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An Investigation into the Indirect Diversification Benefits of US Equity Products

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A dissertation submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy in Business Studies

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Abstract

The benefits of international diversification for portfolio investors have long been highlighted, as historically, low correlations among national stock markets have allowed investors to reduce their risk for a given return. Despite the reduction of many previous barriers to foreign investment, the corresponding increase in international investing that would have been expected as a result, has failed to materialise. Investors have been found to be persistently overweight in domestic equities. This phenomenon is known as the home bias puzzle, and is found to exist in most countries (Chan, Covrig, & Ng, 2005). While several explanations for the home bias puzzle have been proposed within the literature (Grinblatt & Keloharju, 2001; Morse & Shive, 2011), I examine an alternative explanation; that the benefits of international diversification may be achieved domestically. This thesis examines whether the benefits of international diversification are available via investment in domestically-traded US products over a fifteen year period between 1996 and 2011. The equity products investigated are Multinational Corporations, Industry Indices, American Depository Receipts, and single country exchange-traded funds; Closed-End Country Funds and iShares. It incorporates three investigations into the benefits of indirect diversification.

Firstly, using firm-level data from the Russell 1000 index, I conduct a longitudinal study of the internationalisation of US firms. I categorise firms using three measures of internationalisation and investigate their levels and changes in internationalisation every year between 1996 and 2011. I test and compare the extent to which firms with the highest *level* and *speed* of internationalisation can yield home-based diversification benefits to US investors. In a period in which both the level and scope of internationalisation of US multinational firms increased dramatically, I find that MNCs can provide diversification benefits to US investors. I find that MNCs that are consistently the most international over time, with sales spread across the greatest number of countries and regions, provide the greatest diversification benefits to US investors. By investing in internationalised firms, US investors can achieve the benefits of international diversification without investing overseas.

Secondly, I conduct an in-depth investigation into the international diversification benefits of five types of US-traded equity products; Multinational Corporations (MNCs), Industry Indices,

American Depository Receipts (ADRs), Closed-End County Funds (CCFs) and iShares. I compare the diversification benefits of investing in each type of US-traded product to each other and to investing in 37 foreign country indices traded overseas. I test the diversification benefits over the full period from 1996 to 2011 and for three sub-periods to test the robustness of my results. My analysis reveals that portfolios of ADRs and MNCs achieve most of, and in some cases more than, the benefits of investing directly in foreign country indices. iShares and CCFs provide some diversification benefits but less than ADRs and MNCs in times of crisis. Industry Indices are of limited benefit to US investors and less than the other US-traded products.

Thirdly, I investigate whether it is possible to exhaust the benefits of investing overseas by investing in portfolios of US-traded products. I form portfolios comprised of a combination of MNCs, Industry Indices, the Russell 1000 Index, ADRs, CCFs and iShares for each of 37 foreign countries. For each country I create three types of replicating portfolios that seek to mimic the returns of the foreign country index. I test whether additional benefits can be obtained by adding the foreign country index to the replicating portfolio. If not, then the benefits of diversifying internationally can be exhausted by investing in portfolios of domestically-traded assets. This is tested from the perspective of US investors for 22 developed and 15 emerging markets between 1996 and 2011. I conduct the analysis for the full period and for three sub-periods. For the full period and for two of the sub-periods, I find that it is possible to replicate all 37 foreign country indices. In the second sub-period, 2003 to 2007, I find that for over half of the countries, replicating the foreign country index is only possible when ADRs, CCFs or iShares are included. My findings show that US-traded equity products provide excellent diversification benefits and can replicate foreign country returns.

Overall, I conclude that US investors do not need to invest overseas to obtain the benefits of international diversification. My findings for MNCs imply that the phenomenon of home bias is not an irrational choice. I find that ADRs and MNCs provide greater diversification benefits than Industry Industries, iShares and CCFs. I find that it is possible to exhaust the benefits of investing in foreign country indices for 37 countries by investing in US-traded equity products. Using foreign country indices to measure the benefits of investing overseas may overstate the benefits of international diversification; US-traded products are a more achievable and cost-efficient means of diversifying internationally.

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Table of Contents

List of Figures

List of Tables

Chapter 1 Introduction

1.1 Introduction

Practitioners and academics alike recommend holding a well-diversified portfolio to reduce the risk of equity investment. The benefits of international portfolio diversification have been extensively highlighted throughout the literature (Levy and Sarnat, 1970; Solnik, 1974; Driessen and Laeven, 2007), as historically, low correlations among national stock markets have allowed investors to reduce their risk for a given return. Moreover, given an individual's probable exposure to the economic performance of their domestic market via the property and labour market, it would be advisable to diversify investments internationally to mitigate that exposure (Baxter & Jermann, 1997). Possible deterrents to foreign investment include exchange rate risk, foreign investment restrictions, capital controls, transaction costs and asymmetric information. In recent decades the costs and restrictions on foreign investments have fallen substantially, yet investors continue to hold a disproportionate amount of their equity portfolio investment domestically. This phenomenon is known as the home bias puzzle (Ahearne, Griever and Warnock, 2004; Suh, 2005). In a world where the capital asset pricing model (CAPM) developed by Sharpe (1964) and Lintner (1965) holds, all investors will hold the same equity portfolio, namely, the market portfolio. In a simplistic version of the international CAPM developed by Adler & Dumas (1983) and Stulz (1984),[1] investors should hold the world market portfolio of risky assets regardless of their country of residence, in which case there would be no home bias. The proportion of foreign stocks held by US investors represents a disproportionately small share of overall equity holdings when compared to the relative stock market capitalisation of other countries. In 2011, the US equity market represented 31 percent of the world equity market capitalisation, with the rest of the world representing 69 percent.[2] The Department of the Treasury estimated US foreign holdings in 2011 at just 14 percent of total equity, implying a large degree of home bias in equity portfolio allocations. The phenomenon is

[1] Assuming the absence of market imperfections such as transaction costs, deviations from purchasing power parity, and inflation risk.
[2] Market Capitalisation figures from World Bank data.

not confined to the US. Chan, Covrig and Ng (2005) conduct a study in 26 developed and developing countries and find that home bias exists in every country.

Traditionally international diversification involves directly investing in equities traded abroad, which entails costs, such as transaction costs and withholding taxes, and risks such as currency, liquidity, country and capital control risk. In addition, investors investing directly in foreign markets need to fully understand local market conditions, for example, trading mechanisms, information that may be difficult and time consuming to obtain. Investing in broad-based foreign country indices are often used to measure the benefits of international diversification. Investing in all of the shares making up these indices is not a realistic option for most investors given the transaction costs and restrictions on portfolio size. An alternative is to invest in equities that trade domestically and provide international exposure. This may provide an indirect method of obtaining the benefits of international diversification, while avoiding the costs and inconveniences of investing abroad.

There are several indirect routes by which an investor may achieve exposure to foreign equity returns in a domestic setting. US Multinational companies (MNCs) that are operating in overseas markets may provide exposure to foreign countries. Some of the gains from international diversification are considered to be due to differences in industrial structure across countries (Flavin, 2004). Therefore investment in specific Industry Indices may mimic foreign country index returns. Other products traded in the US provide indirect access to foreign equities such as American Depository Receipts (ADRs), which represent a claim on foreign equities, and exchange-traded country funds; Closed-End Country Funds (CCFs) and iShares. This thesis is an investigation into the benefits of indirect international diversification. It attempts to reconcile the benefits of international diversification with investor preferences for home-based investments.

The purpose of this chapter is to act as an introduction to the thesis and is organised as follows. Section 1.2 introduces the three research questions that form the basis of my thesis. Section 1.3 outlines the justification for each study and articulates their main contributions to the existing body of knowledge. Section 1.4 discusses the organisation of the thesis, briefly outlining the content of each chapter. Section 1.5 lists the conferences where the results from this thesis have been presented and the journals where papers related to this thesis are under review. Section 1.6

provides a conclusion to the chapter and point the reader towards the literature review chapter, Chapter 2.

1.2 Research Questions and Contributions

In this thesis I conduct an in-depth investigation into the benefits of indirect international diversification in the US. I investigate whether it is possible for US investors to obtain the benefits of international diversification by investing in domestically-traded equity products between 1996 and 2011. The findings of this thesis will be of benefit to the academic fields of international business and international finance and of practical relevance to portfolio managers. Three main research questions are addressed.

Firstly, given the many ways of measuring firm-level internationalisation, is there an optimal method to select US MNCs that yield the greatest international diversification benefits? I compile a unique longitudinal data set on the internationalisation of US firms over a 15 year period to analyse the changing patterns of firm-level internationalisation over time. I use three different measures of internationalisation. The first is the firm's foreign sales as a percentage of its total sales. Although a reliable quantitative measure of foreign involvement, it gives no information on how many markets the foreign sales occur in or the location of those markets. The second is the number of geographic segments in which a firm reports material sales, as specified in its annual accounts. Counting the number of geographic segments disclosed provides useful information on the dispersion of a firm's sales. The third is number of regions of the world in which the firm's sales are located. The importance of taking the location of the segments in which the firms reports sales into account is implied by the findings by Baxter & Kouparitsas (2005) that correlations of business cycles decrease with distance. A high level of foreign sales does not necessarily imply that firms are operating in large number of countries or across a wide geographic scope. By using three measures to classify firms, I capture different aspects of internationalisation. I analyse the impact of age, industry and size on the firms' level of internationalisation. My longitudinal dataset allows me to select the most consistently international firms and firms with the greatest changes in internationalisation. Many authors have suggested that a longitudinal dataset be used to analyse firm-level internationalisation rather than the many cross-sectional studies that exist to date (Contractor, 2007; Glaum & Oesterle, 2007; Casillas & Acedo, 2013). My dataset allows me to provide unique and detailed insights

into the patterns of internationalisation of US firms over time, which have not previously appeared in the literature. I rigorously compare a large number of portfolios of MNCs to test their diversification benefits for US investors. Findings from previous studies investigating the diversification benefits of MNCs are mixed. The results are difficult to compare as firms are selected using different measures of internationalisation such as percentage foreign sales, number of foreign subsidiaries, foreign tax revenue amongst others. Almost all previous studies select MNCs based on criteria at a single point in time. My study makes two major contributions to the literature. It is the first to compare the diversification benefits of firms selected by several different measures of internationalisation, and it is the first to use a dataset which incorporates these measures over time.

Secondly, which type of equity investment provides the greatest international diversification benefit to a US investor? I compare the indirect diversification benefits of portfolios of MNCs, Industry Indices, ADRs, Closed-End Country Funds and iShares to each other and to direct diversification benefits, measured as the benefit of investing in portfolios of foreign country indices. Using different methods of portfolio weighting and sub-period analysis I conduct an in-depth comparison of the indirect international diversification benefits of US-traded equity products. From my investigation into the diversification benefits of MNCs, I incorporate a more robust selection method of MNCs. I divide my fifteen year time period into three sub-periods, to test if my findings are robust over time. Many studies examine the international diversification benefits of one type of US equity product, while a small number of studies compare two or three types. I am unaware of any previous study that directly compares the diversification benefits of these five US-traded equity products. I provide a more in-depth investigation into the indirect diversification products of US equity products than exists in the literature to date.

Thirdly, can the benefits of international diversification be exhausted domestically via investment in US-traded equity products? I create portfolios combining the US-traded equity products (MNCs, Industry Indices, ADRs, CCFs and iShares) available for each of 37 countries to attempt to replicate each foreign country index. I create replicating portfolios for each country for the full period and for sub-periods, and test whether further diversification benefits are attainable overseas beyond those available domestically. Rather than comparing products, I combine them to form portfolios for each of 37 foreign country indices. I update and expand on

a previous study by Errunza, Hogan, & Hung (1999). Since that study, there have been a number of developments that warrant an updated investigation of the topic. Firstly, there is a greater availability of US-traded products that offer foreign exposure for a greater number of countries, allowing me to increase the number of countries under investigation from 16 to 37. Secondly, as became evident from my longitudinal study of MNCs, a large increase in the internationalisation of US MNCs has occurred since 1996. I incorporate a more robust selection method for MNCs than was used in the Errunza et al. study. Thirdly, the growing relative importance of industrial versus country diversification has been highlighted in many studies (Baca, Garbe, & Weiss, 2000; Cavaglia, Brightman, & Aked, 2000; Serra, 2000), which may alter the relative importance of Industry Indices in the replicating portfolios. Fourthly, iShares were introduced in 1996, and have experienced huge growth since their inception. Given these developments, and using a more recent dataset that incorporates two crisis periods in the US, I investigate whether the results of the Errunza et al. (1999) study have changed substantially.

1.3 Structure of the Thesis and Main Findings

In Chapter 2 I review the literature in the area of direct and indirect international diversification, providing the context and motivation for the thesis. In Chapter 3 I describe the methodological approach of my thesis. In Chapters 4 I conduct an investigation into the internationalisation of US firms over time. In Chapters 5, 6 and 7, I describe the results and conclusions of the three empirical studies on the indirect diversification benefits of US-traded products. In Chapter 8 I summarise my conclusions, comment on the limitations of the research and identify areas for future research.

