the probability of survey respondents being aware of the existence of stocks, mutual funds, and investment accounts is positively correlated to education, household resources, long-term banking relations, and proxies for social interaction.

Guiso and Jappelli (2008) linked financial literacy to portfolio diversification in the case of Italian investors. They used 2007 Unicredit Customer Survey (UCS) which had detailed information about investors' portfolio choice, financial literacy and demographic features. They found that even after controlling for socioeconomic factors and proxies for risk aversion, financial literacy is strongly correlated with the degree of portfolio diversification. Christiansen et al. (2008) used panel-data set containing detailed information about Danish investors' educational attainment along with other financial and socioeconomic variables. The results showed that investors' stock holdings increased if individuals completed a degree related to economics and also if an economist moved to the neighbourhood.

From the macro point of view economic literacy is essential for good and efficient working of the markets and policies as lack of financial knowledge can lead to deceitful financial practices and unfair competition in financial markets. Mishkin (2008) stressed that households with better knowledge and information are able to discipline policy makers to make better economic-policy decisions.

2.6 Econometric background of OLS and Instrumental Variable (IV) methods

2.6.1 Asymptotic Properties of OLS

This section provides various asymptotic properties of ordinary least squares (OLS) estimation technique. The population equation in vector form can be written as the following:

$$y = x\beta + u$$

where x is a 1 x K vector of regressions and $\beta \equiv (\beta_1, \beta_2 \dots \dots \beta_k)'$ is a K x 1 vector.

It is assumed that a random sample of size N from the population to estimate β; thus, $\{(x_i, y_i)\colon\ i = 1, 2 \dots\dots, N\}$ are treated as independent, identically distributed random variables, x_i is 1 x K and y_i is a scalar. For each observation i there is

$$y_i = x_i\beta + u_i$$

which is convenient for deriving statistical properties of estimators (Wooldridge, 2002).

I. Consistency

The key assumption for OLS to consistently estimate β is the population orthogonality condition:

Assumption 1: $E(x'u) = 0$.

Since x contains a constant, the Assumption 1 is equivalent to saying that u has mean zero and is uncorrelated with each regressor. The other assumption required for consistency of OLS is that the expected outer product matrix of x has full rank, so as to there are no exact linear relationships among the regressors in the population. This is stated in the following assumption:

Assumption 2: rank E($x'x$) = K.

As E($x'x$) is a symmetric K x K matrix, Assumption 2 is equivalent to assuming that E($x'x$) is positive definite. Thus, under Assumptions 1 and 2, the parameter vector β is identified. To check that β is identified, it is multiplied by x' and then expectations are taken to get:

$$\beta = [E(x'x)]^{-1}E(x'y)$$

As (x, y) are observed, β is identified. In the method of moments, the population moments $E(x'x)$ and $E(x'x)$ are replaced with the corresponding sample averages.

The theorem for 'Consistency of OLS' states that under Assumptions 1 and 2, the OLS estimator $\hat{\beta}$ obtained from a random sample following the population model is consistent for β (Wooldridge, 2002).

II. Asymptotic Inference using OLS

The asymptotic distribution of the OLS estimator is represented as:

$$\sqrt{N}(\hat{\beta} - \beta) = \left(N^{-1}\sum_{i=1}^{N} x'_i\, x_i\right)^{-1} (N^{-\frac{1}{2}}\sum_{i=1}^{N} x'_i u_i)$$

A homoskedasticity assumption makes the OLS asymptotic variance simpler:

Assumption 3: $E[u^2x'x] = \sigma^2E(x'x)$, where $\sigma^2 \equiv E(u^2)$. As $E(u) = 0$, σ^2 is equal to Var(u).

The theorem for 'Asymptotic Normality of OLS' shows that under assumptions 1-3,

$$\sqrt{N}(\hat{\beta} - \beta) \sim Normal(0, \sigma^2 A^{-1})$$

where the above equation treats $\hat{\beta}$ as approximately normal with mean β and variance $\frac{\sigma^2[E(x'x)]^{-1}}{N}$. The usual estimator of σ^2, $\hat{\sigma}^2 \equiv SSR/(N-K)$, where SSR=$\sum_{i=1}^{N} \hat{u}_i$ is the OLS sum of squared residuals, is shown to be consistent. When $E(x'x)$ is replaced with sample averages (X'X/N), it becomes

$$\text{Avâr}\,(\hat{\beta}) = \hat{\sigma}^2(X'X)^{-1}$$

The right hand side of the above equation is the usual OLS variance matrix estimator under the classical linear model assumptions. As per the theorem of 'Asymptotic Normality of OLS', under assumptions 1-3, the usual OLS standard errors, t statistics and F statistics are asymptotically valid (Wooldridge, 2002).

2.6.2 Importance of Instrumental Variables Estimation

Consider a linear population model

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ \ldots\ldots + \beta_k x_k + u$$

$$E(u) = 0, \qquad Cov(x_j, u) = 0, \qquad j = 1,2, \ldots\ldots, K-1$$

but where x_k might be correlated with u. This implies that the explanatory variables $x_1,\ x_2, \ldots\ldots, x_k$ are exogenous but x_k is endogenous. Endogeneity can arise mainly for three reasons: Omitted variables, Measurement Error and Simultaneity Problem. Omitted variables appear when we try to control for one or more explanatory variables but due to data unavailability are not able to include all variables in the model. Measurement error arises when we aim to measure the partial effect of a variable but we are able to observe only an imperfect measure of that variable. Finally, simultaneity problem arises if one of the variables is simultaneously determined along with y.

OLS estimations in the case of endogenity generally results in inconsistent estimators of all the β_j if Cov $(x_k, u) \neq 0$. Thus, the method of instrumental variables (IV) provides a general solution to the problem of endogeneity. To use the IV estimation with x_k endogenous variables, an observable variable z_1 is required that satisfies two main conditions:

1. Cov $(z_1, u) = 0$, which implies like $x_1,\ x_2, \ldots\ldots, x_{k-1}, z_1$ is also exogenous.

2. The relationship between z_1 and the endogenous variable, x_k requires linear projection of x_k onto all exogenous variables:

$$x_k = \delta_0 + \delta_1 x_1 + \delta_2 x_2 + \ldots\ldots + \delta_{k-1} x_{k-1} + \theta_1 z_1 + r_k$$

where, by definition E(r_k)=0 and r_k is uncorrelated with $x_1, x_2, \ldots, x_{k-1}$ and z_1. The main assumption of this linear projection is that the coefficient on z_1 is nonzero:

$\theta_1 \neq 0$

When z_1 satisfies the two conditions, then it is said to be an instrumental variable (IV) candidate for x_k. The two-stage least squares (2SLS) estimator is considered to be the most efficient IV estimator (Wooldridge, 2002).

2.7 Empirical implementation

2.7.1 Baseline model

To establish the impact of different levels of education on international diversification in equity markets this chapter models the determinants of equity home bias and checks whether education has a significant effect. Following the recent literature on international diversification (see Chan et al., 2005 and Mondria and Wu, 2013) the empirical models are estimated using Ordinary Least Squares (OLS) methods[3]. A dummy variable is included to capture financial development (*Fin.Dev)* which takes the value one if a country's stock market capitalisation is greater than the mean and zero otherwise. The *Fin.Dev* dummy enters on its own in order to measure the direct impact of financial development on equity home bias. The following baseline model is considered:

$$E\mathcal{HB}_{it} = a_0 + a_1 Edu_{it} + a_2 Fin.Dev_{it} + a_3 \mathcal{X}_{it} + e_{it}, \qquad (9)$$

where i = 1, 2, …., *N* refers to the cross-section of units (countries in this case), t = 1, 2, …., *T* refers to the time period, $E\mathcal{HB}_{it}$ is the equity home bias for country i and year t. *Edu* denotes education in country i and year t measured in three different ways using country averages of tertiary education, mathematical numeracy taken from OECD-PISA test scores and the degree of managers' financial skills. The vector $\mathcal{X}$ is of country-specific factors which includes macro-economic conditions, information related-variables, financial liberalisation, financial market development, diversification benefits and finally, foreign exchange risk. e_{it} is a disturbance term which varies with time and across different countries. In order to control for cyclical factors originating from the business

[3] To ensure that the results are not driven by potential endogeneity in the regressors this chapter also uses an instrumental variables (IV) method.

cycle time dummies are included in the regressions. Country dummies that take into account cross-country differences are also included. Finally, standard errors are clustered at the country level to control for serial correlation across countries.

The dependent variable is the equity home bias in international portfolios. Following Cooper and Kaplanis (1994), Brealey at al. (1999), Sercu and Vanpée (2007, 2012) and De Moor and Vanpée (2013) the equity home bias is calculated by subtracting proportional market capitalisation from proportion of domestic equities in a country's portfolio. Thus,

$$E\mathcal{HB}_{it} = \frac{\mathcal{EQ}_{it}}{\mathcal{TEQ}_{it}} - \frac{\mathcal{MEQ}_{it}}{\mathcal{WEQ}_{it}} \qquad (10)$$

where $\mathcal{EQ}_{it}$ is domestic equity holdings of investors in country i at time t, $\mathcal{TEQ}_{it}$ is the total equity portfolio held by the investors in country i at time t, $\mathcal{MEQ}_{it}$ is equity market capitalisation of country i for time t and $\mathcal{WEQ}_{it}$ is the total world equity market capitalisation.

The effects of education on various aspects of financial behaviour have been examined in previous studies (Kennickell et al., 1996; Karlsson and Nordén, 2007; Kyrychenko and Shum, 2009; and Stango and Zinman, 2009). Taking this literature ahead, three main measures of education are employed to capture the effects of changes in education on international portfolio diversification[4]. First, tertiary school enrolment rates are used to capture the effects of formal education (Jappelli, 2010)[5]. Further, in the spirit of Jappelli (2010) education is measured by a broader definition of education measured by OECD-PISA test scores which indicate mathematical numeracy. Finally, education is measured by the availability of financial skills from managers' surveys. The finance skills question is laid out as follows: "Finance skills are readily available". Then respondents should evaluate this statement on a 0-10 scale[6]. Both financial skills and mathematical numeracy are good measures of financial literacy since they are related to three concepts of financial knowledge, as identified by Lusardi and Mitchell (2014). These are numeracy and capacity to perform calculations related to interest rates and understanding the concepts of inflation and risk diversification. Higher levels of *education* imply higher levels of financial sophistication and investor competence, therefore, increasing financial market participation (Cole et al., 2012). In turn, higher levels of financial education are expected to be associated with lower levels of home bias in equity markets.

[4] Table A2.1 in the appendix provides precise definitions of the measures of education and other variables.
[5] The World Bank defines tertiary education as university-level education that includes undergraduate or postgraduate education (e.g universities, colleges, technical training institutes, community colleges, nursing schools, research laboratories, centres of excellence and distance learning centres).
[6] Note that education in Finance, which was an alternative variable of financial education used in Jappelli (2010) and Giofre (2012), was not available to us. The data-set in the present study was downloaded in August 2013 and this particular data item was removed from the database.

In addition to different measures of education, which is the core explanatory variable, a set of other control variables are included in Vector *X* which explains portfolio diversification in previous studies. These variables are categorised into six groups[7]:

Macro-economic conditions: Economic development of a country is measured by the growth in its *Gross Domestic Product (GDP)*[8]. GDP growth can have both positive and negative impact on home bias. Countries with fast growing GDP can attract more foreign investments resulting in a decline in the home bias. While on the other hand, countries growing faster are mostly the emerging market economies that face higher risk and thus discouraging foreign investments resulting in an increase in home bias.

Foreign direct investment (FDI) was used by Chan et al. (2005) as a measure of economic development. It is measured by foreign direct stock investment inward, scaled by GDP. This indicator is important as a country's level of economic development is likely to affect the flow of foreign investments.

Information-related variables: Following De Moor and Vanpée (2013), trade, the English legal origin and labour force size are employed as proxies for information asymmetries and familiarity. *Trade* is calculated as the average of exports and imports scaled by GDP. The *English legal origin* is a dummy variable that takes the value as one if the country has English as the legal origin, and zero otherwise. La Porta et al. (2008) showed that a country's legal origins have a statistically large impact on investor protection which is related with improved levels of financial development. Thus, both trade and English legal origin are anticipated to affect home bias negatively.

Labour force size is likely to influence individuals' investment decisions by affecting their risk preferences. It is measured by the total population in the age group of 15 and older who are economically active. Several researchers concluded that older investors are more experienced, practiced and are more likely to diversify their investment portfolios. Hence, labour force size and home bias should be negatively correlated. This means that as individuals are economically more active, their levels of income and diversification increase (Goetzmann and Kumar, 2003).

Financial liberalisation: Following Mondria and Wu (2010), financial liberalisation and financial openness in a country is measured by the *Chinn-Ito Index of financial openness*. Financial openness of a country is likely to affect home bias negatively. This measure is a combination of four binary dummy variables mentioned in IMF's Annual Report on

[7] Another control variable, namely the corruption index, was also included to deal with the concept of governance. This variable, however, proved to be highly co-linear with both financial skills, Pisa scores and tertiary education as well as with financial openness. Therefore, it has not been included in the specifications.

[8] The log of GDP per capita is also used as a measure of economic development and the results are broadly similar. However, the variable has high correlation with PISA scores, tertiary education and financial openness. Thus, this variable is not included in the main models.

Exchange Arrangements and Exchange Restrictions (AREAER). These variables are the presence of multiple exchange rates, the existence of restrictions on current account transactions, the existence of restrictions on capital account transactions and the requirement of the surrender of export proceeds. Hence, by structure the Chinn-ito index is a de-jure measure of financial openness[9].

Financial market development: The financial market development is measured by turnover ratio, domestic credit and market capitalisation. These variables are expected to have a negative relationship with equity home bias. *Market turnover* is measured by turnover ratio, an asset's ability to be sold without causing much movement in price and value. Following Levine and Zervos (1996), the turnover ratio helps in measuring market liquidity and transaction costs[10]. According to Bekaert et al. (2007), the effect of liquidity is more distinct in emerging markets where executing transactions are time-consuming.

Domestic credit provided by the banking sector as a percentage of GDP was used by Rose and Spiegel (2009) and De Moor and Vanpée (2013) to measure the domestic financial depth. This variable includes all credit to various sectors on a gross basis with the exception of credit to the central government which is net[11].

Market capitalisation, as a percentage of GDP, measures the share price multiplied by the number of shares outstanding. This is an efficient measure of stock market size. According to Chan et al. (2005), larger stock markets are more visible, more recognised and more developed, and, therefore, are able to attract more foreign equity portfolio investments. Thus, home bias in a country is likely to decrease with an improvement in a country's financial depth and liquidity.

Diversification benefits: Following Edison and Warnock (2004), the *current ratio* is used which signals the ability of the firms to meet short-term obligations. This ratio is calculated as current assets over current liabilities. Thus, an increase in current ratio should have a negative impact on home bias as firms which are more liquid are able to attract higher levels of foreign investments, thus reducing the home bias.

In addition, *Leverage* is calculated as the ratio of total debt to total assets. More indebted companies face a higher degree of information asymmetries and maintain weak financial position. These companies are less likely to attract foreign investors and, therefore, as the leverage increases, the home bias decreases.

[9] One potential drawback of this index is that investors may find loopholes and thus may escape the capital account restrictions, invalidating the effect of capital account restrictions.

[10] Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996) and Datar et al. (1998) show that assets with lower liquidity trade at a lower price relative to their expected cash flows. Thus, illiquid assets command a higher risk premium and therefore higher expected returns.

[11] The banking sector includes monetary authorities and deposit money banks as well as other banking institutions where data are available.

Foreign exchange risk: Following De Moor and Vanpée (2013), foreign exchange rate risk is taken into account by creating a dummy (*Euro*) which takes value one if the country is a member of the Euro-area, and zero otherwise. Baele et al. (2007) established that home bias was lower for those countries which were part of the European monetary union as compared to other countries.

2.7.2 Accounting for financial development across countries

This section tries to explore the extent to which an increase in the level of education may have a different impact on the home bias of countries by characterising countries according to different degrees of financial development. To do so the degree of stock market capitalization is used as a sorting device. Stock market capitalisation to gross domestic product (GDP) ratio is an efficient measure of stock market size. Larger stock markets are likely to have higher mobility of capital, less volatility and risk, and are more internationally integrated (Demirgüç-Kunt and Levine, 1996). Further, investors are attracted more towards developed stock markets due to the fact that they are characterised by lower transaction costs and higher liquidity (Chan et al., 2005). The countries in the sample are classified into more and less financially developed on the basis of the average stock market capitalization using the dummy *Fin.Dev*[12]**.** Due to higher degree of home bias in international portfolios among less developed economies, the impact of education on equity home bias is expected to be more crucial for less financially developed economies as compared to their more developed counterparts. With the purpose of testing this hypothesis, the equation (9) is modified by including interactions between education (Edu) and the financial development dummy (*Fin.Dev).*

$$EHB_{it} = a_0 + a_1 Edu_{it} * Fin.Dev_{it} + a_2 Edu_{it} * (1 - Fin.Dev_{it}) + a_3 Fin.Dev_{it} + a_4 X_{it} + e_{it}, \qquad (11)$$

The specifications above capture the impact of education on more and less financially developed economies. If the interacted coefficients are statistically different from each other it can be concluded that there is a difference of impact of education on the home bias between more and less financially developed economies.

2.7.3 Accounting for differences between crisis and non-crisis periods

Having identified a relationship between education and home bias for more and less financially developed economies, an attempt is made to explore if this linkage has evolved over time. The sample covers the most recent global financial crisis and this provides an interesting setup to investigate the extent to which, controlling for other factors, home bias

[12] The robustness of the findings is checked by using an alternative classification scheme of the mean of stock value traded (as a percentage of GDP). In addition, the mean of stock market capitalisation and outstanding domestic private debt securities to gross domestic product (GDP) is also used as a measure to classify countries.

differs in crisis years as compared to more tranquil periods. Therefore, equations (11) is expanded with a financial crisis dummy (*Crisis*) which takes value one over the period 2007-10, and zero otherwise. Interaction of the education variable with the *Crisis* and the *Fin.Dev* dummies are used to examine whether the sensitivity of countries' home bias to changes in the level of education differs between crisis and non-crisis periods for more and less developed economies. There is evidence that the most recent financial crisis adversely influenced equity markets in the world. Countries with poor credit market regulations and larger pre-crisis current account deficits were hit the hardest (Giannone et al., 2010 and Lane and Milesi-Ferretti, 2011). The estimated model is described as follows:

$$EH\mathcal{B}_{it} = a_0 + a_1 Edu_{it} * Fin.Dev_{it} * Crisis_t + a_2 Edu_{it} * (1 - Fin.Dev_{it}) * Crisis_t + a_3 Edu_{it} * Fin.Dev_{it} * (1 - Crisis_t) + a_4 Edu_{it} * (1 - Fin.Dev_{it}) * (1 - Crisis_t) + a_5 Fin.Dev_{it} + a_6 X_{it} + e_{it} \quad (12)$$

If the interacted terms during the crisis are significantly different from the same terms outside of the crisis, then the additional response of the home bias to education during the crisis is noticeable as compared to tranquil periods.

2.8 Data and summary statistics

2.8.1 Data

The data for this chapter are taken from different sources including the Coordinated Portfolio Investment Survey (CPIS), the IMD World Competitiveness Yearbook (WCY), World Federation of Exchanges (WFE), the Datastream and the World Development Indicators (WDI) of the World Bank. These are combined in a new way to throw light on the effect of education on international diversification in equity markets. The data covers 38 countries over the period 2001 to 2010[13].

Home bias measure

Portfolio holdings data for constructing the equity home bias measure are taken from Coordinated Portfolio Investment Survey (CPIS) held by the IMF. This survey contains comparable multi-country data at the security level from end-investors, custodians and a combination of the above. Portfolio investment is broken down into instrument (equity)

[13] Due to missing data in CPIS dataset for India and Mexico the home bias data for these countries begin from 2003. This data-set is comparable to De Moor and Vanpée (2013) with the exception of Canada, Germany, Singapore and South Africa that suffer from missing data on education variables. In line with the literature outliers are not removed from the chosen variables, but in regressions, after dropping outliers from the equity home bias term and the regression variables, the results remain unchanged. These results are not reported but are available upon request.

and residence of issuer[14]. The equity market capitalisation data are drawn from World Federation of Exchanges (WFE).

Education

The main indicator of education is measured using tertiary school enrolment rates, mathematical numeracy and financial skills. The data for tertiary school enrolment rates are drawn from WDI of the World Bank. As a measure of mathematical numeracy OECD PISA test scores for 15 year old individuals are used. These are taken from the IMD World Competiveness Yearbook (WCY). This is a good proxy for economic literacy as it provides an assessment of financial knowledge and skills (Jappelli, 2010). This variable also captures the numerical ability as the propensity to invest is related with numerical ability and verbal fluency (Christelis et al., 2010). Finally, an indicator for financial skills across managers is used which is drawn from IMD WCY database. This indicator is based on a survey conducted on senior business managers who represent a cross-section of the business community in the countries examined. The survey tries to answer questions related to efficiency and ability of managers to adapt towards changing enterprise competitiveness. WCY also reports questions related to value added activities in business, since skilled labour force is able to enhance a country's competitiveness. The distribution and ranking of economies in the survey carried out by WCY is very likely to those provided by the Survey of Health, Assets, Retirement and Expectations (SHARE), which gives information on the cognitive ability at the individual level in 11 European countries (see Jappelli, 2010 and Jappelli and Padula, 2013). Thus, WCY can provide a representative base for conducting our empirical analysis.

Other influences

Data on GDP growth, foreign direct investment (FDI), trade and labour force size are extracted from the WDI of the World Bank. Turnover ratio and domestic credit data and stock market capitalisation data are also sourced from the WDI of the World Bank. Finally, data on Leverage and Current ratio are from Datastream Global Index. Datastream is a global financial and macroeconomic database for equities, stock market indices, currencies, company fundamentals and fixed income securities. This database is maintained by Thomson Reuters Limited which provides time series information for over two million financial instruments, securities and indicators for over 175 countries and 60 markets worldwide. It provides a historical dataset of 50 years over 8,000 different fields.

[14] The CPIS provides the most comprehensive survey of international portfolio investment holdings and has been employed by a number of recent studies (e.g Fidora et al., 2007; Bekaert and Wang, 2009 and Gianetti and Koskinen, 2010). However, it is still subject to a number of important caveats. See http://www.imf.org/external/data.htm#financial

2.8.2 Summary statistics

By way of preliminary analysis descriptive statistics for equity home bias and other control variables are presented in Table 2.1. Table 2.1 provides values for the whole sample (column 1); for more and less financially developed economies (columns 2 and 3); and a p-value for the test of equality of means with unequal variances (column 4). It can be observed that the average equity home bias for the whole sample, as shown in column 1, takes the value 77.12% which reveals that all the countries are home biased towards equity with the highest average home bias existing in Turkey during the period of 2001-2010. On the other hand, the lowest average equity home bias exists in the United States.[15]

Further, columns 2 and 3 show that home bias is more prevalent in the less financially developed economies. It is shown that the average equity home bias in the more financially developed economies is 68.70%, while that for the less developed economies is 82.13%. This implies that investors in the less financially developed economies hold less than $1/5^{th}$ of the required foreign equities according to the basic international CAPM model. This supports the notion put forward by Coeurdacier and Rey (2013) that home bias in equities is likely to be more prevalent in economies with less developed financial markets.[16] In addition, Sercu and Vanpée (2007) point out that emerging market economies have more volatile stock markets and hence display higher equity home bias. They argue that international investors are reluctant to invest in these economies due to higher risk. According to Eichengreen et al. (2006), during adverse economic events foreign investors tend to escape the emerging markets because these are characterised by lower liquidity, higher volatility and domestic risk. This can be another reason for lower level of foreign investments and the higher degree of home bias in emerging markets.

As expected, with respect to other control variables education measures are significantly higher in more financially developed economies. This statistic lends support to Jappelli (2010) who argues that economic literacy is generally lower in poorer demographic groups. Variables which reflect economic health such as GDP growth and FDI display significantly different values for the two groups of countries[17]. Specifically, less financially developed economies are growing faster as compared to their developed counterparts. While the level of FDI is higher for the more financially developed group as opposed to the less developed market group. With respect to information-related variables trade, labour force size and the English origin have significant differences across the two

[15] See Table A2.2 in the Appendix for home bias statistics across the countries used in this chapter.
[16] Coeurdacier and Rey (2013) show that emerging markets have less diversification in their equity portfolios than developed economies and do not display any downward trend in home bias.
[17] Table A2.2 also provides the average of different measures of education for 2001-2010 across countries.

groups of countries. The labour force size is larger for less financially developed countries as compared to more developed countries. This statistic is mainly influenced by India which has the largest labour force amongst the less developed countries. Financial openness is significantly higher for more financially developed economies than less developed economies. Moving to financial market indicators, turnover ratio, domestic credit and market capitalisation are on the higher side for the more developed countries and are also significantly different from the less developed group. For current ratios and leverage, less developed economies display a higher value but the differences are not statistically significant. Finally, the coefficient of the Euro dummy is higher for more financially developed economies and also significantly different from the less developed group.

Overall, two points can be highlighted from these preliminary statistics. First, equity portfolios are significantly home biased in this sample. Second, more financially developed economies relish an advantageous position in attracting foreign investments due to higher levels of education, stronger economic and financial market factors, financial market liberalisation and lower exchange rate risk than less developed economies. Though it remains to be seen, whether these preliminary findings continue to hold when controlling for a number of factors which are play an important role in international diversification studies. In the sections that follow a formal regression analysis framework is tested to find out whether education has a statistically significant influence on equity home bias.

2.9 Empirical results

2.9.1 Baseline model

In this section specifications are estimated using ordinary least squares (OLS) method. The empirical tables report simple OLS method and instrumental variables (IV) regressions[18]. The identification of the impact of education requires the availability of exogenous instruments that are correlated with education, but are uncorrelated with the error term. For this purpose, primary education enrolment rates and unemployment rates (percentage of total labour force) are used as instruments which can provide plausible exogenous source of variations in the level of education[19]. In addition, both instruments are expected to affect education and financial literacy but they do not impact the degree of

[18] The first stage IV estimates and statistics are reported in Table A2.3.

[19] Scatter plots with best-fitting regression lines are presented in Figure A2.1 to document the strong relationship between equity home bias and tertiary education, mathematical numeracy and financial skills. On the other hand, the scatter plot shows a weak relationship between equity home bias and primary education with a very low correlation coefficient (0.13).

diversification directly. It is also assumed that all the other control variables used in the model are possibly endogenous. Thus, these variables are instrumented using their own values lagged twice. Lags of the variables are legitimate candidates since they contain information about the current values of the potentially endogenous variables and remain uncorrelated with the current value of the measurement error (see Almeida et al., 2010).[20] To check the relevance and validity of the instruments used for education as well as for our control variables a number of diagnostics are employed. P-values for these tests are reported at the foot of the tables.

Table 2.2 reports the OLS estimates of equity home bias for different measures of education in columns 1-3 and IV estimates in columns 4-6[21]. Table reports tertiary education in column 1 and then PISA math scores and financial skills in subsequent columns. The point estimates on education suggest a robust relationship between the different measures of education and the home bias for equity portfolios. Education attracts a negative and highly significant coefficient in the equity home bias regressions which help in assessing the impact of a *ceteris paribus* increase in different levels of education on the degree of equity home bias. This finding is both statistically and economically important and percentage point effects are calculated by dividing the coefficient value (marginal effect) with the predicted probability of the model. Therefore, a 10% increase in *tertiary education* leads to a 3.39% reduction in home bias. An identical increase in *PISA* scores and *financial skills* will drop equity home bias by 1.24% and 7.22% respectively. The IV results show similar magnitudes for tertiary education and PISA scores. A 10% increase in *tertiary education* and *PISA* scores reduce home bias by 6.09% and 2.57% respectively. These results show that increasing the percentage of university graduates or the level of mathematical numeracy is likely to reduce the level of equity home bias. On the other hand, *financial skills* do not exert a significant impact on equity home bias indicating that the previous finding might be subject to endogeneity bias not controlled for in the OLS estimates. Overall, these results are in line with Cole et al. (2012) and Graham et al. (2009) who show that financial market participation increases if the education attained at the school level improves. Importantly, these results also confirm the findings of Karlsson and Nordén (2007) and Giofre (2012) that higher levels of education encourages international investments which imply lower equity home bias.

[20] Following the bulk of the literature on firm-level behaviour, financial variables such as turnover ratio, trade, market capitalisation, current ratio, domestic credit and leverage are instrumented using their own values lagged two times.

[21] Results obtained by Seemingly Unrelated Regression (SUR) method are quantitatively similar to the OLS results implying that the error terms are uncorrelated.

Focusing on the country-specific control variables[22], countries which are fast growing display a higher level of equity home bias, while countries with higher *FDI* levels are likely to reduce the degree of equity home bias. Moving to information-related variables, *trade* enters with a negative but insignificant coefficient in the equity home bias regression. Both *labour force size* and the *English legal origin* dummy, when significant, enter with the expected negative coefficients. The former finding implies that greater participation in labour force is likely to have a positive impact on foreign portfolio diversification. The latter finding shows that countries that have English as their legal origin display lower levels of home bias as it has a strong impact on their financial market development (La porta et al., 2008).

Financial openness enters with the expected negative sign and is significant in all OLS models. This result highlights that an increase in a country's financial openness is likely to reduce the equity home bias. This finding is in line with Bekaert and Wang (2009) and Mondria and Wu (2013). While *turnover ratio* is insignificant, a negative and highly statistically significant coefficient for *domestic credit* is observed which is a measure of financial depth. This suggests that an improvement in a country's liquidity and expansion of financial markets help to attract more foreign investment, resulting in a negative relation with equity home bias. Both the financial development dummy and stock market capitalisation are generally insignificant.

Current ratio coefficient has the expected negative sign, while *leverage* is quantitatively unimportant. Firms with a higher current ratio are in better financial shape and can attract more foreign investments (Edison and Warnock, 2004). Thus, an increase in foreign investments tends to reduce equity home bias. Finally, the coefficient on the *Euro dummy* is consistently negative and highly significant. The point estimates indicate that countries within Euro-area have lower home bias in equity portfolios as shown by De Moor and Vanpée (2013). This result implies that countries with a common currency such as the Eurozone countries experience lower home bias in terms of equities (Baele et al., 2007).

Regarding the IV diagnostics, the Kleibergen-Paap statistics reject the null hypothesis that the equation is underidentified. The Anderson-Rubin and Stock-Wright statistics which are the weak instrument-robust inference tests, do not reject the null hypothesis that

[22] Table A2.4 provides the correlation matrix between all the explanatory variables which show that the variables do not suffer from high correlation.

the coefficients of the excluded instruments are jointly equal to zero. Finally, the Hansen J statistic of the overidentifying restriction also shows that the instruments are valid[23].

2.9.2 Accounting for differences between developed and emerging economies

On identifying a direct relationship between education and home bias this section tries to explore whether this link differs for countries with different levels of financial market development. Table 2.3 presents estimates for the interaction terms between education and *Fin.Dev* and (1-*Fin.Dev*) dummies. The results reveal the heterogeneity between countries that is hidden in the estimates for the full sample.

The parameter estimates are reported in Table 2.3. The coefficients associated with the interaction terms are negative and significant for the less financially developed countries, while they are quantitatively irrelevant for their developed counterparts. To put it differently, improving education is likely to decrease the level of home bias for less financially developed economies. The magnitude of the interacted coefficients suggests an economically meaningful result. Specifically, a 10% increase in *tertiary education* and *PISA scores* will reduce home bias in less developed economies by 6.39% and 1.99% respectively. The IV results show that a 10% increase in *tertiary education* and *PISA scores* will reduce home bias in less developed economies by 5.52% and 3.97% respectively[24].

In other words, countries which are characterised by less developed financial markets exhibit a higher sensitivity of equity home bias to education. Tests of equality for the education coefficients between the two groups of countries indicate that the null hypothesis of equality can be rejected in all regression models. This is a novel finding which highlights that education plays a more important role in less developed financial markets which are more home biased. Hence, it suggests that an increase in the percentage of University graduates and an improvement in mathematical numeracy can be a crucial factor in reducing equity home bias in economies that display a lower level of equity market development.

Moreover, this finding echoes the argument made by Klapper et al. (2013) that financial literacy should not be necessarily prevalent in economies with developing financial markets. Hence, an increase in the level of education helps in strengthening investor's competence and financial sophistication which in turn encourages the investor to diversify their portfolio in terms of foreign investments. Lastly, with respect to the

[23] In addition to the statistics reported in the tables of the results, the Anderson Rubin chi-square test was also implemented and obtained identical p-values with the Anderson Rubin F-test.

[24] The estimated coefficients on *financial skills* do not show any statistically significant impact on equity home bias when the countries are split on the basis of their financial development. One potential explanation for this finding might be the fact that financial skills are widespread across both developed and developing economies and it is difficult to detect any heterogeneity.

other control variables in the model, they retain their significance in most cases and behave as conjectured.

2.9.3 Accounting for differences between crisis and non-crisis periods

This section addresses the response to the crisis by examining the sensitivity of home bias to education in the 2007–2010 financial crisis. The coefficients on variables interacted with the dummy variable *Crisis* and $(1-Crisis)$ along with the dummies (*Fin.Dev*) and (1-*Fin.Dev*) are reported.

The results reported in Table 2.4 show the impact of the equity home bias in more and less financially developed economies during the crisis and non-crisis periods. To begin with the coefficients on the interaction terms are negative and highly significant for less financially developed economies in both crisis and non-crisis periods. The results reveal that education plays a more important role in reducing the equity home bias in economies with lower levels of equity market development during the crisis and non-crisis periods as compared to more financially advanced economies. In terms of economic significance, during the crisis period a 10% increase in *tertiary education* and *PISA scores* will lead to a reduction in the equity home bias of less financially developed economies by 6.36% and 3.09% respectively. In tranquil periods, an identical increase in *tertiary education* and *PISA scores* will drop the equity home bias in less developed economies by 6.32% and 2.66% respectively.

The IV estimates show comparable magnitudes. During the crisis period a 10% increase in *tertiary education* and *PISA scores* will lead to a reduction in the equity home bias of less financially developed economies by 6.88% and 3.78% respectively. In non-crisis periods an identical increase in *tertiary education* and *PISA scores* will drop the equity home bias in less developed economies by 6.47% and 3.31% respectively. The test of equality of the coefficients, which is reported at the foot of the table, shows a statistically significant difference between the above mentioned coefficients. Finally, the results show that there is no significant impact of financial skills on the equity home bias during crisis and non-crisis periods for both more and less financially developed economies.

To summarise, the greater sensitivities of equity home bias to changes in the level of education are recognised for less financially developed economies during the crisis than tranquil periods. According to Eichengreen et al. (2006), during adverse economic events foreign investors tend to escape emerging markets because these are characterised by lower liquidity, higher volatility and domestic risk. This finding was also noted in Mizen and Tsoukas (2012), who documented a substantial increase in the bond market external

finance premium for the emerging Asian markets. This results in lower levels of foreign investments and higher degree of home bias in emerging markets.

Thus, these findings suggest that having more university graduates, or a higher level of mathematical numeracy reduce the extent of local equity home bias during the crisis, especially in less developed economies. This could be one important factor in improving the adverse effects of financial crises with respect to international diversification.

2.10 Robustness check

2.10.1 Alternative estimation methods

Given the panel dimension of the data-set used in this chapter, and to ensure that the main results do not suffer from unobserved country-specific heterogeneity, both random and fixed effects models are employed. The estimates obtained from random and fixed effects are reported in columns 1-3 and 4-5 respectively of Table 2.5. It is apparent that the main results are upheld. The estimates of the random effects model include both the within-entity and the between-entity effects which represent the average effect of education over equity home bias when education changes across time and between countries. More specifically, the results show a reduction in equity home bias by 3.51% and 1.02% when *tertiary education* and *mathematical numeracy* increase by 10% respectively across time and between countries. On splitting the countries on the basis of financial development, the estimates show that a 10% increase in *tertiary education* and *PISA* scores reduces home bias by 5.58% and 1.98% respectively in the less developed countries. Finally, the estimates during the crisis period show that a 10% increase in *tertiary education* and *PISA* scores in less developed countries leads to a reduction in the equity home bias by 5.53% and 2.36% respectively across time and between countries. In tranquil periods, an identical increase in tertiary education and PISA scores in less developed countries will drop the equity home bias by 5.24% and 1.67% respectively across time and between countries.

The fixed-effects model is aimed at examining the robustness of our findings within countries. The results show that for a given country, as *tertiary education* and *mathematical numeracy* increase by 10% across time, equity home bias drops by 1.97% and 1.69% respectively. Further, it can be observed that a 10% increase in *tertiary education* reduces home bias in less developed countries by 2.95%. Finally, the estimates during the crisis period show that a 10% increase in *tertiary education* and *PISA* scores leads to a reduction in the equity home bias across less developed countries by 2.90% and 2.32% respectively. In tranquil periods, an identical increase in *tertiary education* and

PISA scores will drop the equity home bias in less developed countries by 2.14% and 1.87% respectively[25]. Taking these results into consideration, it can concluded that employing both random and fixed effects methods do not make a substantial difference, suggesting that the main results are robust to alternative estimation techniques.

2.10.2 An alternative measure of home bias and financial development

The robustness of the results is checked by modifying the measure of equity home bias proposed by Bekaert and Wang (2009). Bekaert and Wang (2009) indicated that there is a size bias in the older measure of home bias mentioned in equation (10) and hence large markets might show lower home bias. To solve this problem of size bias, Bekaert and Wang (2009) scaled the home bias measure in equation (10) by the maximum home bias:

$$\overline{\mathcal{HB}_i} = \frac{\mathcal{HB}_i}{(1 - \frac{\mathcal{M}_i}{\mathcal{W}})}$$

where $\mathcal{HB}_i$ is the home bias measure in equation (10), $\mathcal{M}_i$ is the market capitalisation of country i, $\mathcal{W}$ is the world market capitalisation.

Columns 1-3 of Table 2.6 present the results using the scaled equity home bias measure. The results in panel 1 are again both quantitatively and qualitatively similar to the main baseline results, which demonstrate the robustness of the empirical results. Taking into account the differences across more and less financially developed economies in panel 2 the results indicate that education reduces scaled equity home bias in less financially developed economies significantly more than the more developed economies. Finally in panel 3 education is more sensitive in reducing scaled equity home bias in less financially developed economies as compared to more developed economies during the crisis period. Other explanatory variables retain their significance and expected signs. To sum up, it can be concluded that the main results are robust to an alternative measure of home bias.