Chapter 2 provides an overview of previous literature to provide a context for the thesis. It begins by reviewing the literature on the benefits of international diversification in equity investment and how they are evolving over time. The phenomenon of home bias, whereby investors are overweight in domestic investments, is well documented. I review the literature surrounding the area of the internationalisation of the firm and how firms are classified by internationalisation. A wealth of studies exists on the indirect diversification benefits of different equity types. Many studies review one equity type individually, while some compare two or

three equity types. This chapter motivates Chapters 4 to 7 which contain the empirical studies that form the basis of the thesis.

In Chapter 3 I describe the methodological approach of the thesis. I state my research methodology as positivist and explain why quantitative methods are appropriate for the empirical studies in the subsequent chapters. I detail the empirical data that I use for the studies in Chapters 4 to 7. I subsequently describe the quantitative methods that I use in those chapters to construct portfolios and to measure the diversification benefits of portfolios. Finally, I explain how my sub-periods are selected.

In Chapter 4 I conduct an in-depth longitudinal study of the internationalisation of the constituent firms of the Russell 1000 index in the US between 1996 and 2011. I rank firms by three measures of internationalisation; their percentage foreign sales, the number of geographic segments in which they report material sales and the number of regions of the world in which those segments are located. I find that higher foreign sales are not necessarily consistent with firms having sales in a larger number of segments or regions. I find that there has been a steady increase in the internationalisation of firms over the 15 year period, with most firms experiencing more rapid change in the number of segments and regions initially, followed by increases in foreign sales. The credit crisis of 2007/08 had a greater impact on foreign sales than on the other two measures. I find that the age of the firm has little impact on its level of internationalisation, but that industry and size do. Basic Materials and Technology are the most international industries while Financial, Utilities and Telecommunications are the least. Larger firms are on average more international but small firms had a greater increase in internationalisation over the sample period.

In Chapter 5 I conduct a study of the diversification benefits of US MNCs. I use Mean-Variance Spanning and Sharpe ratios to test the statistical and economic benefit of adding different categories of MNCs to a portfolio of purely domestic firms. For example, I test whether firms with foreign sales over 50 percent in every year or firms with the greatest increase in foreign sales provide greater benefits. My results provide strong evidence that the benefits of international diversification can be gained indirectly via investments in portfolios of MNCs.

Firstly, I find that firms with sales in the greatest number of reported geographic segments or in the greatest number of regions of the world provide greater diversification benefits than firms with the highest percentage foreign sales when portfolios are equally weighted. Secondly, I find that firms that remain over thresholds of internationalisation for the entire period provide greater diversification benefits than those that increase the most in internationalisation, when portfolios are equally weighted or optimised with no short sales. Thirdly, I find that selecting firms that are consistently the most international in every year is superior to selection at either the start or at the end of my sample period. From my findings I recommend that portfolio selection of MNCs be extended beyond ranking firms by their percentage foreign sales on a static basis, as is common in the literature.

In Chapter 6 I compare the diversification benefits of investing in 5 types of US-traded equity products, which may provide *indirect* international diversification benefits, to the benefits of *direct* international diversification, measured as investing in foreign country indices. I compare portfolios of MNCs, Industry Indices, ADRs, CCFs and iShares to portfolios of 22 developed and 15 emerging markets. To conduct a thorough comparison, I weight the portfolios in three ways, equally weighted, optimally weighted with no short sales and optimally weighted with short sales. I compare the benefits of direct and indirect international diversification for US investors over the full 15 year period and over three sub-periods, two of which include crisis periods. I find that ADRs and MNCs provide most and in some cases more benefits than investing in foreign country indices. These results are robust to three different methods of weighting portfolios, and hold across sub-periods. The diversification benefits of iShares and CCFs vary between sub-periods. In times of high volatility in the US they offer less benefit than that of other products, whereas in times of low volatility, they are of greater benefit. Industry Indices offer only limited benefits of diversification and in all cases less than those of other US-traded products, consistent with the findings by Bekaert et al. (2009) that the increasing relative importance of industry factors appears to have been temporary.

In Chapter 7 I test whether it is possible for a US investor to exhaust the benefits of investing overseas by investing in domestically-traded equity products. I build on a study of the indirect diversification benefits of US-traded equity products by Errunza, Hogan, & Hung (1999) and more recently in the UK by Antoniou, Olusi, & Paudyal (2010). For each country I form three

types of replicating portfolios of MNCs, Industry Indices, the Russell 1000 Index, ADRs, CCFs and iShares and test whether they can exhaust the benefits of investing in each foreign country for the full period and for three sub-periods. The first type of replicating portfolio includes only Industry Indices. The second type includes Industry Indices, MNCs and the Russell 1000. The third type adds ADRs, iShares and CCFs. For the full period and for two sub-periods, I find that all of the replicating portfolios can mimic the returns of the foreign country indices. In the sub-period 2003 to 2007, for nearly half of the countries, portfolios of MNCs, Industry Indices and the Russell 1000 do not exhaust the benefits of diversifying internationally, the inclusion of ADRs, iShares and CCFs is necessary to mimic the foreign country indices. Overall, my results suggest that US-traded products provide an excellent source of foreign equity exposure and that trading overseas is no longer necessary. Errunza et al. (1999) finds that the benefits of 11 of the 16 countries analysed can be replicated using US-traded products, while Antoniou, Olusi, & Paudyal (2010) find that 37 foreign country indices can be replicated using UK-traded products. With a more recent dataset and an increased number of assets, I find that it is possible for a US investor to replicate 37 country indices over the full period and 36 over the three sub-periods.

In Chapter 8 I draw together the main finding and contributions of the thesis. I present my overall conclusions and their implications. I outline the limitations of my work and the potential avenues for future research.

1.4 Conference presentations and Journal Submissions based on the thesis

The results reported in Chapter 4 and 5 were presented at the 39th Academy for International Business UK and Ireland (AIB UKI) Annual Conference (Edinburgh, March 2011), at the 9th INFINITI Conference on International Finance (Dublin, June 2011), at the 40th AIB UKI Annual Conference (Birmingham, 2013) and at the 11th INFINITI Conference on International Finance (Aix-en-Provence, June 2013). The results reported in Chapter 6 were presented at the 40th AIB UKI Annual Conference (Liverpool, March 2012) and at the 10th INFINITI Conference on International Finance (Dublin, June 2012). The results reported in Chapter 7 were presented at the Irish Society of New Economists Conference (NUI Maynooth, September 2013) and at the 12th INFINITI Conference on International Finance (Prato, Italy, June 2014).

1.5 Summary and conclusions

This opening chapter gives a broad introduction to my research topic, which investigates the benefits of indirect international diversification for US investors between 1996 and 2011. I state the sub-questions that form the basis of my empirical studies in Chapters 4 to 7. I describe the motivation for undertaking these studies, and I briefly outline the contributions that they will make from a theoretical, practical, empirical and methodological perspective. I describe the structure of each chapter to provide an overview of the thesis, and state the main findings of my empirical studies. Finally, I list the conferences and journals where I have submitted and presented extracts from the thesis. The next chapter provides a review of the literature in the areas of firm internationalisation and direct and indirect international diversification in equity portfolio investments.

Chapter 2 Review of Relevant Literature

2.1 Introduction

This chapter sets the scene for the thesis and the motivation for each of the research questions. I begin with an examination and discussion of the literature on international diversification. The benefits of international diversification have been found to vary over time due to two factors that can cause a decrease in the segmentation of national stock markets. The first is economic globalisation, making equity markets less segmented as companies increasingly operate across borders. The second is periods of financial crisis; adverse shocks to the economy of one country have been shown to cause contagion, increasing correlations between countries (Brusco & Castiglionesi, 2007). I subsequently discuss the phenomenon of home bias, which is stubborn in its persistence over several decades. However, its measurement is coming under increased scrutiny, as only factoring in direct exposure to foreign markets may significantly understate the total foreign exposure of domestic investors. There are a number of equity products that may provide indirect international exposure in a domestic setting. Those investigated in this thesis are MNCs, Industry Indices, ADRs, Closed-End Country Funds and iShares. I begin by reviewing the literature on the diversification benefits of US MNCs and on the measurement and degree of firm-level internationalisation. I subsequently review the literature on the diversification benefits of Industry Indices, ADRs, CCFs and iShares and the studies which compare the diversification benefits of these equity products. Studies by Errunza et al. (1999) and Antoniou et al. (2010) consider whether it is possible to replicate foreign market returns by creating portfolios that combine domestically-traded assets in the US and the UK.

The remainder of this chapter is organised as follows, Section 2.2 focusses on the literature on international diversification. Section 2.3 discusses the phenomenon of home bias. Section 2.4 reviews the literature on firm-level internationalisation and on each of the indirect international diversification benefits of each equity type. Section 2.5 summarises my main findings from the review of the literature.

2.2 International Diversification

The benefits of international portfolio diversification have long been highlighted throughout the literature as historically, low correlations among national stock markets allowed investors to reduce their risk for a given return. Grubel (1968) finds substantial diversification benefits for US investors from investing in 11 countries between 1959 and 1966, with countries furthest from the US; Australia, Japan and South Africa, providing greater benefits than European and North American countries. Levy & Sarnat (1970) create an optimal diversification portfolio using country indices from 28 countries between 1951 and 1964, and find investment in emerging market countries to be of particular benefit to US investors. Solnik (1974) finds that substantial risk reduction can be achieved by adding foreign county indices to a domestic portfolio for the US and 7 European countries between 1966 and 1971, while Lessard (1974) finds similar results for US investors investing in 15 developed markets between 1959 and 1973.

Arshanapalli & Doukas (1993) use cointegration analysis to study the linkages between Germany, UK, France, Japan and the US between 1980 and 1990, analysing the periods pre and post the stock market crash of 1987 separately. They find low linkages between the countries prior to 1987 but far greater linkages after 1987 apart from with Japan which shows little linkage in either period. De Santis & Gerard (1997) investigate the diversification benefits of investing in the G7 countries and Switzerland to a US investor over the period 1970 to 1994. They find that although contagion occurs in times of financial crises, the long-term gains from international diversification are substantial and not decreasing. Goetzmann, Li, & Rouwenhorst (2001) analyse the correlations between 45 countries over a 150 year period. They find that diversification benefits vary over time and are low compared to historical results. They suggest that globalisation brings with it both advantages and disadvantages; expanding the investment opportunity set but causing diversification benefits to rely increasingly on investment in peripheral markets. Hyde, Nguyen, & Bredin (2007) examine correlation dynamics in the returns of Asia-Pacific countries, Europe and the US between 1991 and 2006. They find that correlations between Asian countries increase during the Asian crisis of 1997, and between US and European countries in the early 2000s. They document a general rise in correlation over the entire sample period indicative of greater international integration. Driessen & Laeven (2007) conduct a study of the diversification benefits of 52 countries, 29 of which are emerging markets,

between 1985 and 2002. They find that benefits exist for almost all of the countries examined, but that the benefits are decreasing over time. They find that most of the benefits are gained from investment outside the region in which each country is located. Investors in countries with higher country risk obtain the greatest benefits from investing overseas. You & Daigler (2010) conduct a study of diversification benefits of 21 country and regional indices between 1997 and 2002 and find that the benefits are time-varying and dependent upon the benchmark used. Using correlation analysis and four-moment tail risk, they find limited benefits of diversifying beyond the S&P500. Lucey & Muckley (2011) examine the correlations between the US and European and Asian markets between 1988 and 2007. They find marked differences between short-term correlation and long-term interdependencies, finding better long-term diversification opportunities from European markets than from Asian markets. They conclude that short-term measures of interdependence are not appropriate for long-term investors.

A marked increase in correlations between country indices was evident during the 2007/2008 financial crisis, but since then the long term benefits of international diversification have been defended by Asness et al. (2011) who analyse the conditional value-at-risk of 22 developed markets from 1950 to 2008, for varying holding periods. They conclude that international diversification works over longer time periods. Financial crises can have a spillover effects in the short term, but country-specific performance is the dominant factor in the long run. Christoffersen et al. (2012) examine the dynamic diversification benefits of 13 emerging and 16 developed markets between 1989 and 2008. They find that benefits are still available for emerging markets but have dramatically reduced for developed markets.

2.3 Home Bias

Investors have been found to be persistently overweight in domestic equities compared to the relative size of the market capitalisation of their country of residence as a proportion of the world market capitalisation. That investors are reluctant to invest overseas despite the benefits outweighing the costs has become known as the home bias puzzle. Home bias in international portfolios was first documented by French and Poterba (1991) and Tesar and Werner (1995) and more recently by Ahearne et al. (2004), VanNieuwerburgh and Veldkamp (2009) and Morse and

Shive (2011). Its existence is considered to be one of the least contentious empirical findings in international finance.

Despite the reduction of many previous barriers to foreign investment, such as investment restrictions, capital controls, taxes and transaction costs, the corresponding increase in international investing that would have been expected as a result, has failed to materialise. Table 2.1 presents a timeline of US foreign equity holdings from 2003 to 2011. These figures are calculated from the US Treasury Report on U.S. Portfolio Holdings of Foreign Securities as of December 31, 2011. Tesar & Werner (1995b) estimate that US investors held less than 2 percent of their investments in foreign equities in 1975, Ahearne et al. (2004) estimated that this had risen to 10 percent in 1997 and reached a peak of 18 percent in 2010. This appears disproportionately small when compared to the 69 percent of the world market capitalisation represented by other countries in 2011. In 2003 the US equity market capitalisation as a percentage of the world equity market capitalisation was 46 percent, by 2011 that had fallen to 31 percent.[3] Therefore, although US investors are investing more overseas, the market capitalisation of the US as a percentage of the world has fallen over the same period, thereby causing little reduction in the degree of home bias.

Possible explanations include exchange rate risk, political risk, taxes, transaction costs and asymmetric information. Grinblatt & Keloharju (2001) find that familiarity with other markets, measured by distance, language and culture, appears to have a greater effect on foreign equity holdings than correlations of returns. Portes & Rey (2005) find that gravity models of trade apply equally well to financial assets. They show that distance has a negative effect on investment despite the absence of transportation costs that exist for trade. The most likely explanation for this is that informational asymmetries are positively correlated with distance. Morse & Shive (2011) attribute greater home bias to greater patriotism. Aggarwal, Kearney, & Lucey (2012) combine measures of gravity, informational asymmetries and cultural variables to analyse patterns of foreign portfolio investment between countries. They find that the inverse relationship between gravity and investment can in some cases be offset by other factors. For example, the negative effect of geographical distance between countries on investment may be offset by a common language or religion. Dziuda & Mondria (2012) find that home bias is

[3] Market Capitalisation figures from World Bank data.

Table 2.1 US holdings of foreign equity as a percentage of total equity holdings

Billions of dollars	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
1. US foreign equity holdings	2,079	2,560	3,318	4,329	5,253	2,748	3,995	4,647	4,501
2. Market cap of US firms	17,941	22,002	23,941	26,508	31,710	28,714	22,647	24,633	30,998
3. Foreign holdings of US firms	1,564	1,930	2,144	2,430	3,130	2,969	2,252	2,814	3,830
4. US total equity holdings = 1+2-3	18,456	22,632	25,115	28,407	33,833	28,493	24,390	26,466	31,669
% foreign holdings = 1/4	11%	11%	13%	15%	16%	10%	16%	18%	14%

Notes: This table calculates the holdings by US investors of foreign equities as a percentage of their total equity holdings. The total equity holding is the market capitalisation of all US firms less the amount held by foreign investors plus foreign equity holdings by US investors.

being magnified in the US as higher-ability portfolio managers invest more domestically. They propose a model based on the following assumptions. Firstly, investors chose portfolio managers based on their ability to generate excess returns, secondly investors are more informed about domestic assets and thirdly, portfolio managers are equally informed about domestic and international assets. Given that domestic investors are more informed about the domestic market, they can more accurately identify high-ability portfolio managers that are investing domestically. This creates more demand for funds investing domestically and gives higher ability mangers an incentive to specialise in domestic assets. They contend that that as most portfolio transactions are performed by fund managers, informational asymmetry about international assets is not the cause of home bias but rather the uncertainty surrounding managers' abilities. Foad (2012) finds that home bias fell in the Euro area since the Euro was introduced, mainly due to the reduction in information asymmetries. Mondria & Wu (2013) suggest that information asymmetries arise as a result of lack of financial integration, the two being complementary rather than competing explanations for home bias. Levy & Levy (2013) suggest that home bias persists as the opportunity cost of not investing abroad is decreasing as correlations between countries increase.

2.4 Indirect International Diversification

Traditionally international diversification involves directly investing in equities traded abroad. Errunza et al. (1999) introduce the concept of 'home-made' international diversification. Investing in securities that trade domestically and provide international exposure may be an indirect method of reaping the benefits of international diversification, while avoiding the costs and inconvenience of investing abroad. Many estimates of investors' exposure to foreign markets include only direct international portfolio investments, ignoring the indirect exposure that can be achieved via domestic equity products. Investors' tendencies to overinvest domestically may be partly due to a preference for this *indirect* foreign exposure. A study by Cai & Warnock (2012) argues that a more comprehensive analysis of the home bias puzzle requires careful distinction between 'domestic' and 'international' investment. By regressing US firms' returns on both the US market and foreign market indices, they estimate a foreign beta for each firm. They find a positive relationship between a firm's foreign sales and its foreign beta; for

each 1 percent increase in foreign sales, they find an increase of around a half of a percent for the firm's foreign beta. They estimate the total indirect foreign holdings in the US as the product of US holdings of domestic equity, the percentage foreign sales of those firms and the estimated relationship between the firm's foreign beta and foreign sales. They calculate that the foreign exposure of US investors is almost twice that suggested by the official estimates of US holdings of foreign equity. They contend that the degree of home bias is overestimated when this home-based foreign exposure is not counted as 'foreign' investment.

I investigate five US-traded equity products that may provide international diversification benefits in a domestic setting; MNCs, Industry Indices, ADRs, CCFs and iShares. The treatment of these five products differs with respect to how they are counted as foreign or domestic portfolio holdings. Investments by US investors in MNCs and Industry Indices are counted as domestic equity holdings. An increase in investment in these products and a decrease in foreign equity holdings would cause an increase in the degree of home bias, as it is currently measured. Holdings of ADRs, CCFs and iShares are counting as foreign equity holdings.[4] Any change in the holding of these assets relative to other foreign equity holdings would have no effect on the degree of recorded home bias.

In this section I review the literature on the diversification benefits of each type of equity product. I begin by reviewing studies on the diversification benefits of MNCs and on the measurement and extent of their internationalisation at the firm level. I then review the literature on industrial diversification and on the diversification benefits of ADRs, CCFs and iShares. I review studies that compare the diversification benefits of more than one type of equity product. Finally, I review studies that investigate whether it is possible to exhaust the benefits of international investment via domestically-traded products.

2.4.1 MNCs

MNCs with substantial foreign operations may provide some of the benefits of international diversification. Many studies have considered whether investors can benefit from indirect

4 Report on U.S. Portfolio Holdings of Foreign Securities. Department of the Treasury Federal Reserve Bank of New York, Board of Governors of the Federal Reserve System.

international diversification via investments in MNCs. To date there is a lack of agreement on the topic. However, it is difficult to compare the results of different studies as different measures of internationalisation are used to select firm samples.

Hughes, Logue, & Sweeney (1975) compare 46 US MNCs selected by percentage foreign sales to domestic firms. They find that MNCs have lower risk but that the risk-adjusted return of both is similar. Agmon & Lessard (1977) rank US MNCs by foreign sales and regress them on the NYSE and on the rest of the world. They find that firms with higher levels of foreign sales have a higher beta with the rest of the world than those with less foreign sales. Mikhail & Shawky (1979) find that a portfolio of US MNCs that have a significant equity interest in enterprises in at least 6 foreign countries outperforms an investment in the S&P500. Fatemi (1984) finds that while the returns of a portfolio of MNCs with over 25 percent foreign sales are no different to those of a portfolio of domestic firms, the risk and betas of the MNC portfolio are lower and more stable. Qian (1996) finds evidence that MNCs with over 30 percent percentage foreign sales outperform domestic firms but that the number of foreign markets in which a firm has operations has little impact on its performance. Rowland & Tesar (2004) select firms in G7 countries with one or more branch or subsidiary in another country and using mean-variance spanning find evidence that US and German MNCs provide diversification benefits. Berrill & Kearney (2010) rank firms by the geographical spread of their international activities and find home-based international diversification benefits of MNCs in the G7 countries using mean-variance spanning. Antoniou et al. (2010) find that UK MNCs with over 30 percent foreign sales and at least one foreign subsidiary play a vital role in a homemade diversification strategy.

Other studies find no evidence of diversification benefits. Jacquillat & Solnik (1978) regress multinational firms' returns on the returns of national stock market indices and find that the degree of influence of the foreign stock market returns bears little relationship to the extent of foreign activities of the firms. Senchack & Beedles (1980) select firms with over 25 percent foreign sales and foreign earnings and find little difference in the risk reduction capability of MNCs compared to domestic firms. Brewer (1981) selects firms with an equity interest in at least 6 countries and by percentage foreign sales and finds no difference in the risk-adjusted return of domestic firms and MNCs. Michel & Shaked (1986) select manufacturing firms with over 20 percent foreign sales and capital investment in at least 6 foreign countries and find that

domestic firms have a superior risk-adjusted performance to MNCs. Omer, Durr, Siegel, & Khursheed (1998) select firms based on their ratio of foreign to total taxes over a 6 year period and find that the degree of internationalisation of a firm has no effect on risk and return. Salehizadeh (2003) selects MNCs with a minimum of five foreign subsidiaries and 20 percent foreign sales, and finds low correlation between a portfolio of MNCs and foreign country indices.

The results for MNC diversification benefits are very mixed. To summarise, some authors find that firms selected based on their percentage foreign sales alone yield diversification benefits (Hughes, Logue, & Sweeney,1975; Agmon & Lessard, 1977; Fatemi, 1984; Qian, 1996), while others combine percentage foreign sales with other selection criteria but fail to find diversification benefits (Senchack & Beedles, 1980; Michel & Shaked,1986; Salehizadeh, 2003). Some studies use alternative measures to percentage foreign sales; Mikhail & Shawky (1979) find that firms selected by the number of countries in which they have an equity interest provide diversification benefits and Berrill & Kearney (2010) find diversification benefits for firms selected by the location of their foreign operations. It is difficult to conclude from these studies that one method of firm selection is superior, as well as the fact that they are conducted at different times with different firm samples. A comparison of the diversification benefits of MNCs selected by different measures of internationalisation has not been conducted. With the exception of Omer et al. (1998), all previous studies select firms based on criteria at one point in time. A longitudinal analysis of firm-level internationalisation which tracks the patterns of firms' internationalisation over time is lacking, this is an issue which is addressed in the literature (Casillas & Acedo, 2013).

2.4.2 MNC Internationalisation

Many systems exist to classify firm-level internationalisation. Perlmutter's (1969) categorises firms based on managerial attitudes to the management and staffing of subsidiaries as ethnocentric, polycentric and geocentric. Bartlett & Ghoshal's (1989) create a fourfold typology of MNC organisational structure as multinational, international, transnational and global. Sullivan's (1994) creates a Degree of Internationalisation (DOI) scale which incorporates factors

such as percentage foreign sales, R&D intensity, assets, percentage overseas subsidiaries, and managers' international experience. The Transnationality Index is calculated by the United Nations Conference on Trade and Development (UNCTAD). It calculates the average of three ratios; foreign sales to total sales, foreign assets to total assets and foreign employment to total employment. Zahra & George (2002) conduct a review the literature in international entrepreneurship and find that the majority of studies on firm internationalisation focus on firms' percentage foreign sales. Rugman (2003) and Rugman & Verbeke's (2004) divide the world into three regions, which they term triads; North America, Europe and Asia-Pacific. They apply thresholds and categorise firms as home-region orientated, host-regional orientated, bi-regional and global, based on foreign sales. Aggarwal, Berrill, Hutson, & Kearney (2011) divide the world into 6 regions and categorise firms by the breadth and depth of their international engagement. Breadth is measured as the extent of the geographical spread of a firm's operations. Depth is measured as the degree of engagement with each geographic region. They create a matrix whereby each firm can be classified by both the breadth and depth of its international activity. Casillas & Acedo (2013) discuss three measures of firm internationalisation in the context of the relationship between firm internationalisation and performance or diversification benefits; extent, scope and speed. Sullivan's DOI scale and the UNCTAD Transnationality Index could be considered measures of the extent of a firm's internationalisation, while the classifications used by Bartlett & Ghoshal, Rugman and Aggarwal et al. attempt to measure the scope of a firm's foreign activities. There is a dearth of studies which consider the changes in either of these two measures.

Several authors have suggested that a longitudinal study of MNCs would be more beneficial than the many cross-sectional studies that have appeared to date. Contractor (2007) conducts a review of studies on firm internationalisation in the US, and finds that almost all of the studies use cross-sectional data to analyse firm internationalisation. He suggests that longitudinal studies would be of far greater benefit. Hennart (2007) conducts an evaluation of the theoretical arguments used to explain a positive relationship between firm internationalisation and performance. He suggests that it should be tested longitudinally over periods of at least ten years. Glaum & Oesterle (2007) review papers in the area of firm internationalisation and performance, they note that most studies employ cross-sectional data. They strongly recommend a longitudinal dataset to explore this relationship. Asmussen, Benito, & Petersen (2009) argue

that a dynamic view of how firms internationalise is needed to study characteristics of MNCs. Kuivalainen et al. (2012) conduct an overview of the literature on the internationalisation patterns of small and medium sized enterprises and recommend that future research should focus on the time dimension of internationalisation patterns to capture the dynamics of internationalisation. Casillas & Acedo (2013) contend that the speed of firm internationalisation has often been ignored in the literature and recommend that longitudinal data be used to study the speed at which firms internationalise.