The results are also re-estimated using an alternative measure of financial development of countries and the results are reported in columns 4-6 of Table 2.6. In order to ensure that the main results are not driven by the way the sample is divided, a robust framework is used in order to achieve a good measure of financial development. In particular, countries are classified into more and less financially developed using the mean

[25] The estimates of both random and fixed effects models show that the impact of financial skills on equity home bias remains largely insignificant.

of total value of stock traded to gross domestic product (GDP) ratio[26]. A dummy variable (*Fin.Dev2)* is constructed which takes the value one for more developed economies and zero otherwise.

Thus, the main findings are broadly confirmed that increasing tertiary education and mathematical numeracy are likely to lead to a reduction in the equity home bias. In addition, that this outcome is stronger in the less developed economies as compared to their more developed counterparts during the crisis periods. Overall, it is found that the main results are robust to alternative classification of financial development.

2.10.3 Tobit regressions

A Tobit model is employed to account for the fact that the dependent variable, equity home bias, is censored from above and below. Columns 1-3 of Table 2.7 report results of equity home bias with an upper limit of 90 and lower limit of 10, while columns 4-6 refer to an upper limit of 80 and a lower limit of 20 for the equity home bias.

The results confirm a negative and significant impact of *tertiary education* and *mathematical numeracy* on equity home bias. Further, the results show that this negative effect is stronger for less financially developed countries as compared to their more developed counterparts. Finally, during both the crisis and non-crisis periods education reduces equity home bias in less financially developed countries. Hence, it can be concluded that the results are robust even while using Tobit models which account for the fact that the equity home bias is bounded from above and below.

2.10.4 Regressions for different sub-samples

To confirm that the results are not affected by any outliers i.e. countries which have extreme values of equity home bias, the regressions are run separately for the two groups of economies[27]. Columns 1-3 of Table 2.8 present results for less financially developed countries and columns 4-6 show the results for more financially developed countries. The baseline results in Panel 1 are similar qualitatively and quantitatively to the main results. The estimates show a significant and negative impact of *tertiary education* and *mathematical numeracy* on equity home bias for the less financially developed countries, while education has an insignificant impact for more financially developed countries.

[26] This variable has been employed in a number of recent studies such as Chinn and Ito (2006), Aizenman and Pasricha (2012) and Čihák et al. (2013) as a measure of financial development. The data for total value of stock traded to GDP are drawn from the World Bank.

[27] In the main results instead of estimating the models for different sub-samples, the education variable was interacted in all our specifications with dummy variables indicating different time periods or groups of economies. This approach helped to avoid problems of endogenous sample selection; gain degrees of freedom; and to take into consideration the fact that economies can transit between groups.

Panel 2 takes into account the crisis and non-crisis periods and the results show that education helps to reduce equity home bias for less developed countries in both crisis and non-crisis periods, while education has an insignificant impact for more developed countries. The test of equality for education also shows a significant difference between the coefficient values in crisis and non-crisis periods for less developed countries. Overall, it can be confirmed that the results are similar qualitatively and quantitatively to the main results.

2.11 Conclusion

This chapter examines the impact of education on the home bias in international portfolios. These results, based on a panel of both more and less developed countries during the period 2001–2010, suggest that education plays a crucial role in reducing the equity home bias. After dividing countries into more and less financially developed groups, using the average stock market capitalization, it is found that less financially developed countries tend to benefit more from an improvement in the level of education as compared to their more developed counterparts. It can be concluded that Klapper et al. (2013) were right to point out the importance of difference between developed and emerging market economies in the context of financial literacy, since the results in this chapter document a differential effect of financial education in terms of international portfolio diversification. To conclude, this chapter also highlights that less financially developed economies are more sensitive to the level of education during the global financial crisis than the more developed economies.

The above results are relevant for policy initiatives towards reducing home bias and improving international portfolio diversification. With an increase in education and financial literacy of the investors in a country, equity home bias gets reduced substantially and it enhances the international portfolio diversification. International portfolio diversification is advantageous in helping to spread risks across different countries and stock markets, increase the gain and returns from stock diversification and in reducing the risk from exchange rate volatility. These measures can further enhance the growth, development, social and economic welfare of a country and its citizens.

Tables

Table 2.1: Summary statistics for the explanatory variables

Variables	(1) Whole sample	(2) Fin.Dev	(3) (1-Fin.Dev)	(4) p-value
Average equity home bias (%)	77.12 (21.10)	68.70 (18.44)	82.13 (21.03)	0.000
Tertiary education	55.38 (20.96)	60.87 (16.55)	52.05 (22.63)	0.000
PISA	480.34 (51.25)	506.55 (34.60)	464.17 (52.81)	0.000
Financial skills	65.51 (10.35)	71.82 (7.85)	61.67 (9.80)	0.000
GDP growth	2.91 (3.43)	2.37 (2.71)	3.22 (3.76)	0.011
FDI	3.96 (6.18)	4.97 (6.09)	3.37 (6.17)	0.014
Trade	82.30 (60.43)	96.62 (86.36)	73.94 (35.55)	0.004
Labour force size	36.90 (76.02)	25.47 (39.42)	43.57 (90.22)	0.007
English legal origin	0.24 (0.43)	0.43 (0.50)	0.13 (0.33)	0.000
Financial openness	1.42 (1.31)	2.12 (0.74)	1.01 (1.40)	0.000
Turnover ratio	82.18 (61.27)	106.50 (62.60)	67.82 (55.81)	0.000
Domestic credit	107.43 (62.80)	151.10 (64.01)	81.72 (45.58)	0.000
Market capitalisation	77.65 (75.35)	135.03 (95.08)	43.91 (25.30)	0.000
Current ratio	4.23 (16.73)	4.12 (15.41)	4.30 (17.53)	0.919
Leverage	36.43 (8.64)	35.55 (8.20)	36.96 (8.88)	0.122
Euro	0.24 (0.46)	0.29 (0.45)	0.21 (0.41)	0.097
No. of observations	375	140	235	

Notes: The Table presents sample means with standard deviations in parentheses. The p-value of a test of equality of means with unequal variances is reported. Fin.Dev is a dummy which takes the value one if a country's stock market capitalisation is higher than the average, and zero otherwise.

Table 2.2: Baseline model for the equity home bias

	Dependent variable = Equity home bias					
	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
Main measure	**Tertiary education**	**PISA**	**Financial skills**	**Tertiary education**	**PISA**	**Financial skills**
Education	-0.260**	-0.091**	-0.554**	-0.470**	-0.186*	0.340
	(-2.45)	(-2.05)	(-2.63)	(-2.22)	(-1.79)	(0.92)
GDP growth	0.562*	0.085	0.586	-0.642	-0.283	-0.287
	(1.72)	(0.34)	(1.38)	(-1.49)	(-0.99)	(-1.04)
FDI	-0.288	-0.145	-0.172	-0.232	-0.231	0.001
	(-1.22)	(-0.90)	(-1.24)	(-0.84)	(-1.11)	(0.00)
Trade	-0.015	-0.033	-0.023	-0.164	-0.056	0.050
	(-0.38)	(-0.42)	(-0.35)	(-1.59)	(-0.46)	(0.59)
Labour force size	-0.021	-0.033	-0.007	-0.135***	-0.197***	-0.137
	(-0.92)	(-0.49)	(-0.14)	(-2.60)	(-2.77)	(-1.34)
English legal origin	-11.277**	1.499	-2.396	1.281	24.135	8.562
	(-2.08)	(0.34)	(-0.52)	(0.13)	(1.52)	(0.61)
Financial openness	-4.341**	-7.420**	-8.477***	0.966	6.390	-3.971
	(-2.46)	(-2.68)	(-4.34)	(0.35)	(1.28)	(-1.62)
Turnover ratio	0.004	0.017	-0.009	0.068	0.008	-0.001
	(0.13)	(0.53)	(-0.37)	(1.59)	(0.23)	(-0.05)
Domestic credit	-0.089**	-0.154***	-0.122**	-0.211***	-0.194***	-0.207***
	(-2.11)	(-2.96)	(-2.39)	(-3.98)	(-4.01)	(-4.61)
Market capitalisation	0.037	0.021	0.020	0.092	-0.005	-0.052
	(0.93)	(0.68)	(0.80)	(1.55)	(-0.08)	(-0.84)
Fin.Dev	4.946	2.899	7.497	-7.241	-8.919	5.120
	(0.81)	(0.40)	(1.08)	(-0.60)	(-0.56)	(0.36)
Current ratio	-0.038	-0.056**	-0.033	-0.221	-0.200*	-0.094
	(-1.54)	(-2.24)	(-0.91)	(-1.39)	(-1.80)	(-0.94)
Leverage	-0.015	0.213	0.268	-0.044	-0.076	0.048
	(-0.07)	(0.69)	(1.07)	(-0.26)	(-0.30)	(0.23)
Euro	-16.704**	-3.842	-6.705	-16.147***	-15.952***	-29.129***
	(-2.40)	(-0.47)	(-1.04)	(-3.39)	(-4.61)	(-2.97)
Constant	112.797***	136.313***	126.294***	133.848***	181.252***	78.735***
	(11.36)	(5.64)	(8.24)	(15.43)	(4.49)	(3.77)
Predicted probability	76.81	73.24	76.78	77.12	72.47	76.30
N	345	244	349	320	222	316
R^2	0.79	0.78	0.81	0.91	0.91	0.91
Kleibergen-Paap	-	-	-	0.031	0.060	0.032
Anderson-Rubin	-	-	-	0.000	0.000	0.000
Stock-Wright	-	-	-	0.000	0.004	0.000
Hansen J	-	-	-	0.551	0.621	0.854

Notes: Columns 1-3 report OLS regression results, while columns 4-6 report IV (2SLS) regression results. Robust t-statistics (OLS) and z-statistics (IV) are reported in the parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Time dummies and country dummies are included in the specifications. The standard errors are adjusted for clustering at the country-level. In the IV regressions the main measures of education are instrumented using the percentage of individuals with primary education and unemployment rates, while the other control variables are instrumented using their lagged levels at t-2. The Kleibergen-Paap is a test of under-identification, distributed as chi-square under the null of under-identification. The Anderson Rubin and Stock-Wright LM S statistic are weak-instrument-robust inference tests, which are distributed as F-test and chi-square respectively, under the null that coefficients of the endogenous regressors in the structural equation are jointly equal to zero, and the over-identifying restrictions are valid. Hansen J statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity.

Table 2.3: Accounting for different levels of financial development

	Dependent variable = Equity home bias					
	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
Main measure	**Tertiary education**	**PISA**	**Financial skills**	**Tertiary education**	**PISA**	**Financial skills**
Edu*(Fin.Dev)	0.164	-0.002	-0.054	0.297	-0.006	0.664
	(1.23)	(-0.04)	(-0.27)	(1.11)	(-0.07)	(1.06)
Edu*(1-Fin.Dev)	-0.491***	-0.146***	-0.135	-0.424**	-0.287*	-0.612
	(-4.96)	(-2.99)	(-0.89)	(-2.15)	(-1.81)	(-1.62)
GDP growth	0.073	-0.049	0.063	0.803	-0.291	-0.115
	(0.46)	(-0.22)	(0.41)	(1.16)	(-0.68)	(-0.38)
FDI	-0.095	-0.070	-0.115	0.062	0.180	0.160
	(-1.03)	(-0.81)	(-1.09)	(0.41)	(1.51)	(1.10)
Trade	0.002	0.010	0.025	-0.105	-0.161**	-0.184***
	(0.03)	(0.18)	(0.45)	(-0.76)	(-2.01)	(-2.79)
Labour force size	-0.116***	-0.088*	-0.024	-0.121**	-0.455	0.061
	(-3.23)	(-1.81)	(-0.45)	(-2.20)	(-1.10)	(0.17)
English legal origin	7.587	10.640**	4.530	-4.797	8.373	-0.910
	(1.67)	(2.31)	(1.13)	(-0.76)	(1.35)	(-0.14)
Financial openness	-2.187	-0.762	-5.434***	3.629	0.014	1.340
	(-1.23)	(-0.34)	(-3.88)	(1.41)	(0.50)	(0.51)
Turnover ratio	-0.017	0.021	-0.004	-0.019	-0.153**	0.022
	(-1.28)	(1.01)	(-0.22)	(-0.92)	(-2.46)	(1.16)
Domestic credit	-0.151***	-0.191***	-0.185***	-0.185***	-142.671**	-0.138**
	(-4.78)	(-5.92)	(-6.60)	(-3.84)	(-2.02)	(-2.48)
Market capitalisation	0.021	0.019	0.009	0.052	0.006	-0.002
	(0.67)	(0.79)	(0.33)	(1.62)	(0.23)	(-0.03)
Fin.Dev	-44.986***	-78.045**	-6.863	-47.950**	-0.013	-96.912*
	(-2.81)	(-2.69)	(-0.47)	(-2.26)	(-0.51)	(-1.74)
Current ratio	-0.047**	-0.053***	-0.047*	0.007	0.082	-0.030
	(-2.61)	(-3.13)	(-1.85)	(0.15)	(0.26)	(-1.33)
Leverage	0.063	0.240	0.181	-0.004	-15.134	0.197
	(0.41)	(0.82)	(0.93)	(-0.03)	(-1.58)	(1.36)
Euro	-23.910***	-21.157***	-20.057***	-30.889***	13.635	-12.480***
	(-5.53)	(-5.33)	(-5.44)	(-2.91)	(1.04)	(-4.10)
Constant	123.960***	157.847***	105.284***	121.926***	229.238***	137.907***
	(13.65)	(6.80)	(8.13)	(12.15)	(3.56)	(5.73)
Predicted probability	76.89	73.24	76.83	76.85	72.21	77.02
N	345	244	349	321	230	315
R^2	0.92	0.92	0.90	0.92	0.904	0.87
Test of equality (p. value): Edu	0.002	0.020	0.682	0.043	0.062	0.095
Kleibergen-Paap	-	-	-	0.095	0.011	0.075
Anderson-Rubin	-	-	-	0.000	0.000	0.000
Stock-Wright	-	-	-	0.000	0.000	0.000
Hansen J	-	-	-	0.348	0.163	0.118

*Notes: Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).The p-value refers to the test of equality between Edu*Fin.Dev and Edu*(1-Fin.Dev). Also, see notes to Table 2.2.*

Table 2.4: The role of the recent financial crisis

	Dependent variable = Equity home bias					
	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
Main measure	**Tertiary education**	**PISA**	**Financial skills**	**Tertiary education**	**PISA**	**Financial skills**
Edu*Crisis* Fin.Dev	0.162 (1.20)	-0.015 (-0.17)	-0.004 (-0.02)	0.004 (0.02)	0.010 (0.09)	0.940 (1.33)
Edu*Crisis* (1-Fin.Dev)	-0.489*** (-4.87)	-0.226** (-2.36)	-0.198 (-1.19)	-0.530*** (-3.11)	-0.276*** (-2.83)	-0.702 (-1.57)
Edu*(1-Crisis)* Fin.Dev	0.156 (1.03)	0.003 (0.04)	-0.002 (-0.01)	0.022 (0.09)	0.028 (0.24)	0.873 (1.25)
Edu*(1-Crisis)* (1-Fin.Dev)	-0.486*** (-4.50)	-0.195** (-2.22)	-0.154 (-0.99)	-0.498** (-2.31)	-0.242*** (-2.65)	-0.608 (-1.44)
GDP growth	0.073 (0.44)	-0.043 (-0.24)	0.052 (0.34)	0.162 (0.77)	0.026 (0.11)	-0.094 (-0.28)
FDI	-0.096 (-1.06)	-0.091 (-0.78)	-0.115 (-1.12)	0.173 (1.53)	0.033 (0.28)	0.157 (1.15)
Trade	0.001 (0.02)	-0.059 (-1.02)	0.018 (0.32)	-0.303*** (-4.20)	-0.066 (-1.24)	-0.191*** (-3.06)
Labour force size	-0.115*** (-3.13)	-0.114* (-1.81)	-0.027 (-0.51)	-0.287*** (-2.97)	-0.203** (-2.22)	-0.009 (-0.02)
English legal origin	7.709 (1.66)	6.333 (0.82)	4.713 (1.15)	-7.176 (-1.21)	-7.016 (-0.51)	-0.143 (-0.02)
Financial openness	-2.167 (-1.20)	3.074 (0.82)	-5.324*** (-3.71)	4.783** (2.14)	6.503** (2.10)	1.816 (0.69)
Turnover ratio	-0.017 (-1.27)	0.007 (0.22)	-0.004 (-0.26)	0.004 (0.14)	0.003 (0.09)	0.015 (0.64)
Domestic credit	-0.153*** (-5.10)	-0.187*** (-4.49)	-0.181*** (-6.61)	-0.103** (-2.13)	-0.138*** (-2.82)	-0.164** (-2.54)
Market capitalisation	0.022 (0.70)	0.065 (1.37)	0.011 (0.38)	0.053 (1.53)	0.057 (1.25)	-0.010 (-0.13)
Fin.Dev	-44.490*** (-2.73)	-108.207** (-2.20)	-13.825 (-0.90)	-38.460** (-2.24)	-136.078** (-2.45)	-115.796* (-1.90)
Current ratio	-0.047** (-2.55)	-0.039** (-2.68)	-0.044* (-1.92)	-0.016 (-0.53)	-0.034 (-1.49)	-0.012 (-0.52)
Leverage	0.063 (0.37)	0.082 (0.34)	0.156 (0.76)	-0.213 (-0.90)	0.378 (1.46)	0.122 (0.69)
Euro	-23.805*** (-5.62)	-14.827** (-2.39)	-19.623*** (-5.05)	-23.810*** (-2.85)	-27.476*** (-2.98)	-11.273*** (-3.56)
Constant	123.881*** (13.62)	198.252*** (4.61)	109.061*** (7.69)	143.080*** (10.84)	203.834*** (5.07)	146.172*** (5.60)
Predicted probability	76.89	73.24	76.85	76.99	73.01	76.97
N	345	244	349	300	225	316
R^2	0.92	0.87	0.91	0.92	0.87	0.87
Test of equality (p. value):						
Edu*Crisis	0.003	0.048	0.344	0.027	0.013	0.045
Edu*(1-Crisis)	0.005	0.059	0.433	0.051	0.018	0.065
Edu*Fin.Dev	0.899	0.488	0.953	0.717	0.807	0.343
Edu*(1-Fin.Dev)	0.953	0.246	0.381	0.614	0.668	0.205
Kleibergen-Paap	-	-	-	0.021	0.018	0.078
Anderson-Rubin	-	-	-	0.000	0.000	0.000
Stock-Wright	-	-	-	0.000	0.000	0.000
Hansen J	-	-	-	0.354	0.130	0.224

*Notes: Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). With reference to the test of equality, Edu*Crisis gives the test of equality between Edu*Crisis*Fin.Dev and Edu*Crisis*(1-Fin.Dev), Edu*(1-Crisis) for Edu*(1-Crisis)*Fin.Dev and Edu*(1-Crisis)*(1-Fin.Dev), Edu*Fin.Dev for Edu*Crisis*Fin.Dev and Edu*(1-Crisis)*Fin.Dev. Finally, Edu*(1-Fin.Dev) refers to the test of equality between Edu*Crisis*(1-Fin.Dev) and Edu*(1-Crisis)*(1-Fin.Dev). Also, see notes to Table 2.2.*

Table 2.5: Robustness: Random-effects and fixed-effects regressions

Dependent variable = Equity home bias						
Main measure	(1) RE **Tertiary education**	(2) RE **PISA**	(3) RE **Financial skills**	(4) FE **Tertiary education**	(5) FE **PISA**	(6) FE **Financial skills**
Panel 1:						
Education	-0.271***	-0.075**	-0.567***	-0.155**	-0.124*	0.098
	(-3.67)	(-2.13)	(-3.02)	(-2.34)	(-1.95)	(1.44)
Predicted probability	76.89	73.24	76.85	78.83	73.24	78.60
N	345	244	349	345	244	349
R^2	0.31	0.26	0.16	0.38	0.36	0.38
Panel 2:						
Edu*(Fin.Dev)	0.093	-0.008	-0.092	-0.009	-0.165	-0.006
	(0.84)	(-0.18)	(-0.43)	(-0.10)	(-1.08)	(-0.05)
Edu*(1-Fin.Dev)	-0.429***	-0.145***	-0.084	-0.232***	-0.114	0.150*
	(-6.39)	(-3.02)	(-0.65)	(-3.08)	(-1.57)	(1.83)
Predicted probability	76.90	73.24	76.83	78.70	73.24	78.69
N	345	244	349	345	244	349
R^2	0.33	0.25	0.28	0.39	0.36	0.38
Test of equality (p. value): Edu	0.000	0.010	0.973	0.038	0.770	0.255
Panel 3:						
Edu*Crisis*Fin.Dev	0.087	-0.003	-0.017	-0.024	0.104	-0.037
	(0.87)	(-0.06)	(-0.09)	(-0.23)	(0.74)	(-0.31)
Edu*Crisis* 1-Fin.Dev)	-0.425***	-0.173***	-0.211	-0.228***	-0.170**	0.057
	(-6.40)	(-3.19)	(-1.46)	(-2.96)	(-2.26)	(0.67)
Edu*(1-Crisis)* Fin.Dev	0.081	0.034	-0.004	-0.009	0.124	-0.019
	(0.82)	(0.63)	(-0.02)	(-0.08)	(0.88)	(-0.17)
Edu*(1-Crisis)* (1-Fin.Dev)	-0.403***	-0.122**	-0.131	-0.168**	-0.137*	0.126
	(-4.77)	(-2.47)	(-1.00)	(-2.05)	(-1.97)	(1.53)
Predicted probability	76.90	73.24	76.86	78.63	73.24	79.13
N	345	244	349	345	244	349
R^2	0.34	0.33	0.33	0.40	0.48	0.39
Test of equality (p. value):						
Edu*Crisis	0.000	0.004	0.396	0.087	0.088	0.517
Edu*(1-Crisis)	0.000	0.007	0.555	0.223	0.105	0.302
Edu*Fin.Dev	0.887	0.053	0.743	0.462	0.261	0.327
Edu*(1-Fin.Dev)	0.629	0.013	0.135	0.002	0.064	0.000

Notes: The Table reports random-effects regression results in columns 1-3 and fixed-effects regression results in columns 4-6. The remaining specifications, which are not reported for brevity, are identical to those in Tables 2.2 to 2.4. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 2.2.

Table 2.6: Robustness: Using alternative measures of equity home bias and financial development

	Dependent variable = Scaled equity home bias			*Dependent variable = Equity home bias*		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Main measure	**Tertiary education**	**PISA**	**Financial skills**	**Tertiary education**	**PISA**	**Financial skills**
Panel 1:						
Education	-0.205***	-0.164**	-0.594**	-0.328***	-0.221**	-0.647**
	(-2.92)	(-2.23)	(-2.28)	(-3.73)	(-2.17)	(-2.43)
Fin.Dev2	-	-	-	9.502*	1.646	-3.274
	-	-	-	(2.02)	(0.19)	(-0.55)
Predicted probability	78.59	75.08	78.59	76.88	73.24	76.87
N	345	244	349	345	244	349
R^2	0.93	0.85	0.85	0.93	0.84	0.85
Panel: 2						
Edu*(Fin.Dev)	0.169	-0.014	0.095	-	-	-
	(1.26)	(-0.17)	(0.50)	-	-	-
Edu*	-0.411***	-0.258**	-0.019	-	-	-
(1-Fin.Dev)	(-4.54)	(-2.44)	(-0.16)	-	-	-
Edu*(Fin.Dev2)	-	-	-	0.004	0.208	-0.957**
	-	-	-	(0.02)	(1.34)	(-2.19)
Edu*	-	-	-	-0.445***	-0.340***	-0.414*
(1-Fin.Dev2)	-	-	-	(-4.21)	(-4.25)	(-1.86)
Predicted probability	78.60	75.08	78.59	76.95	73.24	76.86
N	345	244	349	345	244	349
R^2	0.92	0.90	0.91	0.85	0.91	0.85
Test of equality (p. value): Edu	0.004	0.027	0.554	0.051	0.005	0.239
Panel: 3						
Edu*Crisis*	0.171	-0.001	0.105	-	-	-
Fin.Dev	(1.27)	(-0.01)	(0.57)	-	-	-
Edu*Crisis*	-0.428***	-0.265**	-0.104	-	-	-
(1-Fin.Dev)	(-4.67)	(-2.41)	(-0.74)	-	-	-
Edu*(1-Crisis)*	0.211	-0.000	0.132	-	-	-
Fin.Dev	(1.47)	(-0.01)	(0.72)	-	-	-
Edu*(1-Crisis)*	-0.396***	-0.253**	-0.044	-	-	-
(1-Fin.Dev)	(-3.97)	(-2.31)	(-0.35)	-	-	-
Edu*Crisis*	-	-	-	-0.021	0.216	-0.932**
Fin.Dev2	-	-	-	(-0.11)	(1.25)	(-2.04)
Edu*Crisis*	-	-	-	-0.465***	-0.420***	-0.487**
(1-Fin.Dev2)	-	-	-	(-4.42)	(-4.62)	(-2.10)
Edu*(1-Crisis)*	-	-	-	-0.003	0.298*	-0.900**
Fin.Dev2	-	-	-	(-0.02)	(1.80)	(-2.03)
Edu*(1-Crisis)*	-	-	-	-0.420***	-0.320***	-0.424*
(1-Fin.Dev2)	-	-	-	(-3.85)	(-4.01)	(-1.91)
Predicted probability	78.60	75.08	78.60	76.94	73.24	76.88
N	345	244	349	345	244	349
R^2	0.92	0.90	0.92	0.85	0.92	0.85
Test of equality (p. value):						
Edu*Crisis	0.004	0.023	0.316	0.051	0.003	0.355
Edu*(1-Crisis)	0.004	0.026	0.364	0.072	0.004	0.313
Edu*Fin.Dev	0.258	0.938	0.376	0.561	0.002	0.374
Edu*(1-Fin.Dev)	0.468	0.043	0.221	0.127	0.001	0.007

Notes: The Table reports OLS regression results for scaled equity home bias in columns 1-3 and equity home bias in columns 4-6. The remaining specifications, which are not reported for brevity, are identical to those in Tables 2.2 to 2.4. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 2.2.

Table 2.7: Robustness: Tobit models

Dependent variable = Equity home bias						
Main measure	(1) TOBIT **Tertiary education**	(2) TOBIT **PISA**	(3) TOBIT **Financial skills**	(4) TOBIT **Tertiary education**	(5) TOBIT **PISA**	(6) TOBIT **Financial skills**
Panel 1:						
Education	-0.405***	-0.167**	-0.729***	-0.308***	-0.196**	-0.884***
	(-3.32)	(-2.06)	(-3.21)	(-2.60)	(-2.37)	(-3.11)
Predicted probability	88.33	78.02	85.17	90.84	88.32	96.61
Uncensored Observations	211	170	216	163	133	165
Left Censored Observations	0	0	0	1	1	1
Right Censored Observations	134	74	133	181	110	183
Pseudo R^2	0.20	0.19	0.25	0.28	0.24	0.30
Panel 2:						
Edu*(Fin.Dev)	0.061	-0.016	-0.085	0.040	-0.018	-0.032
	(0.42)	(-0.32)	(-0.46)	(0.39)	(-0.87)	(-0.18)
Edu*(1-Fin.Dev)	-0.559***	-0.181**	-0.058	-0.480***	-0.363*	0.020
	(-3.68)	(-2.15)	(-0.33)	(-2.93)	(-1.69)	(0.14)
Predicted probability	85.91	78.17	85.76	86.99	86.89	88.88
Uncensored Observations	211	170	216	163	133	165
Left Censored Observations	0	0	0	1	1	1
Right Censored Observations	134	74	133	181	110	183
Pseudo R^2	0.39	0.33	0.32	0.41	0.42	0.40
Test of equality (p. value): Edu	0.011	0.043	0.899	0.022	0.092	0.812
Panel 3:						
Edu*Crisis* Fin.Dev	0.172	-0.001	-0.021	0.097	-0.024	0.041
	(1.64)	(-0.01)	(-0.15)	(1.29)	(-0.29)	(0.28)
Edu*Crisis* (1-Fin.Dev)	-0.722***	-0.314**	-0.229	-0.423***	-0.521***	-0.184
	(-4.47)	(-2.46)	(-1.12)	(-3.88)	(-3.26)	(-0.70)
Edu*(1-Crisis)* Fin.Dev	0.206*	-0.007	0.009	0.143	0.021	0.053
	(1.72)	(-0.08)	(0.06)	(2.75)	(0.25)	(0.32)
Edu*(1-Crisis)* (1-Fin.Dev)	-0.656***	-0.302**	-0.096	-0.327***	-0.461***	-0.077
	(-4.41)	(-2.43)	(-0.52)	(-3.31)	(-3.24)	(-0.38)
Predicted probability	85.40	80.51	86.10	88.02	85.71	88.35
Uncensored Observations	211	170	216	163	133	165
Left Censored Observations	0	0	0	1	1	1
Right Censored Observations	134	74	133	181	110	183
Pseudo R^2	0.36	0.28	0.33	0.42	0.34	0.41
Test of equality (p. value):						
Edu*Crisis	0.000	0.014	0.286	0.001	0.002	0.452
Edu*(1-Crisis)	0.000	0.018	0.570	0.000	0.003	0.617
Edu*Fin.Dev	0.527	0.858	0.492	0.396	0.516	0.807
Edu*(1-Fin.Dev)	0.327	0.703	0.076	0.167	0.380	0.230

Notes: The Table reports Tobit regressions with an upper bound of 90 and lower bound of 10 in columns 1-3 and Tobit regressions with an upper bound of 80 and lower bound of 20 in columns 4-6. The remaining specifications, which are not reported for brevity, are identical to those in Tables 2.2 to 2.4. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 2.2.

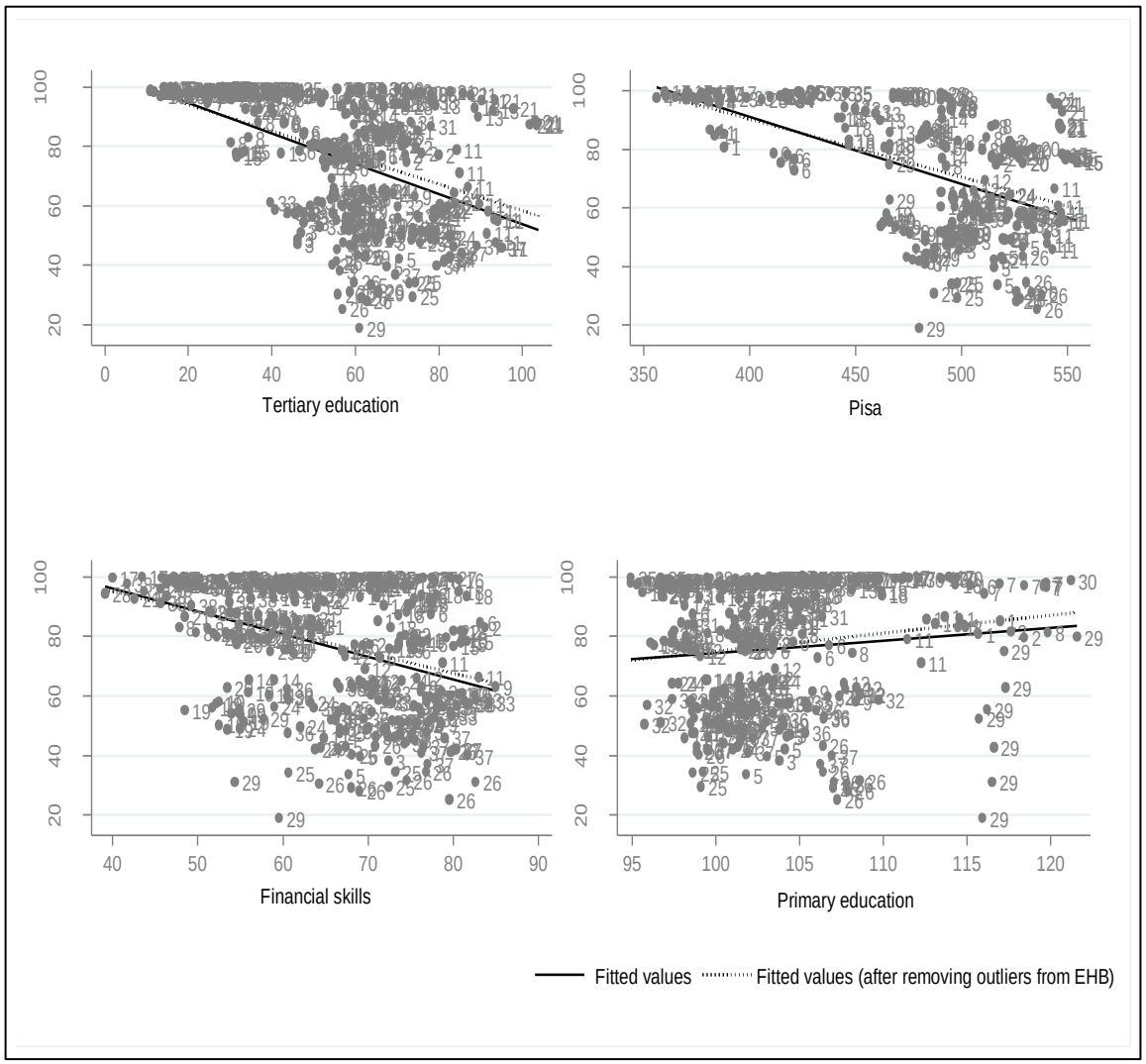
Table 2.8: Robustness: Regressions for different sub-samples

Dependent variable = Equity home bias						
	Less Financially Developed Countries			***More Financially Developed Countries***		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Main measure	**Tertiary education**	**PISA**	**Financial skills**	**Tertiary education**	**PISA**	**Financial skills**
Panel 1:						
Education	-0.226***	-0.108*	-0.358*	0.172	0.176	-0.369
	(-3.24)	(-1.89)	(-1.78)	(1.09)	(1.72)	(-1.64)
Predicted probability	106.56	78.46	74.96	83.46	71.75	75.42
N	209	150	210	136	94	139
R^2	0.96	0.88	0.86	0.97	0.98	0.90
Panel 2:						
Edu*Crisis	-0.281***	-0.096*	-0.335	0.344	0.266	-0.537*
	(-3.42)	(-1.85)	(-1.47)	(1.53)	(1.64)	(-1.82)
Edu*(1-Crisis)	-0.190**	-0.042	-0.366*	0.306**	0.270	-0.344
	(-2.21)	(-1.15)	(-1.81)	(2.37)	(1.66)	(-1.49)
Predicted probability	84.97	74.79	74.96	72.34	60.07	75.90
N	209	150	210	136	94	139
R^2	0.95	0.92	0.86	0.96	0.97	0.90
Test of equality (p. value):						
Edu	0.002	0.061	0.805	0.787	0.005	0.336

Notes: The Table reports OLS regression results for less financially developed countries in columns 1-3 and more financially developed countries in columns 4-6. The remaining specifications, which are not reported for brevity, are identical to those in Tables 2.2 to 2.4. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 2.2.

Chapter 2- Appendix

Figure A2.1: Scatter plots for different measures of education and equity home bias (EHB)



Notes: The graph shows best fitting regression lines for education and equity home bias. The dotted fitted line is generated from regressions after dropping outliers in the 5% upper and lower tails of the distribution of the equity home bias variable. Country codes: 1- Argentina, 2- Australia,, 3- Austria, 4- Brazil, 5- Belgium, 6- Chile, 7- Colombia, 8- Czech. Republic, 9- Denmark, 10- Egypt, 11- Finland, 12- France, 13- Greece, 14- Hungary, 15- Hong Kong, 16-. India, 17- Indonesia, 18- Israel, 19- Italy, 20- Japan, 21- Korea, 22- Malaysia, 23- Mexico, 24- New Zealand, 25- Norway, 26- Netherlands, 27- Philippines, 28- Poland, 29- Portugal, 30- Russia, 31- Spain, 32- Sweden, 33- Switzerland, 34- Thailand, 35- Turkey, 36-United Kingdom, 37- United States, 38- Venezuela.

Table A2.1: Definitions of the variables

Variables	Description	Source
Tertiary education	This is measured as school enrolments to tertiary education. Tertiary school enrolment is the total enrolment in tertiary education (ISCED 5 and 6), regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving.	World Development Indicators (WDI) of World Bank
Financial skills	*'Financial skills'* question reads as 'finance skills readily available' and this statement is evaluated on a scale of 0-10.	IMD World Competitiveness Yearbook (WCY)
PISA	Evaluates the knowledge and skills of 15-year-olds in mathematics.	IMD World Competitiveness Yearbook (WCY)
Primary education	Total enrolment in primary education, regardless of age, expressed as a percentage of the population of official primary education age.	IMD World Competitiveness Yearbook (WCY)
Fin.Dev	This is a dummy equal to one if a country's stock market capitalisation is greater than the average than the mean and zero otherwise.	World Development Indicators (WDI) of World Bank
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency.	World Development Indicators (WDI) of World Bank
Foreign Direct Investment (FDI)	Net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.	World Development Indicators (WDI) of World Bank
Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Development Indicators (WDI) of World Bank
Labour force size	Total labour force comprises people ages 15 and older who supply labour for the production of goods and services during a specified period.	World Development Indicators (WDI) of World Bank
English legal origin	This is a dummy equal to one if a country has English as the legal origin and zero otherwise.	La porta et al., 2008
Financial openness	This variable includes the presence of multiple exchange rates, the existence of restrictions on current account transactions, the existence of restrictions on capital account transactions and the requirement of the surrender of export proceeds.	Chinn-Ito Index of financial openness
Market turnover	It is the total value of shares traded during the period divided by the average market capitalisation for the period.	World Development Indicators (WDI) of World Bank
Domestic credit	It refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment.	World Development Indicators (WDI) of World Bank
Stock market capitalisation	Market capitalisation is the share price times the number of shares outstanding of listed companies as a percentage of GDP.	World Development Indicators (WDI) of World Bank
Current ratio	It is the ratio of total current assets to total current liabilities.	DataStream
Leverage	It is the ratio of total debt to total assets.	DataStream
Euro	Euro is a dummy equal to one if a country is a member of the Euro-area and zero otherwise.	Eurozone website
Unemployment rate	The share of the labour force that is without work but available for and seeking employment.	World Development Indicators (WDI) of World Bank

Notes: The Table reports the exact definition of the variables used in the models.