The extent to whether firms are regional or global in their activities is a source of much debate within the literature. Yip (2002), Gupta, Govindarajan, & Wang (2008) and Regnér & Zander (2014) recommend that firms follow a global strategy rather than a home region or bi-regional strategy to maximise competitiveness, while others such as Doremus, Keller, Pauly, & Reich (1998) argue that the impact of globalisation has been exaggerated and that MNCs are impacted by the countries in which they operate, mostly maintaining a regional focus. Ghemawat (2003) reports that in reality cross-border integration is not complete due to the residual barriers and costs of internationalising, and that firms are more likely to pursue a semi-global strategy. Rugman (2003) and Rugman & Verbeke (2004) analyse the foreign sales of the firms in the Fortune 500 in 2001 and find that only 9 firms are truly global. For the 320 firms for which geographic sales data were available, they find an average of 80 percent of sales are in their home regions. From the same list of firms, Rugman & Collinson (2005) analyse 118 European firms and show that an average of 63 percent of their sales are in the home region of Europe. Rugman & Brain (2003) show that the 20 firms on the 2000 Fortune 500 list with the highest ratio of foreign to total sales in 2000 are mainly home-region based. They conclude that most of the world's largest MNCs are regional rather than global, and that globalisation is a myth.

The evidence presented by Rugman and his co-authors has been criticised by several authors. Stevens & Bird (2004) point to several shortcomings in his research, such as it having no robust definition of globalisation, ill-defined regions, arbitrary thresholds for percentage foreign sales, and no acknowledgment of the potential shortcomings of only using sales data. They strongly disagree with their conclusions and argue that a shift towards a culture of globalisation is strongly evident. Aharoni (2006) argues that they fail to capture the dynamics of firm internationalisation by not using longitudinal data. Dunning, Fujita, & Yakova (2006) find that

MNCs do operate regionally but contend that this reflects the gross domestic product and trade of the countries concerned rather than reflecting a strategic regional focus by the firms as suggested by Rugman et al. Flores & Aguilera (2007) examine the foreign location choice of 100 US MNCs between 1980 and 2000 and find them to be far more globalised than suggested by regionalisation theorists. Asmussen (2008) find that large MNCs have home-region oriented paths of internationalisation but suggest that this focus is due mainly to efficiencies of operations. Osegowitsch & Sammartino (2008) question the rationale of Rugman's classification scheme, and find his results to be far from robust. They perform a longitudinal analysis at two points in time and find that large firms are increasingly extending their sales beyond their home region. With relatively simple adjustments to his thresholds they find that many firms are active beyond their home region and could be classified as bi-regional or global. Berrill (2014) analyses the breadth and depth of internationalisation of 1,289 firms from G7 countries using the classification method proposed by Aggarwal et al. (2011) and finds that global strategy is alive and well. Collectively, these authors find that the evidence in favour of regionalisation is not as overwhelming as suggested by Rugman and others. They question the veracity of their claim that globalisation is a myth and suggest that an increasing shift towards semi-globalisation or globalisation is occurring.

2.4.3 Industry Diversification

Some of the gains from international diversification are considered to be due to differences in industrial structure across countries (Lessard, 1974; Flavin, 2004). Therefore, diversifying by industry may be a substitute for investing in foreign country indices. Several studies compare the role of country factors and industry factors in explaining the variation in national country indices. Using data for 16 developed markets between 1959 and 1973, Lessard (1974) finds that country factors are more important than industry factors in explaining the variance of national indices. Roll (1992) analyses 24 countries between 1988 and 1991, using 7 major industry classifications. He finds that industry factors play a major role in the determination of country indices, and finds that up to 40 percent of their variation can be explained by their industrial composition. Heston & Rouwenhorst (1994) refute Roll's findings, claiming that the industy factors are being overstated as the method that he uses for extracting industry factors also

includes country factors. They analyse the same 7 industries for 12 European countries between 1978 and 1992 and find that less than 1 percent of of the variation in national indices can be explained by their industrial composition. Griffin & Karolyi (1998) extend Heston & Rouwenhorst's analysis to 25 countries using data between 1993 and 1995 and also find that industry factors have little impact on country indices returns. Baca et al. (2000) examine country and industry effects for 7 European countries and 10 industry sectors between 1979 and 1999 and find a significant shift from country to industry factors. They find that their significance is roughly equal to each other. They attribute the increase in industry factors to be due to convergence between European countries and the increasing globalisation of MNCs. Cavaglia et al. (2000) find even stronger effects; for 21 developed markets between 1986 and 1999, they find that industry dominate country factors. Serra (2000) conduct a study of emerging market countries. For 26 emerging markets and 8 industry sectors between 1990 and 1992, they find that country factors are more important than industry factors for emerging markets. Flavin (2004) analyses industry and country factors for 11 European countries and 10 industry sectors between 1995 and 2002 and finds that industry factors dominate country effects. Ferreira & Ferreira (2006) analyse markets over a longer time period, 1975 to 2001. For 11 European countries and 10 industry sectors, they find that although industry factors increased in importance over the 1990s, country factors dominate over a longer time period. They find industry factors to be equal in importance to country factors over the period since the introduction of the Euro. Phylaktis & Xia (2006) analyse 37 countries between 1990 and 2002. They find that country effects are strongest in emerging markets and industry effects are strongest in developed markets. Bekaert et al. (2009) analyse 23 developed markets between 1980 and 2005 and find that the increasing relative importance of industry factors appears to have been temporary. De Moor & Sercu (2011) find that country factors remain the most influential factor for 21 countries and 10 industry sectors between 1980 and 1999 and find no sign that this is being significantly altered. Lee & Hooy (2012) find country effects to be stronger in the Asean 5 countries between 1994 and 2010. Marcelo, Quirós, & Martins (2013) analyse 9 European countries over the period 1990 to 2008. They find country diversification to be preferable over longer time periods but industry diversification to be of relatively more benefit in volatile times, when country factors become more highly correlated in periods of financial crisis.

2.4.4 ADRs

An American Depository Receipt represents the shares of a non-US company that trades in US financial markets. Officer & Hoffmeister (1987) examine 45 ADRs from 5 countries between 1973 and 1983 and find that adding as few as four ADRs to a domestic US portfolio significantly reduces the risk of the portfolio. A subsequent study by Wahab & Khandwala (1993) uses daily data between 1987 and 1990 to analyse the returns and variance of different portfolios of ADRs, and similarly finds that ADRs offer excellent diversification benefits. Webb, Officer, & Boyd (1995) examine the time series relationship between the daily returns of the US market and regional portfolios of 85 ADRs between 1985 and 1989. They find that ADRs are significantly correlated with the US market and that the US market is the lead pricing factor. Jiang (1998) creates optimised portfolios of 113 ADRs from 8 countries with and without short sales and using cointegration analysis compares their diversification benefits to those of portfolios of foreign country indices. She finds that the portfolios of ADRs outperform the country portfolios. Peterson & O'Shaughnessy (2000) examine Mexican and South American ADRs, and evaluate the role of currency and liquidity risk as well as the standard deviation of returns. They find that currency and liquidity risks are minimal, and that the ADRs are weakly correlated with the US market, and provide good diversification opportunities. Patro (2000) reports no significant relationship between exchange rates and ADR performance between 1992 and 1997 for 123 ADRs from 16 countries, and finds that the price of the underlying stock in the home market is the most important factor in determining ADR returns. Kim, Szakmary, & Mathur (2000) examine the role of FX rates, the returns of the underlying shares and the US market in the price determination of 56 ADRs from 5 countries between 1998 and 1991. They find the underlying shares to be the most important factor, but that the effect of the US market and FX rates is significant and increasing over time. Fang & Loo (2002) find that 133 ADRs from six countries are significantly affected by their respective home markets between 1995 and 1999 and are an effective diversification tool. Gagnon & Karolyi (2010) examine arbitrage opportunities between 506 ADRs and other cross-listed shares from 35 countries and their underlying shares and find only small price differences between the two. Kabir, Hassan, & Maroney (2011) use mean-variance spanning tests and stochastic discount factor spanning tests to investigate the

diversification benefits of ADRs from 23 countries. They find that ADRs are a good substitute for foreign investment for many countries but with some exceptions for Latin America. Using time series regressions, Lee, Chen, Li, & Chang (2011) compare ADRs from 13 emerging markets located in Asia and Latin America and find that the home market returns have a large impact on Latin American ADRs but that the US market sentiment has the biggest impact on Asian country ADRs. Peterburgsky & Yang (2013) use regression analysis and Sharpe ratios to evaluate the diversification benefits of ADRs from 23 countries and find that they are less effective than holding the underlying stocks during periods of low returns in the US. In summary, with some exceptions, most studies find that ADRs are heavily affected by their home market and provide an effective means of diversification to US investors, but their effectiveness can be dependent on their region of origin.

2.4.5 Closed-End Country Funds

The first of two types of exchange-traded country funds that are prevalent in the US is Closed-End Country Funds (CCFs). CCFs are mutual funds that issue a fixed number of shares at inception, which causes the value of the fund to be determined by demand and supply as well as the fund's net asset value (NAV). Two strands of literature exist on CCFs, the first on the so-called Closed-End Fund Puzzle, where CCFs trade at a premium or discount to the net asset value of the underlying assets in the fund, and the second on the diversification benefits of CCFs. Errunza, Senbet, & Hogan (1998) suggest that premia on emerging market country funds are due to barriers on international investment, often country funds that invest in restricted markets will trade at a premium. Bonser-Neal, Brauer, Neal, & Wheatley (1990) provide empirical support for this view and find that when investment restrictions are relaxed lower fund premia occur. Khorana, Nelling, & Trester (1998) find that CCFs experience a decrease in trading volume and an increase in the discount from the NAV of their underlying assets in the six months after the introduction of iShares in 1996. Patro (2005) finds that when new country funds are listed, this reduces the premia of existing country funds. Lee, Shleifer & Thaler (1991) and Bodurtha, Kim, & Lee (1995) suggest that changes in fund premia or discounts are due specifically to US investor sentiment. Chiang, Wisen, & Zhou (2011) find the effect of investor sentiment on CCF returns to be short-lived.

Bailey & Lim (1992) examine the diversification benefits of CCFs and find that the returns of 19 country funds between 1985 and 1989 are more correlated with US market returns than with the returns of foreign indices they claim to represent. Chang et al. (1995) examine the correlation of returns of 15 funds with the US market between 1985 and 1990 and find that they perform more like US assets than their underlying assets but conclude that they still offer diversification benefits. Bekaert & Urias (1996) use mean-variance spanning tests and find significant diversification benefits for UK-traded country funds, but not for US-traded country funds. Choi & Lee (1996) find that the returns of 21 CCFs are more heavily influenced by local market returns than US returns. Patro (2001) examines the performance of 45 CCFs between 1991 and 1997 and finds that they do not underperform their corresponding foreign market indices. Lee & Hong (2002) document that between 1995 and 1999, 33 CCF returns are more heavily influenced by their corresponding foreign country returns than by US returns, which implies that investing in country funds is useful for diversification benefits. Chiang & Kim (2003) examine the cointegration of 47 CCFs with their NAV, the US market and foreign market indices, and find that emerging market CCFs display higher cointegration with the NAV and the foreign market indices in the long-term but that the US market has a significant influence in the short-term. Using correlation analysis and mean-variance spanning, Charitou, Makris, & Nishiotis (2006) test whether CCFs are an adequate substitute for investment in foreign market indices and find that foreign markets have more influence on 23 CCFs between 1993 and 2002 than the US market. Chen, Morse, & Nguyen (2009) look at the impact of the growth of iShares on CCFs, and find that although the volume of investment in CCFs is significantly reduced, their liquidity is not affected.

2.4.6 Single country iShares

The second type of exchange-traded country funds are iShares. Single country iShares are designed to track MSCI country indices. Demand and supply does not have a significant effect on the value of the fund, as new shares can be created or redeemed at will (Pennathur, Delcoure, & Anderson, 2002). The index tracking capability of iShares may be affected by the fact that they only invest in a subset of the MSCI index that they claim to track. This is achieved by using a portfolio optimisation approach which seeks to minimise transaction costs (Tsai and Swanson,

2009). Khorana, Nelling, & Trester (1998) analyse 14 single country iShares for 6 months following their introduction in 1996 and find that they closely track their corresponding foreign market index and display low correlation with the US market, thereby offering good diversification opportunities. Using a two factor model Pennathur et al. (2002) find that 17 iShares have considerable exposure to the US market between 1996 and 1999 and conclude that they are no substitute for directly investing abroad. Phengpis & Swanson (2004) point out that using foreign indices to measure diversification may be overstating the benefits as it is not possible to replicate many foreign country indices and even where possible the transaction costs of holding each component of the index can be prohibitive. Using cointegration analysis they evaluate the diversification benefits of 20 iShares between 2000 and 2003 and find that they offer benefits but that emerging market iShares offer less benefit than those for developed markets. They suggest that the benefits of investing in emerging markets may not be as substantial as previously believed. Zhong and Yang (2005) use a three-factor model to assess the exposure of 20 iShares between 1996 and 2002 to home market returns, US returns and exchange rate risk. They find that the iShares returns are significantly influenced by US returns and question their effectiveness as a diversification tool. Miffre (2007) creates portfolios of 16 iShares that optimise the portfolio Sharpe ratio between 1996 and 2004 and finds them to be a low-cost, low tracking-error and tax-efficient means of gaining international exposure. Barari, Lucey, & Voronkova (2008) also note that using foreign market indices to measure diversification may overestimate the benefits. Using cointegration analysis they find that iShares offer limited long term diversification benefits due to substantial exposure to the US market. Using a two-factor model to investigate the exposure of 20 iShares to the US market and their corresponding home market between 1996 and 2007, Phengpis and Swanson (2009) report that iShares are most exposed to their underlying market and are effective diversification instruments. Huang and Lin (2011) calculate the Sharpe ratios of optimally weighted portfolios of 19 iShares between 2003 and 2009 and find that they are an effective diversification tool for US investors. Levy & Lieberman (2013) study the intraday prices of iShares and find that they overreact to US market returns when foreign markets are closed. In summary, the results are mixed. Several studies find that iShares have considerable exposure to the US market and question their diversification benefits (Pennathur et al., 2002; Zhong and Yang, 2005; Barari, Lucey, &

Voronkova, 2008), while other studies maintain that they do they provide diversification opportunities to US investors (Miffre, 2007; Phengpis and Swanson, 2009; Huang and Lin 2011).

2.4.7 Multiproduct Studies

Many studies investigate the indirect diversification benefits of one equity type individually, while a number of studies compare the diversification benefits of two or three equity products. Russell (1998) uses a two-factor model which regresses US returns and foreign market returns on the returns of twenty CCFs, ADRs and MNCs between 1991 and 1995. He finds that all three products have higher betas with the US market than with foreign country indices and concludes that US-traded products are no substitute for investing in foreign markets. Khorana, Nelling, & Trester (1998) compare the performance and correlations of iShares and CCFs in the six month period after iShares were introduced in March 1996. They find that iShares perform as well as CCFs but exhibit lower correlation with the US market, thereby offering a preferable diversification opportunity. Bekaert & Urias (1999) use mean-variance spanning tests to compare the diversification benefits of emerging market closed-end and open-end mutual funds and ADRs in the UK and the US between 1990 and 1996. They find that UK CCFs offer diversification benefits but that US CCFs offer benefits only in the second sub-period 1993 to 1996. In the latter period they find that all three product types offer significant diversification benefits to a US investor but that direct exposure to emerging market indices almost always provides diversification benefits at least as strong as those of the US and UK-traded products. Pennathur et al. (2002) use a two-factor model to assess the exposure of 17 iShares and CCFs to the home market they represent and to the US market between 1996 and 1999 and find that iShares more closely replicate the home index but that both products are considerably exposed to the US market returns. Schwebach, Olienyk, & Zumwalt (2002) conduct a study of 11 CCFs and iShares before and after the 1997 Asian crisis and find that in an optimised portfolio iShares dominate CCFs before the crisis but CCFs dominate after the crisis. Coe (2002) compares the performance of portfolios of ADRs and CCFs for 23 countries between 1990 and 1999 using the Sharpe ratio, the Treynor index and Jensen's alpha, and finds that ADRs have similar returns to CCFs but lower risk. Harper et al. (2006) measure the risk-adjusted performance of 22 iShares and CCFs between 1996 and 2001, using the Sharpe ratio and Jensen's alpha and find that

iShares deliver superior risk-adjusted returns. Tsai and Swanson (2009) compare the performance of 14 iShares and CCFs between 1996 and 2004. They compare optimally weighted portfolios of each asset with no short sales, and find the risk-adjusted performance of iShares to be higher than CCFs and the diversification benefits to be greater. Using regression analysis and Sharpe ratios, Peterburgsky & Yang (2013) compare the diversification benefits of ADRs and CCFs between 1993 and 2008 and find that direct investment in foreign markets is preferable in periods of low US returns. While ADR returns are sensitive to the state of the US economy, it seems to have little impact on the diversification benefits of CCFs.

While these studies compare equity types, Errunza, Hogan, and Hung (1999) combine US-traded products into portfolios which attempt to replicate each of 16 foreign country indices, 9 emerging markets and 7 developed markets. Using data from 1976 to 1993, they find that US investors can mimic foreign market returns with domestically traded securities by investing in Industry Indices, MNCs, CCFs and ADRs. They claim that the gains from international diversification are overstated and should only be measured beyond those attainable through home-based diversification. They find that most of the diversification benefits are found when portfolios include ADRs and Country Funds. Using Mean-Variance Spanning they find that the replicating portfolios provide diversification benefits for 9 countries using Ordinary Least Squares (OLS) estimation and for 11 countries using Generalised Method of Moments (GMM) estimation. A similar study was conducted in the UK by Antoniou, Olusi, & Paudyal (2010) which tests whether portfolios of UK-traded equity products can mimic foreign market indices between 1994 and 2003. As well as Mean-Variance Spanning, they further test the diversification benefits of their replicating portfolios using modified Value-at-Risk and Stochastic Dominance tests. They find international diversification benefits to be mainly attainable via UK MNCs, cross-listings and country funds and less so via industrial diversification. They conclude that overseas investment is no longer necessary for UK investors to reap the benefits of international diversification. To the best of my knowledge, these are the only two studies that investigate the possibility of replicating foreign country indices with portfolios of combinations of domestically-traded products.

2.5 Conclusion

This chapter reviews the literature in the area of direct and indirect international diversification. It provides the backdrop and motivation for each of the subsequent chapters. Whether MNCs provide diversification benefits is far from clear from the existing literature. Given the range of selection methods that have been used, a direct comparison to establish an optimal selection method for the purpose of diversification benefits would be beneficial to investors. Almost all previous studies have used cross-sectional data of firm-internationalisation. Many studies have suggested that a longitudinal dataset would be of far greater benefit. What is also evident from the literature is that a comprehensive comparison of the diversification benefits of several different equity types is lacking. No more than three equity types have been directly compared to date. Lastly, while Errunza et al. (1999) explore whether the benefits of international diversification can be exhausted domestically, since that study the number of products that may offer indirect diversification benefits has increased greatly, allowing a widening of the scope of that study to a greater number of countries via a greater number of US equity types.

Chapter 3 Methodology

3.1 Introduction

Having set the context for my research questions by reviewing the literature, in this chapter I describe the data and methodologies that I use to investigate those questions. I begin with a brief description of my overall research methodology. I subsequently detail the data that I use for the studies in Chapters 4, 5, 6 and 7. I describe how portfolios are constructed using mean-variance optimisation and stepwise regression and how diversification benefits are measured using Mean-Variance Spanning tests, Sharpe ratios and modified Value-at-Risk. Finally I illustrate how I select the break-dates, January 2003 and January 2008, for my sub-period analysis.

3.2 Research Method

The dominant approach to research adopted in the existing literature on diversification in international finance is best described as Positivist. Positivism asserts that the social world is singular and exists independently which stands in contrast to the socially constructed view of reality that characterises the interpretive position (Guba & Lincoln, 1982). Positivism is based on the assumption that it is possible to observe social life and to establish reliable, valid knowledge about how it functions. Introspective and intuitive knowledge are rejected. It contends that, much as the physical world operates according to gravity and other absolute laws, so too does society. In the area of finance, examples exist where methods from the natural sciences have been applied to the social sciences. For example, in the pricing of derivatives, diffusion processes from physics are applied to share price movements (Black & Scholes, 1973; Kou, 2004). Stock markets, which are essentially a reflection of human behaviour, are modelled using theories from the natural sciences.

Positivism assumes that empirical verification is possible, and that we can rely on our observations or measurements of the world to provide us with accurate data. Scientific methods or experimental testing are considered the best approach to achieving this knowledge. This

generally involves hypothesis generation and testing: proving or refuting. Typically, quantitative methods are used. Verified data received from the senses are known as empirical evidence (Morgan, 1983).

Research conducted using the positive approach is evaluated using three criteria. Validity, the extent to which a measurement approach or procedure gives the correct answer, reliability, the extent to which a measurement approach or procedure gives the same answer whenever it is carried out, and generalisability, the extent to which the findings of a study can be applied externally or more broadly outside of the study context.

There is an inextricable link between the researcher's philosophical stance and the methods employed in research (Burrell & Morgan, 1979). He & Yang (2012) note that there has been a movement towards using a method and research approach most appropriate for the phenomenon under investigation. In this investigation the research methodology employed is quantitative, which assumes an objective and independent reality. Thus, in part, the decision to pursue quantitative research has been influenced by its appropriateness for this study. The study uses empirical data to test hypotheses. The choice of quantitative method in each study is dictated to by the study itself and follows commonly used methods in the area of empirical research in international finance.

3.3 Data Collection

Historical financial data, all of which are publicly available, are used in this thesis. All products used are exchange-traded. The trading prices are published at least daily and in most cases on an intra-day basis. The accounting data that I use for MNCs is available on Datastream and is obtained from firms' Form 10-K, which is an annual report required by the U.S. Securities and Exchange Commission (SEC). It gives a comprehensive summary of a company's performance, including audited financial statements, among other information.

I select firms from the 2011 constituent list of the Russell 1000 index. The Russell 1000 Index was founded in 1936. It is a subset of the Russell 3000 Index and includes approximately 1,000 of the largest firms in the US based on market capitalisation. It is market value weighted and

represents approximately 92 percent of the US market. For each firm in the Russell 1000, I obtain its foreign sales as a percentage of total sales for each year from 1996 to 2011. I also obtain the geographical breakdown of each firm's sales for every year over the same period.[5] Firms may specify up to ten geographic segments in which material sales occur. The relevant accounting standard for geographical segment disclosure, International Financial Reporting Standard (IFRS) 8, replaced the International Accounting Standard (IAS) 14 in 2006. Although the accounting standard does not specify a minimum threshold for 'material' sales or assets, it is assumed to be between 5 and 10 percent. Firms must disclose a segment that accounts for over 10 percent of its total assets, profit or revenue. Firms with incomplete data for either percentage foreign sales or the geographic breakdown of sales are excluded. For each firm I also obtain its age, the Industry Classification Benchmark (ICB)[6] code and size of each firm in each year as measured by its total sales or revenue in each year. Full data is available for 396 firms.

I obtain price data for the following 5 US-traded equity products; MNCs, Industry Indices, ADRs, CCFs and iShares from 22nd March 1996 to 24th June 2011. The start date is determined by single country iShares which began trading on the 22nd March 1996. Only products with data for the full time period are selected. Countries with data for either a Closed-End Country Fund, iShare or an ADR are included. This yields a sample of twenty-two developed markets; Argentina, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Portugal, Singapore, Spain, Sweden, Switzerland and the UK and fifteen emerging markets; Brazil, Chile, China, Colombia, India, Indonesia, Malaysia, Mexico, Philippines, Russia, South Africa, South Korea, Taiwan, Thailand and Turkey.[7] MSCI country indices are used to measure the benefits of investing overseas.[8] US returns are measured using the S&P500. The weekly 3 month T-Bill rate is used

[5] Many firms are excluded due to lack of data for the full period. I compare the level of internationalisation of the firms with data available in each year to those with data available for every year. The average percentage sales of all firms for the full sample in each year is between 2% and 3% higher than for my sub-sample of 396 firms. The proportion of firms which are purely domestic is higher for the full sample than for the 396 firms. For the full sample between 34% and 49% of firms have no foreign sales in a given year. For my sub-sample between 28% and 33% of firms have no foreign sales in a single year.

[6] The Industry Classification Benchmark (ICB) is an industry classification taxonomy launched by Dow Jones and FTSE in 2005 and now owned solely by FTSE International. It uses a system of 10 industries, partitioned into 19 supersectors, that are further divided into 41 sectors, that then contain 114 subsectors.

[7] The 2011 MSCI list of emerging markets is used to classify countries as emerging or developed markets.

[8] MSCI country indices are used to measure foreign market returns as these are the indices that iShares are designed to track.

as the risk free rate. As of July 2011, the accounting data for the firms' percentage foreign sales and geographic segment data, was only available for 2010. Therefore the data used for the MNC studies in Chapters 4 and 5 are from 1st January 1996 to 27th December 2010. The data used in Chapter 6 and 7 is from 22nd March 1996 to 24th June 2011.

I use S&P Industry Indices which follow the Global Industry Classification Standard (GICS) classification.[9] The ten sectors represented are Consumer Discretionary, Consumer Staples, Energy, Financials, Healthcare, Industrials, Information Technology, Materials, Telecommunications and Utilities. For the MNCs it was only possible to obtain the Industry Classification Benchmark (ICB) codes of each firm, whereas the S&P Industry Indices follow the GICS industry codes. However, 8 of the 10 industry categories are the same for both ICB and GICS classifications. For the remaining two, GICS divide retail spending into Consumer Discretionary and Consumer Staples, whereas ICB divide it into Consumer Goods and Consumer Services.

An American Depository Receipt represents the shares of a non-US company that trades in US financial markets. It must meet the listing requirements of the US exchange, comply with Securities and Exchange Commission regulations and follow US accounting standards. ADRs are denominated, and pay dividends, in US dollars, and may be traded like shares of US companies. They enable domestic investors to buy the securities of a foreign company without the accompanying inconveniences of cross-border and cross-currency transactions. Level 1 ADRs are traded over the counter, level 2 and 3 ADRs are traded on exchanges. Four banks issue ADRs; J.P. Morgan, Citibank, Deutsche Bank and BNY Mellon. There are approximately 400 ADRs listed on the New York Stock Exchange, American Stock Exchange and Nasdaq as of June 2011. Price data is not readily available for level 1 ADRs. 95 level 2 and level 3 ADRs have data for the full period.