Table A2.2: Distribution of the equity home bias and measures of education over 2001-2010

Country	Average equity home bias (%)	Tertiary education	PISA score	Financial skills
Argentina	86.53	66.33	385.34	63.65
Australia	79.40	72.75	518.84	75.45
Austria	50.60	52.72	502.02	74.31
Brazil	97.40	21.91	372.35	60.54
Belgium	45.87	62.64	520.61	70.55
Chile	82.63	50.36	417.18	75.67
Colombia	96.89	30.89	376.50	65.23
Czech Republic	82.35	47.63	505.00	53.83
Denmark	57.22	72.64	509.61	77.14
Egypt	98.39	30.98	-	-
Finland	59.03	90.56	544.32	75.82
France	66.18	54.65	499.87	70.00
Greece	90.51	78.18	458.24	60.66
Hong Kong	77.60	42.99	550.75	76.69
Hungary	82.43	58.15	490.42	63.33
India	97.92	12.65	-	73.73
Indonesia	99.43	17.64	375.87	47.35
Israel	90.10	57.81	444.86	76.84
Italy	54.57	61.89	470.73	53.11
Japan	78.65	55.53	528.03	56.33
Malaysia	96.38	30.63	-	67.93
Mexico	98.10	24.60	405.31	49.74
Netherlands	33.47	59.15	530.68	73.32
New Zealand	57.24	76.81	521.23	64.23
Norway	45.35	75.50	494.18	70.05
Philippines	99.52	28.70	-	72.66
Poland	96.57	64.46	493.84	50.56
Portugal	57.67	56.99	473.89	56.58
Russia	98.51	70.32	470.81	60.91
South Korea	92.82	94.99	545.63	54.50
Spain	85.39	67.85	482.54	60.00
Sweden	56.46	76.22	500.96	76.37
Switzerland	57.30	46.54	530.61	79.07
Thailand	98.33	43.33	417.62	57.54
Turkey	99.57	35.49	431.77	68.51
UK	56.48	59.35	493.62	64.90
USA	42.77	82.90	481.41	77.05
Venezuela	95.28	55.22	-	49.64

Notes: The Table reports the average equity home bias and different measures of education.

Table A2.3: Diagnostic and identification statistics from first-stage IV regressions

Main measure	(1) Tertiary education	(2) PISA	(3) Financial skills
Panel 1:			
Unemployment rate	-0.790**	-0.083	-0.170
	(-2.07)	(-0.08)	(-0.92)
Primary education	-0.973***	-2.219***	-0.299**
	(-4.17)	(-2.80)	(-2.39)
F test	0.000	0.000	0.000
Angrist-Pischke chi-square test	0.037	0.000	0.002
N	320	222	316
R^2	0.78	0.97	0.78
Panel 2:			
Edu*(Fin.Dev):			
Unemployment rate	0.595***	1.288	0.102
	(3.69)	(1.07)	(0.87)
Primary education	0.228*	2.735***	0.436***
	(1.77)	(4.60)	(6.75)
F test	0.000	0.000	0.000
Angrist-Pischke chi-square test	0.019	0.065	0.373
N	321	230	315
R^2	0.96	0.99	0.99
Edu*(1-Fin.Dev):			
Unemployment rate	-1.318***	-1.034	-0.438**
	(-4.32)	(-1.21)	(-2.29)
Primary education	-0.650***	-5.188***	-0.520***
	(-3.76)	(-11.47)	(-4.30)
F test	0.000	0.000	0.000
Angrist-Pischke chi-square test	0.000	0.003	0.000
N	321	230	315
R^2	0.95	0.99	0.98
Panel 3:			
Edu*Crisis*Fin.Dev:			
Unemployment rate	2.147***	-1.171	0.234
	(4.22)	(-0.85)	(0.29)
Primary education	0.162	1.778***	0.358
	(0.95)	(3.91)	(1.49)
F test	0.000	0.000	0.000
Angrist-Pischke chi-square test	0.002	0.009	0.999
N	300	225	316
R^2	0.91	0.99	0.76
Edu*Crisis*(1-Fin.Dev):			
Unemployment rate	-1.108**	-3.950*	0.167
	(-2.51)	(-1.70)	(0.38)
Primary education	-0.060	-2.799***	-0.482***
	(-0.34)	(-3.88)	(-2.99)
F test	0.000	0.000	0.000
Angrist-Pischke chi-square test	0.012	0.292	0.645
N	300	225	316
R^2	0.91	0.99	0.90
Edu*(1-Crisis)*Fin.Dev:			
Unemployment rate	-1.260***	1.898	-0.033
	(-2.58)	(1.21)	(-0.04)
Primary education	-0.180	1.949***	0.074
	(-0.95)	(3.50)	(0.29)
F test	0.000	0.000	0.000
Angrist-Pischke chi-square test	0.015	0.011	0.999
N	300	225	316
R^2	0.93	0.99	0.82
Edu*(1-Crisis)*(1-Fin.Dev):			
Unemployment rate	0.083	1.089	-0.812*
	(0.26)	(0.39)	(-1.75)
Primary education	-0.324	-4.181***	-0.078
	(-1.62)	(-4.79)	(-0.42)
F test	0.000	0.000	0.000
Angrist-Pischke chi-square test	0.092	0.681	0.710
N	300	225	316
R^2	0.92	0.98	0.91

Notes: The Table reports first-stage regressions for the two instruments of education- unemployment rate (%) and primary education (%). The F statistic provides a test of excluded instruments and Angrist-Pischke chi-square test is a test of under-identification under the null that the particular endogenous regressor in question is unidentified. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

Table A2.4: Correlation matrix of explanatory variables

	EHB	Scaled EHB	Fin. skills	PISA	Ter.edu.	Pri. edu.	GDP	FDI	Trade	Labour size	English	Fin. open.	Turnover ratio	Dom. credit	Current ratio	Lev.	Euro	Market cap.	Stock traded	Unem
EHB	1.00																			
Scaled EHB	0.97[a]	1.00																		
Fin. skills	-0.38[a]	-0.35[a]	1.00																	
PISA	-0.55[a]	-0.54[a]	0.40[a]	1.00																
Ter. edu	-0.49[a]	-0.46[a]	0.11[b]	0.57[a]	1.00															
Pri. edu.	0.13[b]	0.10[c]	-0.15[a]	-0.45[a]	-0.30[a]	1.00														
GDP	0.37[a]	0.37[a]	-0.00	-0.25[a]	-0.22[a]	0.39	1.00													
FDI	-0.14[a]	-0.15[a]	0.15[b]	0.20[a]	-0.01	-0.13[b]	0.05	1.00												
Trade	-0.10	-0.14[a]	0.21[a]	0.39[a]	-0.07	-0.31[b]	0.06	0.58[a]	1.00											
Labour size	0.19[a]	0.28[a]	0.03	-0.42[a]	-0.37[a]	0.14[b]	0.23[a]	-0.14[a]	-0.25[a]	1.00										
English	-0.01	0.06	0.27[a]	0.12[c]	-0.05	-0.24[a]	0.11[b]	0.09[c]	0.26[a]	0.30[a]	1.00									
Fin. open.	-0.68[a]	-0.66[a]	0.26[a]	0.54[a]	0.39[a]	-0.21[a]	-0.33[a]	0.21[a]	0.17[a]	-0.37[a]	-0.06	1.00								
Turnover ratio	-0.35[a]	-0.27[a]	0.10[c]	0.37[a]	0.40[a]	-0.21[a]	-0.11[b]	0.02	-0.05	0.17[a]	0.13[b]	0.19[a]	1.00							
Dom. credit	-0.56[a]	-0.48[a]	0.23[a]	0.46[a]	0.30[a]	-0.16[a]	-0.33[a]	0.02	0.09[c]	-0.06	0.23[a]	0.55[a]	0.42[a]	1.00						
Current ratio	-0.03	-0.04	-0.01	0.03	-0.02	0.02	-0.13[b]	-0.04	0.06	-0.03	0.01	0.02	0.04	-0.00	1.00					
Lev.	-0.12[b]	-0.12[b]	-0.02	-0.12[c]	0.11[b]	0.04	-0.24[a]	-0.14[a]	-0.22[a]	0.03	-0.02	0.11[b]	0.08	0.14[a]	-0.09[c]	1.00				
Euro	-0.45[a]	-0.49[a]	0.03	0.22[a]	0.25[a]	0.10[c]	-0.25[a]	0.05	0.01	-0.19[a]	-0.31[a]	0.43[a]	0.13[b]	0.21[a]	-0.06	0.27[a]	1.00			
Market cap.	-0.15[a]	-0.11[b]	0.43[a]	0.38[a]	0.06	-0.23[a]	0.08	0.45[a]	0.65[a]	-0.05	0.40[a]	0.25[a]	0.17[a]	0.34[a]	-0.05	-0.14[a]	-0.10[c]	1.00		
Stock traded	-0.32[a]	-0.24[a]	0.30[a]	0.43[a]	0.26[a]	-0.21[a]	-0.05	0.37[a]	0.40[a]	0.03	0.31[a]	0.30[a]	0.61[a]	0.46[a]	0.00	-0.06	0.00	0.77[a]	1.00	
Unem	0.32[a]	0.30[a]	-0.17[a]	-0.28[a]	-0.06	0.29[a]	-0.05	-0.09[c]	-0.27[a]	-0.13[b]	-0.036[a]	-0.17[a]	-0.28[a]	-0.35[a]	0.03	0.14[a]	0.09[c]	-0.26[a]	-0.29[a]	1.00

Notes: The Table reports the pairwise correlation matrix between different explanatory variables used in the models. Statistical significance is denoted at 1% ([a]), 5% ([b]) and 10% ([c]). Abbreviations: Fin. Skills: Financial skills. Ter. edu: Tertiary education. Pri.edu: Primary education. GDP: GDP growth. English: English legal origin dummy. Fin. Open.: Financial openness. Dom. Credit: Domestic credit. Lev.: Leverage. Euro: Euro dummy. Market cap.: Stock market capitalisation. Unem: Unemployment rate.

Chapter 3: Bond Market Initiatives and Firms' Access to External Finance: Evidence from a Panel of Emerging Asian Economies[28]

3.1 Introduction

In corporate finance literature the pecking order theory explains that firms have three main sources of finance, that is, internal funds, debt and new equity. Internal funds are easily accessible and are the preferred option for financing. Second source is debt issuance and final source is raising equity which is used as a 'last resort'. From the viewpoint of an outside investor, equity is riskier than debt and so an investor would demand a higher rate of return for equity. While for those inside the firm, retained earnings are preferable over debts and equity. In terms of external finance, debt is prioritised over equity as issuing of equity would mean involvement of external ownership into the company. Debt issues are also associated with lower information costs. Myers (1984) and Myers and Majluf (1984) were the first to highlight the pecking order theory of financing. In their seminal work Modigliani and Miller (1958) argued that in perfect capital and credit markets, firms' financing decisions are irrelevant to maximising firm value. However, in case of imperfect markets, financial constraints like information asymmetries affect firms' investment decisions. An increase in information asymmetries raises the cost of financing, which is reflected on firms' financing decisions.

An extensive theoretical literature in corporate finance reflects that the ideal choice of securities depends upon information availability and the ability to monitor compliance and legal regulations. The availability of information to investors depends on financial institutions and firms' financial structure which differs across countries. Recent literature shows that most firms operate in imperfect and incomplete markets, where they have limited access to external finance, and internal funds are cheaper as compared to external funds. Asymmetric information (Greenwald et al., 1984; Meyers and Majluf, 1984), higher agency costs (Bernanke and Gertler, 1989; Gertler, 1992), legal and financial environment of a country (La Porta et al., 1997, 1998; Demirgüç-Kunt and Maksimovic, 1998; Rajan and Zingales, 1998), institutional differences across countries (Demirgüç-Kunt and Maksimovic, 1999; Booth et al., 2001; Fan et al., 2012) are the main country level factors affecting access to external finance. At the firm level, the pricing of loans is

[28] I am grateful to Serafeim Tsoukas for providing the balance sheet data of Asian firms. I also thank Igor Cunha, Sai Ding, Alexandros Kontonikas, Costas Labrinoudakis, Frank Liu, Georgios Panos and Sandra Poncet for their useful comments and suggestions.

based on the risks observed in the balance sheets of the firms. This creates a wedge between the relative price of lending and other sources of external funds. The price is based on the firm level factors like profitability of firms, financial health, outstanding debt and loan payment history (Leland and Pyle, 1977; Fama, 1984).

This chapter focuses on two relevant literatures of corporate external finance and bond market development in Asia. The Asian financial crisis of 1997-98 opened the gates for new developments and improvements in the financial markets of Asian economies. After the crisis the need for developed local financial markets was realised in order to prevent further financial crises. It has been widely accepted that the main reason behind the Asian financial crisis was greater dependence on bank-dominated financial system and under-developed bond markets. Under-developed bond markets forced Asians to borrow money in foreign currencies which exposed these countries to foreign exchange risk. This resulted in currency mismatch as huge amounts of foreign currency were entering into domestic market and were getting converted into domestic currency to finance domestic investments in 1990. Adding to this currency mismatch was maturity mismatch, which is a common feature in the banking sector due to long-term lending and short-term deposits. Currency mismatch and maturity mismatch led to worsening of domestic financial institutions and thereby leading to a collapse.

Since the financial crisis Asian countries had huge amount of foreign exchange reserves which reflected a flow in exports and higher personal savings. A major portion of these savings were invested in developed markets like the United States and Europe which later recycled back in the region as risky assets like equities and foreign direct investments. The main drawback in channelling Asian savings back into the region was currency risk which was a part of cross-border flows of capital quality gap between issuers' low credit ratings and investors' minimum credit requirements (Park and Oh, 2006). Thus, the need to develop sound and more liquid bond markets to prevent further capital account crises was realised. In order to eliminate the problem of 'original sin', domestic policies and institutions are important (Bordo et al., 2003). The term 'original sin' was introduced by Eichengreen and Hausmann (1999) which means the inability of countries to borrow from abroad in their local currencies. It is a key factor of financial instability and possibility of default in a country.

At least three major government sponsored organisations are contributing towards the development of local bond markets in Asia (Battellino, 2004). First, the Asia Pacific

Economic Cooperation (APEC) forum[29] which forms a part of the Pacific Economic Cooperation Council (PECC) brings together initiatives of government, business and academia. Such initiatives include development of credit guarantees and securitisation. Second, the Association of South East Asian Nations plus Three (ASEAN+3) framework[30] focuses on the issues of securitised debt instruments, mechanism of credit guarantee, settlement of foreign exchange transactions, issuance in local currency by multinational corporations, local and regional credit rating agencies and coordinated technical assistance. Third, the Executive Meeting of East Asia and the Pacific (EMEAP) central banks[31] introduced the initiative of Asian Bond Funds (Ma and Remolona, 2006). Further, the ASEAN countries with the support of the Asian Development Bank started the Asian Bond Market Initiative (ABMI) to improve the infrastructure of the bond markets.

The contribution of this chapter is threefold. First, this chapter analyses the role of the Asian Bond Funds (ABF and ABF-2) and the Asian Bond Market Initiative (ABMI) in the composition of external finance. While previous studies identified that the regional initiatives in Asia had a greater and positive impact on firms' decisions to issue bonds in Asia (see Mizen and Tsoukas, 2014), this chapter goes one step further by examining the impact of these initiatives on firms' external finance using the difference-in-differences method. This chapter adds value to the existing empirical literature on difference-in-differences method (Card and Krueger, 1994; Angrist and Lavy, 2001; Bentolila et al., 2013), bond market development (Braun and Briones, 2006; Eichengreen et al., 2006; Gochoco-Bautista and Remolona, 2012) and access to external finance (Rajan and Zingales, 1995; Demirgüç-Kunt and Maksimovic, 1998, 2002; Bougheas et al., 2006).

Second, this chapter exploits firm-level heterogeneity by considering whether firms that face financial constraints are more or less likely to alter their composition of external finance. In doing so, characteristics such as firms' profitability and coverage ratio as measures of financial constraints are employed. These characteristics are likely to be critically important in influencing firms' access to financial markets. These characteristics also help to explore how the interplay between deteriorations in financial health and the

[29] APEC includes 21 members, namely, Australia, Brunei Darussalam, Canada, Chile, China, Hong Kong SAR,Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, Taiwan (China), Thailand, the United States, and Vietnam.

[30] ASEAN members include countries which are Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam, China, Japan, and Korea.

[31] EMEAP central banks include the Reserve Bank of Australia, People's Bank of China, Hong Kong Monetary Authority, Bank Indonesia, Bank of Japan, Bank of Korea, Bank Negara Malaysia, Reserve Bank of New Zealand, Bangko Sentral ng Pilipinas, Monetary Authority of Singapore and Bank of Thailand.

introduction of policy initiatives affect the choice of external finance for more and less constrained firms.

Finally, this chapter builds on the extant literature of firms' investment spending (Fazzari et al., 1988; Almeida and Campello, 2007) by considering whether the policy intervention by the Asian regional governments has impacted firms' investment spending. It also allows for the fact that firms of different riskiness with varying levels of profits, liquidity, debt and collateral might respond to the policy initiative disproportionately. Hence, the relationship between external finance and firm's investment spending before and after the policy initiative is explored.

This chapter explores the financial health of the firm reflected in the quality of its balance sheet. Then different types of external finance, such as short-term or long-term debt, are considered and ratios that measure firms' choice of external finance are constructed. Finally, this chapter observes a unique policy experiment, namely the ABF initiative, which will be used to identify the effects of the policy change on firms' composition of external finance. This empirical work is based on an assessment of the policy initiative on firms' access to external finance using an unbalanced panel of 7,436 Asian listed firms for 1996-2012. Data from different sources including Bondware, Bloomberg, Standard and Poor's Compustat Global database, Global Financial database and IMD World Competitiveness Yearbook are merged together. Difference-in-differences model will tease out the influences of regional bond development and policy initiatives. The treated group includes seven Asian economies namely- Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. In order to separate the effects of this regional development from the effect of regional policy initiatives, Taiwan is referred to as a control. Taiwan saw similar development in its national bond market and is comparable to the other Asian economies, but it did not participate in the ABF, ABF-2 or ABMI initiatives.

The motivation of this chapter stems from the fact that the initiative of Asian Bond Funds (ABF and ABF-2) encouraged expansion and liquidity in the Asian domestic bond markets by minimising restrictions for foreign investors. The measures implemented in market reforms include liberalising foreign exchange administration rules, tax reforms to exempt withholding tax of non-resident investors, improving regulatory framework for exchange traded funds (ETF), strengthening domestic market infrastructure and decreasing cross-border settlement risk, and creating transparent and credible bond indices (Packer and Remolona, 2012). The share of local currency bond market has increased substantially from 42.8% since the launch of the ABMI in 2003 to 54.5 % in Q3 2008,

thus improving market liquidity in the Asian markets (Spiegel, 2012). Levinger et al. (2014) highlighted that the corporate bond market capitalisation in Asia has reached to 24.2% of the region's GDP by 2012 from 16.7% in 2008. In terms of value, the amount of corporate bonds outstanding has almost tripled since 2008, thus amounting to USD 3.2 trillion by Q3 2013. The rapid growth of Asian corporate bond markets has been partly triggered by the regional initiatives aimed at establishing domestic government bond markets in the region.

The identifying assumption for the research design is that economies which participated in the policy initiative and those economies that did not participate would have trended similarly in the absence of the policy change. The parallel trends assumption is supported by the institutional background of the Asian bond initiatives as well as graphical evidence[32]. Figure 3-1 graphs the evolution of bond market size in Asian markets over the sample period of 1996-2012. Panel A displays similar growth patterns of bond market size for both the control and treated groups until the end of the Asian financial crisis in 1999. However, from 1999 there is an upward trend in bond market size for the treated group and the gap between the control and treated group further widens after the introduction of ABF-2 at the end of 2004 (see the solid vertical line which indicates the introduction of the policy initiative). Panel B shows the evolution of corporate bond market, thus displaying a similar pattern. It shows a widening gap between the control and treated groups after the introduction of the policy initiatives. While, panel C shows that the control group (Taiwan) showed similar growth patterns over the years with majority of East Asian economies in terms of bond market development[33]. Figure 3-2 graphs the development of the banking sector in the treated and control groups over the same period. The graph displays the growing trend of the banking sector in the treated group after the Asian financial crisis, while the growth in the control group almost remains constant throughout the period. The graphs described above confirm the parallel trends assumption in the data which suggests that in the absence of the policy the two groups would have continued to track each other.

This chapter is divided into ten sections. Section two summarises the trends in Asian financial markets. Section three highlights the objectives of the ABF-2 initiative, while section four provides a detailed literature on access to external finance, bond market

[32] In the robustness section of the paper a placebo test is presented to show that there are no underlying trends in the pre-policy period which can influence the treatment effect.

[33] Amongst the countries in the treated group, Korea has the largest bond market. Hence, in order to confirm that the results are not driven by Korea, Korea is excluded from the treated sample and the results are given in section 9.6. The results are both qualitatively and quantitatively similar to the main results including Korea.

developments across the world and relation between external finance and corporate investment spending. Section five gives the theoretical framework of the difference-in-differences approach and empirical application of this method, while section six provides the empirical methodology of the chapter. Further, section seven describes the data used in the empirical analysis along with the summary statistics. Section eight analyses the empirical results and section nine deals with the robustness checks of the main results. Finally, section ten concludes the chapter.

3.2 Trends in Asian financial markets

In the past Asian bond markets have been identified as under-developed and illiquid. Minimum efficient scale, corruption and low level of bureaucracy, poor accounting standards (Eichengreen and Luengnaruemitchai, 2006), capital controls, taxation, limited availability of hedging instruments (Takeuchi, 2006) were some of the obstacles in developing the bond markets in Asia. Bae et al. (2006) stressed that it is important to build investment friendly institutions to encourage foreign participation in order to develop the local bond markets. Further, a need for multiple interventions to strengthen creditor rights, improving regulatory design and removing tax measures and other capital controls were identified (Eichengreen, 2006).

Since the 1990s many emerging countries in Asia tried to enhance their financial markets. Some of the benefits of the development of financial markets are faster growth and greater welfare of the economies (King and Levine, 1993a,b; Levine and Zervos, 1996; Levine, 1997, 2005; Luintel and Khan, 1999), alleviating growth constraints and increasing access to finance for small and medium enterprises (Beck and Demirgüç-Kunt, 2006; Beck et al., 2008; De la Torre et al., 2010) and lower volatility to shocks and less susceptibility to financial crises (Acemoglu and Zilibotti, 1997; Aghion et al., 1999; Easterly et al., 2000). Overall, there has been a significant financial development in Asian countries, especially in India and China, over the past two decades. Regardless of this financial development, Asian economies are still lagging behind other developed countries.

Didier and Schmukler (2014) highlighted the trends in the Asian financial sector focusing on the banking sector, bond and equity markets. The banking system in the East Asian economies increased by 47% between 1980-89 and 2000-2009, while in Eastern Europe, G-7 economies and Latin America increased by 25%, 20% and 5% respectively during the same period. On the other hand, the bond markets expanded by almost 57% in East Asia, 345% in China and 66% in India during the 2000s relative to the 1990s. Even

with higher growth rates in Asian bond markets they are still smaller as compared to G-7 economies. In contrast, the developments in the Asian bond market are still the highest among other developing countries. For instance, the bond markets in Eastern Europe and Latin America grew at 28% and 32% of GDP respectively, exceptionally lower than 56% in East Asia.

A more detailed review of the financial systems in Asian countries is presented by Didier and Schmukler (2014). With respect to the banking system they show that the structure of private credit and public credit has changed considerably across the world over the past two decades. In East Asian economies private sector lending has increased from 44% to 72% of GDP as compared to 50% in the 1980s to 98% in the 2000s in other advanced economies. While public sector lending accounts 10% and 13% of total claims by the banking sector in G-7 and East Asian economies during the 2000s.

Despite substantial growth between 2000 and 2009, private bond markets including corporate and financial institutions in Asian economies remain relatively small as compared to the developed countries and public bond markets. For instance, during the 2000s private bond market capitalisation constituted around 40% of the GDP in developed countries as compared to 23%, 13% and 2% of GDP in East Asian countries, China and India respectively. However, across Asian economies private bond markets have grown less as a percentage of GDP as compared to government bonds. In East Asian economies during the 2000s the capitalisation of private bonds is 42% on average of total bond market capitalisation, which is less than 45% in the 1990s (Didier and Schmukler, 2014).

Trading volumes have increased in East Asian economies from 27% during 2000-2003 to 45% in 2008-2009 as compared to around 60% in G-7 economies and on average 146% in other developed countries. Firm financing in Asian economies are more restricted in terms of private bond markets when compared to the G-7 economies. For instance, during the 2000s the number of firms that issued bonds in East Asia, Latin America and other developed economies are 21, 19 and 27 respectively as compared to 432 firms in G-7 countries (Didier and Schmukler, 2014).

Evidence from the East Asian markets shows an expansion of equity markets by 4% each year on an average between 2000 and 2009. In terms of equity market capitalisation as a percentage of GDP Asian economies have smaller share as compared to G-7 countries. There has been an increase in equity market capitalisation in China and India between the 1990s and 2000s, while it is stagnant in East Asian economies. The value of new capital raised in equity markets dropped in East Asia over the periods of the 1990s

and 2000s, whereas in India there was a significant rise. The new capital raised in equity markets by developed economies accounted 26% to 31% on average (Didier and Schmukler, 2014).

Overall, the financial trends highlight the fact that Asian economies are more developed as compared to Eastern Europe and Latin America due to rapid financial improvements in India and China during the 2000s. However, they still need to catch up with other developed economies in order to have more liquid and developed financial system.

3.3 Objectives of the Asian Bond Fund-2 (ABF-2) initiative

The first phase of the ABF initiative, namely ABF-1, was introduced in June 2003 and USD 1 billion were fully invested in dollar denominated bonds in the EMEAP central bank economies. The second phase of this initiative, called ABF-2, was launched in December 2004. ABF-2 invested USD 2 billion in domestic bonds issued by sovereign and quasi-sovereign issuers in eight local currency markets of the region where the eight EMEAP central banks operate. These markets include China, Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand.

The ABF-2 initiative was planned to improve size and liquidity in the Asian bond markets along with enhancing investor awareness and interest in Asian bonds. A large investor base is crucial for a diversified domestic bond market. In order to achieve these goals of diversity and higher liquidity the following measures were implemented:

Exemption of withholding taxes and improvement in local currency convertibility conditions: Four months before the announcement of ABF-2, countries like Hong Kong SAR and Singapore relieved non-residents from withholding taxes in order to attract more foreign investments in local currency securities by increasing the investment yield. Since then there has been progress in this respect in other countries as well. In Malaysia, the creation of ABF-2 fastened the review process by National Bond Market Committee of withholding taxes. Exemption of investment income for all government and corporate bonds was also permitted by the Securities Commission in September 2004. Further, Thailand exempted withholding taxes on interest and capital gains arising from government, state agency and state enterprise bonds in 2005. Recently Korea stopped withholding tax on interest income on government securities for foreign investors. By the end of 2009, listed bond holdings of Korean debt securities by non-Korean Asian nationals rose to 27.9 trillion won or almost half of all foreign investors' listed bond holdings. It continued to increase through the first quarter of 2010. However, due to heavy

rush of destabilising capital inflows, Thailand and Korea imposed back withholding taxes on capital gains and interest payments for government bonds in October 2010 and January 2011 respectively (Packer and Remolona, 2012).

Packer and Remolona (2012) highlighted that the conditions on local currency convertibility has improved over the past five years and thereby reducing foreign exchange risk. In April 2005 in Malaysia, non-resident investors were permitted to sell off forward foreign exchange contracts against ringgit and also allowed outflows for divestments in ringgit assets. In Korea, foreign investors were allowed to trade in forward foreign exchange transactions without any restriction with local counterparty banks.

Further, the ability to borrow funds in the local market by foreign investors help in lowering the funding costs and assures higher returns for them. In Malaysia, overdraft facilities to foreign stockbrokers from authorised dealers for the settlement of purchase of listed securities were expanded. However, in some countries there are still restrictions on credit like overdrafts and loans for foreign investors. Removal of these restrictions can further help in increasing foreign investor contribution in local bond markets (Packer and Remolona, 2012).

Reducing transaction costs and improvement in settlement process: The initiative of ABF-2 brought about an effective measure of international integration which gives the non-resident investors an opportunity to use omnibus accounts. For omnibus accounts, a local custodian is responsible for holding the investments of multiple clients in one account. Restriction on the omnibus accounts can cause higher transaction costs. In this respect, there has been a significant improvement in omnibus accounts and global clearing system in all the ABF-2 economies. In Korea since 2008 omnibus accounts in the name of international central securities depositories (ICSD) are allowed at the Korean Securities Depository (KSD). The benefits of these accounts include less costly investor registration certificates and the settlement between off-shore parties even outside the Korean time zone. Further, the introduction of ABF-2 has helped in reducing transaction costs for investors by establishing bond funds as exchange traded funds (ETF). ETF are more transparent for trading and also trade information is made available to all the participants as well as the authorities (Packer and Remolona, 2012).

Improved governance: Improved governance helps in attracting more foreign investments in a country. For strengthening governance establishment of independent supervisory committees was suggested in the interest of all unit-holders in the performance of their monitoring functions (Packer and Remolona, 2012).

Reducing barriers to entry and cross-border hindrances: The main drawback in international bond portfolio diversification is barriers to entry. With the launch of ABF-2 new foreign issuers were brought into the market in order to issue in local currency. Low liquidity in the foreign exchange derivatives market was another hindrance for the issuers to borrow from domestic bond markets. So, new measures were introduced in some countries like Malaysia where investors were allowed to buy forward contracts against ringgit to hedge payment. The Malaysian market was successful in attracting non-resident borrowers into the local market. In May 2005, Bank Negara Malaysia further liberalised the regulations to draw more foreign participation (Packer and Remolona, 2012).

Exploiting the advantages of home bias in Asian economies: The vast literature on home bias in international portfolios confirms the advantages of geographical proximity. Investors tend to invest in economies which are geographically closer to them (Coval and Moskowitz, 2001) and share a common language (Eichengreen and Park, 2003). Packer and Remolona (2012) show evidence of high degrees of home bias among Asian economies. In the corporate bond market around 53% of the issuance of bonds was by investors from the Asian region. Thus, setting up an ABF-2 can help in exploiting the advantages of this home bias for the development of local currency bond markets in these regions.

3.4 Background literature

3.4.1 Access to external finance:

Country-level studies

There has been a lot of research to identify the factors which affect access to external financing. Most of the literature which explains external financing focuses on macroeconomic factors. Kashyap et al. (1993) was the first to examine the effect of monetary policy on firms' financing decisions. The results of the US firms in the period from the early 1960's to the late 1980's show that contraction in the monetary policy reduces access of firms' to bank loans. Oliner and Rudebusch (1995, 1996a, 1996b) further extended this analysis and while examining the impact of monetary policy. They emphasised that firms' financing decisions are also affected by firm size. The empirical results over a period of 1973 to 1991 showed that a broad lending channel existed since small firms reduced their access to external finance during monetary contractions.

A number of studies focused on cross-country comparisons of financial patterns. Rajan and Zingales (1995) explored firm's decision of capital structure in seven developed countries. They found that in the US financial structure variables were also

correlated to leverage in their sample of international firms. In a sample of 10 developing countries Booth et al. (2001) found that the variables affecting financing decisions are similar in both developed and developing countries. Demirgüç-Kunt and Maksimovic (1998, 2002) analysed the capital structure in 30 developed and developing countries and found that the main reason behind the differences in financing patterns are differences in legal structures, development of stock markets and banks across countries. However, they did not find any evidence that firms' external financing can be predicted by proxies for relative development of the banking system and stock market development. Fan et al. (2012) used a cross-section of 47 developed and developing countries. They confirmed that leverage was higher and debt-maturity was shorter in countries with poor governance which is indicated by corruption levels. Barclay and Smith (1995) established that the US firms with larger information asymmetries issue more short-term debt.

Using a panel of large firms of 13 developing countries Laeven (2003) showed that financial openness and liberalisation helped in reducing financial constraints for the smaller firms. Using a sample of 36 countries Love (2003) proved that financial development helped in increasing access to external finance and this impact is greater on the financially constrained firms in countries with low levels of financial development. Further, Harris et al. (1994), Jaramillo et al. (1996) and Rajan and Zingales (1998) confirmed the importance of financial liberalisation and development of capital markets.

Higher costs and barriers to entry also affect external finance. Bertrand et al. (2004) advocated that in France reforms in the banking sector during the 1980s enhanced competitiveness in the market. This was done by increasing entry and exit of firms and reducing industry concentration in industries which were bank dependent. Across Italian provinces Guiso et al. (2004) showed that financial development enhances entrepreneurship. Further, Black and Strahan (2002) showed that increased competition and deregulation facilitated entry of new firms. Overall, rise in the entry of new firms and improvement in credit market efficiency help in developing sources of external finance.

The empirical evidence of developing countries shows that foreign bank participation (Clarke et al., 2006), and property rights protection for smaller firms (Beck et al., 2008) help in improving the access to external finance. The quality of legal system (Demirgüç-Kunt and Maksimovic, 1998) and investor protection (Love and Mylenko, 2003) help in reducing market asymmetries which further increases the share of bank financing. Beck et al. (2008) used a database covering 48 countries to investigate how financial and institutional development affects financing of large and small firms. They found that property rights protection significantly increased external financing of small firms more

than that of large firms due to its effect on bank finance. Love and Mylenko (2003) combined firm-level data from the World Bank Business Environment Survey (WBES) and found that the existence of private credit registries are associated with lower financing constraints and higher share of bank financing.

Berger and Udell (1998), Galindo and Schiantarelli (2003) found that in both developed and developing economies, small firms have restrictive access to external finance. Beck and Demirgüç-Kunt (2005) showed that in countries with better and advanced legal and financial systems the effect of growth obstacles on firm's growth is less. Further, using a data across Mexican states, Laeven and Woodruff (2007) proved that legal efficiency is positively correlated with firm size and the effect is stronger in the sectors with dominant proprietors.

Cetorelli (2001) showed that countries which have more concentrated banking sector generally have larger average firm size. Further, Cetorelli (2003) argued that larger bank concentration is a barrier for the entry of young firms and delays the exit of older firms. Cetorelli and Strahan (2006) stressed that on comparing the industries in the local markets within USA or across different countries (developed or developing), it can be concluded that banks with market power pose a threat to entry which damages the commercial sector of the economy. This is done mainly to protect the profits of their existing borrowers. Thus, reduction in political, legal and regulatory barriers to bank competition can help in increasing access to external finance, leading to faster growth of the economy.

Firm-level studies

With respect to the firm-specific factors Kashyap et al. (1996) realised that further analysis is required at the micro level of both individual banks and individual firms to study the access to external finance. The results showed that tighter monetary policy shifts firms' mix of external financing and such shifts in loan can affect investments. Shumway (2001), Hillegeist et al. (2004) upheld the same opinion. Using a panel of US firms over a period of 1975 to 1986 Whited (1992) established that firms having financial constraints had less access to external finance, which in turn had an impact on firms' capital investment decisions. Atanasova and Wilson (2004) used a panel of UK firms over a period of 1989 to 1999 to highlight that tight monetary policy increases the demand for bank financing but reduces the supply. They also found that firms have a higher substitution rate between loans and trade credit as compared to loans and internal funds. Better financial inclusion also helps to promote efficient asset portfolios and innovation (Claessens and Laeven, 2004; Ayyagari et al., 2007) and provides greater incentives for firms to acquire benefits from risk diversification and limited liability. Demirgüç-Kunt et

al. (2006) used firm-level data of 52 countries to investigate as to how the institutions in a country affect the choices of firms. They found that businesses are more likely to choose the corporate form in countries which have developed financial markets, efficient legal systems and proper creditor rights.

Shin and Park (1999) and Hoshi et al. (1991) underlined the importance of business group affiliation in Korea and Japan respectively. Access to finance increases as they have access to group's internal capital markets which are likely to have strong financial ties with large banks. Using a dataset of East Asian non-financial firms Allayannis et al. (2003) examined a firm's choice between local, foreign and hedged foreign currency debt. They found that the use of synthetic local currency debt is related to the biggest drop in market value due to illiquidity in the currency derivative market during the crisis. Bougheas et al. (2006) used data from UK manufacturing firms over a period of 1989 to 1999. They used the ratio of a firm's short-term debt to total external debt as their measure of bank financing and the ratio of a firm's total external debt to its total liabilities which more closely tracks overall access to external financing. They used various firm-level characteristics such as size, collateral, profitability, riskiness, etc. and concluded that smaller, riskier and younger firms have a strong impact from monetary policy conditions.

Using a data of over 4000 firms in 38 countries Beck and Demirgüç-Kunt (2005) showed that firms that have French legal origin face higher restrictions in accessing external finance than firms in common law countries. They stress that legal system adaptability is crucial for corporate finance. Faulkender and Petersen (2006) examined firms' choice of capital structure and found that firms' decision of capital structure is constrained by capital markets. The costs of contracting and monitoring increase the cost of capital raised from the market, and thus lowering the desired leverage. González et al. (2007) used firm-level data of 60,000 Spanish non-financial firms from 1992 to 2002 to find that Spanish firms are largely dependent on short-term non-bank financing which accounts for 65% of the total firm debt. Short-term bank debt is mostly used at the time of economic expansions. This suggests a shift from non-bank financing as firm's conditions improve.

Beck et al. (2006) showed that older, larger and firms with foreign ownership take the benefit of larger external finance. Using a firm-level database of 48 countries Beck et al. (2008) showed that firm size, financial development and property rights protection are important factors in influencing the financing decisions of external finance. Their results showed that firms which are smaller in size finance only a smaller portion of their investment with formal sources of external finance. The figures showed that smaller firms

fund 12 percentage points less of investment using bank finance as compared to large firms as smaller firms use more of informal sources of finance. Tang (2009) claimed that with the availability of better credit information (via Moody's 1982 credit rating) investors have better information about a firm's quality which improves firm's access to finance. Further, Duchin et al. (2010) studied the effect of financial crisis on the supply of external finance. The results showed a negative effect on the supply of external finance for non-financial firms and the decline is more for the firms which have higher short-term debt or are financially constrained.

Nofsinger and Wang (2011) concluded that high levels of property rights, contract enforcement, and corruption protection are important determinants of access to finance for start-up firms to remove information asymmetry and moral hazard problems. Clarke et al. (2012) evaluated firms' financial constraints and their likelihood of survival during the early phase of the recent global financial crisis in Eastern Europe and Central Asia. Their results showed that firms with greater access to financing were able to survive the crisis. The impact on the operation of large and older firms was less by mid-2009 as compared to smaller and younger firms. As information asymmetries between borrower and lender are less for larger and older firms, they have access to cheaper and easier credit (Beck et al., 2008a).