Closed-End Country Funds (CCFs) are exchange-traded mutual funds that issue a fixed number of shares at inception. Like other mutual funds, they are actively managed. A shareholder in a closed-end fund redeems shares with the issuer as with open-end funds, but may trade shares. As the number is fixed, the value of shares in a closed-end fund is determined by demand and

[9] GICS is an industry taxonomy developed by MSCI and Standard & Poor's (S&P). It consists of 10 sectors, 24 industry groups, 68 industries and 154 sub-industries into which all major public companies have been categorized.

supply as well as the fund's net asset value (NAV). Following the introduction of iShares in 1996, many CCFs have been liquidated since 2002/03. Price date is available for CCFs for the full period for 19 countries.

The second type of exchange-traded fund is iShares, a group of exchange-traded funds (ETFs) that are designed to track a bond or stock market index. iShares represent approximately 45 percent of the US ETF market and are managed by the US investment management company BlackRock.[10] Single country iShares are designed to track MSCI country indices. iShares were initially known as WEBS (World Equity Benchmark Shares) but were subsequently rebranded. There are currently 28 single country iShares but only 17 exist since 1996. All trade on the New York stock exchange.

For all of the equity products I use Datastream's return index (RI) which includes all dividends paid. It calculates a theoretical growth in the value of a shareholding assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date. RI is calculated as follows,

$$RI_t = RI_{t-1} * \frac{P_t}{P_{t-1}} \tag{3.1}$$

where P_t is the price at time t, except when t = ex-dividend date of the dividend payment. In this case the dividend is added to the price and the equation becomes

$$RI_t = RI_{t-1} * \frac{P_t + D_t}{P_{t-1}} \tag{3.2}$$

where P_t is the price on the ex-dividend date, P_{t-1} is the price on the previous day and D_t is the dividend payment associated with the ex-dividend date t. Gross dividends are used where available and the calculation ignores tax and re-investment charges. Adjusted closing prices are used throughout to determine the price index and hence the return index. Return indices for new issues are initially based on an anticipated annualised dividend until data on the first actual dividend payment becomes available. At this point the RI is calculated back to the base date. I

[10] BlackRock is the largest issuer of ETFs both in the US and globally (Fortune Magazine, August 2009).

use the closing RI price at weekly intervals for the five US-traded equity products. Table 3.1 lists the iShares, CCFs and ADRs available for each of the 37 countries in my sample. iShares are available for 17 countries, CCFs for 19 and ADRs for 26. For the 15 emerging markets in my sample, iShares exist for 2 countries, CCFs for 11 and ADRs for 9. For the 22 developed markets in my sample, iShares exist for 15 countries, CCFs for 8 and ADRs for 17. The full list of ADRs is detailed in Appendix A.1.

Weekly returns, r_t, are calculated as

$$r_t = ln(RI_{t+1}) - ln(RI_t) \tag{3.3}$$

where RI_t is the return index of the equity product at time t. The annualised return is calculated as the average weekly return times 52. The annualised standard deviation is calculated as the average weekly standard deviation times the square root of 52. I test all of the return series for stationarity, using the Dickey-Fuller Unit Root test (Dickey & Fuller, 1979) as non-stationarity could affect the inferences in my tests. The use of OLS relies on the stochastic process being stationary. If it is not stationary, the use of OLS can produce invalid estimates. The null hypothesis is that the returns of the equity product have a unit root against the alternative that they do not. I test for unit roots based on the following model:

$$r_t = \alpha_1 r_{t-1} + \mu_t \tag{3.4}$$

The null hypothesis of a unit root can be stated as

$$H_0: \alpha_1 = 1 \tag{3.5}$$

In all cases, the null hypothesis of having a unit root is rejected, indicating that the return series are stationary. These results are consistent with findings by Chang et al. (1995) and Ben-Zion, Choi, & Hauser (1996) for CCFs, Jiang (1998) for ADRs, Salehizadeh (2003) for MNCs,

Table 3.1 List of US-Traded Products for each Country

	iShare	*Number of ADRs*	*CCF*
Developed Markets			
Argentina		5	
Australia	√	2	Aberdeen Australia Equity Fund
Austria	√		
Belgium	√		
Canada	√		
Denmark		1	
Finland		1	
France	√	2	
Germany	√	2	New Germany Fund
Hong Kong	√		Greater China Fund
Ireland		4	New Ireland Fund
Israel		2	Aberdeen Israel Fund
Italy	√	4	
Japan	√	10	Japan Equity Fund
Netherlands	√	6	
New Zealand		1	
Portugal		1	
Singapore	√		Singapore Fund
Spain	√	3	
Sweden	√	1	
Switzerland	√	2	Swiss Helvetia Fund
UK	√	15	
Emerging Markets			
Brazil		4	
Chile		7	Aberdeen Chile Fund
China		2	China Fund
Colombia		1	
India			India Fund
Indonesia		2	Aberdeen Indonesia Fund
Malaysia	√		Malaysia Fund
Mexico	√	8	Mexico Fund
Philippines		1	
Russia			Templeton Russia & Eastern European Fund
South Africa		5	
South Korea		2	Korea Fund
Taiwan			Taiwan Fund
Thailand			Thai Fund
Turkey			Turkish Investment Fund

Notes: This table lists the number of ADRs for each country and whether an iShare or CCF exists for each country. Only countries for which either an ADR, iShare or CCF exists are included in the dataset.

Zhong & Yang (2005) for iShares, and Goetzmann, Li, & Rouwenhorst (2001) and Bekaert et al. (2009) for industry and country indices.

3.4 Portfolio Optimisation

In Chapters 5 and 6, I compare the diversification benefits of portfolios of equity assets weighted using equal and optimised weights. To create the optimised portfolios, I solve for the weights of the equity assets which maximise the risk-adjusted return of each portfolio.[11] I subsequently use Mean-Variance Spanning to test if portfolios of assets provide international diversification benefits to US investors. In Chapter 7, to create portfolios which aim to replicate foreign country indices, I solve for the weights of the equity assets which maximise the correlation of the portfolio with the foreign country index. In this section I describe the method of portfolio optimisation that I use in Chapter 5 and 6, while the in next section I describe the method used in Chapter 7.

In order to maximise the risk-adjusted return of the portfolios I construct portfolios which allow long or short positions in each equity asset. I also construct portfolios which only allow a long position in the assets. I solve for the weightings ω that maximise the portfolios' risk-adjusted return. The optimisation problem is subject to the constraint that the sum of the weights equal one. For long-only portfolios I apply a second constraint which forbids short-selling. In mathematical terms, the optimisation problem reads as follows,

$$\max_{\omega}\left[\frac{E(R_P)}{\sigma_P}\right] = \max_{\omega}\left[\frac{\omega' R}{\sqrt{\omega' V \omega}}\right] \tag{3.6}$$

subject to $\sum_{i=1}^{N} \omega_i = 1$ and $\omega_i \geq 0$ for i=1,..,N. If short selling is allowed then only the first constraint is applied to the optimisation problem. ω is an N vector of portfolio weights, R is an N vector of mean returns, σ_P is the portfolio standard deviation and V is a covariance matrix.

[11] Although the mean-variance methodology is widely used for portfolio diversification by pension and mutual funds, it suffers from drawbacks. The estimate of risk by variance is only appropriate, when returns are normally distributed, which is only an approximation for most equity returns. For this reason I also calculate modified Value-at-Risk which incorporates the third and fourth moments of return; skew and kurtosis.

The resulting portfolio is called the optimal risk-return portfolio. I perform these optimisations in Excel using the Solver Add-in.

3.5 Step-wise Regression

In Chapter 7, rather than maximise the risk-adjusted return of the portfolios, I maximise their correlation with the foreign country indices. The number of available assets for each country ranges from 41 to 56 (10 Industry Indices, 29 MNCs, the Russell 1000, and the CCF, iShare or ADRs available for that country). In order to select the optimal asset weightings, I could use all of the explanatory variables and conduct a regression with up to 56 independent variables, or try to simplify the regression by only selecting the significant variables.

In order to reduce the number of explanatory variables, I aim to remove those variables which have no explanatory power. I require a method which will simplify the model while maintaining good predictive ability. This common problem of selecting a subset of independent variables in regression analysis has led to various subset selection procedures. Stepwise least squares regression allows some or all of the variables in a standard linear multivariate regression to be chosen automatically, using various statistical criteria. It uses a stopping criterion using a p-value statistic for adding or removing variables. It selects the independent variable that maximises the squared partial-correlation coefficient with the dependent variable, given the variables already selected. The process 'stops' whenever the sample partial correlation is 'non-significant' as shown by the standard F test (Bendel & Afifi, 1977). Another method for choosing a subset of regression variables is Bayesian model averaging (Raferty, Madigan, & Hoeting, 1997), which involves averaging over all possible combinations of predictors. This approach was not practical for my study given the large number of independent variables. Following Errunza et al. (1999) and Antoniou et al. (2010) I use the technique of stepwise regression.

Beginning with a pool of assets for each country, I use stepwise least squares regression with a forward p-value threshold of 0.05.[12] This effectively optimises the weighting in each asset so as

[12] Stepwise regression can use either a forward or a backward p-value threshold. I tested several portfolios using both and found the results to be almost identical.

to maximise the correlation of the replicating portfolio with the foreign country index, which results in the equation

$$R_{i,t=}b_1R_{j1,t} + b_2R_{j2,t} + b_3R_{j3,t} + \cdots + b_iR_{ji,t} + e_t \qquad (3.7)$$

where $R_{i,t}$ is the return of country i at time t and R_j are the returns of the US-traded assets.

Errunza et al. (1999) and Antoniou et al. (2010) employ a threshold p-value of 0.20. Errunza et al. (1999) state "In order to preserve degrees of freedom, we use stepwise regressions to determine these portfolios. The stepwise procedure is based on a forward and backward p-value threshold of 0.20." Antoniou et al. (2010) only consider increasing the threshold: "The stepwise procedure is based on a forward and backward p-value of 0.20. Increasing this threshold does not significantly enhance the ability of the mimicking portfolios to replicate their target foreign indices." I elect to be more stringent in my portfolio selection and to use a threshold of 0.05 which results in a smaller number of independent variables than when using a threshold of 0.20. Portfolios with a smaller number of assets will have lower transaction costs. If a smaller portfolio can achieve the same diversification benefits as a larger portfolio, the smaller will always be preferable due to these not insignificant costs. I subsequently test the diversification benefits of each portfolio using Mean-Variance Spanning (detailed in the next section). For any portfolios which do not span the relevant foreign country index, I test whether by allowing a higher threshold for the p-value or by using a standard regression including all possible predictor variables alters the results. I reconstruct those portfolios using a stepwise threshold of 0.20 and using all variables in an OLS regression for comparative purposes.

Stepwise regression has been subject to many criticisms, mainly that of potentially excluding important explanatory variables. In an early study Bendel and Afifi (1977) test the method of stepwise regression using between 10 and 30 independent variables and find subset selection to be generally more useful. They note, however, that for cases with fewer than 10 predictors the inclusion of all variables is probably the best strategy. Hoerl, Schuenemeyer, & Hoerl (1986) assert that subset selection using the stepwise procedure is not consistently better than the full model unless at least 60 percent of the variables were found to be superfluous. In Chapter 7, I find that the number of variables reduces from at least 41 to a maximum of 15, using either a p-

value threshold of 0.05 or 0.20, finding at least 60 percent of the independent variables to be insignificant. Roecker (2011) notes that the trade-off in samples between model size and accuracy is not well defined, but suggests that the full model will often be best unless more than half of the available predictor variables are shown to be insignificant, which is the case for my replicating portfolios.[13]

3.6 Test for Diversification Benefits

In the review of the literature in Chapter 2, it is evident that many different methodologies have been used to measure the diversification benefits of equity products. The methodologies most commonly used are as follows. Many studies use pairwise correlation of returns as an initial measure of diversification benefits (Bailey & Lim, 1992; Chang et al., 1995; Khorana et al., 1998; Peterson & O'Shaughnessy, 2000). The returns, risks and betas of portfolios of assets are analysed (Agmon & Lessard, 1977; Fatemi, 1984; Webb et al., 1995) and performance measures such as the Sharpe ratio, the Treynor Index and Jensen's alpha are used to compare portfolio performance (Coe, 2002; Harper et al., 2006). Two-factor models are used to disentangle the effect of the domestic and foreign market on returns (Chang et al., 1995; Russell, 1998; Pennathur et al., 2002) or three-factor models to study the effects of domestic, foreign and currency returns (Zhong & Yang, 2005; Tsai & Swanson, 2009). Several studies use co-integration analysis to study the relationship between markets (Chang et al., 1995; Jiang, 1998; Chiang & Kim, 2003; Barari et al., 2008; Phengpis & Swanson, 2010) or use alternative correlation measures such as the dynamic correlation coefficient (Hyde, Nguyen, & Bredin, 2007; Barari et al., 2008; You & Daigler, 2010; Christoffersen et al., 2012). I use the methodology of Mean-Variance Spanning because of its analytical rigour in facilitating a series of related tests of the statistical significance of diversification benefits, using consistent benchmark portfolios. I accompany these with Sharpe ratio measures of their economic benefits.