Ellul et al. (2012) analysed the linkages between taxes, transparency, access to finance and investment. They show that there is a trade-off between external financing and tax costs of transparency. This trade-off depends on the corporate tax rates, auditor's quality and cash flows from companies' asset base. The results highlight that there is a negative relation between firm-level transparency and tax pressure, while a positive relation exists between transparency and audit quality. Adding to this, investment and access to finance are greater for firms with higher transparency and lower tax burden.

3.4.2 Bond market development and policy initiatives across the world

A considerable amount of research has been carried out focusing on the development of banking and financial systems across the world in the past few years. As majority of the firms use bank credit as the main source of external finance, development of financial and bond markets are essential. Although bond markets have been growing, they are still not distinctively large as compared to the size of banking sector. Important factors affecting bond market development include economic stability of a country, quality of property rights and contracting institutions (Braun and Briones, 2006).

During the time period of 1991-2001, Braun and Briones (2006) showed that across 46 countries 82% of the capital raised by the firms accrued from bank debt. Further, bond

issuance was majorly concentrated in the developed countries with U.S. and Japan accounting for almost two-thirds of the stock. On the other hand, emerging countries constituted only 6.7% of the total, half of it in East Asia and Pacific Area.

Various policy initiatives have been undertaken across the world for the development of bond markets. Eichengreen et al. (2006) provided a comparative analysis of the bond market developments in the two regions of East Asia and Latin America. They showed that the Asian bond markets are larger and better capitalised due to stable policies, stronger investor protections. On the other hand, Latin American bond markets are more liquid but progress in terms of corporate bonds is slow in both Latin America and East Asia. So, policy initiatives are undertaken to develop the financial markets in both Latin America and East Asia. These policy initiatives are divided into five categories. These are strengthening of legal and financial system in general, more investments for building up market infrastructure, policies to encourage institutional investor participation, measures to promote foreign investors' participation and finally extra-national initiatives. In Asia extra-national initiatives include efforts to build bond markets at the regional level, while in Latin America these are focused on enhancing the access of borrowers to international financial markets.

In November 2011, the G-20 nations supported an action plan for the development of local currency bond markets. International institutions like the IMF, the World Bank, the European Bank for Reconstruction and Development (EBRD), and the OECD developed a diagnostic framework identifying the general preconditions, important components and obstacles for successful bond market development. The diagnosis included desirable reforms such as adopting growth supporting policies that encourage the private sector to increase investment or relax capital account restrictions for broadening investor base, assessing the legal and regulatory framework for public debt management. Other reforms recommended in corporate bond markets include reducing cost of issuance, establishment of standard documentation for corporate bond issuance, defining the role of intermediaries, creating over-the-counter (OTC) trading and credit rating requirements (IMF, 2013).

Lee and Park (2008) confirmed that the financial crisis of 2008 had an impact on the Asian offshore bond markets due to re-pricing of credit and liquidity risk. This resulted in a decline in offshore bond issuance. However, the deterioration in external debt financing had minor impact on Asian currency debt markets. According to Ghosh (2006), since the financial crisis of 1998, the East Asian securities market has almost tripled. However, in the East Asian bond markets firms have limited access to finance. Most of the growth in the bond markets (more than 50% of the growth during 1997-2004 in all economies in the

region except Hong Kong SAR, China and Korea) was due to the bonds issued by governments.

Chan et al. (2011) highlighted the contribution of ABF-2 initiative to a broader, highly liquid, low-cost and efficient investment technique in broadening the investor participation. ABF-2 initiative has performed well in the past few years, however, their impact in attracting investors other than EMEAP central banks has been mixed. By the end of July 2010, total non-EMEAP investment in the ABF-2 market funds was USD 129 million as compared to USD 716 million in the Pan Asia Bond Index Fund (PAIF). With respect to the increase in market size ABF-2 has done considerable improvement in the local markets of eight ABF-2 economies. Since 2005 maximum development happened in China, Korea, Malaysia and Singapore. Government bonds dominate most of the markets, except Hong Kong SAR, Korea, Malaysia and Singapore, where corporate bonds have a larger share. There has been a huge increase in the local currency corporate bond issuance in ABF-2 regions especially since 2008. Since 2008 the corporate bond issuance in local currency has been around 86%. The development of local corporate markets played an important role during the crisis of 2008-2009. While raising of funds in the global corporate markets during the financial crisis became difficult, Asian companies raised funds from their local bond markets in large quantities.

Corporate bond markets act as a 'spare-tyre' in capital markets, when the banks stop lending. Gochoco-Bautista and Remolona (2012) stressed that the global financial crisis of 2008 affected the international bond markets adversely and domestic bond markets in the ASEAN nations provided finance in a limited way. While on the other hand, Shim (2012) emphasised that from 2005 till 2011 the corporate bond markets in emerging Asia continued to grow rapidly even during the financial crisis period. Further, the sharp increase in the corporate bond issuance during the period of 2008-2009 compensated for the decline in corporate bank lending.

Using a dataset of nine Asian economies, China, Hong Kong SAR, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand and Taiwan, for the period of 1995 to 2007, Mizen and Tsoukas (2014) emphasised that firm-specific characteristics play a crucial role in firms' decision to issue bonds. On the other hand, market development factors like market size and liquidity have smaller but significant role in issuance of corporate bonds. They further confirmed that policy initiatives of ABF and ABF-2 helped in improving domestic corporate bond issuance by encouraging greater market depth and liquidity.

3.4.3 Relation between firm's leverage and investment

There is a wide literature in corporate finance focusing on the ways in which financing constraints and fluctuations in the availability of finance can affect firms' investment activity (Fazzari et al., 1988; Hoshi et al., 1991; Kaplan and Zingales, 1997). The main theme of these studies is based on liquidity and the availability of internal funds. This is an important factor in influencing corporate investment when there are information asymmetries in the capital market.

Fazzari et al. (1988) estimated an equation of investment spending as a function of cash flow and Tobin's Q using firm-level data on 421 manufacturing firms over the period of 1970 to 1984. Their results showed that cash flow has a higher impact on firms' investments for the firms facing financial constraints and interpreted this as an evidence of information-related capital market imperfection. Hoshi et al. (1991) explored the relationship between firms' capital structure and investment for Japanese firms. They found that investment is more sensitive to liquidity for firms which have weaker links to a main bank and thus face more problems in raising capital. On the other hand, firms which have closer linkages to larger Japanese banks which serve as a primary source of external finance. Kaplan and Zingales (1997) investigated the relationship between financing constraints and investment-cash flow sensitivities by analysing the firms identified by Fazzari et al. (1988). Their results showed that firms which are less financially constrained show higher sensitivities than firms that are more financially constrained. Thus, higher sensitivities cannot be interpreted as evidence for the fact that firms are more financially constrained.

Following Fazzari et al. (1988), the literature on the relationship of cash flow and investment started to grow. Whited (1992), Hubbard et al. (1995), Ng and Schaller (1996) used financial variables as control variables in the estimation of a standard Euler equation for various categories of firms. They used data for US firms and found that the standard Euler equation holds for firms facing less financial constraints. Bond and Meghir (1994) found similar results for UK firms. Another branch of literature tried to identify the relation between capital market imperfections and firms' investment using alternative measures of investment opportunities rather than Q. Gilchrist and Himmelberg (1995) used a set of VAR forecasting equations for a subset of information available to the firm for evaluating a linear expectation of the present discounted value of marginal profits. This was used as a measure of firms' investment opportunities. They, then, estimated the investment regression using this variable and cash flow.

Almeida and Campello (2007) compared the effect of tangibility on investment-cash flow sensitivities for different measures of financial constraints. The results showed that investment-cash flow sensitivity should increase the tangibility of firm's assets only for financially constrained firms. Carpenter and Guariglia (2008) used the contracted capital expenditure of UK firms to capture information about investment opportunities available to insiders. To improve the measurement of investment opportunities firms' contractual obligations were used as a proxy. Inclusion of this variable along with Tobin's Q helped in improving the degree in which investment opportunities are measured. Their results showed that cash flow helps in capturing the effect of credit frictions. Guariglia et al. (2012) focused on a panel of unlisted firms from transition economies and found that financially constrained firms are likely to face higher irreversibility and might be more hesitant to raise investment spending. Irreversibility, therefore, hampers the investment-cash flow sensitivities even for firms which are liquidity constraint.

Wei and Zhang (2008) used firm-level data for eight East Asian emerging economies for the period before the Asian financial crisis, that is, from 1993–1996. They found that there is a decline in the sensitivity of a firm's capital investment to its cash flow as cash flow rights of shareholders increase. While this sensitivity increases as the degree of the divergence between control rights and cash flow rights of firm's shareholders increase. George et al. (2011) analysed the firms in India which are affiliated to Indian business groups. They find strong investment-cash flow sensitivity for firms which are both independent as well as affiliated to groups, but they could not find any significant difference in the sensitivity between them.

More recently Arslan et al. (2006) investigated the relationship between financial constraints and investment-cash flow sensitivities by focusing mainly on the cash holdings of firms. The main idea of the paper was that higher cash holdings of firms increase their ability to undertake profitable investment opportunities. The results showed that the hedging role of cash is more important in countries with higher asymmetric information and excessive costs of external finance. Dell'Ariccia et al. (2008) found that banking crises results in negative growth in industries that are more dependent on external financing. Lemmon and Roberts (2010) studied the effects of the collapse of the junk-bond market in 1990 on the investment of firms which were dependent on junk bond financing. Further, Duchin et al. (2010) studied the impact of the recent financial crisis on firm's investment. The results showed that corporate investment declined significantly following the beginning of financial crisis, controlling for firm fixed effects and investment opportunities. They also showed that the decline is larger for firms which are

more dependent on short-term debt or operate in industries which rely more on external financing. Hackbarth and Mauer (2012) studied the interaction between financing and investment decisions in a dynamic model. They found that financially unconstrained firms with less growth opportunities prefer senior debt while constrained firms favour junior debt.

3.5 Difference-in-differences modelling

3.5.1 Theoretical literature

Difference-in-differences estimation is used in most of the literature with policy analysis exploiting natural experiments. In the simplest case, there are two time periods and two groups- control and treatment group. The treatment group might consist of people, cities, countries, firms, etc. and the two time periods chosen would include the period of policy change. Following the approach in Wooldridge (2010) the difference-in-differences method is described in this section.

Let $\mathcal{X}$ be the control and Z be the treatment group; the dummy variable of dZ equals 1 for those in the treatment group, and 0 otherwise. Let dummy $d2$ denote the second time-period (post-policy-change). The impact of the policy change can be analysed as follows:

$$Y = \beta_0 + \beta_1 dZ + \mathrm{a}_0 d2 + \mathrm{a}_1 d2.dZ + e \qquad (13)$$

where Y is the dependent variable. The dummy variable of dZ captures the difference between the treated and control groups before the policy change. The time period dummy $d2$ captures the aggregate factors that would cause changes in Y in the absence of a policy change. The coefficient of interest is a_1 on the interaction term $d2.dZ$ which is the dummy variable equal to 1 for the observations in the treatment group in the second period.

Let $\bar{\mathrm{Y}}_{X,1}$ and $\bar{\mathrm{Y}}_{Z,1}$ denote the sample average of Y for the control and treated groups respectively in the first year. Let $\bar{\mathrm{Y}}_{X,2}$ and $\bar{\mathrm{Y}}_{Z,2}$ are the averages of Y for the control and treated groups respectively in the second year. Then the OLS estimator $\hat{\mathrm{a}}_1$ can be expressed as:

$$\hat{\mathrm{a}}_1 = \left(\bar{\mathrm{Y}}_{Z,2} - \bar{\mathrm{Y}}_{Z,1}\right) - \left(\bar{\mathrm{Y}}_{X,2} - \bar{\mathrm{Y}}_{X,1}\right) \qquad (14)$$

This estimator is represented as the difference-in-differences (DD) estimator.

The basic equation (13) can be modified further by obtaining both a different state and control group within the treatment state. If the two periods are again labelled as 1 and 2, let Z represent the state implementing the policy and let F denote the new state group, then the equation can be expanded as:

$$Y = \beta_0 + \beta_1 dZ + \beta_2 dF + \beta_3 dZ.dF + \mathrm{a}_0 d2 + \mathrm{a}_1 d2.dZ + \mathrm{a}_2 d2.dF + \mathrm{a}_3 d2.dZ.dF + e, \quad (15)$$

The coefficient of interest is now a_3, the coefficient on the triple interaction term $d2.dZ.dF$, and the OLS estimate $\hat{\mathrm{a}}_3$ can be denoted as:

$$\hat{\mathrm{a}}_3 = \left(\bar{\Upsilon}_{Z,F,2} - \bar{\Upsilon}_{Z,F,1}\right) - \left(\bar{\Upsilon}_{X,F,2} - \bar{\Upsilon}_{X,F,1}\right) - \left(\bar{\Upsilon}_{F,E,2} - \bar{\Upsilon}_{F,E,1}\right) \quad (16)$$

where the $\mathcal{X}$ subscript means the state not implementing the policy and the E subscript means the new control group within the state. The estimator in equation (16) is called the difference-in-difference-in-differences (DDD) estimator.

3.5.2 Empirical literature

Econometric methods which are most commonly used in quasi-experimental studies are instrumental variables, regression discontinuity methods, and difference-in-differences technique for policy analysis. The use of these econometric methods has grown and has become more sophisticated since the 1970s. Difference-in-differences is a common method of analysis in microeconomic studies related to development, environment, education, labour, public finance and health, but is still somewhat under-used in industrial organization and macroeconomics. Difference-in-differences policy analysis compares the outcome within groups affected more or less by a policy change.

Card and Krueger (1994) examined the long-run effects of the 1992 minimum-wage increase in New Jersey from USD 4.25 to USD 5.05 per hour. They tested the fast-food employment growth in New Jersey and Pennsylvania before and after the rise. They found that the New Jersey minimum wage increase did not reduce total employment, however, it slightly reduced the average number of hours of work per employee. Moehling (1999) used difference-in-differences approach to examine the effect of state child labour laws on child labour employment. The results showed that the laws contributed little in reducing child labour. Angrist and Lavy (2001) examined the impact of teacher's training on pupil achievement in Jerusalem elementary schools using difference-in-differences approach. The estimates showed that providing training to teachers is a cost-effective means of increasing test scores of pupils.

Slaughter (2001) analysed the relation between trade liberalization and per capita income across countries. Using difference-in-differences approach on four post-1945

multilateral trade liberalisations no strong and systematic link was found between trade liberalisation and convergence. Alatas and Cameron (2003) tried to exploit the geographic differences to compare the employment changes in clothing, textiles, footwear and leather industries on either side of the Jakarta-West Java border. Using matched difference-in-differences they found negative employment impact for small-domestic firms while no impact for large firms- foreign or domestic firms. While Bainbridge et al. (2003) estimated the effect of public child care subsidies on single mothers' employment rates from 1991–1996. The results showed that expenditure on child care subsidies had significant and substantial beneficial impact on the employment of single mothers with young children.

Leigh (2003) analysed the impact of Western Australian minimum wage increase arising from six increases between 1994 and 2001 from 3.49% to 9.29%. On aggregating the increases the elasticity of labour demand with respect to the minimum wage was found to be -0.13. Kugler (2005) assessed the wage effects of severance payments savings accounts (SPSAs) in Colombia after the 1990 Labour Market Reform. The results showed that SPSAs shifted between 60% and 80% of firm's contributions towards workers' lower wages. Neumark et al. (2005) presented nonparametric difference-in-differences estimates of the effects of minimum wages on 'family income to needs distribution' in the United States. The results did not show any evidence that increase in minimum wage reduces the proportions of poor and low-income families.

Solé-Ollé and Sorribas-Navarro (2006) used Spanish database of grants received by 900 municipalities during the period of 1993-2003 from upper-tier government. Using differences-in-differences they tested the hypothesis that political alignment affects the distribution of grants across municipalities. The results showed significant effect of partisan alignment on the amount of grants received by municipalities. In the case of single-party, aligned municipalities received over 40% more grants as compared to the unaligned municipalities. Draka et al. (2006) studied the impact of minimum wage policy in the UK in 1999 on firms' profitability. They used pre-policy information to create treatment and control groups for the implementation of difference-in-differences approach. Their results showed that firms' profitability was significantly reduced by the introduction of minimum wage policy. Using a dataset of Irish manufacturing plants Görg et al. (2008) analysed the relationship between government subsidy and exporting activity by firms with a difference-in-differences estimator. The results showed that large grants influence exporting firms to compete more effectively in the international market.

Pellizzari (2010) explored the empirical effects evidence for European countries using the European Community Household Panel (ECHP) and discovered a large cross-country and cross-industry wage differences between jobs found through informal and formal methods. They argued that such variation can be explained by firms' recruitment strategies. In labour markets where employers invest largely in formal recruitment activities, matches created through formal channel are likely of better quality than those created through informal networks. Imberman and Kugler (2012) examined the impact of in-class breakfast programmes on class performance as measured by standardized test scores, grades and attendance rates. Using difference-in-differences strategy they identified the schools where this programme was introduced. They found that in-class breakfast increased maths and reading achievements by about one-tenth of a standard deviation relative to providing breakfast in the cafeteria.

Vandoros et al. (2013) used difference-in-differences approach to compare health trends, before and after the financial crisis in Greece, with trends in a control population (Poland) that did not experience a recession. The results showed strong evidence of a statistically significant negative effect of the financial crisis on health trends. Relative to Poland, Greece experienced a significantly larger increase in the odds of reporting poor health after the crisis, while there was no difference in health trends between Poland and Greece before the financial crisis. Nakamura et al. (2014) evaluated the impact of Scottish ban on multi-buy promotions of alcohol in 2011 using difference-in-differences method. This method was used to compare the volume of alcohol purchased by Scottish households with those in England and Wales between January 2010 and June 2012. They found that there was no significant impact of the ban on the volume of alcohol purchased either by the whole population or individual socio-economic groups.

3.6 Empirical methodology

3.6.1 Baseline model

To confirm the impact of bond market policy initiatives on firms' access to external finance, this chapter examines the determinants of external finance to explain the effect of the policy initiatives. Following the recent literature which verifies the impact of policy initiatives (Card and Krueger, 1994; Vandoros et al., 2013; Mizen and Tsoukas, 2014) the empirical models are estimated using difference-in-differences methods. The difference-in-differences method (DD) helps in differentiating the impact of the policy initiative on firms in the countries which participated in the initiative (treated group) from the firms in Taiwan (control group) which did not participate in the policy initiative but faced similar

bond market development. The treated group includes seven Asian economies namely- Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand.

The dependent variables capture measures of external finance and are based on the ratios of short-term debt to total debt (Bougheas et al., 2006) and long-term debt to total assets (Demirgüç-Kunt and Maksimovic, 1999)[34]. The former ratio refers to access to bank finance versus market finance, while the latter ratio is more related to access to bond financing as compared to total assets held by the firms. These ratios help to remove demand-side influences as increase in the demand of credit is likely to affect both numerator and denominator of the ratio, leaving the ratio unchanged (Bougheas et al., 2006). The baseline models are represented as follows:

$$\frac{STD_{ijt}}{TD_{ijt}} = a_0 + a_1 Treat_j + a_2 After_t + a_3 Treat_j * After_t + a_4 \mathcal{X}_{ijt} + e_{ijt}, \quad (17)$$

$$\frac{LTD_{ijt}}{TA_{ijt}} = a_0 + a_1 Treat_j + a_2 After_t + a_3 Treat_j * After_t + a_4 \mathcal{X}_{ijt} + e_{ijt} \quad (18)$$

where i = 1, 2, …., N refers to the cross-section of units (firms in this case) in country j at time t. $\frac{STD_{ijt}}{TD_{ijt}}$ and $\frac{LTD_{ijt}}{TA_{ijt}}$ are the ratios of short-term debt to total debt and long-term debt to total assets respectively. $Treat_j$ is a country dummy which takes value one if a country participates in ABF, ABF-2 or ABMI and zero otherwise. $After_t$ is a time dummy which takes value one for the years 2005-2012 and zero otherwise[35]. The policy effect is given by the coefficient of the interaction term $Treat_j * After_t$. A significant coefficient value on the interaction term should imply that the policy initiative had a crucial impact on access to finance with a considerable difference between the control and treated group.

The models are estimated using difference-in-differences with firm fixed effects to control for unobserved heterogeneity at the firm-level. Country dummies are included in the model to control for country-level differences, while time dummies interacted with industry dummies are included in order to control for all time-varying demand shocks at the industry level (Brown et al., 2009 and Brown and Petersen, 2009). Clustered standard errors at the firm level are included as the observations over time might be correlated

[34] Short-term debt is made up of the sum of bank overdrafts, short-term group and director loans, hire purchase, leasing and other short-term loans, but is predominantly bank finance. Long-term debt is made of bonds, mortgages, loans and similar debt which represents debt obligations due for more than one year from the company's balance sheet date or due after the current operating cycle.

[35] By observing the treatment after 2005, this chapter is mainly focusing on the impact of Asian Bond Fund-2 in 2005. ABF-2 initiative differs from others as it involves the actual creation of local currency bond funds. The earlier ABF initiative had limited itself to dollar-denominated issues that are traded mostly in more developed international bond markets. ABF was important because it afforded the EMEAP central banks an opportunity to work together for building trust in order to foster cooperation and further develop financial markets in the region (Ma and Remolona, 2006).

within firms. Finally, $\mathcal{X}$ is the vector of explanatory factors at firm-level and country-level and e_{ijt} are the disturbance terms.

The set of control variables, which are included in vector $\mathcal{X}$, are taken from previous studies. With respect to the firm-level factors previous literature suggests that *firm size* is an important indicator of external financing. Firm size is measured as the natural logarithm of total assets (Gopalan et al., 2013 and Mizen and Tsoukas, 2014). Larger firms have better access to external finance as they are less financially constrained, while smaller firms are more dependent on short-term bank financing (Bougheas et al., 2006; Beck et al., 2008).

Liquidity of firms is measured by the ratio of current assets to current liabilities. According to Ozkan (2001), liquidity of firms is likely to have a mixed impact on access to external financing. Higher liquidity might encourage firms for higher debt ratios due to increased ability to meet short-term obligations. This implies a positive relationship between liquidity and external finance. However, firms with higher liquidity might also reduce their debt access exerting a negative impact on external finance. Following Bougheas et al. (2006) *gearing* is measured by total liabilities to shareholder's equity. González et al. (2007) shows that more leveraged firms have fewer requirements of external financing. On the contrary, Mizen and Tsoukas (2014) show that higher leveraged firms are more likely to issue corporate bonds.

Following Mizen et al. (2012) the *expansion rate* of firms is measured by investments to total assets ratio. According to Pagano et al. (1998) and Datta et al. (2000), growing firms are more likely to issue bonds as compared to the firms with less opportunities for expansion. Also, firms with higher expansion rate are likely to undertake bond issuance earlier (Hale and Santos, 2008). Firm's *operating cycle* is calculated as the ratio of net sales to net fixed assets. Firms with higher operating cycle depend more on short-term debt to finance the sales (Demirgüç-Kunt and Maksimovic, 1999; Beck et al., 2008). Finally, *cash flow* is measured by the ratio of earnings before extraordinary items plus depreciation and amortization to total assets (Almeida and Campello, 2010). Firms with higher cash flow or higher cash surplus are expected to reduce their leverage (Demirgüç-Kunt and Maksimovic, 1999).

In addition to firm-level variables, this chapter also controls for other economic factors in vector $\mathcal{X}$ such as *GDP growth rate, legal regulation and balance of trade*

(scaled by GDP)[36]. Among the economic factors, GDP growth rate and balance of trade are the measures of economic development of a country. Better economic conditions might encourage firms to shift towards non-debt liabilities and thus showing a negative effect on external finance. Firms in countries with higher levels of legal regulation are more likely to rely on external financing due to reduced information asymmetries. This results in higher growth (La Porta et al., 1998) and better working of financial contracts (Demirgüç-Kunt and Maksimovic, 1999).

3.6.2 Access to external finance and investment after the policy change

This section examines the influence of external finance on firms' investment spending during the post-policy period[37]. One of the objectives of the Asian bond market initiatives is to provide alternative sources of financing for private and public investments to enterprises (Kawai, 2010). It is particularly interesting to examine the impact of long-term debt issued for firms' investment spending as the Asian Bond Fund initiatives are expected to expand long-term debt issuance. It is argued that this is likely to have a positive effect on firms' investment spending. To test this hypothesis the dependent variable of firms' investment spending (*Inv*) is measured as the ratio of annual capital expenditure to total assets (Duchin et al., 2010). The models are estimated as follows:

$$Inv_{ijt} = a_0 + a_1 Treat_j + a_2 After_t + a_3 Lev_{ijt} + a_4 Treat_j * After_t * Lev_{ijt} + a_5 Treat_j * After_t + a_6 After_t * Lev_{ijt} + a_7 Treat_j * Lev_{ijt} + a_8 Q_{ijt} + a_9 CF_{ijt} + e_{ijt}, \quad (19)$$

where Lev_{ijt} refers to the measures of external finance i.e. both short-term and long-term debt ratios, CF measures firm's cash flow and Q controls for firm's investment opportunities. The main variable of interest is the interaction term between leverage and the DD coefficient, $Treat_j * After_t * Lev_{ijt}$, captures the impact of post-policy access to external finance on firms' investment expenses for the treated group. Due to unavailability of data on market value of assets (e.g. number of shares outstanding and stock price) in Global Compustat it was difficult to construct Tobin's Q (Baum et al., 2011), but investment opportunities are controlled for in two ways. First, following Konings et al. (2003) and Bakucs et al. (2009) sales growth is used as a proxy for Tobin's Q. Second, time dummies interacted with industry dummies in all the specifications, are used which is an indirect way for controlling investment opportunities as used in Guariglia et al. (2012).

[36] Other additional controls are also included such as stock market capitalisation, global liquidity indicator and a global financial crisis dummy. These results are given in section 3.9.5 and it confirms that the main results remain unchanged even after including other control variables.

[37] The direct impact of the ABF policies on firms' investment spending was also explored and the results showed a positive and significant impact, implying an increase in investment spending by firms after these policies were introduced.

3.6.3 Accounting for firm-level heterogeneity

Intuitively, not all firms are expected to benefit equally from the above mentioned policy initiatives. Fazzari et al. (1988) highlight the importance of differences across firms in relation to financial constraints originating from the imperfections of capital market. Due to asymmetric information firms facing higher costs of external finance are likely to be more financially constrained. Bris et al. (2014) find that larger firms in the Euro area benefited the most from financial integration. Consistent with this result, Gozzi et al. (2010) find that larger firms have better financing from international capital markets. Stiebale (2011) further stressed that financially constrained firms face difficulties in obtaining external finance. It is also argued that firms that face financial constraints might be less well positioned to take advantage of the policy initiatives in Asia. Since these firms are more susceptible to information asymmetry effects. The well-known fact is that there is little public information available for financially constrained firms and it is difficult for financial institutions to gather this information. Obtaining external finance is, therefore, likely to be particularly difficult and/or costly for them. Therefore, this chapter hypothesises that financially unconstrained firms are more likely to reap the benefits of a policy change.

To test this hypothesis, firms are divided into constrained and unconstrained groups using two main criteria: profits and coverage ratio. The former classification scheme is measured by the ratio of earnings before interest and taxes relative to total assets (Baker and Wurgler, 2002). Evidence shows that less profitable firms are more financially constrained (Gertler and Gilchrist, 1994; Livdan et al., 2009). Coverage ratio is measured as earnings before interest and taxes over total debt which measures project quality (Mizen and Tsoukas, 2012). Hence, this classification scheme captures firms' creditworthiness[38]. As the policy initiative might be related to unobserved within-firm changes, firms are divided into constrained and unconstrained categories using the pre-policy period of 1996-2004[39]. Firms are classified as constrained if their profits and coverage ratio are below the 50th percentile of the distribution in the pre-policy period.

Further, the differential impact of the influence of external finance on firms' investment spending across constrained and unconstrained firms is investigated. Theory predicts that firms with financial frictions accompanied with negative shocks to external finance might lack sufficient financial slack to fund profitable investment opportunities

[38] Interest coverage was used by Gertler and Gilchrist (1994) and Guariglia (1999) as an indicator of financial constraints to identify differences in inventory investment.

[39] A firm is classified as constrained or unconstrained in the post-policy period of 2006-2012 using values of 2004, that is, one year prior to the onset of the policy as firm variables are likely to be endogenous to the choices made by firms.

internally (Stiglitz and Weiss, 1981; Holmstrom and Tirole, 1997). These effects are stronger for constrained firms that face greater costs in raising external capital (Duchin et al., 2010).

3.7 Data and summary statistics

3.7.1 Data

The data of this chapter includes eight Asian economies namely Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand[40]. The data covers the period of 1996 to 2012 which also includes the period of major bond market development initiatives. The data are extracted from different sources including Dealogic Bondware, Standard and Poor's Compustat Global database, Bloomberg, Global Financial database and IMD World Competitiveness Yearbook (WCY).

Bondware is a database compiled by Dealogic, an independent financial-information provider. The main purpose of Bondware is to permit the ranking of bookrunners (the lead underwriters controlling the distribution of paper) by amount or number of deals underwritten; indeed, the data are effectively provided by the bookrunners. This is why Bondware only captures those issues that the bookrunner wants to advertise. Bondware provides coverage of the debt markets in the world with information along various dimensions on the entire population of bond offerings. In this chapter Bondware is used in identifying the corporate bonds issued in the international markets and to accumulate data relating to issue date, maturity date, outstanding amount and currency[41].

Bloomberg is an online database providing current and historical financial quotes, business newswires, and descriptive information, research and statistics of over 52,000 companies worldwide. Bloomberg is used to categorise similar data for firms that issue bonds in the Asian domestic markets. Thus, the data covers bond issues of firms denominated in local currency as well as in foreign currency, mainly US dollars.

Compustat Global database is a financial database which provides market information on active and inactive global companies throughout the world. It covers publically traded companies in more than 80 countries which represents 90% of the world's market capitalisation including coverage of more than 96% of European market capitalisation and

[40] China is not taken into consideration due to its disparities with other East Asian economies in terms of growth, capital account convertibility and restricted financial markets. Corporate savings in China are higher due to domination of state-owned banks and restricted equity market which favour the large firms by improving their retained earnings and profitability (Lin, 2009). In addition, repressed financial system in China provides cheap capital (lower interest rate) which again favours large firms (Prasad, 2009).

[41] The definition of corporate bonds is in line with recent studies on Asian bond markets (see Gyntelberg et al., 2005; Mizen and Tsoukas, 2014) and includes all non-government long-term issues in a given currency.

88% of Asian market capitalisation. In addition, Compustat Global offers data models specific to industrial companies and financial services sectors including banks, insurance companies, real estate investment trusts and brokers/security dealers. In this chapter the balance sheet data for these Asian firms are taken from Compustat Global database. The initial sample included a total of 71,792 annual observations on 7,436 companies. Information on financial accounts and ratios are provided for the period of 1996-2012[42]. Finally, the data for economic factors such as GDP growth rate, balance of trade (scaled by GDP), interest rate spread, inflation and property rights protection are taken from the Global Financial database and IMD WCY database. WCY database analyses and ranks how nations and enterprises organise their competencies to achieve increased prosperity.

Following normal selection criteria used in the literature, companies with incomplete records of explanatory variables and negative sales are excluded from the data. In addition, observations in the 1% from the upper and lower tails of the distribution of the regression variables are excluded to control for the potential influence of outliers. Finally, the panel has unbalanced structure with a total of 62,237 annual observations and 518 firms in Hong Kong SAR, 451 in Indonesia, 1,599 in Korea, 1,219 in Malaysia, 253 in the Philippines, 861 in Singapore, 1,745 in Taiwan, and 640 in Thailand that function between 1996 and 2012 within different sectors such as manufacturing, utilities, resources, services and financials.

3.7.2 Summary statistics

Table 3.1 shows summary statistics for all the variables, differentiating between control and treated groups, as well as before and after the introduction of the policy initiative. The values for the whole sample (column 1); treated and control groups (columns 2 and 3); before and after the policy initiative (columns 5 and 6); p-values for the test of equality of means (columns 4 and 7) are reported. From columns 2 and 3 significant difference in the short and long-term debt issued across the two groups of economies can be found. Further, columns 5 and 6 show the debt levels for pre- and post-policy periods. Regarding the short-term debt the results do not show any significant difference between the two time periods. On the other hand, long-term debt values show considerable improvement after the introduction of the policy and this difference is significant at the 5% level. With respect to other variables the results show that firms are larger, have higher levels of gearing, lower liquidity and expansion rate and higher investment spending in the treated group as compared to the control group. As for

[42] Bond tickers are used to link the bond-specific data from Bloomberg with accounting data from Compustat Global. The matching of the bond data from Bondware with data from Compustat Global was made feasible using firms' names.

country-specific variables the treated group displays higher GDP growth, lower legal regulation and higher balance of trade compared to the control group. Moving to columns 5 and 6, all variables show significant differences before and after the policy with GDP growth being the only exception. On average, introduction of the policy, helped in improving firm-level factors such as firm size, liquidity, expansion rate and operating cycle of firms.

On the whole, these preliminary statistics indicate two main points. First, there is a noticeable difference between the control and treated group in terms of both short and long-term debt issuances. Second, there is an improvement in the level of long-term debt issuance after the implementation of the policy initiatives. Also, there is a notable improvement in the performance of firms highlighted by the firm-level factors after the policy initiative. In the following sections a formal regression analysis framework tests the role of the policy initiative in firms' access to external finance.

3.8 Empirical results

3.8.1 Baseline model

Table 3.2 reports the results for the baseline model. The main variable of interest, '$Treat_j * After_t$', measures the impact of the policy initiative on the treated group. To ascertain the magnitude of the DD coefficient, percentage point effects are calculated by dividing the coefficient value (marginal effect) with the predicted probability of the model. The results show that the introduction of the policy in the treated group led to a reduction in firms' access to short-term debt by 4.87% and an increase in firms' access to long-term debt by 11.96%. This finding emphasises the fact that policy initiatives helped firms in the treated group to improve their access to long-term debt while reducing their short-term debt finance as compared to the control group. This also implies that firms issued long-term debt that they would not have done in the absence of the policy implementation.

These findings lend support to the evidence presented in Mizen and Tsoukas (2014) who show that the policy initiatives of ABF, ABF-2 and ABMI had a significant effect on a firm's decision of bond issuance. It also supports the findings of Shim (2012) that domestic corporate bond markets in emerging Asia experienced a rapid growth from 2005 to 2011 as compared to other emerging markets even during the global financial crisis. One of the factors affecting the rapid growth in corporate bond issuances is the functioning of credit rating agencies which are established as a part of the government initiatives (Shim, 2012).

Focusing on firm-level factors, a significant coefficient on *firm's size* shows that larger firms have greater access to long-term debt and reduce their short-term debt. This confirms the finding by Bougheas et al. (2006) that size is an important determinant of access to bank and market debt. *Liquidity* of firms shows a negative impact on short-term debt, while a positive impact on long-term debt suggesting that firms with higher liquidity are likely to raise more long-term debt and reduce short-term debt. Ozkan (2001), Aggarwal and Zong (2006) show that higher liquidity of firms improve access to external finance. Moving to *gearing* of firms, it enters with the expected negative and positive signs on short and long-term debt ratios respectively. This result is in line with González et al. (2007) for short-term debt as they confirm that more leveraged firms have less desire for external financing. On the other hand, firms with higher leverage are likely to issue more corporate bonds (Mizen and Tsoukas, 2014) resulting in an increase in access to long-term debt.

Expansion rate measured by investments to assets ratio shows a negative and positive effect on short and long-term debt ratios respectively. This indicates that firms with higher investments are more likely to opt for long-term debt issuance. *Operating cycle* measured by sales to assets ratio attains a negative coefficient on long-term debt ratio, while a positive coefficient on short-term debt ratio. This confirms that firms depend more on short-term debt rather than on long-term debt to finance their increasing sales. *Cash flow* enters with a negative coefficient on both long and short-term debt ratios which show that firms with substantial cash flow require less in terms of external finance.

Country-specific factors include GDP growth, legal regulation and balance of trade. *GDP growth* is generally insignificant, but the balance of trade shows a positive effect on short-term debt and an insignificant effect on long-term debt. Improvement in the *balance of trade*, an indicator of economic health of a country, increases access to external financing in the form of short-term debt. Finally, *legal regulation* registers a positive effect on long-term debt ratio and a negative effect on short-term debt ratio. This implies that with an improvement in a country's legal framework firms are more likely to increase their long-term debt issuance rather than short-term debt exposure.

3.8.2 Accounting for firm-level heterogeneity

This section explores the link between the policy shift and firms' financing while taking into account firm-level heterogeneity. The results are reported in Table 3.3. Columns 1-2 in the table gives results for the firms with low and high profits, followed by low and high coverage ratios in columns 3-4 for short-term debt ratio. Similarly, results for the long-term debt ratio for different firm classifications are provided in columns 5-8.

The results of the DD coefficient show that unconstrained firms are able to reap more readily the benefits of the policy change. On the contrary, constrained firms were mainly unaffected by the policy change. The economic interpretation provides a more interesting story as the unconstrained firms reduce their short-term debt and increase their access to long-term debt ratio much more as compared to constrained firms after the policy initiative. In economic terms, after the introduction of the policy, unconstrained firms in the treated group reduced their access to short-term debt by around 9.45%-9.51%, while they increased their access to long-term debt by 18.25%-26.84% as compared to unconstrained firms in the control group. The test of equality for constrained and unconstrained firms shows a significant difference at 5% level for both short and long-term debt ratios.

This result provides support to the evidence given by Fazzari et al. (1988) that financially constrained firms face higher external financing costs. Constrained firms are less likely to have access to external finance as they face higher agency costs of borrowing from financial markets when compared with the cost of internal financing (Bernanke and Gertler, 1995). Overall, the results show that unconstrained firms are able to access external finance easily as compared to the constrained firms in the treated group.

3.8.3 The impact of investment spending

This section takes into account the role of firms' financing position in influencing the impact of the policy initiative on investment spending. Table 3.4 reports the results of post-policy firms' investment spending for different measures of leverage[43]. Column 1 provides the results for short-term debt to total debt and in column 2 leverage is measured as long-term debt to total assets.

The findings show that the interaction term of leverage and DD is negative for firm's investment spending in column 1 and positive in column 2. The magnitude of the interacted coefficients suggests that after the policy was introduced firms reduced their investment spending using short-term debt by 10.04%, while increased their investment spending using long-term debt by 67.65%. These coefficients are statistically significant at the 1% level. The results indicate that as firms reduced their access to short-term debt, after the policy implementation, firms reduced their investment spending using short-term debt. On the contrary, firms' increased access to total long-term debt after the policy which helped them to spend more of long-term debt on their investment spending.

[43] The term After*Lev has been omitted from the results due to very high correlation with other variables such as Treat*After*Lev and Lev.

The above results support the evidence provided by previous studies that the development of financial markets helps to improve growth and investment in emerging markets (Rajan and Zingales, 1998; Love, 2003). With respect to other control variables both *sales growth* and *cash flow* have a positive and significant coefficient for investments in almost all the columns. This result is again in line with the empirical studies such as Fazzari et al. (1988) and Wei and Zhang (2008) which show that firms' cash flow per unit of capital is positively related to the rate of investment per unit of capital even when a measure of Tobin's Q is included as an explanatory variable of investment.

Overall, the results confirm that the growth of Asian domestic bond markets has helped firms to finance their investments by increasing their access to long-term debt. Levinger et al. (2014) show that strong growth in Asia's corporate bond markets have made funds available for investment and expansion in recent years along with deepening of capital markets and diversification of financing sources.

3.8.4 Accounting for financial constraints

Next, the link between the policy change and firms' financing is explored while categorising firms into financially constrained and unconstrained. Table 3.5 reports the results of the post-policy investment spending and leverage for constrained and unconstrained firms. The results indicate that the policy initiative did not have any significant impact on the investment spending of constrained firms. On the contrary, unconstrained firms reduced their investment spending using short-term debt and increased their investment spending using long-term debt after the introduction of the policy. The economic interpretation is even more interesting which indicates that unconstrained firms reduced their investment spending using short-term debt by 9.78%-12.67%, while they increased their investment spending using long-term debt by 88.50%-89.60%. However, the test of equality does not show a significant difference between the two groups for short-term debt ratio but it shows a significant difference between the groups at 5% level for long-term debt ratio. In sum, the results again indicate that it is the unconstrained group of firms in the treated group that benefited the most from the policy initiative in comparison to the firms in the control group.

This outcome is in line with the study of Holmstrom and Tirole (1997) that capital tightening has worse effect on poorly capitalised firms. Fazzari et al. (1988) found that financial effects on investment differs across firms and are likely to be more severe for firms facing financial constraints in the capital market. Thus, there is a stronger relationship between external finance and investment spending for unconstrained firms in comparison with constrained firms.

3.9 Robustness section

3.9.1 Propensity score matching

This chapter employs a propensity score matching technique to check the validity of the treated and control groups. One to one matching technique of the firms is used without replacement. This means that once an untreated firm has been selected to be matched to a given treated firm, that untreated firm is no longer available for consideration as a potential match for subsequent treated firms. Hence, each untreated firm is included in at the most one matched set. Matching without replacement increases the efficiency of matching as compared to matching with replacement. However, regardless of theoretical differences several studies have provided evidence that the number of matches and the choice of matching with or without replacement has a minimum effect on treatment effect's bias and efficiency (Ho et al., 2007 and Stuart, 2010). Matching is done using non-categorical variables such as firm size, liquidity, leverage, expansion rate, operating cycle and cash flow using caliper 0.001 (Yörük, 2008)[44].

The results of the main variables of interest are reported in Table 3.6. The results in panel A verify the significant and positive impact of the policy initiative on firms' access to long-term debt ratio and the negative impact on access to short-term debt ratio. Panel B confirms that the policy initiative helped unconstrained firms to increase their access to long-term debt and reduce their short-term finance. Panel C demonstrates that firms reduced their investment spending using short-term debt, while they increased their investment spending using long-term debt after the policy was introduced. Finally, in panel D the relationship between external finance and investment spending is found to be stronger for unconstrained firms as compared to their constrained counterparts. Thus, it is confirmed that the main results are robust to a matching technique which also shows the validity of the control and treatment groups in the main models.

3.9.2 Using the ABF index as a measure of the treatment

To further support the accurate identification of the policy initiative on the treated group, an index is used as a measure of the treatment. Specifically, the Markit iBoxx ABF index is used which is designed to reflect the performance of the local currency denominated sovereign and quasi sovereign debt from eight Asian countries/territories.

[44] Although not reported here, caliper value of 0.0001 is also used for the propensity score matching method. In every procedure with calipers 0.001 and 0.0001 the propensity score and the coefficient estimate of almost all the control variables are statistically indifferent between the treated and control group.

The index gives a broad coverage of the sovereign and sub-sovereign bond universe of the treated countries whilst upholding minimum standards of investability and liquidity[45].

The results shown in Table 3.7 confirm that the main findings are upheld. The results continue to show that firms reduced their access to short-term debt, while increasing their access to long-term debt in the post-policy period. Further, it is found that firms reduced their investment spending using short-term debt, while they increased their financing of investment spending using long-term debt. Thus, it can be concluded that employing an index as a measure of treatment does not alter the results drastically.

3.9.3 Addressing potential endogeneity concerns

This section presents the instrumental variable method (two-stage least squares 2SLS) used to deal with the potential endogeneity concern of the explanatory variables and bond market policy initiative. The identification of the policy initiative requires an exogenous variable which is correlated with the bond market development policy but does not directly impact firm's access to external finance. As credible exogenous instruments for the policy initiative legal origin of a country, such as British, French and German origin, are implemented. Legal origin has also been used previously as an instrument for financial development of a country in a recent study by Liberti and Mian (2010). La porta et al. (2008) explained that a country's legal origins based on British, French, German, or Scandinavian legal origins have a statistically large impact on country's level of financial development. Beck et al. (2003) further stressed that legal traditions of a country effects the ability of a system to adjust to changing commercial requirements and encourages financial development of a country.

In addition to the policy initiative, it is also believed that all the control variables used in the model are endogenous and they are instrumented by using their own values lagged twice. The validity and importance of the instruments for both the policy and other control variables are verified using a number of tests. The results for these tests are reported at the foot of the tables[46].

Table 3.8 shows the results of the 2SLS model. The results validate a significant and positive impact of the policy initiative on firms' access to long-term debt ratio and a negative impact on access to short-term debt ratio with a stronger effect on unconstrained

[45] The index history statistics starts on 31/12/2000 and covers a variety of markets with small (Hong Kong, Singapore) and large (Korea, China) bond markets. Using simple weights will skew the index in favour of larger markets and reduce the weight of smaller markets. Hence, the baseline weight of these indices is adjusted by the local bond market size, sovereign local debt rating and GEMLOC investability indicator.

[46] In addition to the statistics reported in the tables of the results, the Anderson Rubin chi-square test was also employed and obtained identical p-values as with Anderson Rubin F-test.

firms. Further, the results show that with an increase in firms' access to long-term debt, their post-policy investment spending also increased, while post-policy investment declined for firms dependent on short-term debt. Finally, the link between leverage and post-policy investment is much stronger for unconstrained firms as compared to their constrained counterparts. Other control variables maintain their significance and expected signs.

Overall, the diagnostic tests do not specify any problems regarding the application of instruments used. The Kleibergen-Paap statistics reject the null hypothesis that the equation is underidentified. The Anderson-Rubin and Stock-Wright statistics, which are the weak instrument-robust inference tests, accept the null hypothesis that the coefficients of the excluded instruments are jointly equal to zero. Finally, the Hansen J statistic of the overidentifying restriction also shows that the instruments are valid[47]. Thus, these results provide a reliable robustness check to the main results.

3.9.4 Placebo tests: Difference-in-differences for pre-policy period

This section presents placebo tests as a robustness check to the main results. If homogeneity across time-periods is assumed then similar results should also hold prior to the treatment period. Following Angrist and Krueger (1999) and Imberman and Kugler (2012), the difference-in-differences is conducted for the pre-policy period of 1996-2004. Instead of the reform taking place in 2005-2012, it is assumed that the reform took place in 2002-2004[48]. If there are any pre-existing trends, then there should be a significant impact of the policy on access to finance. This procedure checks if any underlying trends are influencing the results. If the results show insignificant effects of the policy on access to finance, then it proves the validity of the treatment effect.

Table 3.9 presents the results which demonstrate an insignificant impact of the policy initiative on both short-term and long-term debt ratios for both constrained and unconstrained firms. Further, the results of post-policy investment spending and leverage show an insignificant effect of firms' leverage on post-policy investment outlays for both constrained firms and their counterparts. In sum, the placebo test strengthens the validity of the empirical strategy and main results.

[47] In addition to the statistics reported in the tables of the results, we also employed the Anderson Rubin chi-square test and obtained identical p-values with the Anderson Rubin F-test.

[48] Difference-in-differences test for the pre-policy period are also performed using the reform period after 1999, 2002 and 2003. The results are almost similar, both quantitatively and qualitatively, to the results of 2002-2004 reform period.

3.9.5 Including additional control variables

In this section additional control variables are included in the models, while a wide set of explanatory variables have been explained in the main models to ensure that the findings are not driven by omitted-variable bias. A dummy for the global financial crisis is included which takes value one for the period 2007-2010, and zero otherwise. Additional control variables, such as stock market capitalisation and global liquidity are also added. Stock market capitalisation is likely to be an important determinant of external financing as countries with larger stock markets help firms to increase long term credit and access to external finance (Demirgüç-Kunt and Maksimovic, 1999). Global liquidity is measured by cross-border credit growth in the Asia-Pacific region. This variable is included to capture the market reactions to quantitative easing and tapering by United States on emerging economies in terms of capital flows across borders. Thus, this section tries to unravel the impact of the policy initiative on firms' external financing by controlling for these additional variables.

The results are given in Table 3.10 and confirm that the policy did have a significant impact on firms' external financing. The results again confirm that firms increased their access to long-term debt and reduced their short-term debt. Further, firms increase their investment spending using long-term debt, while they reduce their investment spending using short-term debt. Finally, the results show that both these relationships are stronger for unconstrained firms as compared to constrained firms.

3.9.6 Excluding Korea

In order to confirm that the main results are not driven by Korea which is the biggest bond market country in the treated group, Korea is removed from the sample. The results are shown in Table 3.11 which confirms that the results are both qualitatively and quantitatively identical to the main results. The results show that firms reduced their access to short-term debt, while increased their access to long-term debt in the post-policy period. Further, the results show that firms reduced their investment spending using short-term debt while they increased their financing of investment spending using long-term debt. Finally, these relationships are found to be more sensitive for unconstrained firms, compared to their constrained counterparts. Thus, it can be concluded that the inclusion of Korea in the sample does not bias the results in any way.

3.9.7 Alternative classification of firms

In the main empirical results the firms are classified into constrained and unconstrained using the 50th percentile of the distribution in the pre-policy period. In order to confirm that these results are not driven by the way the sample is divided, a

robust framework of classification scheme is used. Following Tsoukas (2011), the firms are divided into constrained and unconstrained firms using the 75th percentile as a cut-off point in the pre-policy period. Thus, constrained firms take value one if their profits and coverage ratio are below the 75th percentile of the distribution of all the firms in that particular year, and zero otherwise. Table 3.12 confirms that the policy helped unconstrained firms to increase their access to long-term debt and reduce their short-term debt much more as compared to the financially constrained firms. In addition, unconstrained firms increased their investment spending using long-term debt much more as compared to firms which are financially constrained. While in terms of short-term debt there is no significant difference between constrained and unconstrained firms with respect to their post-policy investment spending. Hence, to conclude, the main results are also robust to an alternative classification of firms.

3.10 Conclusion

After the Asian financial crisis of 1997-98 the need for developing local financial markets was realised in order to reduce over-dependence on bank-dominated financial system and under-developed bond markets. Thus, in order to develop sound and more liquid bond markets to prevent further capital account crises and financial instability, Asian bond market initiatives were introduced in eight Asian economies. Using a unique panel dataset on eight Asian countries over a period of 1996 to 2012, this chapter analyses the impact of the Asian bond market initiatives on firms' access to external finance. The results based on the difference-in-differences method suggest that firms' reduced their short-term debt and increased their access to long-term debt after the introduction of the ABF-2. With respect to the firm-level heterogeneity, the results show that the policy initiatives helped unconstrained firms to increase their corporate bond issuances and reduce their bank finance much more as compared to their financially constrained counterparts. Next, the chapter takes into account the influence of firms' external finance on investment spending in the post-policy period. The results show that increased access to credit for firms in the form of total long-term debt had a positive impact on firms' investment spending. Finally, this chapter finds that with respect to long-term debt ratio unconstrained firms are able to increase their post-policy investment spending much more as compared to constrained firms. This is due to their increased access to long-term debts after policy.

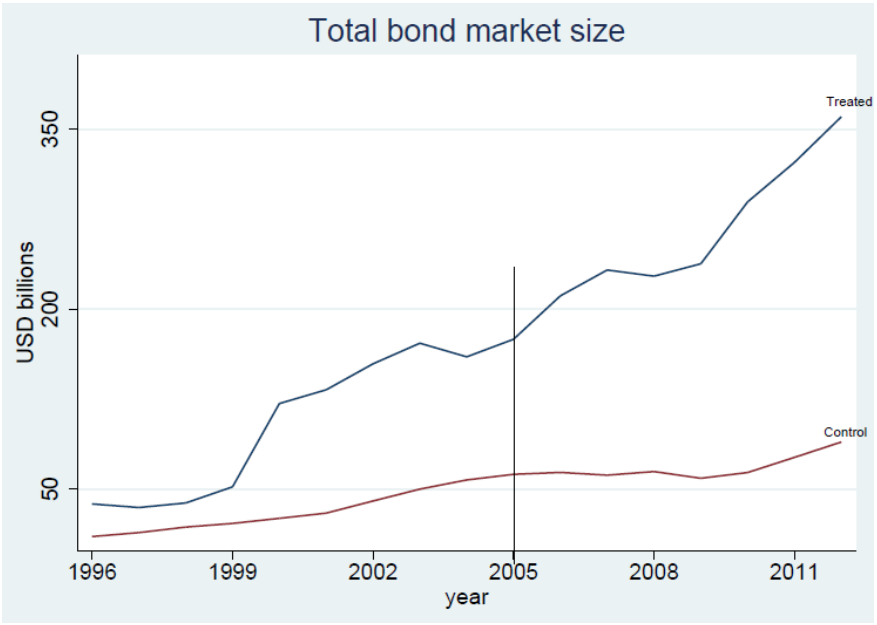
The results of this chapter confirm the fact that the Asian bond market initiatives helped in expanding the Asian domestic bond markets. However, the level of development is widely diverse between different ASEAN countries. These policy

initiatives have helped in expanding the local sovereign bond markets in Asia but the progress in terms of corporate bond markets is still low. Thus, more progress is required for growing diversified issuer base so that firms can receive funding from various sources without increasing shock volatility. This is crucial as significantly advanced corporate bond markets have a substantial effect on investment and regional growth by supplying long-term funding opportunities.

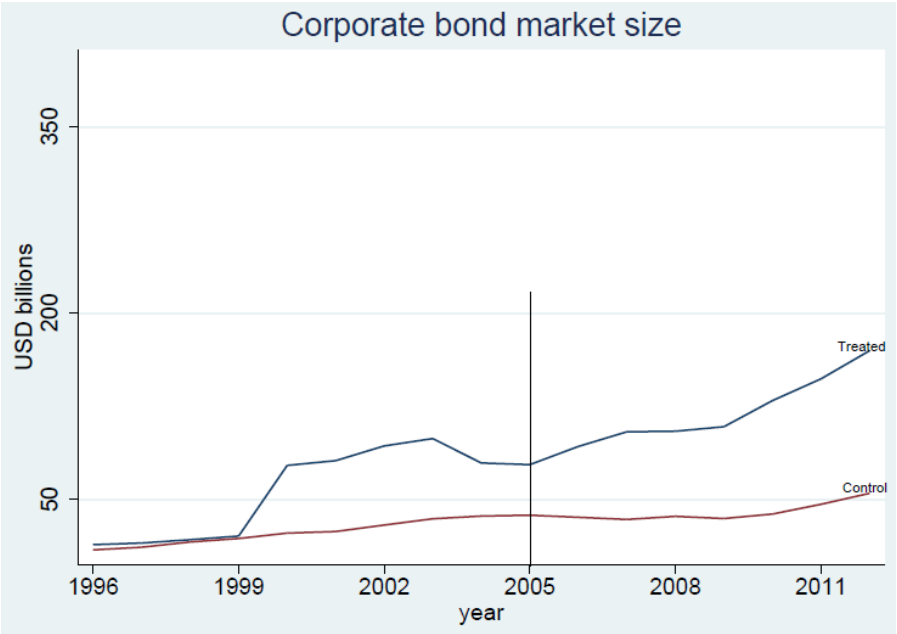
Figures

Figure 3-1: Size of bond markets for treated and control groups

(a) LCY bond market size (USD billions)

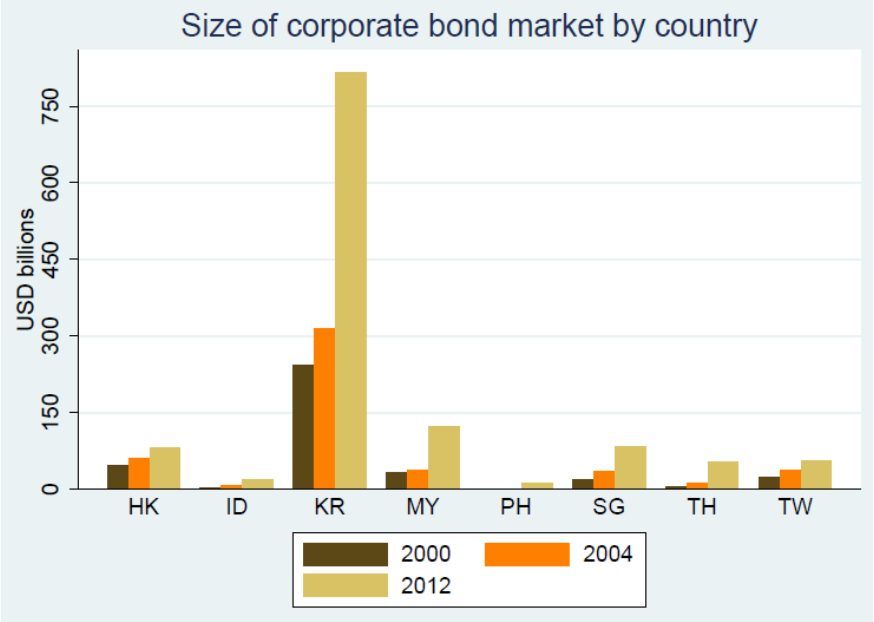


(b) LCY corporate bond market size (USD billions)



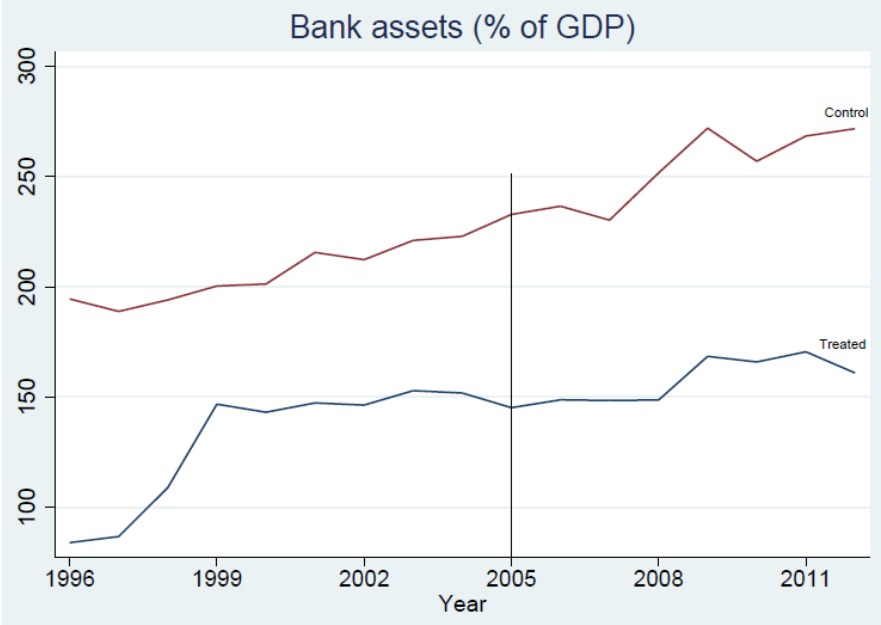
Notes: Treated group includes Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand, while the control group is Taiwan.

(c) Size of bond market by country



Notes: Country abbreviations: HK= Hong Kong SAR; ID = Indonesia; KR = Korea; MY= Malaysia; PH = Philippines; SG = Singapore; TH= Thailand; TW= Taiwan

Figure 3-2: Banking sector development in treated and control group



Tables

Table 3.1: Statistics for all the explanatory variables

Explanatory Variables	Whole sample (1)	Treated group (2)	Control group (3)	p-value (4)	Before ABF-2 (5)	After ABF-2 (6)	p-value (7)
Short-term debt (in USD bn)	47.03 (266.61)	60.10 (302.41)	3.15 (14.64)	0.000	46.37 (260.73)	47.45 (270.34)	0.629
Long-term debt (in USD bn)	52.29 (328.68)	66.89 (372.80)	2.91 (14.37)	0.000	49.06 (299.32)	54.41 (346.62)	0.051
Firm Size	8.41 (3.11)	8.42 (3.43)	8.37 (1.59)	0.127	8.17 (3.10)	8.56 (3.11)	0.000
Liquidity	2.12 (1.89)	2.07 (1.93)	2.27 (1.77)	0.000	1.92 (1.67)	2.25 (1.99)	0.000
Gearing	1.57 (2.40)	1.66 (2.49)	1.29 (2.07)	0.000	1.72 (2.59)	1.48 (2.27)	0.000
Expansion rate	0.48 (0.35)	0.47 (0.36)	0.49 (0.33)	0.001	0.47 (0.35)	0.48 (0.35)	0.033
Operating cycle	6.36 (12.84)	5.98 (12.20)	7.47 (14.53)	0.000	4.96 (10.09)	7.21 (14.19)	0.000
Cash flow	9.10 (8.47)	9.12 (8.51)	9.03 (8.37)	0.301	9.26 (8.22)	9.00 (8.61)	0.002
Investment spending	5.24 (5.40)	5.27 (5.39)	5.16 (5.43)	0.053	5.37 (5.56)	5.15 (5.29)	0.000
Sales growth	0.08 (0.28)	0.84 (0.28)	0.81 (0.28)	0.334	0.09 (0.29)	0.08 (0.28)	0.000
GDP growth	4.44 (3.64)	4.46 (3.72)	4.38 (3.35)	0.033	4.41 (4.12)	4.45 (3.30)	0.200
Legal regulation	5.50 (3.64)	5.06 (0.52)	5.63 (1.98)	0.000	5.91 (1.71)	5.26 (1.77)	0.000
Balance of Trade	6.25 (9.10)	6.41 (10.28)	5.68 (1.43)	0.000	6.91 (9.06)	5.83 (9.10)	0.000
Observations	62,237	48,375	13,862		24,174	38,063	

Notes: The table presents sample means with standard deviations in parentheses. The p-values of test of equalities of means are reported. Treat is a dummy that takes value one for the firms in countries which participated in the policy initiative of 2005, and zero otherwise. After is a dummy that takes value one for the period from 2005-2012 and zero otherwise. Firm size: Log of total assets. Liquidity: Current assets/Current liabilities. Gearing: Total liabilities/Shareholder's equity. Expansion rate: Total investments/Total assets. Operating cycle: Net sales/Net fixed assets. Cash flow: Earnings before extraordinary items plus depreciation and amortization/Total assets. Investment spending: Capital expenditures/Total assets. Tobin's Q: Sales growth is used as a proxy. GDP growth: Annual percentage growth rate of GDP at market prices based on constant local currency. Legal regulation: An index of 0 to 10 based on a survey question of "The legal and regulatory framework encourages the competitiveness of enterprises". Balance of trade: Sum of exports and imports of goods and services measured as a share of GDP.

Table 3.2: Baseline model for access to external finance

	Short-term debt to total debt	**Long-term debt to total asset**
	(1)	(2)
Treat*After	-3.110***	1.073***
	(-3.51)	(3.79)
Firm size	-5.614***	2.877***
	(-10.46)	(13.37)
Liquidity	-5.111***	0.354***
	(-19.77)	(5.89)
Gearing	-0.732***	1.209***
	(-6.06)	(15.21)
Expansion rate	-10.691***	4.534***
	(-7.17)	(7.85)
Operating cycle	0.141***	-0.031***
	(4.75)	(-4.00)
Cash flow	-0.105***	-0.081***
	(-3.83)	(-9.08)
GDP growth	-0.047	0.015
	(-0.70)	(0.59)
Legal regulation	-0.930***	0.415***
	(-3.23)	(4.35)
Balance of Trade	0.125**	0.014
	(2.53)	(0.82)
Predicted probability	63.80	8.97
N	42,117	46,061
R^2	0.074	0.109
No. of firms	5,912	6,100

Notes: In column 1 the dependent variable is short-term debt to total debt, while in column 2 the dependent variable is long-term debt to total asset. Country dummies and time dummies interacted with industry dummies are included in the models with fixed effects, clustered over firms. Robust t-statistics are reported in the parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

Table 3.3: Access to external finance and firm-level heterogeneity

	Short-term debt to total debt				Long-term debt to total assets			
	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat*After	-0.332	-6.096***	-0.756	-6.152***	0.417	1.619***	-0.279	2.131***
	(-0.26)	(-4.53)	(-0.64)	(-4.23)	(0.89)	(4.45)	(-0.54)	(6.75)
Firm size	-5.354***	-6.435***	-5.558***	-6.302***	2.870***	2.971***	2.907***	2.406***
	(-5.64)	(-7.88)	(-6.16)	(-7.84)	(7.13)	(9.42)	(7.30)	(9.25)
Liquidity	-5.344***	-5.204***	-6.770***	-4.564***	0.362***	0.419***	1.086***	0.229***
	(-11.93)	(-15.70)	(-12.07)	(-14.72)	(3.31)	(6.45)	(6.48)	(4.31)
Gearing	-0.325**	-1.320***	-0.330**	-1.448***	0.782***	1.722***	0.790***	1.727***
	(-2.23)	(-6.14)	(-2.39)	(-5.97)	(7.83)	(13.14)	(8.52)	(12.06)
Expansion rate	-7.825***	-11.527***	-9.455***	-10.954***	3.668***	4.953***	4.708***	3.716***
	(-3.42)	(-5.77)	(-4.25)	(-4.87)	(3.99)	(6.65)	(4.94)	(5.55)
Operating	0.138***	0.135***	0.124***	0.147***	-0.038***	-0.027***	-0.047***	-0.030***
cycle	(2.93)	(3.36)	(2.71)	(3.43)	(-2.86)	(-2.74)	(-2.81)	(-3.51)
Cash flow	-0.191***	-0.062	-0.173***	-0.090**	-0.016	-0.104***	0.001	-0.061***
	(-4.09)	(-1.61)	(-3.82)	(-2.36)	(-0.98)	(-9.12)	(0.04)	(-6.23)
GDP growth	-0.130	-0.021	-0.179*	0.098	0.013	0.014	0.028	-0.004
	(-1.23)	(-0.23)	(-1.90)	(1.02)	(0.30)	(0.46)	(0.63)	(-0.14)
Legal regulation	-1.618***	-0.395	-1.129***	-0.538	0.366**	0.391***	0.276	0.338***
	(-3.41)	(-1.09)	(-2.60)	(-1.40)	(2.03)	(3.68)	(1.52)	(3.40)
Balance of Trade	0.087	0.064	0.104	0.069	-0.017	0.032	-0.018	0.019
	(1.17)	(0.95)	(1.44)	(1.00)	(-0.61)	(1.62)	(-0.57)	(1.12)
Predicted probability	62.05	64.52	60.75	64.67	9.90	8.87	11.49	7.94
N	16,368	25,749	16,616	25,501	17,400	28,661	16,893	29,168
R^2	0.086	0.077	0.116	0.066	0.085	0.132	0.116	0.113
No. of firms	2,684	4,980	2,657	4,929	2,744	5,186	2,658	5,151
Test of equality								
p.value: Treat*After	0.002		0.004		0.042		0.000	

Notes: The p-value refers to the test of equality between constrained and unconstrained firms. Robust t-statistics are reported in the parenthesis. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.4: Post-policy investment and access to external finance

	Dependent variable = Investment spending	
	Short-term debt to total debt	Long-term debt to total asset
	(1)	(2)
Treat*After*Lev	-0.523**	3.450***
	(-2.26)	(5.36)
Sales growth	0.820***	0.768***
	(8.74)	(8.65)
Cash flow	0.032***	0.037***
	(6.12)	(7.72)
Lev	-1.134***	5.002***
	(-4.90)	(5.20)
Treat*After	0.487**	-0.192
	(2.09)	(-1.22)
Treat*Lev	-0.071	-3.171***
	(-0.24)	(-2.91)
Predicted probability	5.21	5.10
N	39,300	42,926
R^2	0.054	0.053
No. of firms	5,675	5,861

Notes: The dependent variable is firm-level investment spending measured as the ratio of capital expenditures to total assets. 'Lev' is measured as short-term debt to total debt in column 1 and long-term debt to total assets in column 2. Robust t-statistics are reported in the parenthesis. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.5: Firm-level heterogeneity for post-policy investment and leverage

	Dependent variable = Investment spending							
	Short-term debt to total debt				Long-term debt to total assets			
	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat*After*Lev	-0.470	-0.754**	-0.365	-0.572*	1.422	5.117***	1.553*	5.018***
	(-1.45)	(-2.10)	(-1.07)	(-1.69)	(1.47)	(5.42)	(1.87)	(3.89)
Sales growth	0.729***	0.794***	0.742***	0.775***	0.684***	0.741***	0.725***	0.689***
	(5.54)	(5.82)	(5.16)	(6.05)	(5.48)	(5.81)	(5.17)	(5.87)
Cash flow	0.016**	0.021***	0.018**	0.026***	0.022***	0.027***	0.022***	0.034***
	(1.96)	(2.78)	(2.20)	(3.50)	(2.89)	(3.89)	(2.90)	(5.06)
Lev	-1.967***	-0.650**	-1.920***	-0.673**	6.854***	3.357**	6.415***	3.869***
	(-4.79)	(-2.28)	(-4.80)	(-2.41)	(4.71)	(2.45)	(4.95)	(2.74)
Treat*After	0.126	0.772**	0.248	0.575*	-0.371	-0.111	-0.232	-0.165
	(0.37)	(2.26)	(0.73)	(1.70)	(-1.57)	(-0.49)	(-0.94)	(-0.79)
Treat*Lev	0.686	-0.295	0.605	-0.481	-3.220**	-3.002*	-4.014***	-1.654
	(1.42)	(-0.70)	(1.25)	(-1.18)	(-1.99)	(-1.88)	(-2.80)	(-0.90)
Predicted probability	4.20	5.95	4.34	5.85	4.10	5.77	4.19	5.67
N	15,715	23,585	15,914	23,386	16,707	26,219	16195	26731
R^2	0.051	0.068	0.058	0.064	0.050	0.065	0.058	0.062
No. of firms	2,542	4,588	2,513	4,556	2,594	4,787	2,513	4,769
Test of equality p.value: Treat*After*Lev	0.575		0.678		0.006		0.023	

Notes: The p-value refers to the test of equality between constrained and unconstrained firms. Robust t-statistics are reported in the parenthesis. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.4.

Table 3.6: Robustness: Propensity score matching

Panel 1:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After	-4.293***				1.379***			
	(-3.95)				(4.25)			
N	22,584				25,609			
R^2	0.093				0.119			
Panel 2:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After	-1.426	-6.770***	-0.320	-7.039***	0.470	1.681***	-0.053	1.982***
	(-0.84)	(-4.19)	(-1.57)	(-4.04)	(0.86)	(4.11)	(-0.09.)	(5.81)
N	8,707	13,877	8,650	13,934	9,561	16,048	9,000	16,609
R^2	0.103	0.110	0.134	0.096	0.111	0.157	0.126	0.139
Test of equality								
p.value: Treat*After	0.023		0.014		0.080		0.004	

Dependent variable: Investment spending

Panel 3:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After*Lev	-0.843**				4.578***			
	(-2.30)				(3.73)			
N	20,631				22,931			
R^2	0.059				0.057			
Panel 4:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After*Lev	-1.099**	-1.152**	-0.947	-1.002*	3.999**	6.480***	2.708	5.951**
	(-2.13)	(-1.97)	(-1.53)	(-1.90)	(2.16)	(3.64)	(1.51)	(2.50)
N	8,192	12,439	8,073	12,558	8,805	14,126	8,271	14,660
R^2	0.058	0.082	0.060	0.078	0.055	0.076	0.059	0.070
Test of equality								
p.value: Treat*After*Lev	0.952		0.952		0.332		0.276	

Notes: The Table reports regression results for propensity score matching technique. The remaining specifications, which are not reported for brevity, are identical to those in Tables 3.2 to 3.5. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.7: Robustness: ABF index

Panel 1:	Short-term debt to total debt				Long-term debt to total assets			
ABF index*After	-0.168*				0.097***			
	(-1.67)				(2.59)			
N	26,887				29,117			
R^2	0.066				0.100			
Panel 2:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
ABF index*After	-0.146	0.060	-0.260*	0.057	0.061	0.034	0.122*	0.008
	(-0.90)	(0.39)	(-1.88)	(0.32)	(0.95)	(0.64)	(1.74)	(0.20)
N	9,896	16,991	9,909	16,978	10,464	18,653	10,031	19,086
R^2	0.083	0.068	0.117	0.054	0.077	0.124	0.127	0.110
Test of equality								
p.value: ABF index*After	0.342		0.165		0.865		0.107	

Dependent variable: Investment spending

Panel 3:	Short-term debt to total debt				Long-term debt to total assets			
ABF index*After*Lev	-0.004**				0.021***			
	(-2.12)				(4.06)			
N	26,019				28,162			
R^2	0.044				0.042			
Panel 4:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
ABF index*After*Lev	-0.004	-0.004	-0.003	-0.003	0.010	0.021***	0.009	0.006
	(-1.37)	(-1.41)	(-1.00)	(-1.15)	(1.16)	(2.82)	(1.16)	(0.63)
N	9,946	16,073	9,928	16,091	10,511	17,651	10,054	18,108
R^2	0.034	0.061	0.037	0.059	0.034	0.059	0.035	0.059
Test of equality								
p.value: ABF index*After*Lev	0.999		0.999		0.441		0.834	

Notes: The Table reports regression results of ABF index as a measure of treatment. The remaining specifications, which are not reported for brevity, are identical to those in Tables 3.2 to 3.5. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.8: Robustness: IV regressions

Panel 1:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After	-3.426***				1.161***			
	(-3.69)				(3.89)			
N	32,555				35,776			
R^2	0.071				0.104			
Kleibergen-Paap	0.000				0.000			
Anderson-Rubin	0.000				0.000			
Stock-Wright	0.000				0.000			
Hansen J	0.778				0.698			
Panel 2:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After	-0.410	-6.425***	-0.660	-6.095***	0.343	1.784***	-0.487	2.244***
	(-0.31)	(-4.60)	(-0.52)	(-4.08)	(0.69)	(4.72)	(-0.90)	(6.77)
N	12,253	19,428	12,601	19,130	13,069	21,829	12,837	22,124
R^2	0.080	0.075	0.112	0.062	0.081	0.126	0.110	0.103
Kleibergen-Paap	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anderson-Rubin	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Stock-Wright	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J	0.693	0.562	0.456	0.361	0.624	0.841	0.811	0.898
Test of equality								
p.value: Treat*After	0.002		0.005		0.022		0.000	
Dependent variable: Investment spending								
Panel 3:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After*Lev	-2.431				7.509***			
	(-6.12)				(4.90)			
N	18,051				24,289			
R^2	0.020				0.022			
Kleibergen-Paap	0.000				0.000			
Anderson-Rubin	0.000				0.000			
Stock-Wright	0.000				0.000			
Hansen J	0.778				0.698			
Panel 4:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After*Lev	-0.623	-2.390***	0.523	-2.244***	2.368	4.918**	-1.083	8.141***
	(-1.60)	(-4.48)	(-1.11)	(-4.07)	(0.83)	(2.55)	(-0.42)	(4.01)
N	7,430	7,033	7,686	7,238	9,654	14,422	9,428	14,736
R^2	-0.140	0.029	-0.557	0.029	-0.760	0.023	-0.628	0.025
Kleibergen-Paap	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anderson-Rubin	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Stock-Wright	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J	0.693	0.562	0.456	0.361	0.624	0.841	0.811	0.898
Test of equality								
p.value: Treat*After*Lev	0.007		0.017		0.459		0.005	

Notes: Robust z-statistics for IV (2SLS) regressions are reported in the parenthesis. The remaining specifications, which are not reported for brevity, are identical to those in Tables 3.2 to 3.5. The Kleibergen-Paap is a test of under-identification distributed as chi-square under the null of under-identification. The Anderson Rubin and Stock-Wright LM statistic are weak-instrument-robust inference tests, which are distributed as F-test and chi-square respectively, under the null that coefficients of the endogenous regressors in the structural equation are jointly equal to zero, and the over-identifying restrictions are valid. Hansen J statistic is a test of the overidentifying restrictions, distributed as chi-square under the null of instrument validity. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.9: Robustness: Placebo test

Panel 1:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After	-0.467				-0.989*			
	(-0.26)				(-1.67)			
N	15,387				16,492			
R^2	0.097				0.096			
Panel 2:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After	-3.363	7.460*	-1.973	5.080	-0.399	-2.507***	-1.007	-1.446
	(-1.26)	(1.74)	(-0.84)	(1.19)	(-0.32)	(-2.69)	(-0.82)	(-1.56)
N	4,809	8,999	4,925	8,883	4,982	9,814	4,952	9,844
R^2	0.110	0.102	0.142	0.095	0.087	0.142	0.121	0.128
Test of equality								
p.value: Treat*After	0.032		0.149		0.180		0.764	

Dependent variable: Investment spending

Panel 3:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After*Lev	0.493				-0.531			
	(1.53)				(-0.67)			
N	13,145				14,049			
R^2	0.070				0.066			
Panel 4:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After*Lev	0.678	0.841	0.841	0.268	-2.438*	0.417	-1.567	2.641
	(1.28)	(1.42)	(1.54)	(0.46)	(-1.67)	(0.27)	(-1.31)	(1.25)
N	4,527	7,166	4,641	7,052	4,692	7,800	4,668	7,824
R^2	0.109	0.058	0.126	0.045	0.103	0.056	0.126	0.047
Test of equality								
p.value: Treat*After*Lev	0.841		0.478		0.174		0.084	

Notes: Table provides placebo test results. Robust t-statistics are reported in the parenthesis. The remaining specifications, which are not reported for brevity, are identical to those in Tables 3.2 to 3.5. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.10: Robustness: Including additional control variables

Panel 1:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After	-3.640***				1.302***			
	(-4.05)				(4.64)			
N	37,922				41,673			
R^2	0.078				0.099			
Panel 2:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After	-0.920	-6.844***	-1.353	-6.907***	0.709	1.912***	-0.023	2.348***
	(-0.71)	(-5.02)	(-1.12)	(-4.71)	(1.51)	(5.28)	(-0.04)	(7.42)
N	14,310	23,612	14,488	23,434	15,289	26,384	14,764	26,909
R^2	0.088	0.082	0.120	0.068	0.075	0.124	0.112	0.108
Test of equality								
p.value: Treat*After	0.002		0.003		0.046		0.000	

Dependent variable: Investment spending

Panel 3:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After*Lev	-0.740***				3.796***			
	(-3.03)				(5.52)			
N	35,828				39,292			
R^2	0.046				0.045			
Panel 4:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After*Lev	-0.471	-0.933**	-0.520	-0.695*	1.565	4.571***	1.840**	3.517**
	(-1.37)	(-2.43)	(-1.42)	(-1.94)	(1.53)	(4.37)	(2.04)	(2.31)
N	13,928	21,900	14,064	21,764	14,872	24,420	14,344	24,948
R^2	0.033	0.065	0.035	0.062	0.034	0.062	0.035	0.060
Test of equality								
p.value: Treat*After*Lev	0.368		0.735		0.039		0.342	

Notes: Table provides test results using additional control variables. Robust t-statistics are reported in the parenthesis. The remaining specifications, which are not reported for brevity, are identical to those in Tables 3.2 to 3.5. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.11: Robustness: Excluding Korea

Panel 1:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After	-3.429***				1.199***			
	(-3.58)				(3.94)			
N	34,850				38,570			
R^2	0.073				0.109			
Panel 2:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After	-0.436	-6.468***	-0.355	-6.728***	0.463	1.594***	-0.406	2.247***
	(-0.31)	(-4.51)	(-0.27)	(-4.30)	(0.92)	(4.06)	(-0.74)	(6.68)
N	14,135	20,715	14,274	20,576	15,123	23,447	14,545	24,025
R^2	0.084	0.079	0.112	0.068	0.081	0.140	0.113	0.121
Test of equality								
p.value: Treat*After	0.002		0.002		0.073		0.000	

Dependent variable: Investment spending

Panel 3:	Short-term debt to total debt				Long-term debt to total assets			
Treat*After*Lev	-0.271				2.755***			
	(-1.07)				(3.81)			
N	32,777				36,231			
R^2	0.056				0.054			
Panel 4:	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After*Lev	-0.377	-0.417	-0.303	-0.415	0.525	3.336	0.533	3.892***
	(-1.07)	(-1.05)	(-0.80)	(-1.11)	(0.50)	(3.24)	(0.58)	(2.99)
N	13,599	19,178	13,662	19,115	14,550	21,681	13,938	22,293
R^2	0.051	0.069	0.060	0.067	0.049	0.066	0.059	0.063
Test of equality								
p.value: Treat*After*Lev	0.936		0.818		0.057		0.035	

Notes: Table provides results excluding Korea. Robust t-statistics are reported in the parenthesis. The remaining specifications, which are not reported for brevity, are identical to those in Tables 3.2 to 3.5. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Table 3.12: Robustness: Alternative classification schemes

Panel 1:	Short-term debt to total debt				Long-term debt to total assets			
	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After	-0.287	-10.113***	-1.962**	-8.053***	0.604*	2.075***	0.591	2.098***
	(-0.29)	(-4.74)	(-2.12)	(-3.39)	(1.73)	(4.00)	(1.55)	(6.15)
N	25,735	16,382	25,508	16,609	27,491	18,570	25,944	20,117
R^2	0.083	0.082	0.118	0.058	0.099	0.121	0.123	0.104
Test of equality								
p.value: Treat*After	0.000		0.017		0.019		0.003	

Dependent variable: Investment spending

Panel 2:	Short-term debt to total debt				Long-term debt to total assets			
	Profit		Coverage ratio		Profit		Coverage ratio	
	Low	High	Low	High	Low	High	Low	High
Treat*After*Lev	-0.503*	-1.347**	-0.660**	-0.688	2.064***	6.012***	2.739***	2.224
	(-1.90)	(-2.57)	(-2.36)	(-1.45)	(2.65)	(4.04)	(3.72)	(0.63)
N	24,643	14,657	24,359	14,941	26,329	16,597	24,802	18,124
R^2	0.053	0.074	0.057	0.068	0.051	0.072	0.055	0.064
Test of equality p.value: Treat*After*Lev	0.142		0.096		0.019		0.487	

Notes: Robust t-statistics are reported in the parenthesis. The remaining specifications, which are not reported for brevity, are identical to those in Tables 3.2 to 3.5. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 3.2.