[13] Stepwise regressions and Mean-Variance Spanning tests were performed using Eviews7.

3.6.1 Mean-Variance Spanning

To test for diversification benefits I use Mean-Variance Spanning which tests whether the mean-variance efficient frontier of a portfolio shifts when assets are added to the portfolio. Regression-based spanning tests reveal whether an asset or set of assets offers additional diversification opportunities to a portfolio. It measures the difference between two mean-variance efficient frontiers. The null hypothesis of spanning test states that both frontiers statistically coincide. The methodology of Mean-Variance Spanning is documented by Huberman and Kandel (1987), and its geometric interpretation by Kan & Zhou (2012). It is used by Driessen and Laeven (2007) to investigate how the benefits of international diversification differ across countries from the perspective of a local investor. It is also used by Bekaert, Urias, and Francisco (1996), Errunza et al. (1999), Bekaert & Urias (1999), Rowland and Tesar (2004) Charitou, Makris, & Nishiotis (2006), Berrill and Kearney (2010), Antoniou et al. (2010) and Kabir, Hassan, & Maroney (2011) in studies of home based international diversification.

Mean-Variance Spanning tests consider a set of K benchmark assets and N test assets and investigate whether, conditional on the K benchmark assets, the addition of the N test assets can shift the mean-variance efficient frontier. Alternatively, conditional on the K+N benchmark and test assets, can the subset of K benchmark assets yield the same diversification benefits? This will test whether the K benchmark assets span the extended set of K+N assets. I define $R_{1,t}$ as the K×1 vector of returns on the K benchmark assets at time t, I define $R_{2,t}$ as the N×1 returns on the N test assets at time t, and I combine $R_{1,t}$ and $R_{2,t}$ in the K+N vector $R_t=[R_{1,t}, R_{2,t}]$. The expected returns $E[R_t]$ and the covariance matrix of these K+N assets can be written as

$$E[R_t] = \mu = \begin{vmatrix} \mu_1 \\ \mu_2 \end{vmatrix} \qquad Var[R_t] = V = \begin{vmatrix} V_{11} & V_{12} \\ V_{21} & V_{22} \end{vmatrix} \tag{3.8}$$

where V is assumed to be nonsingular. The Mean-Variance Spanning test proceeds by estimating the following model which regresses the N test asset returns on the K benchmark asset returns,

$$R_{2,t} = \alpha + \beta R_{1,t} + \varepsilon_t \tag{3.9}$$

with

$$E[\varepsilon_t] = 0_N \quad \text{and} \quad E[\varepsilon_t R'_{1t}] = 0_{NxK} \tag{3.10}$$

where 0_N is an N-vector of zeros and 0_{Nxk} is an N by K matrix of zeros. α and β can also be expressed as;

$$\alpha = E[R_{2,t}] - \beta E[R_{1,t}] = \mu_2 - \beta\mu_1 \tag{3.11}$$

and

$$\beta = V_{21}V_{11}^{-1} \tag{3.12}$$

where α is an N-dimensional constant term, β is an N x K matrix with slope coefficients and εt is an N-dimensional vector with zero-expectation error terms.

The null hypothesis states that the benchmark portfolio spans the portfolio of the benchmark assets plus the test assets. MVS tests whether the mean-variance portfolio efficient frontiers coincide at all points. The null hypothesis that the K benchmark assets span the entire market of all K+N assets is equivalent to testing the restrictions $\alpha = 0$ and $\beta 1_K = 1$. If this hypothesis is upheld, it implies that for every test asset, it is possible to obtain a portfolio of the K benchmark assets that has the same expected return (because $\alpha = 0_N$ and $\beta 1_K = 1_N$) and a lower variance (because $R_{1,t}$ and ε_t are uncorrelated while $Var(\varepsilon_t)$ is positive definite). This is equivalent to examining whether the frontier of benchmark assets intersects the frontier of benchmark and test assets at two points. The two-fund separation principle then guarantees that if the frontiers intersect at two points, they intersect at all points (Markowitz, 1952). In effect, the test assets are spanned by the benchmark if it is possible to use the benchmark returns to mimic the return on the test assets. In that case the test assets returns do not offer diversification benefits, and I cannot reject the hypothesis that the frontier of the benchmark plus test assets returns is the same as the frontier generated by only the benchmark returns.

Huberman and Kandel (1987) estimate equation 3.9 using OLS. They propose testing the coefficient restrictions $\alpha = 0$ and $\beta 1_K = 1$ using a likelihood ratio test. Kan & Zhou (2012) compare three methods to test the coefficient restrictions, the likelihood ratio test, the Wald test and the Lagrange Multiplier test, which they show to be closely related tests of Mean-Variance Spanning. They derive two eignenvalues λ_1 and λ_2, of which all of the coefficient tests are functions. The likelihood ratio test can be written as

$$LR = T \sum_{i=1}^{2} \ln(1 + \lambda_i) \tag{3.13}$$

the Lagrange multiplier test as

$$LM = T \sum_{i=1}^{2} \frac{\lambda_i}{1 + \lambda_i} \sim X_{2N}^2 \tag{3.14}$$

and the Wald test as

$$W = T(\lambda_1 + \lambda_2) \sim X_{2N}^2 \tag{3.15}$$

All three tests have an asymptotic chi squared distribution. They show that although the power of the tests is difficult to gauge when N>1, in the case where N=1, the Wald test is the strongest of the three. In my tests N=1, therefore I proceed using the Wald test to test the coefficient restrictions.

Kan & Zhou (2012) further demonstrate how the mean-variance spanning tests can be decomposed into two parts, the spanning of the global minimum variance portfolio and the spanning of the tangency portfolio. They show that the asymptotic tests have very good power for test assets that can reduce the variance of the global minimum-variance portfolio, but have little power against test assets that can only improve the tangency portfolio. They therefore suggest a step-down procedure, whereby they first test $\alpha = 0n$ and then test whether $\beta 1_K = 1_N$ conditional on $\alpha = 0_N$. If the null hypothesis of spanning is rejected in the first step-down test the tangency portfolios are significantly different, and if the second test is rejected, the minimum variance portfolios differ significantly.

The step-down asymptotic Wald tests can then be written as:

$$W_1 = T(\lambda_3) \sim X_N^2 \tag{3.16}$$

$$W_2 = T(\lambda_4) \sim X_N^2 \tag{3.17}$$

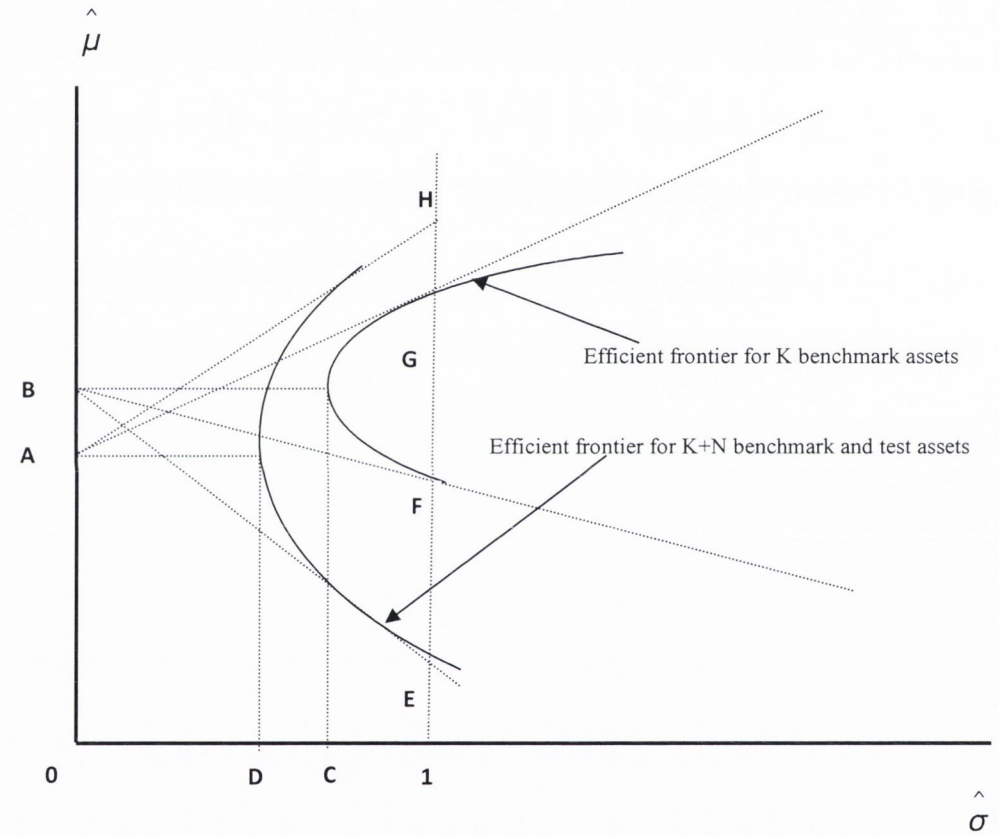
The likelihood ratio, Wald and Lagrange multiplier tests are illustrated graphically in Figure 3.1, which shows the mean-variance efficient frontiers of K benchmark assets and K+N benchmark and test assets. Points A and B denote the minimum variance points of the two efficient frontiers, while BE, BF, AG and AH measure the distance from the minimum variance points to the tangency points with the efficient frontiers.

Using OLS estimation assumes that the error terms are normally distributed and homoscedastic. However, returns and variances of some equity returns have been empirically found to exhibit persistence, rendering them not independently and identically distributed as implied by normality (Nelson, 1991). Ferson, Foerster, & Keim (1993) find that any violation of the homoscedasticity and normality assumptions may have implications on the results of spanning tests. Ferson, Foerster, & Keim (1993), Bekaert & Urias (1996) and Hansen & Jagannathan (1997) propose that the generalised method of moments (GMM) tests of spanning are more appropriate in that case. Kan & Zhou (2012) find that under the non-normality condition, when the error term exhibits conditional heteroskedasticity, none of the previously mentioned test statistics is asymptotically chi-square distributed under the null hypothesis. To ensure robust results I repeat my MVS tests by estimating equation 3.9 using GMM. I also conduct step-down GMM Wald tests of the coefficients individually. The GMM approach has the advantage that it does not require information on the exact distribution of the error terms. The instruments used in the GMM estimation are the regressors themselves, therefore the coefficient estimates are the same, but the standard errors are robust to heteroskedasticity and serial correlation. However, the power of tests using GMM estimation is lower, and can result in larger standard errors than those of OLS estimation, therefore I use both methods of estimation. Kan & Zhou (2012) show that the asymptotic chi-squared distribution of the GMM Wald test can be written as follows:

$$W_a = T\text{vec}(\hat{\Theta}')' \left[(A_T \otimes I_N) S_T (A'_T \otimes I_N)\right]^{-1} \text{vec}(\hat{\Theta}') \sim \chi^2_{2N} \tag{3.18}$$

$$\text{Where } A_T = \begin{bmatrix} 1 + \hat{a}_1 & -\hat{\mu}_1 \hat{V}_{11}^{-1} \\ \hat{b}_1 & -1'_K \hat{V}_{11}^{-1} \end{bmatrix},$$

Figure 3.1 Mean-Variance Spanning Tests



Notes. Derived from Kan and Zhou (2012). In this figure, the geometry of the likelihood ratio (LR) test, the Wald test and the Lagrange multiplier (LM) tests for spanning are as follows.

$$LR = \frac{T-K-1}{2}\left(\frac{OD}{OC}\right)^2\left(\frac{AH}{BF}\right)^2 - 1$$

$$Wald = \left(\frac{OD}{OC}\right)^2 - 1 + \left(\frac{BE}{BF}\right)^2 - 1$$

$$LM = 1 - \left(\frac{OC}{OD}\right)^2 + 1 - \left(\frac{AG}{AH}\right)^2$$

$$\hat{a}_1 = \hat{\mu}_1' \hat{V}_{11}^{-1} \hat{\mu}_1 \text{ and } \hat{b}_1 = \hat{\mu}_1' \hat{V}_{11}^{-1} 1_K,$$

$\hat{\mu}$ and $\hat{V}_{11}$ are maximum likelihood estimators of the expected return and covariance of the K benchmark assets, and I_N is an N x N identity matrix. For the Wald test ST is computed using the unconstrained estimate of B, the minimum variance point of the benchmark set.

3.6.2 Sharpe ratio

Mean-Variance Spanning tests whether there is a significant shift in the mean-variance efficient frontier of the benchmark portfolio when additional test assets are added. While Mean-Variance Spanning tests inform us whether the shift in the mean-variance efficient frontier is significant, they do not provide information on the magnitude of the shift.

The Sharpe ratio of each portfolio is calculated as follows:

$$SR_P = \frac{R_P - R_f}{\sigma_P} \tag{3.19}$$

where SR_P is the Sharpe ratio of the portfolio, R_P is the weekly return of the portfolio, R_f is the risk-free rate, measured as the 3 month Treasury Bill rate, and σ_P is the standard deviation of the weekly portfolio returns.