Chapter 3- Appendix

Table A3.1: Correlation matrix of explanatory variables

	Size	Liq.	Gearing	Exp. rt.	Op. cy.	CF	GDP gr.	LR	Trade	INV	Sales gr.
Size	1.000										
Liq.	-0.183	1.000									
Gearing	0.213	-0.314	1.000								
Exp. rt.	0.069	-0.193	0.001	1.000							
Op. cy.	-0.078	0.059	-0.032	-0.432	1.000						
CF	0.064	0.093	-0.158	0.123	-0.017	1.000					
GDP gr.	-0.095	0.022	-0.042	-0.028	0.034	0.049	1.000				
LR	-0.700	0.077	-0.113	0.113	0.048	-0.024	0.202	1.000			
Trade	-0.445	0.037	-0.033	-0.001	0.003	-0.024	0.077	0.335	1.000		
INV	0.093	-0.115	-0.015	0.306	-0.212	0.261	0.030	-0.029	-0.071	1.000	
Sales gr.	0.066	-0.048	0.022	-0.063	0.050	0.302	0.176	0.020	-0.044	0.144	1.000

Notes: Abbreviations: Size: Firm size Liq.: Liquidity. Gearing: gearing. Exp. rt: Expansion rate. Op. cy.: Operating cycle. CF: cash flow. GDP gr.: GDP growth. LR: Legal regulation. Trade: Balance of trade. INV: Investment spending. Sales gr.: Sales growth

Table A3.2: Definition of variables

Variables	Description	Source
Treat	A country dummy which takes value 1 if a country participates in ABF, ABF-2 or ABMI and 0 otherwise.	Author's interpretation
After	A time dummy which takes value 1 for years after 2005 and 0 otherwise	Author's interpretation
Treat*After	The difference-in-difference (DD) coefficient measuring the policy effect.	Author's interpretation
Firm size	Natural logarithm of total assets	Compustat Global
Liquidity	Current assets/ Current liabilities	Compustat Global
Gearing	Total liabilities/ Shareholder's equity	Compustat Global
Expansion rate	Total investments/Total assets	Compustat Global
Operating cycle	Net sales/ Net fixed assets	Compustat Global
Cash flow	Earnings before extraordinary items plus depreciation and amortization/ Total assets (%)	Compustat Global
Investment spending	Capital expenditure/ Total assets	Compustat Global
Tobin's Q	Sales growth is used as the proxy.	Compustat Global
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency.	Global Financial Database (GFD)
Legal regulation	It is a measure based on an index from 0 to 10. The survey question reads as "The legal and regulatory framework encourages the competitiveness of enterprises".	IMD WCY
Balance of Trade	Sum of exports and imports of goods and services measured as a share of GDP.	GFD Database
Legal origin	Dummy takes value 1 based on country's legal origins as British, French, German.	La porta et al. (2008)
Market capitalisation	Market capitalisation is the share price times the number of shares outstanding as a percentage of GDP.	
Crisis	A time dummy which takes value 1 for years after 2007-2010 and 0 otherwise.	Author's interpretation
Global liquidity	Global cross-border credit in Asia-Pacific region (YOY %).	BIS

Notes: The Table provides the definitions of the variables used in the models.

Chapter 4: Volatility and Firms' Exporting Decisions for Heterogeneous Firms during the Financial Crises[49]

4.1 Introduction

The breakdown of the Bretton-Woods system in 1971-73, after three decades of fixed exchange rate system, to floating exchange rates triggered a lively debate on exchange rate volatility and international trade. In 1984, International Monetary fund (IMF) conducted a study for the General Agreement on Tariffs and Trade (GATT) which examined the effects of exchange rate volatility on world trade. IMF (1984) argued however that there are various channels through which exchange rates can affect trade but exchange rate risk plays a major role. The economic literature on the relationship between exchange rate volatility and trade has evolved over time in recent decades. Two main issues in this literature are related to exchange rate volatility and currency misalignments. In the last thirty years, there has been an enormous liberalisation of capital flows resulting in an increase in the scale and variety of cross-border financial transactions. This has increased the magnitude of exchange rate movements, especially in countries with under-developed capital markets and unstable economic policies. Standard economic analysis implies that movements in exchange rates affect both value of a firm and cash flow of a firm's operations. Thus, such volatility has increased the interest of researchers in studying the exposure of multinational firms to foreign exchange rate risk.

Detailed theoretical and empirical literatures on exchange rate volatility and international trade can be found in Clark et al. (2004), Greenaway and Kneller (2007) and Auboin and Ruta (2013). The studies showing adverse effects of exchange rate volatility on the volume of international trade were widespread throughout the 1970s and 1980s. Notable examples of these studies include Baron (1976), De Grauwe and Verfaille (1988), Giovannini (1988) and Bini-Smaghi (1991). Baron (1976) argued that in a world where exchange rate volatility is the only source of uncertainty, perfect forward markets neutralise any effects of exchange rate uncertainty on trade. Further, Bini-Smaghi (1991) discussed various papers that found slight evidence of exchange rate variability on international trade and assessed some of the reason why the empirical relationship between exchange rate risk and trade could not be fully explained.

Exchange rate volatility also has a significant impact on firm value, regardless of whether a firm is considered to be domestic or foreign (Levi, 1994; Marston, 2001).

[49] I am grateful to Marina-Eliza Spaliara for providing the FAME data of UK manufacturing firms. I also thank Céline Azémar and Sai Ding for their useful comments and suggestions.

Detailed analysis of theoretical and empirical studies on firm-level exchange rate exposure is given by Muller and Verschoor (2006). This detailed study highlights the various determinants which influence a firm's sensitivity to exchange rate fluctuations, such as a firm's cost and revenue structure, elasticity of input and output markets, firm's competitive position in the market, etc. Empirical studies on exchange rate exposure provide mixed and conflicting evidence. According to Bartov and Bodnar (1994), one of the reasons for difficulty in measuring the impact of exchange rate exposure on firm value is that firms are aware of the currency risks faced by them and thus, try to eliminate this risk by hedging.

While macro-economic volatility is well studied, the impact of micro-economic volatility on export openness is unexplored in the literature. Some of the recent studies by Comin and Philippon (2005), Davis et al. (2006) and Buch et al. (2008) study the evolution of firm-level volatility over time. To the best of my knowledge, Buch et al. (2009), Vannoorenberghe (2012) and Vannoorenberghe et al. (2014) study the link between trade openness and output volatility at the firm level. Based on a panel of 500 firms from the Netherlands, Denmark and Israel, a classical chapter by Hirsch and Lev (1971) shows that firms with more diversified exports have less volatile sales, which is in line with standard portfolio theory. A recent study by Juvenal and Monteiro (2013) shows that Argentinean firms face more stable and diversified exports. Volatility can have an adverse impact on firms' profitability and performance. Shaver (2011) predicts that by diversifying sales, firms can reduce financial constraints. Exporting behaviour of firms signal higher firm quality and expected cash flow which can further increase external finance for funding investments. Thus, diversification helps in reducing volatility and improving productivity of firms (Juvenal and Monteiro, 2013), helps firms to finance investment (Shaver, 2011) and improve profitability (Wagner, 2014).

The purpose of this chapter is to study the link between macroeconomic and microeconomic volatility on firm-level exports. Specifically, this chapter looks at the impact of exchange rate volatility at the macro-level and employment growth volatility at the firm-level. The motivation comes from the fact that very few studies look at the relationship of both macro- and micro-level volatility on firms' exports. While, most studies focus on the impact of exchange rate volatility on firms' exports (Ozturk, 2006; Coric and Pugh, 2010), this chapter goes one step further and also looks at the impact of firm-level volatility on exports. The development of aggregate volatility may hide important differences across firms. If outputs across firms are imperfectly correlated, it is likely that the impact of aggregate and firm-level output volatility is developed differently

(Comin and Philippon, 2005; Buch et al., 2006). Thus, it is important to take into account uncertainties at both aggregate and firm-level to study its different impacts.

This chapter uses a unique dataset for the UK manufacturing firms over the period of 1990-2009. Focusing on UK firms is important as the UK is the fifth largest exporter in the world, which provides an interesting case study for both country and firm-level volatility on exports[50]. Another interesting aspect is related to the dataset which majorly includes unquoted and smaller firms, which are more likely to face the adversities of exchange rate and firm-level uncertainties.

There is a wide macro literature which focuses on the relationship between financial constraints and exchange rate volatility. However, these studies are generally using macro or disaggregated data at the sector-level. Caglayan and Demir (2014) and Héricourt and Poncet (2013) are the only studies which study the impact of exchange rate volatility at the firm-level. This chapter departs from these previous studies and also takes into consideration the relationship between financial constraints and firm-level volatility, in addition to exchange rate volatility. An increase in exchange rate and firm-level volatility may increase the sunk costs of exports which can hinder future earnings and investments of exporting firms. Thus, firms which are financially constrained are more likely to face the adversities of macro and micro-level uncertainties.

In addition, for the first time the differences in the responses to exchange rate and micro volatility during the European Exchange Rate Mechanism (ERM) crisis of the early 1990s and the recent global financial crisis are documented in this chapter. This chapter explores the sensitivity of the relationship between country and firm-level volatility to firms' exports for financially constrained and unconstrained firms during two major crises, namely the ERM crisis of early 1990s and the global financial crisis of 2008. The ERM crisis of early 1990s was a traditional exchange rate crisis, while the recent crisis of 2008 was mainly a banking crisis. This offers an interesting experiment to explore the differential effect of volatility to firm-level exports for different types of firms during two different types of financial crises.

Figure 4-1 displays the growing trend of the log of real export sales for the period of 1990-2009. The graph shows an upward trend during the ERM crisis period of 1990-1993 and then stabilises for the rest of the years before it falls sharply during the global

[50] This information is taken from the World Factbook maintained by the Central Intelligence Agency (CIA). The World Factbook provides information on the history, people, government, economy, geography, communications, transportation, military, and transnational issues for 267 world entities. Link: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2078rank.html.

financial crisis period of 2007-2009. Further, Figure 2 provides the graph showing the trend of both exchange rate and firm-level volatility. The panel on the left shows the evolution of exchange rate volatility over the sample period. The graph shows that exchange rate is more volatile during the ERM crisis and then dips from 1996. The exchange rate volatility again rises steeply during the end of the sample which comprises of the global financial crisis. The right panel of Figure 4-2 shows the movement of firm-level volatility for the entire sample period. The graph shows that the firm-level volatility remains constant in the initial part of the sample till 2005 and then starts to increase during the end of the sample which consists of the global financial crisis.

Overall, the graphs show that exchange rate volatility was higher during both the financial crises. However, firm-level volatility was quite stable at the initial part of the sample and started to rise sharply closer to the global financial crisis. Evidence shows that there has been a decline in aggregate volatility (Stock and Watson, 2002) and an increase in firm-level volatility (Comin and Mulani, 2006) over the past thirty years. Comin and Philippon (2005) also provide evidence that there is a negative correlation between aggregate volatility and firm-level volatility for a cross-section of OECD countries during the 1990s. Thus, it would be interesting to explore the differential impact of these uncertainties on firms' real export sales during the two different financial crises using empirical analysis.

The chapter is structured as follows. Section two provides a detailed literature review on exchange rate volatility at both macro and firm-level, and the relationship between firm-level uncertainty and trade openness. Section three gives a comparison of the ERM crisis and the global financial crisis in the context of United Kingdom. In section four the econometric modelling strategy is described. The data used in the empirical analysis, along with summary statistics, is presented in section five, and the econometric results are reported in section six. In section seven various robustness tests for the main models are included and finally, in section eight the concluding remarks are provided.

4.2 Background literature

4.2.1 Exchange rate uncertainty and trade at country-level

There is a vast empirical literature on exchange rate uncertainty and trade conducted by academics and policy-oriented economists in support of theoretical considerations, but it provides mixed results similar to the theoretical models. Studies such as Taglioni (2002), Coric and Pugh (2010) and Ozturk (2006) found 33 studies showing a negative relationship between exchange rate variability and trade volume and 25 studies leading to

the opposite conclusion. IMF (2004) made an attempt to get some conclusive results and found that there was no obvious (negative) association between exchange rate volatility and trade. IMF (2004) used a gravity model which controlled for the determinants of trade patterns other than exchange rates such as GDP (or demand), distance positions and other factors influencing transaction costs relevant to bilateral trade. The results show little evidence of exchange rate variability affecting differentiated or homogeneous products differently, providing little support to earlier theoretical findings. Further, Rahman and Serletis (2009) showed a negative relationship between exchange rate volatility and exports in UK, but exports responded asymmetrically to negative and positive shocks of exchange rate. Chit et al. (2010) investigated exports in five emerging Asian economies and in thirteen industrialised countries. Their results show that exchange rate volatility has a negative and significant impact on exports of emerging Asian economies to the world market.

The early work by Hooper and Kohlhagen (1978) utilized the model of Ethier (1973) and examined the impact of exchange rate volatility on aggregate and bilateral trade flow data for all G-7 countries except Italy. Cushman (1983) used a similar model as Hooper and Kohlhagen (1978) and found a negative and significant effect of volatility for six out of fourteen cases of bilateral trade flows between industrial countries. Finally, the IMF (1984) used the simplified version of Cushman's model to estimate bilateral exports between G-7 countries for the period of first quarter of 1969 to the fourth quarter of 1982. Variability had a significantly negative coefficient in only two cases, while positive coefficients were significant in several cases.

A number of papers studied the empirical relationship between exchange rate depreciation and export surges. Fang et al. (2006) explored the effect of exchange rate depreciation on exports for Asian economies such as Malaysia, Philippines, Indonesia, Japan, Singapore, Chinese Taipei, Republic of Korea, and Thailand. They found that depreciation of currency reduced exports for most countries but its contribution to export growth varied across countries. Bernard and Jensen (2004) studied the sources of manufacturing export booms for US between 1987 and 1992 and found that changes in exchange rates were an important determinant of the rise in exports.

Some recent studies focused on cross-country analysis. For example, Wei (1998) used data on 1000 country pairs and found no evidence in the data to validate the role of hedging hypothesis. Further, he found that country paired with large trade potential and exchange rate volatility deterred goods trade to a larger extent. Dell'Ariccia (1999) analysed the impact of exchange rate volatility on the bilateral trade of 15 EU members

and Switzerland over the period of 1975-1994, using different measures of exchange rate uncertainty. The results showed that exchange rate has small but negative impact on trade. Reducing volatility to zero in 1994 resulted in an increase in trade by 10 to 13 percent, depending on the measure of variability. Arize et al. (2000) focused on the impact of exchange rate volatility on export demand to less developed economies and found a negative relationship in both short-run and long-run.

Doganlar (2002) studied the impact of exchange rate volatility on the exports of five Asian economies. The results showed that exchange rate volatility reduced real exports which meant that exporters in these countries were risk-averse. With the increase in exchange rate volatility, producers in these countries preferred to sell in domestic markets rather than foreign markets. Chit (2008) examined the impact of exchange rate volatility on the bilateral exports within ASEAN-China Free Trade Area (ACFTA) for the period from 1982:Q1 to 2005:Q1. The results showed that bilateral real exchange rate volatility had a significant and negative impact on bilateral exports of ACFTA countries. These results were also robust to different estimation techniques and model specifications.

Using a sample of 12 industrialised countries, Hondroyiannis et al. (2008) studied the relationship between exchange rate volatility and aggregate export volumes. A model with real export earnings of oil-exporting economies as a determinant of export volumes was used for estimation over the period of 1977:1–2003:4. The results showed little evidence of a negative and significant effect of volatility on trade. Calderón and Kubota (2009) examined the ability of trade and financial openness to mitigate or exacerbate real exchange rate volatility using a sample of industrialised and developing countries for the period of 1975-2005. Using the method of instrumental variables, they found that high exchange rate volatility was caused by the volatility of productivity shocks, monetary and fiscal policy shocks. Also, countries which were related to international markets of goods and services faced less volatility of real exchange rate. Finally, financial openness increased the fluctuations in the real exchange rate.

Alvarez et al. (2009) examined the impact of exchange rate volatility on the exported quantity of goods (intensive margin) and on the range of goods (extensive margin). They found that exchange rate volatility had a negative impact on trade as countries reduced the number of goods exported. In addition, they found that exchange rate volatility made countries to choose a narrow set of exported goods, particularly in developing countries with export concentration.

Arize et al. (2008) empirically investigated the impact of exchange rate volatility on the export flows of eight Latin American countries over the quarterly period 1973–2004. The results showed that with an increase in volatility of real effective exchange rate, approximating exchange rate uncertainty, there is a significant and negative effect on export demand in both short-term and long-term for each of the Latin American country. Haddad and Pancaro (2010) provided evidence of the relationship between the real exchange rate and export expansion. They found a positive relationship between the two variables but for countries with low per capita income. However, in the longer run the impact of undervaluation on exports became insignificant for different levels of income.

Caglayan et al. (2010) investigated the effects of exchange rate uncertainty and financial depth on manufacturing exports from 28 emerging countries over the period of 1978-2005. They show that for majority of the countries exchange rate uncertainty had a negative effect on the South-South and South-North trades. In some cases, this effect was also unidirectional; that is, South-South or South-North. Finally, they showed that while financial depth has a positive effect on exports, exchange rate volatility has a negative impact on exports. Arunachalaramanan and Golait (2011) examined the impact of an appreciation of Chinese Renminbi (RMB) on India's bilateral trade with China. The results showed that an appreciation of the RMB against the Rupee improved bilateral trade balance from the Indian perspective. Thus, an appreciation of RMB increases the cost of intermediate products that are not easily substitutable in the short-run.

Freund and Pierola (2012) examined the determinants of 92 episodes of export surges and found that large depreciations of the real exchange rate was an important determinant of export surges especially in developing countries. Nicita (2012) investigated the impact of misalignments on trade estimating fixed effect models for a panel data on 100 countries for the period of 2000-2009. They found that currency devaluation promote exports and reduces imports, contrary to currency overvaluation. These misalignments across currencies have a diversion effect quantifiable at about 1% of world trade. Manova (2013) showed that when financially developed countries became exporters, they were more likely to export bilaterally and ship greater volumes and sell more of each volume.

4.2.2 Theoretical evidence on exchange rate exposure at micro-level

There are various approaches which analytically describe how currency fluctuations can affect firm value. Lessard (1979) was the first to document the degree to which the nature of currency risk exposure changed as the period for which one considered exposure was farther in the future. Later, Stulz and Williamson (2000) split the overall impact of

exchange rate movements on firm value differentiating between transaction-translation exposure, contractual exposure, and competitive exposure, respectively.

Transaction exposure refers to the exposure a firm is facing regarding of its commercial transactions which have already been booked. The terms of these transactions are settled at a given point of time and hence it is easier to measure their exposure by accounting systems. It is important to also take into account the implicit or explicit contractual agreements while measuring the overall exchange rate exposure. Such commitments create contractual exposure. A firm's value of domestic and foreign assets and liabilities are also affected by the currency fluctuations which cause translation exposure. The last component of exchange rate exposure called competitive exposure is measured over longer time horizons. Exchange rate fluctuations also have an impact on the relative prices of goods sold in different countries which affect a firm's competiveness in a particular market and indirectly also influences the economic environment and future development possibilities (Levi, 1994 and Marston, 2001). Direct exposures such as transaction, contractual and translation exposures are easier to manage by well-structured hedging strategies. While, indirect exposures such as competitive exposure provides variability in the cash flows of companies (Di Iorio and Faff, 2000), it is complex to correctly estimate competitive exposure (Luehrman, 1990; Williamson, 2001) and hedge it effectively.

Some authors tried to get a clearer view of the mechanism of exchange rate exposure and built theoretical models to capture the impact of exchange rate volatility on firm value in an analytical way. Shapiro (1975) made the first attempt to model the relationship between firm value and exchange rates. He used a two-country model predicting that a depreciation of the home currency led to an increase in the value of a domestic firm and a decrease in the value of foreign firms. Dumas (1978) and Hodder (1982) elaborated on this Shapiro's model considering a company with both domestic and foreign activities. Describing the impact of currency fluctuations on the profit function that allowed for purchasing, sales and payment collection at three different points in time, Dumas (1978) suggested that a firm's total exchange rate exposure was a function of future exchange rate volatility, macroeconomic effects and the responsive behaviour of the firm. Hodder (1982) took the value of a firm as a starting point and showed that a firm's exchange rate exposure could be divided into four parts- the domestic price related exposure, the foreign real asset exposure, the inflation related exposure and the firm's fully exposed foreign borrowing exposure. Hodder showed that even a domestic firm could be exposed to

exchange rate uncertainties and this exposure was contingent upon the adjustment of prices.

Cornell and Shapiro (1983) and Flood and Lessard (1986) developed another set of models driven by financial intuition. The main idea was that a firm's value was the present value of its current and future cash flows and hence the exchange rate exposure could be estimated by looking at the effects of exchange rate movements on these cash flows. Flood and Lessard (1986) analysed the operating exposure of firms and distinguished between the competitive and the conversion effect of exchange rate volatility. Further, Booth and Rotenberg (1990) generalised Flood and Lessard's model and included commodity arbitrage constraints. The model showed that the key variables influencing currency risk exposure of companies included firm's real price and cost structure, its discount rate, the transaction costs related to the economic barriers to arbitrage, etc.

In another model by Hekman (1985), corporate valuation theory, corporate macroeconomic connections and an expectation theory of exchange rate movements were related. Assuming perfect capital markets, a Cobb-Douglas production function with constant production parameters and constant returns, he explored the impact of exchange rate fluctuations on three components of corporate value which included the value of after-tax, non-financial, operating cash-flows and the value of outstanding debt. This model highlighted the relevance of investment financing choices and hedging decisions.

Tufano (1996) also contributed in understanding that financial risk exposure was of high interest. The interesting feature of this model was that observed exposure decreased as the volatility of gold prices increased. This conclusion was extended to currency risk exposure by Friberg and Nydahl (1997) who found that more volatile exchange rates had less impact on competition and exchange rate pass-through. Levi (1994) explored the relationship between firm value and exchange rates from a micro-point of view of a firm. He developed a multi-currency model, taking into account both the tax rate and firm's net monetary asset and liability position for each currency. He showed that the impact of exchange rate volatility was inversely related to the tax rate and the opportunity cost of capital.

Allayannis and Ihrig (2001) used a Taylor series expansion of the value of a firm around a date state variable and showed that exchange rate changes affected a firm's returns through three channels: the competitive structure of the market, the export share and the import share. Marston (2001) extended this analysis of different competitive

structures and showed that economic exposure was dependent on marginal cost behaviour, product demand elasticity, and output reaction of firms.

Bodnar et al. (2002) used a duopoly model to distinguish between three different impacts of exchange rate volatility on firm's value. The first was related to the impact of exchange rate volatility on profits, the second one related to the impact of the exchange rate movements on the share of total expenditure borne by the exporter and the final one was related to the influence on the domestic-currency profit margin of the exporter due to price changes. Thus, Bodnar et al. (2002) showed a link between the exchange rate exposures and the impact of pricing on profitability pass-through effects. The model implied a negative relationship between product substitutability and pass-through and thus, a positive correlation with exposure. Bartram et al. (2010) extended prior theoretical models to document a global firm's foreign exchange exposure and empirically showed that firms pass through part of the currency changes to customers to utilise both operational and financial hedges. They showed that for a typical firm, pass-through and operational hedging reduced exposure by 10-15% and financial hedging with foreign debt reduced exposure by about 40%.

To summarise, these contributions indicated the sensitivity of firm value to exchange rate volatility depends on various factors such as the nature of a firm's activities, import and export structure of firms, competitiveness of the input and output markets.

4.2.3 Empirical evidence on exchange rate exposure and trade at micro-level

Focusing on firms, rather than on aggregates helps to address the problem of endogeneity arising from the feedback effects of aggregate trade flows on exchange rates. Abbott et al. (2001) examined the impact of exchange rate volatility on UK exports in the period of floating sterling 1973Q2- 1990Q3. The results showed that long-run exchange rate variability did not have any significant influence on UK export volumes. Vita and Abbott (2004) investigated the impact of exchange rate volatility on UK exports to EU countries. They used monthly data for the period 1993m1 to 2001m6 divided by market of destination and sectors. Their results at both aggregate and sectoral level showed that UK exports to EU14 were income elastic, relative price inelastic and largely unaffected by short-term exchange rate volatility. While, long-term measure of volatility showed a negative and significant influence on UK exports to EU countries.

Harchaoui et al. (2005) used industry-level data for 22 Canadian manufacturing industries to examine the relation between exchange rates and investment during 1981-97. The results showed that there was an insignificant effect of exchange rates on total

investments. Using sectoral data, Byrne et al. (2008) studied the impact of exchange rate volatility on the volume of bilateral US trade. Their findings showed that by distinguishing trade into differentiated goods and homogeneous goods, exchange rate volatility has a significant and negative effect across different sectors, with stronger effect for exports of differentiated goods.

Todani and Munyama (2005) examined the characteristics of short-term South African exchange rate volatility and investigated its impact on South African export flows for the period 1984 to 2004. The results showed that there was no significant relationship between exchange rate volatility and export flows in South Africa or when a significant relationship exists, it was positive. Muûls (2008) analysed the interaction between credit constraints and export behaviour at firm-level. The results showed that the chances of firms being exporters were higher if they enjoyed lower credit constraints and higher productivity levels. Further, an exchange rate appreciation influences existing exporters to reduce their exports, entry of credit constrained exporters and exit of less productive exporters.

Greenaway et al. (2006) studied the effect of exchange rate movements on firms' decisions on entry, exit and export share. The results on UK manufacturing firms showed that exchange rate movements had little impact on firms' export participation and exit decisions. On the other hand, it had a significant impact on export share of firms after entering export markets. While analysing the export behaviour of multinational firms, they found that the export behaviour of these firms were less sensitive to exchange rate changes compared to the indigenous firms.

Greenaway et al. (2007) used a panel of 9292 UK manufacturing firms over the period of 1993-2003 to explore the link between firms' export market participation and financial health. The results showed that exporters displayed better financial health than non-exporters. Similarly, continuous exporters were financially better-off compared to the starters. Further, they did not find any evidence that firms with better ex-ante financial health were more likely to start exporting. Greenaway and Kneller (2008) focused on exporting UK manufacturing firms in the period of 1988-2002 in order to isolate the impact of participation in export markets. They found that the proportion of UK firms in the exports market had increased in recent years. Regional and industry agglomerations were important for successful entry of new exporters. Finally, these exporters were also larger and had higher productivity.

Greenaway et al. (2010) studied the effects of exchange rate uncertainty on firm decisions on export market entry and export intensity for UK manufacturing firms from 1988 to 2004. The results showed that exchange rate uncertainty has little impact on firms' export participation but a major impact on export intensity. Greenaway et al. (2010b) studied the effect of exchange rate changes on firms' export decisions. They extended the analysis by considering the changes in imported intermediaries. The results showed that the negative impact of exchange rate on exports of existing exporters is lower in the industries which import a larger share of their intermediate inputs. Taking into account firm-level heterogeneity, they found that larger firms respond more to the changes in the imported input-weighted exchange rate, while firms with the greatest export sales are affected less.

Berthou and Fontagné (2008) studied the effects of introduction of the Euro on trade. Using French firm-level exports data over a period of 1998-2003, they computed intensive and extensive margins of exports. The estimated results showed the existence of a differentiated effect of the Euro on French exports. Finally, they did not find any differentiated effect of the Euro between Eurozone and non-Eurozone destinations, suggesting that the Euro had a positive effect on French exports to non-Eurozone countries. Solakoglu et al. (2008) used annual firm-level data for 500 firms in Turkey for the years 2001 and 2003 to study the relationship between real exports and exchange rate volatility. The results showed that there was no negative or positive relationship between volatility and real exports. Further, they found that level of international activity and firm size did not influence the volatility effect on exports but firms used import revenue to lower exchange rate exposure.

Bellone et al. (2010) analysed the relationship between financial constraints and firms' export behaviour. The results showed that firms which are financially healthy are more likely to become exporters and financial constraints act as barriers to export participation. Firms which have better access to external finance are more likely to start exporting. Berman and Héricourt (2010) used a large cross-country and firm-level data of nine developing and emerging economies to study the effect of financial factors on firms' exporting decisions and exporting volumes. The results showed that firms' access to finance plays an important role in their entry decision to enter the export market. However, better financial health does not increase the probability of a firm remaining in the exporting market. They further find that productivity is an important determinant of exporting decision of firms if firms have better access to external finance. Finally, they

found that an improvement in a country's financial development has a positive impact on both number of exporters and exporters' selection process.

Using a firm-level data base, Berman and Héricourt (2011) found that currency depreciation had two opposite effects on exports for firms which were indebted in foreign currency. It included a pro-competitive effect which increased both the amount of exports by firms and the number of firms. While, a balance-sheet effect forced firms to leave the export market and reduce the number of firms. These results explained the negative relationship of trade after the emerging market crises and gave a finance-based empirical foundation to the "exchange rate disconnect puzzle".

Berman et al. (2012) presented a model to analyse the reaction of exporters to exchange rate changes in the presence of distribution costs in the export market. Using French firm-level data for 1995-2005 with destination-specific export values and volumes, they showed that high performance firms reacted to depreciation by increasing their export price instead of export volumes.

The firm-level analysis of Taglioni (2012) provided a pessimistic result of a direct negative relationship between exchange rate appreciation and export growth in the short-run. The author gave the argument that the impact of exchange rate appreciation on trade differed across intensive and extensive margins of trade. The author also found evidence which supported the offsetting effects of a change in the exchange rate on different margins of trade using firm-level data on Chile, Macedonia, Pakistan, and Turkey.

Cheung and Sengupta (2013) investigated the real effective exchange rate (REER) effects on the share of exports of Indian non-financial sector firms for the period 2000–2010. Their main findings showed that there was a significant negative impact of exchange rate volatility on export shares of Indian firms. Also, Indian firms which had smaller shares of exports had stronger response to REER volatility and change.

Héricourt and Poncet (2013) analysed 100,000 Chinese exporters over the 2000–2006 period to study the impact of real exchange rate volatility on export performance. They confirmed a deterring effect of exchange rate volatility on trade. They extended this analysis and highlighted the importance of financial constraints in determining the macro-effect of REER volatility in real outcomes.

Manova et al. (2011) used Chinese exports data at firm-product-destination level to investigate how comparative advantage of firms reflected local credit constraints. They showed that foreign-owned firms and joint ventures displayed better export performance

compared to private domestic firms, with a greater advantage in sectors with higher financial vulnerability. They further found that private Chinese firms were more successful exporters than state-owned enterprises in financially dependent industries.

Caggese and Cuñat (2013) developed a dynamic model which showed that financial frictions affected decisions of new firms to enter the domestic market along with the riskiness of operating firms. In particular, the model predicted that financial frictions reduced the ability of firms to finance the fixed costs of entering the export market. Further, they predicted that financing frictions reduced the aggregate productivity gains encouraged by trade liberalisation by 30%-50% as they distorted the selection into export of the most productive firms.

Caglayan and Demir (2014) investigated the effects of exchange rate volatility on productivity growth of manufacturing firms with heterogeneous access to debt, domestic and foreign equity markets in Turkey. They found that volatility had a negative effect on productivity growth even if firms had better access to debt and equity markets. They also found that productivity was positively related to credit market access and export-oriented firms reacted positively to currency appreciations and were hurt more from volatility.

4.2.4 Firm-level uncertainty and trade-openness

Over the past thirty years, a decline in the aggregate volatility has been documented by studies such as McConnell and Perez-Quiros (2000), Stock and Watson (2002). While, at the firm-level there is an increase in volatility. Firm-level volatility can be measured using financial or real data. Comin (2000) and Campbell et al. (2001) used financial data for the US and documented an increase in the volatility of idiosyncratic stock returns. Use of accounting data showed an increase in idiosyncratic volatility of sales, employment, earnings and capital expenditures (Chaney et al., 2002; Comin and Mulani, 2006).

Buch et al. (2006) provided a theoretical model of trade openness and output volatility. They showed that there are mainly three factors which can affect volatility of output. Firstly, domestic and exporting firms might react in a different way as they have different elasticities of their labour demand and supply. Studies such as Fabbri et al. (2003) and Navaretti et al. (2003) showed that multinational firms have higher elasticity of labour demand compared to the national firms. Between the period of 1961 and 1991, Slaughter (1996) found that the demand for US production labour demand was more elastic while there was no significant change in the elasticity of demand for non-production labour.

Secondly, exporting firms are exposed to domestic and foreign demand shocks and technology shock in the domestic market. While, domestic firms only face shocks in the domestic market. Finally, the correlation between domestic and foreign demand shocks affect the exposure of firms which in turn affects output volatility. If the shocks are correlated imperfectly across countries, then exporting firms might benefit from the diversification effect, reducing the volatility of output.

There are not many empirical studies which study the link between output volatility and export openness at the micro-level. Di Giovanni and Levchenko (2009) studied the impact of trade openness and output volatility using an industry-level dataset of manufacturing production and trade. Their results showed that sectors which are more open to international trade are more volatile and trade is accompanied by increased specialisations. Finally, they found that the marginal impact of openness on volatility doubled in the last thirty years, which implied that trade became more closely related to volatility over time. Buch et al. (2009) studied the link between export openness and output volatility at the firm-level. They showed that firm-level volatility was higher than the level of aggregate volatility and exporters had a lower volatility of sales compared to non-exporters. As firms increase their international interactions by becoming exporters, output volatility declines. Finally, they found that smaller firms face higher volatility of output.

Caglayan et al. (2012) investigated the empirical linkages between sales uncertainty and firms' inventory investment behaviour while controlling for firms' financial strength. They found that higher sales uncertainty leads to increase in stocks of inventories. They also found that firms with more liquid assets and net trade credit are able to respond to demand shocks efficiently. Thus, the effects of sales uncertainty are stronger for firms which are financially constrained and smaller in size. García-Vega et al. (2012) studied the link between firms' earnings volatility, financial constraints, survival probabilities and export market participation by constructing a dynamic monopolistic competition model with heterogeneous firms. Using a panel of 23,674 UK firms over the period 1993–2006, they showed that trade enables firms to smooth their sales, resulting in a reduction of financial constraints and average probability of bankruptcy.

Vannoorenberghe (2012) studied the impact of exports in the total sales on firm-level volatility. They showed that the share of exports in firms' total sales has a positive and significant impact on the volatility of sales. Further, they pointed that output variations on domestic and export market are negatively correlated at the firm-level. Further, it is shown that export share of firm influenced domestic sales and export volatility.

Di Giovanni et al. (2013) used a database of French firms for the period 1990-2007 to study the role individual firms in generating aggregate fluctuations. They created a multi-sector model of heterogeneous firms which sold to multiple markets in order to justify a theoretically-founded decomposition of firms' annual sales growth rate into different components. They found that the main components contributing to aggregate sales volatility are the firm-specific factors, mattering as much as the factors which capture shocks across firms within a sector or country.

Denis and Kannan (2013) studied the economic impact of uncertainty shocks in the UK during the recent global financial crisis. They found that uncertainty shocks have a significant impact on economic activity, mainly on industrial production and GDP in UK. They measured uncertainty shocks using stock-market volatility and dispersion of one-year ahead forecasts of GDP in UK. Firm-level stock volatility is highly correlated with the real sales growth volatility (Bloom et al., 2007). Their results showed that the impact of uncertainty on industrial production in UK is quite similar to that of the US both qualitatively and quantitatively. However, unemployment is less affected by uncertainty shocks. Finally, uncertainty shocks reduce industrial production by about a quarter of the decline in industrial production during the recent crisis.

Vannoorenberghe et al. (2014) used Chinese firm-level data to show that small exporting firms which sell to more diversified countries have more volatility in exports, compared to larger exporters. This is because a more diversified pool of destinations make small exporters more likely to export occasionally to some markets, resulting in an increase in volatility. Görg and Spaliara (2014a) used firm-level data for UK to investigate the link between export market participation decisions and firm growth and survival during the recent financial crisis. They showed that the financial variables played an important role in predicting export market entry, especially during the financial crisis. They also found that exporters mainly continuous exporters performed well compared to non-exporters, both in and out of the crisis.

Overall, the studies above provide a useful background to setup a linkage between macroeconomic and firm-level volatility to trade openness of firms. However, the studies focused on UK do not take into account the two financial crises of early 1990s and the global financial crisis together.

4.3 Comparison of UK's trade scenario during the ERM crisis and the global financial crisis

This section highlights the United Kingdom's experience during the 1990-93 crisis, as well as during the 2008-09 crisis from a macroeconomic aspect. In the early 1990s, the UK entered into a recession termed as the 'European Exchange Rate Mechanism (ERM) crisis', generated by the double digit inflation of consumer prices from the strong growths at the end of 1980s. The tightening of monetary policy resulted in falling of house prices and a decline in consumer confidence. Due to UK's membership of the ERM, its interest rates were maintained at higher level and had to face inconsistent monetary tightening policy, even though UK's economy was contracting with higher unemployment rates. Thus, when UK decided to withdraw its membership from the ERM in September 1992, the interest rates were free to come down (Fender, 2010).

The ERM crisis was a foreign exchange crisis similar to the previous exchange rate crises of 1949 and 1967 where the UK was forced off an unsustainable exchange rate peg. During the UK recession of the early 1990s, output fell only during the third quarter of 1990. However, unemployment rate was at its peak at 10% in 1992. The ERM crisis occurred when the UK economy was already emerging from the bottom of the recession from the late 1980s. It led to a change in the monetary policy regime of UK to inflation targeting regime. The ERM crisis contributed in improving the rate of growth and the process of growth more stable in UK (OECD, 2010). The UK recession of 1990s did not have much impact on UK's exports. The trade surplus in Q1 1995 stood at £3.3 billion (1.4% of GDP) compared to a trade deficit of £4.6 billion (2.2% of GDP) in the period of Q2 1985-Q4 1988. This trade surplus was supported by the increase in exports, declining imports and persistent depreciation of Sterling, which reduced the severity of the recession (Fender, 2010).

The recovery from the ERM crisis was fast and impressive as the real GDP growth was 3.8% in 1994, with the lowest inflation in 27 years and unemployment fell significantly. This stability of output growth and low inflation suggested that the widespread structural reforms launched in the 1980s made the UK economy more competitive, flexible and less-inflation prone (OECD, 2010).

Vigfusson et al. (2009) accessed the exchange rate sensitivity of export prices and found that the movements in the exchange rate sensitivity of export prices over time have been significantly affected by the country and region-specific shocks such as the Asian financial crisis (for emerging Asia), deepening integration with the United States (for Canada), and the effects of the 1992 ERM crisis (for the United Kingdom). For the United

Kingdom, the rolling regression estimates of Nominal Effective Exchange Rate (NEER) from a ten-year window showed an upward trend in the exchange rate sensitivity through much of the sample period, but it is rapidly reversed in the early 2003. The decline in the exchange rate sensitivity of UK export prices at that time reflected that the impact of the 1992 ERM crisis had finally rolled out of the sample.

In contrast, the recent financial crisis of 2008 was a banking crisis which led to an economic crisis. This crisis was global caused by the collapse of the sub-prime mortgage market in the US. There has been an exceptional drop in the world trade during the last quarter of 2008 and the first quarter of 2009. This drop in world exports was due to a sharp deterioration of worldwide demand and activity, which was severe in the rich club of OECD countries (Araújo and Oliveira-Martins, 2011). Limited availability of trade credit and financial shortages may have led to higher risk aversion and negative confidence effects, which is another important determinant of the global downturn (Auboin, 2009; Bricongne et al., 2012).

OECD (2010) pointed out that the UK in particular was hit the hardest from the global financial crisis as the economy was exposed to the crisis due to its large financial sector and strong cross-border linkages through trade. On the trade side, export volumes dropped by 20% annualised in the last quarter of 2008 and the first quarter of 2009. Since the global recession, both imports and exports of goods have contracted, reflecting a decline in both domestic and foreign demand, respectively. From the last quarter of 1995 till the final quarter of 2007, the trade worsened with a deficit of £12.9 billion. As per the recent DBIS (2011) report, UK's imports and exports totalled USD 1256 billion in 2009 which is equivalent to 4.3% of world trade. From 2008 to 2009, UK's exports dropped by 22.1% in USD and imports by 22.5% in USD. Following the final quarter of 2007, the trade deficit narrowed as both imports and exports fell due to contraction in both domestic and foreign demands in the global recession of 2008. The UK had a persistent downturn than the majority of OECD economies and the effective sterling exchange rate fell by 20% in the second half of the 2008 (Fender, 2010).

In the ERM crisis the government did not implement any extraordinary measures but in the present global crisis UK used a set of extraordinary measures. Since UK is a part of the EU, EU issued a set of guidelines early in the crisis to preserve the financial stability and ensure fair competition. The assistance implemented in UK during the global financial crisis included liquidity support provided by the Bank of England. During the global crisis, it was difficult for both banks and non-financial firms to raise money from the bond markets and bank lending was also under serious pressure. Hence, Bank of

England provided easy credit by buying high quality commercial debt form the secondary market (OECD, 2010).

The evidence above provides an analysis of the impact of the two financial crises in UK. Further, this chapter explores the relationship between both exchange rate and firm-level volatility on trade taking into account firm-level heterogeneity and two recent financial crises. In the following sections this chapter provides the estimation strategy and data.

4.4 Econometric background of fixed effects estimation

Consider the linear unobserved effects model for T time periods:

$$y_{it} = x_{it}\beta + c_i + u_i,\ t = 1, \dots\dots, T \qquad (20)$$

The T equations in the above model can be written down as:

$$y_i = X_i\beta + c_i j_T + u_i$$

where $\boldsymbol{j_T}$ is still the T x 1 vector of ones. This equation represents a single random draw from the cross section.

The fixed effects assumptions are the following:

Assumption 1: E $(u_{it}|x_i, c_i) = 0, t = 1, \dots\dots, T$.

This assumption is of strict exogeneity of the explanatory variables conditional on the unobserved effect, c_i. Estimating β under this assumption transforms the equation by eliminating the unobserved effect c_i. The fixed effects transformation, also called the within transformation, is obtained by first averaging the equation over $t = 1, \dots\dots, T$ to get cross section equation:

$$\bar{y} = \bar{x}_i\beta + c_i + \bar{u}_i \qquad (21)$$

where $\bar{y}_i = T^{-1}\sum_{t=1}^{T} y_{it}$, $\bar{x}_i = T^{-1}\sum_{t=1}^{T} x_{it}$, and $\bar{u}_i = T^{-1}\sum_{t=1}^{T} u_{it}$. Subtracting equation (21) from equation (20) for each t gives the fixed effects (FE) transformed equation,

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)\beta + u_{it} - \bar{u}_i$$

or

$$\ddot{y}_{it} = \ddot{x}_{it}\beta + \ddot{u}_{it},\ t = 1,2, \dots\dots, T$$

where $\ddot{y}_{it} = y_{it} - \bar{y}_i$, $\ddot{x}_{it} = x_{it} - \bar{x}_i$ and $\ddot{u}_{it} = u_{it} - \bar{u}_i$. The time demeaning removed the individual specific effect c_i.

Assumption 2: To ensure that the FE estimator is asymptotically well behaved, a standard rank condition on the matrix of time-demeaned explanatory variables is required:

rank $\left(\sum_{t=1}^{T} E(\ddot{x}'_{it}\ddot{x}_{it})\right)$ = rank $[E(\ddot{\boldsymbol{X}}'_{it}\ddot{\boldsymbol{X}}_{it}]$ = K.

If x_{it} includes an element that does not vary over time for any i, then the corresponding element in $\ddot{x}_{it}$ is identically zero for all t and any draw from the cross sections. The fixed effects estimator can be expressed as

$$\hat{\beta}_{FE} = \left(\sum_{i=1}^{N} \ddot{X}'_i \ddot{X}_i\right)^{-1} \left(\sum_{i=1}^{N} \ddot{X}'_i \ddot{y}_i\right) = \left(\sum_{i=1}^{N}\sum_{i=1}^{T} \ddot{x}'_{it}\ddot{x}_{it}\right)^{-1} \left(\sum_{i=1}^{N}\sum_{i=1}^{T} \ddot{x}'_{it}\ddot{y}_{it}\right)$$

It is also called the within estimator as it makes use of the time variation within each cross section (Wooldridge, 2002).

4.5 Empirical Methodology

4.5.1 Baseline Model

This section studies the impact of both macroeconomic and firm-level volatility on firms' exporting decisions. The baseline model borrows mainly from Greenaway et al. (2010). Following Greenaway et al. (2010), the dependent variable of firm-level exports is measured as the natural logarithm of real export sales. The following baseline model is estimated:

$$Log(Exports)_{it} = a_0 + a_1 REER\_Volatility_t + a_2 Firm\_Volatility_{it} + a_3 \mathcal{X}_{it} + e_{it}, \quad (22)$$

where i = 1, 2, …., N refers to the cross-section of units (firms in this case), for time period t = 1, 2, …., T. $REER\_volatility$ refers to the exchange rate uncertainty at the macro-level. Using monthly real exchange rate series[51], a GARCH (1,1) model is implemented and the monthly measures are annualised to match the frequency of the panel data (Caglayan and Demir, 2014)[52]. $Firm\_volatility$ is measured by employment growth (Comin and Philippon, 2005). Following Buch et al. (2009), it is calculated as the

[51] Real exchange rates are more accurate and superior indicators of changes in competitiveness which are calculated after correcting for the movements in nominal exchange rates for inflation differentials. Effective exchange rate changes are not measured against one particular currency, but instead use an average index of a whole basket of currencies, each weighted according to the issuing countries' respective importance as a trade partner (UNCTAD, 2012).

[52] This measure resembles the volatility clustering which is often found in high frequency financial series (Caglayan and Demir, 2014).

squared residual of a regression of employment growth on its own lagged values and a set of time fixed effects[53]. The baseline model is estimated using firm fixed effects to control for unobserved heterogeneity at the firm-level. Time dummies are included to control for cyclical factors originating from the business cycle. In addition, industry dummies are also included that control for fixed effects across industries. Finally, X is a vector which includes other explanatory variables at the firm-level, e_{it} are the disturbance terms.

Vector X contains various factors which influence firm-level exports in line with the literature. Firms' decision to export is based on a combination of sunk cost and firm-level factors (Melitz, 2003). Exporting is associated with additional upfront expenditures that make production for foreign markets more dependent on external financing. Sunk costs of trade involve collecting information about the profitability of potential export markets; setting up and maintaining foreign distribution networks; making market-specific investments in capacity, product customisation and regulatory compliance (Manova, 2013).

To begin with firm specific characteristics, firm size is an important determinant of exports. *Firm size* is measured as the natural logarithm of total real assets (Mizen and Tsoukas, 2014). Firms which are larger in size are able to cope well with financial constraints and have greater access to external funds, which is necessary to finance the sunk and fixed costs of exports (Cheung and Sengupta, 2013). *Labour productivity* of firms is calculated as the natural logarithm of the ratio of total real sales to total number of employees (Greenaway et al., 2010b). This variable also captures the efficiency of the firms[54]. Efficient firms are more likely to handle unfavourable movements in exchange rates and output levels in a better way. Also, productivity of firms is one of the important determinants of export market decision as more productive firms are less likely to exit the market (Görg and Spaliara, 2013). Following Greenaway et al. (2010b), firm's *age* is measured as the natural logarithm of the number of years after establishment. Firms' age is an important factor affecting sales growth as older firms might have more experience advantages enabling them to sustain international growth (Autio et al., 2000). Finally, *collateral* is measured as the ratio of net tangible assets to total assets, which captures the ability of firms to borrow externally (Cheung and Sengupta, 2013). According to Manova (2013), higher collateralised firms are able to offset potential credit constraints and

[53] These regressions help to avoid growth rates from autocorrelation dynamics and from macroeconomic development affecting all firms uniformly. Thus, this measure gives a 'conditional' idiosyncratic volatility of output growth.

[54] Total factor productivity could not be estimated using the methodology suggested by Levinsohn and Petrin (2003) due to missing data for wages and salaries in the dataset.

expand exports. All time-varying firm-level variables are lagged by one period to reduce possible simultaneity problems.

4.5.2 Accounting for the financial constraints

Since all firms are not expected to be equally affected by the adversities of exchange rate and firm-level volatility, firm-level heterogeneity is taken into account. Both exchange rate and firm-level volatility are expected to increase the transaction and variable costs for exporters, resulting in an increase in uncertainty for exporter's earnings (Ethier, 1973). Firms are classified into constrained and unconstrained firms using two criteria- size and profits. Size is measured by the log of real sales and profits are measured by the real profit and loss for each period. Firms with lower sales and less profits are considered as financially constrained. More profitable firms are able to service their debts and thus pay lower spreads (Santos, 2010). To test this hypothesis, a dummy for constrained firms (*Cons*) is constructed which takes value one if real sales and profits of firms are below the 50th percentile of the distribution of all firms in the sample period, and zero otherwise. This dummy is then interacted with the volatility measures to capture the impact of volatility on export sales for constrained and unconstrained firms.

$$Log(Exports)_{it} = a_0 + a_1 REER\_volatility_t * Cons_i + a_2 REER\_volatility_t * (1 - Cons_i) + a_3 Firm\_volatility_{it} * Cons_i + a_4 Firm\_volatility_{it} * (1 - Cons_{it}) + a_5 \mathcal{X}_{it} + e_{it} \quad (23)$$

If the interaction terms for both exchange rate and firm volatility are significantly different from one another, then it can be concluded that the impact of volatility on firms' export sales are varied across constrained and unconstrained firms.

4.5.3 Accounting for firm heterogeneity during financial crises

The sample included in this chapter spans across two important financial crises in the UK, namely the ERM crisis and the most recent global financial crisis. Therefore, it provides an interesting setup to explore the relationship between volatility and firm-level exports during the two separate crises periods for constrained and unconstrained firms. Dummies for the two separate crises (*Crisis*) are constructed and then interacted with the main volatility measures and constrained (*Cons*) dummy to study the sensitivity of exports to different levels of uncertainties during extreme economic situations for constrained and unconstrained firms. The estimated models are represented as:

$$Log(Exports)_{it} = a_0 + a_1 REER\_volatility_t * Crisis_t * Cons_i + a_2 REER\_volatility_t * Crisis_t * (1 - Cons_i) + a_3 REER\_volatility_t * (1 - Crisis_t) * Cons_i + a_4 REER\_volatility_t * (1 - Crisis_t) * (1 - Cons_i) + a_5 Firm\_volatility_{it} + a_6 \mathcal{X}_{it} + e_{it} \quad (24)$$

$$Log(Exports)_{it} = a_0 + a_1 Firm\_volatility_t * Crisis_t * Cons_i + a_2 Firm\_volatility_t * Crisis_t * (1 - Cons_i) + a_3\, Firm\_volatility_t * (1 - Crisis_t) * Cons_i + a_4 Firm\_volatility_t * (1 - Crisis_t) * (1 - Cons_i) + a_5 REER\_volatility_{it} + a_6 X_{it} + e_{it} \quad (25)$$

where $Crisis_t$ = ERM crisis takes the value one for the periods 1990-1993, and zero for the periods 1994-2006[55]. Evidence shows that the ERM crisis of early 1990s was not a global phenomenon and most of the trade partners of UK were experiencing strong growth. This led to higher demand of UK exports, resulting in a strong growth of UK exports even in crisis (Fender, 2010). $Crisis_t$ = Global financial crisis takes the value one for the period 2007-2009, and zero for the period 1994-2006. In contrast to the ERM recession of 1990s, the effect of 2008 global recession was quite different. During the global financial crisis, the UK faced a persistent downward trend in export growth due to contraction in both domestic and foreign demands (Fender, 2010).

If the interaction terms during the crisis are significantly different from the same terms outside of the crisis, then it can be concluded that the impact of volatility on firms' exports are diverse for constrained and unconstrained firms across different crises and tranquil periods.

4.6 Data and summary statistics

4.6.1 The dataset

The balance sheet and financial data of UK firms are taken from the Financial Analysis Made Easy (FAME) database. According to the UK Companies Act, all limited liabilities companies are required to submit their annual financial statements during a specific period of time from the year-end date to Companies House. Companies house then cautiously inspects this information which is then made available to public. One of the leading providers of legal information in the UK, named Jordan, then collects this data from Companies house. Finally, Bureau van Dijk collects this database from Jordan and provides it for commercial use through the FAME database.

The FAME database provides data on active and inactive, public and private limited liability firms for the maximum period of 10 years. The main advantage of this database is that it provides both balance-sheet and off balance-sheet data on income statements, profit and loss account, cash flow statements and information about ownership. This database includes forms which operate in various industries such as agriculture, manufacturing,

[55] Studies such as Vaitlingam (2009) and OECD (2010) highlight the ERM crisis periods as 1990-1993. While, taking into account the ERM crisis, the data years of the global financial crisis are removed from the sample. Similarly, we remove the ERM crisis years from the sample when considering the global financial crisis.

construction, forestry and mining, retail and wholesale, hotels and restaurants, the public sector, the financial sector, and the regulated utility industry.

FAME is a database of over nine million companies in the UK and Ireland in a detailed format with up to ten years of data. The database helps to search by a wide selection of criteria such as name, code, location, size, and many others. The majority of UK firms in the dataset are not traded on the stock market or quoted on other exchanges such as the Alternative Investment Market (AIM) and the Off-Exchange (OFEX) market. Unquoted firms are characterised by adverse financial conditions such as poor solvency, short track record and low real assets, compared to quoted firms which are generally larger in size with better financial health and long-established credit ratings (Greenaway et al., 2007). In addition, the data for the macroeconomic variables are drawn from the Bank for International Settlements (BIS) database.

The firms included in the dataset operate in the UK manufacturing sector. The dataset used in this chapter is for the period 1990-2009, which is constructed by combining three different data files from 1989-1998, 1994-2004 and 2000-2009. The dataset for the period 1989-1998 is obtained from FAME's archived database, while the datasets for the period 1994-2004 and 2000-2009 are directly downloaded from the FAME database available online. The archived data includes the years of the ERM crisis while the data downloaded from FAME includes the time period of the recent global financial crisis. Thus, combination of these two crises periods provides an interesting setup for the empirical study of this chapter. Following normal selection criteria, firm-years with negative export sales are excluded from the data. In addition, observations in the 1% from upper and lower tails of the distribution of the financial variables are excluded to control for the outliers. Finally, the panel has an unbalanced structure with 97,380 annual observations of firm-level real export sales for 17,251 firms over the period of 1990-2009 in different sectors such as manufacturing, utilities, resources, services and financials.

4.6.2 Summary statistics

Table 4.1 reports the level of exports, exchange rate and firm volatility and other firm factors in the two main crises periods- ERM crisis and global financial crisis. The values for the whole sample (column 1); the ERM and the global financial crises (columns 2 and 3) and the p-value for the test of equality of means (column 4) are given in the table. The statistics show that the level of exports was much lower during the ERM crisis, compared to the global financial crisis. With respect to volatility, exchange rate volatility is much higher during the ERM crisis and firm-level volatility is higher during the global financial crisis. Finally, other control variables also show a significant difference across both the

crises periods. The p-values show a significant difference between the two crises periods at 5% level.

Further, Table 4.2 shows the summary statistics taking into account firm-level heterogeneity in the model. The values for smaller and larger firms (columns 1 and 2); a p-value for the test of equality of means (column 3); for lower and higher profit firms (columns 4 and 5); a p-value for the test of equality of means (column 6) are provided in the table. To begin with, the statistics show that unconstrained firms with larger size and more profits enjoy higher exports, lower firm-level volatility, larger firm size, higher productivity, age and collateral. The p-value also shows a significant difference in the mean values of all the variables between constrained and unconstrained firms at 1% level.

Overall, the summary statistics indicate two main points. Firstly, UK firms faced higher exchange rate volatility during the ERM crisis, while they faced higher firm volatility during the global financial crisis. Secondly, unconstrained firms have better financial health and are benefited from higher firm-level exports. Following sections provide formal regression tests on the relationship between macro and firm-level volatility and firms' exports for constrained and unconstrained firms during the two crises.

4.7 Empirical results

4.7.1 Baseline model

This section explores the relationship between volatility at the macro and micro levels and real exports of firms. The results of the fixed effects model are reported in Table 4.3. The estimates show negative and significant influences of exchange rate and firm-level volatility on firms' exports. To ascertain the magnitude of volatility, percentage point effects are calculated by dividing the coefficient value (marginal effect) with the predicted probability of the model. Therefore, a 1% increase in *exchange rate volatility* leads to a 1.70% reduction in firms' exports. An identical increase in *firm-level volatility* reduces exports by 0.72%. This implies that firms experiencing high exchange rate and firm volatility face adverse effects on trade. These results for exchange rate volatility are very much in line with the previous studies on the UK by Greenaway et al. (2010b). Negative effects of exchange rate appreciations are also reported in studies such as Campa (2004), Das et al. (2007) and Greenaway et al. (2008). This implies that movements in exchange rates can affect the profits of firms and hence, firms are more likely to reduce exports in order to minimise the risk exposure in the absence of hedging incentives (Hooper and Kohlhagen, 1978; Kawai and Zilcha, 1986). The negative effect of firm-level volatility on exports highlights that firms facing higher volatility are more risky and have low market

value, thus, they have difficulty in obtaining external finance at lower costs (García-Vega et al., 2012). Credit constraints distort the level of firm exports as firms lower their export quantities in order to reduce the amount of external capital they need for variable costs (Manova, 2013). Further, Caggese and Cuñat (2013) predicted that financial constraints can reduce the aggregate productivity gains from trade liberalisation by 30% to 50% as they destruct the selection of the most productive firms into export market.

Focusing on other firm-level variables, the results show a positive and significant impact of *firm size* on firms' exports. These results imply that firms which are larger in size are more likely to export. This is because larger firms have more resources to initiate other activities such as entering into international markets (Wagner, 2001; Bonaccorsi, 1992). Firms' *productivity* and *age* do not show any significant impact on export sales of firms. While, firms' *collateral* shows a significant and positive impact on firms' exports at 1% level of significance. Firms with higher collateral are more likely to export as they are in a better financial health. Further, firms with higher collateral value face lower external finance premium which allows them to invest more in assets that can further serve as collateral for borrowing (Jansen and Tsai, 2010; Stiglitz and Weiss, 1981).

4.7.2 Accounting for the financial crises

This section deals with the relationship between volatility and firms' exports for financially constrained and unconstrained firms. Table 4.4 provides results for two main classifications- size and profits in columns 1 and 2 respectively. The volatility coefficients interacted with the dummy variables *Cons* and $(1 - Cons)$ are reported in the table. The test of equalities of exchange rate and firm-level volatility reported at the foot of the table provide the difference in the coefficient values for constrained and unconstrained firms.

The estimation results show that the exports of constrained firms are more adversely affected by the impact of exchange rate and firm-level volatility, compared to the unconstrained firms. In economic terms, a 1% increase in exchange rate and firm-level volatility reduces export sales of constrained firms by 2.03% - 3.4% and 2.66% - 2.68% respectively. While for unconstrained firms export sales are reduced by 1.32% - 1.51% due to a 1% increase in exchange rate volatility and firm-level volatility had insignificant impact. The test of equality for constrained and unconstrained firms shows a significant difference between the coefficient values at 1% level of significance for exchange rate and firm-level volatility. These results are in line with Héricourt and Poncet (2013) which highlight that firms which are financially vulnerable face higher exchange rate volatility. The empirical results also show similar evidence for firm-level volatility. Studies such as Burgstahler and Dichev (1997) show that higher firm-level volatility implies higher

transaction costs with stakeholders. Also, increase in firm volatility reduces firms' access to external finance and increases their costs of borrowing (Minton and Schrand, 1999). Thus, firms which face lower credit constraints are more likely to export more (Muûls, 2008).

Thus, the real export sales of constrained firms are more adversely affected by exchange rate and firm-level uncertainty as compared to their unconstrained counterparts.

4.7.3 Accounting for the financial constraints during crises

This section addresses the response during two crises by examining the sensitivity of exchange rate and firm-level volatility to firms' exports across constrained and unconstrained firms. Tables 4.5 and 4.6 report the results of the ERM crisis and the global financial crisis respectively. The volatility coefficients interacted with the constrained (*Cons*) and *Crisis* dummy variables are reported in the tables. The test of equalities reported at the foot of the tables provide the difference in the coefficient values of exchange rate and firm-level volatility for constrained and unconstrained firms during crisis and non-crisis periods.

Table 4.5 provides the interaction results of exchange rate volatility with *ERM crisis*, *Cons* and (1-*Cons*) dummy (columns 1 and 2) and the interaction of firm-level volatility with *ERM crisis, Cons* and (1-*Cons*) dummy (columns 3 and 4). To begin with columns 1 and 2, during the ERM crisis periods the results show a negative and significant impact of exchange rate volatility on export sales of constrained firms, while unconstrained firms majorly have an insignificant effect of exchange rate volatility. During the non-ERM crisis periods, the results show a negative and significant impact of exchange rate volatility but only for firms which are smaller in size. While, unconstrained firms do not have face any negative impact of exchange rate volatility on their export sales during non-crisis periods. In economic terms, a 1% increase in exchange rate volatility reduces export sales of constrained firms by 0.66% - 2.04% during the ERM crisis periods. The test of equality for exchange rate volatility also shows a significant difference between the coefficient values at 1% level for constrained and unconstrained firms during ERM crisis and non-ERM crisis periods in majority of the cases.

Next, the results in columns 3 and 4 do not show a consistent significant and negative impact of firm-level volatility on constrained and unconstrained firms during the ERM crisis. While during the non-ERM crisis periods, constrained firms face a negative and significant impact of firm-level volatility on real export sales. A 1% increase in firm-level volatility reduces the real export sales of constrained firms by 4.03% - 4.33%.

Unconstrained firms do not face any negative impact of firm-level volatility during the non-ERM crisis periods. The test of equality also shows a significant difference between the coefficient values of firm-level volatility at 1% level of significance for constrained and unconstrained firms during the crisis and non-crisis periods. The other control variables in the model are also mostly significant and behave as conjectured.

Moving to the global financial crisis, results are given in Table 4.6. The table provides the interaction of exchange rate volatility with *Global crisis*, *Cons* and (1-*Cons*) dummy (columns 1 and 2) and the interaction of firm-level volatility with *Global crisis*, *Cons* and (1-*Cons*) dummy (columns 3 and 4). Starting with columns 1 and 2, the results do not show consistent negative and significant impact of exchange rate volatility for constrained and unconstrained firms during both the global crisis and non-global crisis periods. Moving to the columns 3 and 4, the results show a highly significant and negative impact of firm-level volatility for constrained firms as compared to unconstrained firms during both the global crisis and non-global crisis periods. A 1% increase in firm-level volatility reduces real export sales of constrained firms by 1.86% - 2.31% during the global crisis as compared to unconstrained firms. An identical increase in firm-level volatility reduces export sales of constrained firms by 3.09% - 3.84% during non- global crisis periods as compared to unconstrained firms. The test of equality given at the bottom of the table shows a significant difference in the coefficient values of firm-level volatility during crisis and non-crisis periods for financially constrained and unconstrained firms at 1% level.

In summary, it can be concluded that the adverse impact of exchange rate volatility on export sales was more significant for constrained firms during the ERM crisis, compared to unconstrained firms. While during the global financial crisis, the impact of exchange rate volatility was not very significant for both constrained and unconstrained firms. According to Fender (2010), the low value of sterling in the ERM crisis provided support to the UK's total trade balance with strong export growth in capital goods, motor vehicles and other consumer goods. These persistent positive effects from net-trade reduced the severity of the recession of early 1990s. In contrast, Hardie et al. (2013) highlighted that even though the effective sterling exchange rate declined by more than 25% between 2007Q3 and 2009Q1, the balance of trade in goods and services remained unchanged during and after the depreciation. Further, Levchenko et al. (2010) pointed out that the overall trade wedge in UK displayed only a small departure from the norm in the global crisis, implying that the behaviour of imports is rationalised by movements in aggregate demand and relative price movements.

On the contrary, the adverse impact of firm-level volatility on exports of constrained firms was much significant during the global financial crisis, compared to the ERM crisis. Görg and Spaliara (2013) showed that UK firms faced deterioration in their financial position which led to an increase in the hazard of export exit during the recent global financial crisis. Further, Denis and Kannan (2013) highlight that the impact of uncertainty shocks on economic activity in the UK is extremely significant during the recent global financial crisis. Uncertainty shocks reduced industrial production and GDP by 0.6 and 0.3 percent respectively, during the recent financial crisis period. Chowla et al. (2014) also showed that United Kingdom was adversely affected by increase in risk and uncertainty associated with the global financial crisis.

4.8 Robustness tests

4.8.1 Endogeneity concerns

The main results only partly address the problem of endogeneity and selection bias. Hence, following Buch et al. (2009) and Greenaway et al. (2007), the results of two-step GMM estimations are reported in this section to deal with the problem of regressor endogeneity. The identification of the impact of exchange rate and firm-level volatility requires the availability of exogenous instruments that are correlated with volatility, but do not directly affect the firm-level exports. The volatility of money supply is proposed (Clark et al., 2004; Chit et al., 2010) as a plausible exogenous instrument for exchange rate volatility. The motivation of using the standard deviation of the relative money supply as an instrument for the exchange rate volatility is that although relative money supplies are highly correlated with exchange rate, the monetary policies are less affected by export considerations (Frankel and Wei, 1993). In addition, lagged firm-level volatility is used as a reasonable instrument for firm-level volatility (Bo, 2001). With respect to all other control variables, their own values lagged twice and more are used as the instruments (Greenaway et al., 2007). The validity of the instruments is also checked using various diagnostic tests for weak instruments and over-identification, which are reported at the foot of the table.

The results are reported in Table 4.7. The baseline model results mentioned in Panel 1 confirm a negative and significant impact of exchange rate and firm-level volatility on firms' exports. The results for constrained and unconstrained firms are mentioned in Panel 2. The results again show that financially constrained firms face a negative and significant impact of both exchange rate and firm-level volatility on exports. While the impact of both macro and micro-level volatility on unconstrained firms is mainly insignificant.

Further, Panel 3 provides the results for constrained and unconstrained firms during the ERM crisis. The results again confirm that the impact of exchange rate volatility on export sales is highly significant for constrained and unconstrained firms with a significant difference in the coefficient values at 1% level. On the contrary, firm-level volatility had insignificant impact on export sales of constrained and unconstrained firms during the ERM crisis. Finally, Panel 4 shows the results for the global financial crisis. These results confirm that exchange rate volatility had insignificant impact on export sales of constrained and unconstrained firms during the global crisis. While the impact of firm-level volatility was much adverse and significant on the export sales of constrained firms during the global financial crisis. The test of equality confirms a significant difference in the coefficient values of firm volatility for constrained and unconstrained firms during crisis and non-crisis periods at 1% level.

Regarding the diagnostic tests, the Kleibergen-Paap statistics reject the null hypothesis that the equation is underidentified. The Anderson-Rubin and Stock-Wright statistics, which are the weak instrument-robust inference tests, does not reject the null hypothesis that the coefficients of the excluded instruments are jointly equal to zero. Finally, the Hansen J statistic of the overidentifying restriction also shows that the instruments are valid. Hence, it can be concluded that the GMM results provide a reliable robustness check to the main results.

4.8.2 Alternative measures of volatility

In this section, alternative measures of exchange rate and firm-level volatility are used and then the models are re-estimated. Following Cheung and Sengupta (2013), the exchange rate volatility is calculated as the standard deviation of monthly exchange rate indices of the year[56]. While, firm-level volatility is calculated by using the squared residual of a regression of sales growth on its own lagged values and a set of time fixed effects (Buch et al., 2009). The results are given in Table 4.8. The results again display a negative and significant impact of exchange rate and firm volatility on exports of firms in Panel 1. Further in Panel 2, the results show a larger negative and significant impact of exchange rate and firm-level volatility on export sales of constrained firms, compared to their unconstrained counterparts. Panel 3 provides the results of the ERM crisis which show that the negative impact of exchange rate volatility on export sales was significant and higher for constrained firms, compared to unconstrained firms. Finally, in Panel 4 the results show a negative and significant impact of firm-level volatility on real export sales of constrained firms during the global financial crisis as compared to unconstrained firms.

[56] This standard deviation method is also used by Caglayan and Demir (2014), Aghion et al. (2009) and Ghosal and Loungani (2000).

Thus, it can be confirmed that the main results are upheld even after using alternative measures of exchange rate and firm-level volatility.

4.8.3 Alternative classification of firms

In the main empirical results, the firms are divided into constrained and unconstrained firms using the 50th percentile of the distribution. This section confirms that the results are not driven by the way we classify the firms by using a robust classification scheme. Following Tsoukas (2011), firms are divided into constrained and unconstrained firms using the 25th percentile as a cut-off point in the sample period. Thus, constrained firms take value one if their size and profits are below the 25th percentile of the distribution of all firms in the sample period, and zero otherwise. The results are given in Table 4.9. Panel 1 of Table 4.9 provides the results of exchange rate and firm-level volatility for constrained and unconstrained firms. The results show that the export sales of constrained firms are adversely affected by the exchange rate and firm-level volatility, compared to their unconstrained counterparts. Panel 2 provides the results of the ERM crisis which confirm a larger negative and significant impact of exchange rate volatility on export sales of constrained firms as compared to unconstrained firms. Finally Panel 3 shows the results of the global financial crisis. These results show a significant and negative impact of firm-level volatility on export sales of constrained firms, while unconstrained firms are mostly unaffected.

Thus, these results confirm that the main results are robust to an alternative classification of firms.

4.9 Conclusion

Following the build-up of large global imbalances and the outbreak of the financial crisis since the mid-2000s, the economic literature on the relationship between aggregate and firm-level volatility and trade has evolved. The relationship between exchange rate volatility and trade is a complex one and empirical evidence provides mixed evidence. However, on average, exchange rate volatility has a negative impact on trade. While, firm-level volatility is likely to have a negative impact on firms' exports as firms facing higher volatility have less access to external finance due to increased costs of credit (Barnes, 2001). Thus, this chapter explores the link between different volatility at macro and firm levels and trade. In addition this chapter also focuses on two important financial crises and studies the influence of macro and micro volatility on firms' exports during extreme economic events.

Using a unique panel dataset on UK manufacturing firms for the period 1990-2009, this chapter analyses the impact of macroeconomic and firm-level volatility on firms' exports. The results show negative and significant effects of exchange rate and firm volatility on firm-level exports. After taking into account financial constraints at the firm-level, the results show that the negative impact of exchange rate and firm volatility on exports is higher for constrained firms as compared to unconstrained firms. Further, this chapter considers the ERM crisis of early 1990s and the global financial crisis of 2008. The results indicate that during the ERM crisis constrained firms face a significant adverse impact of exchange rate volatility on exports, while the impact of firm-level volatility is mostly insignificant. On the contrary, during the global financial crisis, constrained firms face a significant negative impact of firm-level volatility on exports and an insignificant impact of exchange rate volatility on exports.

Figures

Figure 4-1: Log of export sales for the period of 1990-2009

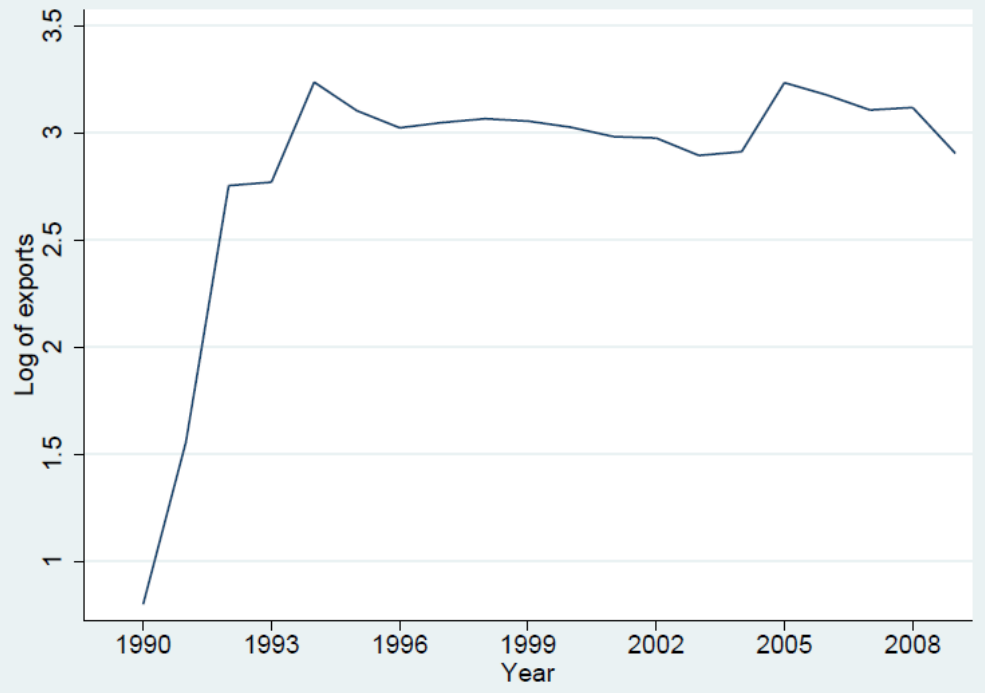
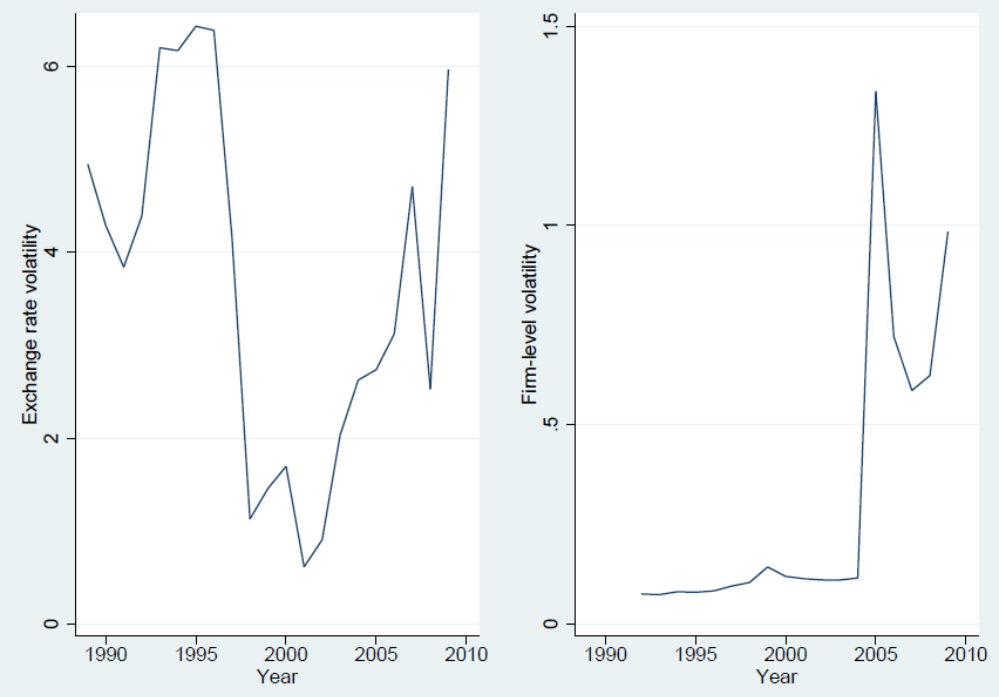


Figure 4-2: Volatility for the period of 1990-2009



Tables

Table 4.1: Summary statistics for crises periods

Explanatory Variables	Whole sample	ERM crisis	Global crisis	p-value
	(1)	(2)	(3)	(4)
Log of exports	3.00 (2.05)	2.68 (2.16)	3.10 (1.93)	0.027
REER volatility	3.89 (1.99)	4.68 (0.90)	4.40 (1.42)	0.000
Firm volatility	0.21 (0.66)	0.07 (0.30)	0.69 (0.12)	0.000
Size	3.47 (1.70)	3.28 (1.68)	4.10 (1.40)	0.000
Productivity	0.02 (0.86)	-0.10 (0.78)	-0.21 (1.17)	0.000
Age	2.72 (1.01)	2.51 (1.10)	2.99 (0.89)	0.000
Collateral	0.28 (0.20)	0.30 (0.19)	0.23 (0.20)	0.000

Notes: The Table reports sample means with standard deviations in parentheses for all the control variables used in the empirical analysis. The p-values of a test of the equality of means are reported. REER volatility is generated from a Garch (1,1) model using monthly real effective exchange rate (REER); Firm volatility is calculated by using the squared residual of a regression of sales growth on its own lagged values and a set of time fixed effects; Firm size is measured by the natural logarithm of total real assets; Productivity refers to labour productivity measured as the natural logarithm of real sales per employee; Age is calculated as the natural logarithm of the number of years since establishment; Collateral is measured as the ratio of tangible assets to total assets.

Table 4.2: Summary statistics for different firm-level classifications

Explanatory Variables	Small firms	Large firms	p-value	Lower profits	Higher profits	p-value
	(1)	(2)	(3)	(4)	(5)	(6)
Log of exports	1.67 (1.65)	3.77 (1.87)	0.000	2.46 (2.06)	3.33 (1.98)	0.000
REER volatility	3.74 (2.06)	3.94 (1.97)	0.000	3.75 (2.14)	3.94 (1.94)	0.000
Firm volatility	0.24 (0.75)	0.20 (0.61)	0.000	0.17 (0.56)	0.24 (0.71)	0.000
Size	2.74 (1.18)	3.76 (1.79)	0.000	3.25 (1.61)	3.56 (1.72)	0.000
Productivity	-0.22 (0.86)	0.20 (0.82)	0.000	-0.10 (0.82)	0.11 (0.88)	0.000
Age	2.72 (0.95)	2.73 (1.03)	0.010	2.77 (0.98)	2.71 (1.02)	0.000
Collateral	0.26 (0.21)	0.29 (0.20)	0.000	0.28 (0.20)	0.28 (0.20)	0.000

Notes: The Table reports sample means with standard deviations in parentheses for the all the control variables used in the empirical analysis. The p-values of a test of the equality of means are reported.

Table 4.3: Baseline model for volatility and exports

Dependent variable = Log of Exports	
	(1)
REER volatility	-0.052***
	(-5.35)
Firm volatility	-0.022**
	(-2.39)
Lagged Size	0.422***
	(20.12)
Lagged Productivity	-0.014
	(-1.04)
Lagged Age	-0.034
	(-0.90)
Lagged Collateral	0.198***
	(2.59)
Constant	1.201***
	(7.31)
Predicted Probability	3.05
N	47,917
R^2	0.053
No. of firms	11,101

Notes: The dependent variable is logarithm of firm-level real export sales. Time dummies and industry dummies are included in the models with firm fixed effects. Robust t-statistics are reported in the parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

Table 4.4: The role of financial constraints

Dependent variable = Log of Exports		
	(1) ***Size***	(2) ***Profits***
REER volatility*Cons	-0.104*** (-10.11)	-0.062*** (-6.36)
REER volatility*(1-Cons)	-0.040*** (-4.20)	-0.046*** (-4.80)
Firm volatility*Cons	-0.081*** (-5.54)	-0.082*** (-3.81)
Firm volatility*(1-Cons)	0.022** (2.05)	-0.006 (-0.62)
Lagged Size	0.401*** (19.67)	0.426*** (20.24)
Lagged Productivity	-0.008 (-0.63)	-0.012 (-0.92)
Lagged Age	-0.035 (-0.93)	-0.039 (-1.05)
Lagged Collateral	0.220*** (2.91)	0.218*** (2.86)
Constant	1.302*** (8.03)	1.195*** (7.27)
Predicted Probability	3.04	3.05
N	47,917	47,917
R^2	0.065	0.056
No. of firms	11,101	11,101
Test of equality (p.value): REER volatility Firm volatility	 0.000 0.000	 0.000 0.001

*Notes: Robust t-statistics are reported in the parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). The 'Cons' dummy takes value one if real sales and profits of firms are below the 50th percentile of the distribution of all firms in the sample period, and zero otherwise. With respect to the test of equality REER volatility gives the test of equality between REER volatility*Cons and REER volatility*(1-Cons); Firm volatility gives the difference between Firm volatility*Cons and Firm volatility*(1-Cons). Also, see notes to Table 4.3.*

Table 4.5: Firm heterogeneity and the ERM crisis

Dependent variable = Log of Exports					
	(1) ***Size***	(2) ***Profits***		(3) ***Size***	(4) ***Profits***
REER volatility* Crisis*Cons	-0.062*** (-7.53)	-0.020*** (-2.99)	Firm volatility* Crisis*Cons	-0.313*** (-2.61)	-0.090 (-1.01)
REER volatility* Crisis*(1-Cons)	-0.004 (-0.66)	-0.013** (-2.19)	Firm volatility* Crisis*(1-Cons)	0.122* (1.68)	0.170** (2.07)
REER volatility* (1-Crisis)*Cons	-0.035*** (-5.73)	0.006 (1.05)	Firm volatility* (1-Crisis)*Cons	-0.132*** (-7.18)	-0.123*** (-4.52)
REER volatility* (1-Crisis)*(1-Cons)	0.035*** (7.17)	0.026*** (5.29)	Firm volatility* (1-Crisis)*(1-Cons)	0.029** (2.12)	-0.014 (-1.24)
Firm volatility	-0.034*** (-3.00)	-0.038*** (-3.23)	REER volatility	-0.019*** (3.89)	-0.019*** (3.87)
Lagged Size	0.384*** (18.28)	0.406*** (18.79)	Lagged Size	0.398*** (18.76)	0.402*** (18.70)
Lagged Productivity	-0.019 (-1.37)	-0.026* (-1.81)	Lagged Productivity	-0.023 (-1.61)	-0.022 (-1.59)
Lagged Age	-0.021 (-0.55)	-0.019 (-0.50)	Lagged Age	-0.010 (-0.26)	-0.015 (-0.40)
Lagged Collateral	0.175** (2.40)	0.177** (2.39)	Lagged Collateral	0.164** (2.23)	0.165** (2.23)
Constant	1.324*** (8.22)	1.206*** (7.37)	Constant	1.215*** (7.48)	1.220*** (7.47)
Predicted Probability	3.04	3.04	Predicted Probability	3.05	3.05
N	44,860	44,860	N	44,860	44,860
R^2	0.059	0.050	R^2	0.052	0.049
No. of firms	10,748	10,748	No. of firms	10,748	10,748
Test of equality (p.value):			Test of equality (p.value):		
REER volatility*Crisis	0.000	0.144	Firm volatility*Crisis	0.001	0.018
REER volatility*(1-Crisis)	0.000	0.000	Firm volatility*(1-Crisis)	0.000	0.000

*Notes: Robust t-statistics are reported in the parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). With respect to the test of equality REER volatility*Crisis gives the test of equality between REER volatility*Crisis*Cons and REER volatility*Crisis*(1-Cons); REER volatility*(1-Crisis) gives the test of equality between REER volatility*(1-Crisis)*Cons and REER volatility*(1-Crisis)*(1-Cons); Firm volatility*Crisis gives the difference between Firm volatility*Crisis*Cons and Firm volatility*Crisis*(1-Cons); Firm volatility*(1-Crisis) gives the test of equality between Firm volatility*(1-Crisis)*Cons and Firm volatility*(1-Crisis)*(1-Cons). Also, see notes to Table 4.3.*

Table 4.6: Firm heterogeneity and the global financial crisis

Dependent variable = Log of Exports					
	(1) ***Size***	(2) ***Profits***		(3) ***Size***	(4) ***Profits***
REER volatility* Crisis*Cons	-0.026** (-2.13)	-0.005 (-0.39)	Firm volatility* Crisis*Cons	-0.057** (-2.18)	-0.071** (-2.11)
REER volatility* Crisis*(1-Cons)	0.022** (2.18)	0.013 (1.25)	Firm volatility* Crisis*(1-Cons)	0.034* (1.89)	0.019 (1.24)
REER volatility* (1-Crisis)*Cons	-0.042*** (-8.13)	0.002 (0.52)	Firm volatility* (1-Crisis)*Cons	-0.118*** (-7.05)	-0.095*** (-3.68)
REER volatility* (1-Crisis)* (1-Cons)	0.032*** (8.93)	0.019*** (5.39)	Firm volatility* (1-Crisis)* (1-Cons)	0.036*** (2.80)	-0.010 (-0.93)
Firm volatility	-0.017* (-1.91)	-0.019** (-2.12)	REER volatility	-0.019*** (3.87)	-0.019*** (3.86)
Lagged Size	0.362*** (16.72)	0.381*** (17.18)	Lagged Size	0.373*** (17.12)	0.375*** (16.97)
Lagged Productivity	-0.011 (-0.82)	-0.015 (-1.14)	Lagged Productivity	-0.017 (-1.24)	-0.015 (-1.11)
Lagged Age	-0.014 (-0.36)	-0.012 (-0.30)	Lagged Age	-0.005 (-0.13)	-0.010 (-0.25)
Lagged Collateral	0.224*** (2.82)	0.219*** (2.74)	Lagged Collateral	0.212*** (2.67)	0.210*** (2.64)
Constant	1.416*** (8.70)	1.324*** (8.03)	Constant	1.303*** (7.62)	1.310*** (7.62)
Predicted Probability	3.06	3.07	Predicted Probability	3.07	3.07
N	43,464	43,464	N	43,464	43,464
R^2	0.049	0.039	R^2	0.042	10,807
No. of firms	10,807	10,807	No. of firms	10,807	0.039
Test of equality (p.value):			Test of equality (p.value):		
REER volatility*Crisis	0.000	0.106	Firm volatility*Crisis	0.002	0.009
REER volatility*(1-Crisis)	0.000	0.000	Firm volatility*(1-Crisis)	0.000	0.001

Notes: Robust t-statistics are reported in the parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 4.5.

Table 4.7: Robustness: GMM model

	Dependent variable = Log of Exports				
Panel 1:					
REER volatility	-0.048***				
	(-2.88)				
Firm volatility	-0.021				
	(-1.31)				
N	20,515				
R^2	-0.601				
No. of firms	5,278				
Kleibergen-Paap	0.000				
Anderson-Rubin	0.000				
Stock-Wright	0.000				
Hansen J	0.150				
Panel 2:					
	Size		***Profits***		
REER volatility*Cons	-0.179***		-0.705***		
	(-5.54)		(-3.22)		
REER volatility*(1-Cons)	-0.030		0.125		
	(-1.19)		(0.94)		
Firm volatility*Cons	-0.054*		0.452		
	(-1.84)		(1.31)		
Firm volatility*(1-Cons)	0.025		-0.185**		
	(1.08)		(-2.16)		
N	34,908		34,908		
R^2	-1.003		-3.655		
No. of firms	7,589		7,589		
Test of equality (p.value):					
REER volatility	0.000		0.012		
Firm volatility	0.032		0.092		
Kleibergen-Paap	0.000		0.012		
Anderson-Rubin	0.000		0.000		
Stock-Wright	0.000		0.000		
Hansen J	0.984		0.180		
Panel 3:	**ERM crisis**				
	Size	***Profits***		***Size***	***Profits***
REER volatility*	-1.892**	-0.331**	Firm volatility*	-6.819	9.094
Crisis*Cons	(-2.52)	(-2.36)	Crisis*Cons	(-1.60)	(1.48)
REER volatility*	-1.535**	-0.452***	Firm volatility*	-4.677	9.788
Crisis*(1-Cons)	(-2.47)	(-2.80)	Crisis*(1-Cons)	(-0.94)	(1.43)
REER volatility*	-1.095***	-0.283**	Firm volatility*	-2.303***	2.503
(1-Crisis)*Cons	(-2.62)	(-2.26)	(1-Crisis)*Cons	(-3.07)	(1.60)
REER volatility*	-1.290**	-0.147	Firm volatility*	2.327***	-0.379**
(1-Crisis)* (1-Cons)	(-2.46)	(-1.37)	(1-Crisis)* (1-Cons)	(3.81)	(-2.34)
N	41,284	41,029	N	40,664	32,433
R^2	-16.192	-15.427	R^2	-4.586	-4.407
No. of firms	8,765	8,708	No. of firms	8,629	7,393
Test of equality (p.value):			Test of equality (p.value):		
REER volatility*Crisis	0.012	0.000	Firm volatility*Crisis	0.226	0.767
REER volatility*(1-Crisis)	0.096	0.004	Firm volatility*(1-Crisis)	0.003	0.087
Kleibergen-Paap	0.042	0.006	*Kleibergen-Paap*	0.051	0.000
Anderson-Rubin	0.000	0.000	*Anderson-Rubin*	0.000	0.000
Stock-Wright	0.000	0.000	*Stock-Wright*	0.000	0.000
Hansen J	0.063	0.071	*Hansen J*	0.328	0.231
Panel 4:	**Global crisis**				
	Size	***Profits***		***Size***	***Profits***
REER volatility*	0.028	0.133	Firm volatility*	-2.646**	-1.722***
Crisis*Cons	(0.05)	(1.27)	Crisis*Cons	(-2.36)	(-2.94)
REER volatility*	-0.036	-0.028	Firm volatility*	-0.240	-1.347
Crisis*(1-Cons)	(-0.37)	(-0.64)	Crisis*(1-Cons)	(-0.27)	(-0.73)
REER volatility*	0.331	0.278***	Firm volatility*	-0.338**	-0.414***
(1-Crisis)*Cons	(0.92)	(2.96)	(1-Crisis)*Cons	(-2.46)	(-3.52)
REER volatility*	0.201	0.302**	Firm volatility*	-0.274*	-0.055
(1-Crisis)* (1-Cons)	(0.91)	(2.52)	(1-Crisis)* (1-Cons)	(-1.80)	(-0.20)
N	33,846	33,846	N	22,848	22,848
R^2	-4.914	-5.861	R^2	-5.073	-3.911
No. of firms	8,201	8,201	No. of firms	6,096	6,096
Test of equality (p.value):			Test of equality (p.value):		
REER volatility*Crisis	0.884	0.120	Firm volatility*Crisis	0.029	0.018
REER volatility*(1-Crisis)	0.359	0.543	Firm volatility*(1-Crisis)	0.906	0.603
Kleibergen-Paap	0.020	0.058	*Kleibergen-Paap*	0.059	0.038
Anderson-Rubin	0.000	0.000	*Anderson-Rubin*	0.000	0.000
Stock-Wright	0.000	0.000	*Stock-Wright*	0.000	0.000
Hansen J	0.344	0.864	*Hansen J*	0.589	0.093

Notes: Robust z-statistics for two- step GMM regressions are reported in the parenthesis. The remaining specifications, which are not reported for brevity, are identical to those in Tables 4.3 to 4.6. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). The main measures of exchange rate and firm volatility are instrumented using volatility of money supply and lagged firm-level volatility, respectively. While, the other control variables are instrumented using their lagged levels at t-2 and more. The Kleibergen-Paap is a test of under-identification, distributed as chi-square under the null of under-identification. The Anderson Rubin and Stock-Wright LM S statistic are weak-instrument-robust inference tests, which are distributed as F-test and chi-square respectively, under the null that coefficients of the endogenous regressors in the structural equation are jointly equal to zero, and the over-identifying restrictions are valid. Hansen J statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Also, see notes to Table 4.3.

Table 4.8: Robustness: Alternative measures of volatility

	Dependent variable = Log of Exports				
Panel 1:					
REER volatility2	-0.035***				
	(-9.23)				
Firm volatility2	-0.151***				
	(-6.79)				
N	50,741				
R^2	0.065				
No. of firms	11,302				
Panel 2:					
	Size		***Profits***		
REER volatility2*Cons	-0.095***		-0.046***		
	(-16.05)		(-10.15)		
REER volatility2*(1-Cons)	-0.020***		-0.027***		
	(-5.00)		(-6.82)		
Firm volatility2*Cons	-0.269***		-0.235***		
	(-5.84)		(-5.97)		
Firm volatility2*(1-Cons)	0.062**		-0.098***		
	(2.11)		(-3.07)		
N	50,741		50,741		
R^2	0.086		0.068		
No. of firms	11,302		11,302		
Test of equality (p.value):					
REER volatility2*Cons	0.000		0.000		
Firm volatility2*Cons	0.000		0.005		
Panel 3:	**ERM crisis**				
	Size	***Profits***		***Size***	***Profits***
REER volatility2* Crisis*Cons	-0.067*** (-7.41)	-0.026*** (-3.50)	Firm volatility2* Crisis*Cons	-0.219** (-2.08)	-0.163** (-2.21)
REER volatility2* Crisis*(1-Cons)	-0.016** (-2.57)	-0.026*** (-3.98)	Firm volatility2* Crisis*(1-Cons)	0.056 (0.64)	0.062 (0.65)
REER volatility2* (1-Crisis)*Cons	-0.063*** (-6.02)	0.017* (1.81)	Firm volatility2* (1-Crisis)*Cons	-0.282*** (-5.43)	-0.247*** (-5.76)
REER volatility2* (1-Crisis)*(1-Cons)	0.073*** (8.40)	0.056*** (6.46)	Firm volatility2* (1-Crisis)*(1-Cons)	0.069** (2.11)	-0.097*** (-2.85)
N	46,100	46,100	N	46,100	46,100
R^2	0.071	0.059	R^2	0.071	0.059
No. of firms	10,772	10,772	No. of firms	10,772	10,772
Test of equality (p.value):			Test of equality (p.value):		
REER volatility*Crisis	0.000	0.941	Firm volatility*Crisis	0.039	0.049
REER volatility*(1-Crisis)	0.000	0.000	Firm volatility*(1-Crisis)	0.000	0.004
Panel 4:	**Global crisis**				
	Size	***Profits***		***Size***	***Profits***
REER volatility2* Crisis*Cons	-0.013 (-1.59)	0.018 (1.54)	Firm volatility2* Crisis*Cons	-0.523*** (-5.09)	-0.818*** (-4.53)
REER volatility2* Crisis*(1-Cons)	0.052*** (8.60)	0.032*** (5.72)	Firm volatility2* Crisis*(1-Cons)	0.085 (0.51)	-0.191 (-1.44)
REER volatility2* (1-Crisis)*Cons	-0.072*** (-6.74)	0.020** (2.08)	Firm volatility2* (1-Crisis)*Cons	-0.278*** (-5.41)	-0.238*** (-5.57)
REER volatility2* (1-Crisis)*(1-Cons)	0.076*** (8.72)	0.056*** (6.33)	Firm volatility2* (1-Crisis)*(1-Cons)	0.072** (2.22)	-0.094*** (-2.78)
N	46,194	46,194	N	46,194	46,194
R^2	0.067	0.053	R^2	0.066	0.054
No. of firms	10,988	10,988	No. of firms	10,988	10,988
Test of equality (p.value):			Test of equality (p.value):		
REER volatility2*Crisis	0.000	0.216	Firm volatility2*Crisis	0.002	0.003
REER volatility2*(1-Crisis)	0.000	0.000	Firm volatility2*(1-Crisis)	0.000	0.006

Notes: Robust t-statistics are reported in the parentheses. The remaining specifications, which are not reported for brevity, are identical to those in Tables 4.3 to 4.6. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 4.3.

Table 4.9: Robustness: Alternative cut-off points for firm classifications

Dependent variable = Log of Exports					
Panel 1:					
	Size			***Profits***	
REER volatility*Cons	-0.130***			-0.063***	
	(-10.71)			(-6.38)	
REER volatility*(1-Cons)	-0.053***			-0.048***	
	(-5.47)			(-4.94)	
Firm volatility*Cons	-0.131***			-0.083***	
	(-4.85)			(-2.83)	
Firm volatility*(1-Cons)	-0.000			-0.012	
	(-0.05)			(-1.34)	
N	47,917			47,917	
R^2	0.061			0.055	
No. of firms	11,101			11,101	
Test of equality (p.value):					
REER volatility*Cons	0.000			0.000	
Firm volatility*Cons	0.000			0.018	
Panel 2:	**ERM crisis**				
	Size	***Profits***		***Size***	***Profits***
REER volatility* Crisis*Cons	-0.060*** (-4.02)	-0.019*** (-2.59)	Firm volatility* Crisis*Cons	0.223 (0.83)	-0.085 (-0.92)
REER volatility* Crisis*(1-Cons)	-0.016*** (-2.77)	-0.014** (-2.46)	Firm volatility* Crisis*(1-Cons)	0.018 (0.27)	0.133 (1.53)
REER volatility* (1-Crisis)*Cons	-0.069*** (-7.46)	0.003 (0.57)	Firm volatility* (1-Crisis)*Cons	-0.226*** (-6.15)	-0.116*** (-3.36)
REER volatility* (1-Crisis)* (1-Cons)	0.023*** (4.61)	0.024*** (4.78)	Firm volatility* (1-Crisis)* (1-Cons)	-0.003 (-0.23)	-0.023** (-2.02)
N	44,860	44,860	N	44,860	44,860
R^2	0.055	0.050	R^2	0.052	0.049
No. of firms	10,748	10,748	No. of firms	10,748	10,748
Test of equality (p.value):			Test of equality (p.value):		
REER volatility*Crisis	0.002	0.430	Firm volatility*Crisis	0.453	0.062
REER volatility*(1-Crisis)	0.000	0.000	Firm volatility*(1-Crisis)	0.000	0.008
Panel 3:	**Global crisis**				
	Size	***Profits***		***Size***	***Profits***
REER volatility* Crisis*Cons	-0.050** (-2.57)	-0.018 (-1.12)	Firm volatility* Crisis*Cons	-0.070* (-1.95)	-0.109** (-2.24)
REER volatility* Crisis*(1-Cons)	0.014 (1.42)	0.012 (1.14)	Firm volatility* Crisis*(1-Cons)	0.013 (0.81)	0.011 (0.75)
REER volatility* (1-Crisis)*Cons	-0.076*** (-8.40)	0.001 (0.21)	Firm volatility* (1-Crisis)*Cons	-0.206*** (-5.92)	-0.083** (-2.56)
REER volatility* (1-Crisis)* (1-Cons)	0.019*** (5.29)	0.017*** (4.75)	Firm volatility* (1-Crisis)* (1-Cons)	0.003 (0.26)	-0.019* (-1.72)
N	43,464	43,464	N	43,464	43,464
R^2	0.044	0.039	R^2	0.041	0.039
No. of firms	10,807	10,807	No. of firms	10,807	10,807
Test of equality (p.value):			Test of equality (p.value):		
REER volatility*Crisis	0.001	0.065	Firm volatility*Crisis	0.031	0.014
REER volatility*(1-Crisis)	0.000	0.000	Firm volatility*(1-Crisis)	0.000	0.052

Notes: Robust t-statistics are reported in the parentheses. The remaining specifications, which are not reported for brevity, are identical to those in Tables 4.4 to 4.6. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*). Also, see notes to Table 4.3.

Chapter 4- Appendix

Table A4.1: Correlation matrix of explanatory variables

	REER volatility	Firm volatility	Size	Productivity	Age	Collateral
REER volatility	1.000					
Firm volatility	-0.0.12	1.000				
Size	-0.039	0.017	1.000			
Productivity	-0.041	0.058	0.193	1.000		
Age	-0.005	-0.008	0.155	-0.078	1.000	
Collateral	0.014	-0.068	0.103	-0.146	0.048	1.000

Notes: The Table reports the correlation matrix between different explanatory variables used in the models.

Table A4.2: Definition of variables

Variables	Description	Source
Exports	Natural logarithm of real export sales	FAME database
REER volatility	A GARCH (1,1) model using monthly real exchange rate series.	BIS
Firm volatility	Squared residual of a regression of sales growth on its own lagged values and a set of time fixed effects	FAME database
Firm size	Natural logarithm of total real assets	FAME database
Productivity	Natural logarithm of the ratio of total real sales to total number of employees	FAME database
Age	Natural logarithm of the number of years after establishment	FAME database
Collateral	Ratio of net tangible assets to total assets	FAME database
Constrained firms	Dummy takes value one if real sales and profits of firms are below the 50th percentile of the distribution of all firms in the sample period, and zero otherwise	Author's interpretation
ERM Crisis	Dummy takes value one for the periods 1990-1993, and zero for 1994-2006.	Author's interpretation
Global Financial Crisis	Dummy takes value one for the periods 2007-2009, and zero for 1994-2006.	Author's interpretation

Notes: The Table reports the definitions of different explanatory variables used in the models.

Chapter 5: Conclusion

5.1 Outline

This thesis explores different studies on international financial markets, firms' capital structure and firm-level exports in both developed and developing economies with special emphasis on country and firm-level studies. This thesis mainly focuses on three main areas of international finance: education and the equity home bias puzzle (Chapter 2), Asian bond markets and firms' external finance (Chapter 3) and finally, exchange and firm-level volatility and firms' real export sales (Chapter 4). The conclusion of the thesis provides in detail the contribution of each chapter and consequently outlines the main implications and prospects of future research of this dissertation.

5.2 Contribution of each empirical chapter

The first empirical chapter of this thesis (Chapter 2) combines two main empirical literatures on the equity home bias and the role of education in international portfolios. This chapter contributes to the existing literature in three parts. Firstly, this chapter empirically examines the impact of different levels of education namely university education, mathematical numeracy and financial skills on the equity home bias of a country. The results show a negative and highly significant impact of education on equity home bias. The empirical literature on the equity home bias puzzle focuses on various institutional factors, financial market features such as exchange rate risk, transaction costs, barriers to entry and information asymmetries, and behavioural biases such as familiarity with domestic forms, patriotism and optimism towards one's own country. Thus, this chapter mainly contributes to the empirical literature by exploring the impact of different levels of education on the equity home bias.

Secondly, this chapter focuses on the differential impact of education on the equity home bias of countries with more and less developed financial markets. Countries with larger financial markets benefit from increased liquidity and higher capital mobility, lower risk and volatility and more international integration (Demirgüç-Kunt and Levine, 1996). The results show that improvement in university and mathematical education helps to reduce the level of equity home bias in countries which are characterised by less developed financial markets. This is an important result which highlights that an increase in the level of education improves the financial awareness of individuals, especially in less financially developed countries. Further, financial awareness encourages individuals to invest in international portfolios and thus reduces the equity home bias in countries with less developed financial markets.

Finally, this chapter takes into account the recent financial crisis to study how the relationship between education and the equity home bias evolved over time across countries with more and less developed financial markets. The results show that education plays an important role in reducing the equity home bias in less financially developed countries during the crisis and non-crisis periods, compared to their more developed counterparts.

The second empirical chapter (Chapter 3) focuses on the impact of the Asian bond market policy initiatives on firms' choice of external finance. This chapter uses difference-in-differences approach to highlight the impact of the regional bond market policies in seven Asian economies, namely Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. Taiwan is used as a control group as it faced similar bond market development which is comparable to these Asian economies. This chapter also graphically confirms an upward trend in the bond market size of the seven Asian economies which participated in the ABMI, compared to Taiwan which is the control group.

The first contribution of this chapter is that it examines the influence of the policy initiatives such as ABMI, ABF and ABF-2 on firms' access to external finance using the difference-in-differences approach. The results show that after the introduction of the policies, firms reduced their access to short-term debt and increased their uptake of long-term debt. The second contribution of this chapter is that it exploits firm-level heterogeneity by classifying firms into financially constrained and financially unconstrained using two main criteria- profitability and coverage ratio of firms. After taking into account the firm-level heterogeneity the results show that unconstrained firms reduced their access to short-term debt and increased their access to long-term debt after the policy initiative, compared to financially constrained firms.

In addition to the literature on external finance, this chapter also adds value to the literature on firms' investment spending (Fazzari et al., 1988; Almeida and Campello, 2007). The third contribution is the investigation of the relationship between external finance and investment spending during the post-policy period. The results show that after the policy was implemented firms reduced their investment spending using short-term debt, while increased their investment outlay using long-term debt. Finally, this chapter explores the link between external finance and investment spending for financially constrained and unconstrained firms. The results again confirmed a positive and significant impact of the policy on financially unconstrained firms. The results showed

that unconstrained firms reduced their investment spending using short-term debt and increased their spending using long-term debt.

The third and final empirical chapter (Chapter 4) of this thesis empirically examines the impact of both macro-level and micro-level volatility on real export sales of firms. This chapter uses a unique firm-level dataset of UK manufacturing firms for the period 1990-2009. The main contribution of this chapter is mainly threefold. Firstly, very limited studies have focused on the relationship between macro and micro-level uncertainties on firms' exports. Majority studies highlight the impact of exchange-rate volatility on exports of firms. However, this chapter also studies the effect of firm-level volatility on export sales of firms. The development of aggregate volatility might be influenced by various factors at the micro-level. Hence, it is important to differentiate between the effects of both aggregate and firm-level volatility. The results show that both exchange rate and firm-level volatility have negative and significant impact on real export sales of firms.

The second contribution of this chapter is that it studies the impact of exchange rate and firm-level volatility at the firm-level, while all other previous studies use macro or disaggregated sector-level data. It also studies the firm-level heterogeneity by exploring relationship between financial constraints and volatility at macro- and micro- levels. The results illustrate that firms which are financially constrained are negatively affected by the volatility at country and firm-level, compared to unconstrained firms.

The third contribution of this chapter is that for the first time it documents the impact of two major financial crises, namely the ERM crisis of early 1990s and the recent global financial crisis of 2008. This chapter explores the differences in the impact of exchange rate and firm-level volatility on export sales for constrained and unconstrained firms during the two separate crisis events. The results show that constrained firms face an adverse impact of exchange rate volatility on exports during the ERM crisis, while the impact of firm-level volatility is mostly insignificant. However, during the global financial crisis, constrained firms face a negative and significant impact of firm-level volatility on exports and an insignificant impact of exchange rate volatility on exports.

5.3 Implications of research

So far, this concluding chapter has provided the assessment of all the empirical chapters. This section will emphasise the possible policy implications of each empirical chapter. The first empirical chapter (Chapter 2) focuses on the role of different degrees of education in reducing the equity home bias. The results find a significant impact of university education, mathematical numeracy and financial skills in lowering the degree

of equity home bias. These results suggest that maintaining higher levels of education and financial literacy would substantially increase international portfolio diversification. Hence, there is a need to implement financial education in the curriculum, especially in the emerging market economies. Improvement in financial literacy of individuals helps in increasing financial sophistication and investor competence (Cole et al., 2012). This further helps investors to make sound financial decisions for their own financial well-being.

The second empirical chapter (Chapter 3) explores the impact of Asian bond market initiatives on capital structure of firms. The results confirm that the policy initiatives helped in improving liquidity in the Asian domestic financial markets. The development of financial markets helped firms to attain effective financing for business and investment which encourages growth of firms (Levinger et al., 2014). These policy initiatives have helped in expanding and improving the liquidity in the sovereign bond markets in Asia. However, the corporate bond markets still remain less developed, and hence more policy initiatives are required for the development of the corporate bond markets. Corporate bond markets which are more liquid and significantly advanced are able to contribute significantly to the investment and regional growth by providing long-term financing.

The third empirical chapter (Chapter 4) investigates the impact of exchange rate and firm-level volatility on real export sales of firms. The results confirm that both types of volatility have a negative and significant impact on real export sales of firms. Next, the chapter focuses on the impact of macro and firm volatility on constrained and unconstrained firms. The results show that constrained firms are affected badly by both exchange rate and firm-level volatility as compared to unconstrained firms. This implies that an increase in the exchange rate and firm-level volatility has a negative effect on the profitability and market value of firms, resulting in a decline in their access to external finance due to increased costs of credit. Further, the chapter focuses on two financial crises of the ERM crisis and the global financial crisis. The results highlight that constrained firms faced significant adverse impact of exchange rate volatility on exports, while the impact of firm-level volatility is mostly insignificant during the ERM crisis. On the contrary, during the global financial crisis, constrained firms face a significant negative impact of firm-level volatility on exports and an insignificant impact of exchange rate volatility on exports. This was also highlighted in some of the studies by Denis and Kannan (2013) and Görg and Spaliara (2013) that UK firms faced much adverse shocks during the recent financial crisis of 2008.

5.4 Prospects of Future Research

This thesis covers various topics of international finance focusing mainly on the international financial markets, firms' capital structure and exporting behaviour of firms in both developed and developing economies. However, there are numerous possible avenues for future research following this thesis. The second chapter demonstrates the impact of education and financial education on the diversification of international portfolios using a panel of developed and developing countries. Due to data constraints this study could not be done at a micro-level. However, for future research it would be interesting to conduct this study at a micro-level using survey data of individual investors in different countries. In this chapter the main focus is on financial education and financial literacy. In 2012 the OECD and its International Network on Financial Education (INFE) have provided a unique policy forum for governments to exchange views and experiences on the issue of financial education. This dataset is provided by the International Gateway for Financial Education[57]. As this chapter includes panel dataset for the period 2001 to 2010 this data item could not be included in the empirical analysis of this chapter. For future research it would be interesting to include this data item for further analysis on the impact of financial education in different aspects of international financial markets.

The third chapter studies the impact of Asian bond market policies such as the Asian Bond Funds (ABF and ABF-2) on external financing of firms in eight Asian economies using the difference-in-differences approach. The treated group includes firms within seven Asian countries namely Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. While Taiwanese firms form a part of the control group. For possible future extension of this research it would be interesting to increase the treated and control groups by including firms within China and India. China can be included as an additional country in the group of treated countries and India in the control group in addition to Taiwan.

Finally, the fourth chapter focuses on the impact of volatility at both macro and micro levels on real export sales of UK manufacturing firms. This chapter analyses the impact of exchange rate and firm-level volatility on real export sales of firms. It would, however, be interesting for future studies to investigate the impact of other types of volatility at both macro and micro levels arising from stock market movements, movements in market value, earnings and cash flow of firms. Further, this chapter gives special emphasis to financial constraints and two crisis events by analysing the impact of volatility on exports for constrained and unconstrained firms during the ERM crisis and global financial crisis.

[57] The Gateway is a global clearing house on financial education which provides access to a comprehensive range of information, data, resources, research and news on financial education issues and programmes around the globe.

For future research it would also be interesting to consider the firm-level heterogeneity in terms of firms' exporting status. Firms can be classified as export continuers, export starters, export switchers and export exiters based on their exporting behaviour and financial health.

5.5 Publication

Finally, I would like to highlight that most of the estimates presented in Chapter 2 have been published in the *Journal of International Financial Markets, Institutions and Money* (see Bose, MacDonald and Tsoukas, 2015). Another working paper derived from Chapter 3 is available online in the discussion paper series of the Adam Smith Business School, University of Glasgow.

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