I calculate the Sharpe ratio for the mean-variance efficient portfolio based on the *K* benchmark assets (and a risk-free asset) and the Sharpe ratio for the mean-variance efficient portfolio based on all $K + N$ assets (and a risk free asset). Mean-variance spanning optimises the weighting in each portfolio, with no restriction on short sales. This may not be realistic for some investors who are not permitted to short sell assets. Where the mean-variance efficient portfolio of $K + N$ assets results in a negative weighting in one portfolio, I calculate the Sharpe ratio of the combined portfolio with and without short sales restrictions. A difference between the Sharpe ratios of the benchmark and the extended set indicates that investors can increase their risk-return trade off by investing in the *N* additional assets. If I fail to reject spanning, then there is no improvement in the Sharpe ratio possible by including the additional assets in the portfolio. The change in the Sharpe ratio is also used by Errunza et al.(1999), Driessen and Laeven (2007) and Berrill and Kearney (2010) to measure the economic magnitude of any shift in the mean-variance

efficient frontier. Bekaert & Urias (1996) suggest that the economic significance of a shift can be assessed by calculating the change in the Sharpe ratio. To test whether the change in the Sharpe ratio is statistically significant is difficult due to its unknown distribution. Using Monte Carlo techniques, they find that changes in the Sharpe ratio of less than 0.057 are not statistically significant at a 95 percent level of significance.

3.6.2 Modified Value-at-Risk

In addition to Mean-Variance Spanning tests, Antoniou et al. (2010) consider two further methodologies that go beyond the mean-variance framework; modified Value-at-Risk and Stochastic Dominance. Stochastic dominance incorporates the entire probability distribution function of returns to compare portfolio performance. There are three degrees of Stochastic Dominance, First Degree Stochastic Dominance (FSD), Second Degree Stochastic Dominance (SSD) and Third Degree Stochastic Dominance (TSD). First degree stochastic dominance assumes that investors are non-satiated, that is, that they prefer more to less $U'(r)>0$. Second order stochastic dominance assumes that investors are risk-averse $U''(r)<0$ and third order stochastic dominance assumes that investors have decreasing absolute risk aversion $U'''(r)>0$, which implies that investors prefer assets with positively skewed returns. FSD implies SSD and SSD implies TSD but not vice versa. Burr, Porter & Gaumnitz (1972) compare portfolio performance when measured by both mean-variance analysis and stochastic dominance and find very little difference in their results. They conclude that except in the case of extreme risk aversion, the choice between the two is not critical. Eun, Kolodny, & Resnick (1991) use the mean squared error approach and stochastic dominance to estimate correlation structures and conclude that the mean squared error approach is superior. Stochastic dominance is used by Isakov & Morard (2001) to evaluate the performance of option strategies and by Kroencke, Schindler, & Schrimpf (2011) to evaluate currency diversification. Stochastic dominance tests have not been widely used in empirical finance, as most tests are pairwise comparisons between investment opportunities and are not practical when comparing numerous investment opportunities. Post & Versijp (2007) have developed multivariate tests for stochastic dominance, increasing their comparability with mean-variance efficiency tests. Those tests have yet to be shown to dominate Mean-Variance Spanning tests except in the case of extreme skewness. In

case of skew or excess kurtosis in the returns of my replicating portfolios in Chapter 7 I calculate the modified Value-at-Risk of the portfolios.

Standard Value-at-Risk calculates the maximum loss of a portfolio over a given period of time for a given probability level. Risk measured by portfolio standard deviation can be underestimated if returns are skewed or have excess kurtosis. Investors generally desire high positive skewness (more positive returns), and those with low tolerance for risk avoid high kurtosis (fat tails). The four-moment Modified Value-at-Risk (MVaR), developed by Favre & Galeano (2002) and used by You & Daigler (2010) and Antoniou et al. (2010) incorporates skew and kurtosis into the calculation of the maximum loss that a portfolio is expected to experience over a given period. The two-moment VaR is a special case of the four-moment VaR when the skewness and excess kurtosis are zero.

MVaR incorporates all four return moments, providing a method to determine the potential downside risk at a given probability level for a portfolio with a specific set of return, risk, skewness, and excess kurtosis values. The number of standard deviations specify the probability of this loss occurring. Favre and Galeano (2002) develop such a four-moment VaR:

$$MVAR = -\mu_p - (z_c + \frac{1}{6}(z_c^2 - 1)S_P + \frac{1}{24}(z_c^3 - 3z_c)K_P - \frac{1}{36}(2z_c^3 - 5z_C)S_P^2)\sigma_P \qquad (3.20)$$

Where μ_p, σ_p, S_p, and K_p are the first four moments of portfolio P (Kp represents excess kurtosis). Zc is the negative number of standard deviations that specifies the tail probability level associated with the four moment VaR. I calculate the MVaR of each portfolio for a 95 and 99 percent confidence level, or -1.96 and -2.33 standard deviations.

3.7 Sub-period analysis

The results of my tests are based on historical data and any inferences drawn from the results rest on the assumption that the time series properties of my data remain stable. In order to strengthen the usefulness of the results, I divide my time period into sub-periods. This will test my

hypotheses under different market conditions, making any results common to all sub-periods robust to different market conditions. In the 15 year period used in this empirical study, the US experienced two financial crises, the dotcom bubble of 1999/2000 and the credit crisis of 2007/2008. I divide my 15 year period into sub-periods as follows.

I firstly used standard statistical techniques to find breakpoints in the data. I initially considered the Chow test (Chow, 1960). However, this test has been criticised in the literature, most notably its endogeneity, whereby it assumes a break in the data and searches for the most suitable break date accordingly. Given this shortcoming, I instead performed the Andrews-Quandt and Bai-Perron tests[14] on the returns of the US market using the S&P500 as a proxy and several of the foreign country indices. Neither test found a structural break in the data.

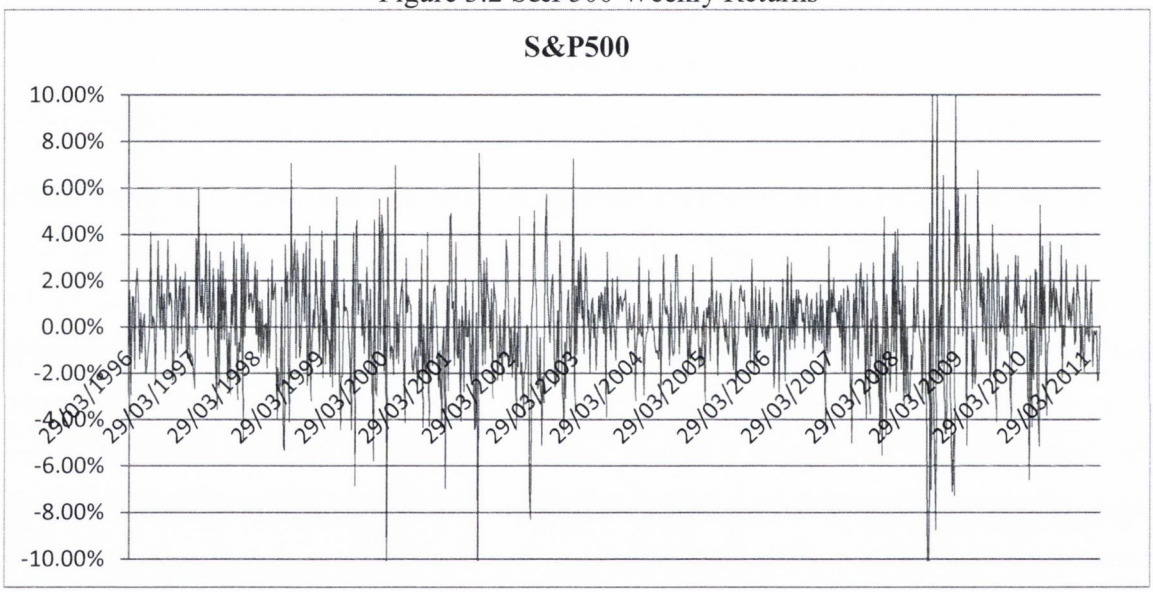
I subsequently graphed the returns of the S&P500 and the foreign country indices. Figure 3.2 graphs the weekly returns of the S&P500 between 1996 and 2011. The period between mid-2003 and mid-2008 is noticeable for its low volatility, compared to the periods that precede and follow it, which correspond to the dotcom bubble and the 2007/08 credit crisis. In addition I compare the performance of the S&P500 to that of the 37 foreign country indices on an annual basis. The results are shown in Figure 3.3, which graphs the annual risk-adjusted return of an equally weighted portfolio of developed markets, emerging markets, all foreign country indices and the S&P500 between 1996 and 2011. In each of the years 2003 to 2007, equally weighted portfolios of foreign country indices outperform the S&P500. This suggests that the potential for international diversification is highest in this period. Between 1996 and 2002, developed markets and the S&P500 outperform emerging markets. Between 2008 and 2011 emerging markets outperform the other markets. I sub-divide my dataset into periods of differing volatility in the US; 22nd March 1996 to 27th December 2002, 3rd January 2003 to 28th December 2007 and 4th January 2008 to 24th June 2011. These sub-periods coincide with differing results for the performance of the S&P500 relative to the performance of foreign market indices. These sub-periods allow me to test if my results are robust to varying market conditions. Antoniou et al. (2010) use similar criteria for their selection of sub-periods to test their results in periods of under and over performance by the UK market.

[14] I performed these tests using Eviews7.

3.8 Conclusion

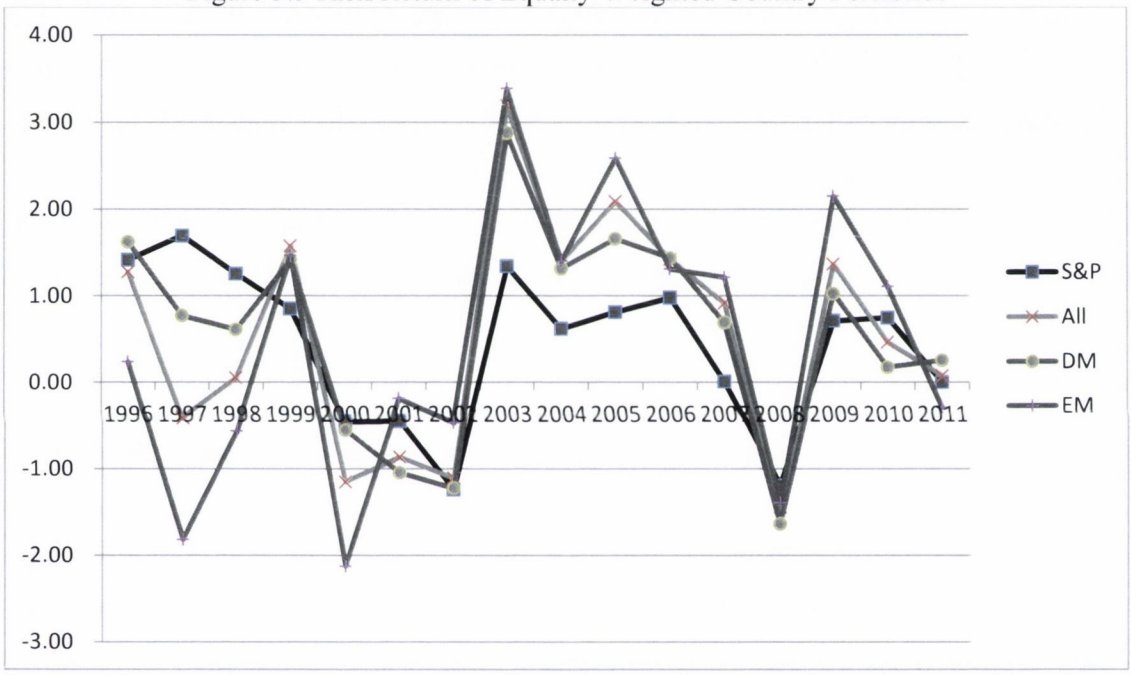
In this chapter I provide a description of my research philosophy, and the data and methodologies used in Chapters 4, 5, 6 and 7. I detail methodologies used in previous investigations of diversification benefits and the methodologies that I use in this thesis. In the next chapter I conduct an investigation into the internationalisation of US MNCs.

Figure 3.2 S&P500 Weekly Returns



Notes: This graph of the weekly returns of the S&P500 shows a period of low volatility between 2003 and 2008.

Figure 3.3 Risk/Return of Equally Weighted Country Portfolios



Notes: This graph shows the annual risk-adjusted return of the S&P500, of an equally weighted portfolio of all countries, of developed markets and of emerging markets

Chapter 4 An In-Depth Longitudinal Analysis of the Internationalisation of US MNCs

4.1 Introduction

Firms with substantial overseas operations have long been considered as a potential avenue for investors to gain exposure to foreign markets in a domestic setting (Hughes et al., 1975; Agmon & Lessard, 1977). The results of previous studies on the diversification benefits of MNCs have been mixed and are difficult to compare given the different measures by which firms are ranked by internationalisation. In addition, almost all previous studies select firms based on criteria at one point in time, with no analysis of a firm's level of internationalisation over time. Papers by Contractor (2007), Hennart (2007), Glaum & Oesterle (2007), Asmussen, Benito, & Petersen (2009) and Casillas & Acedo (2013) have highlighted the need for longitudinal studies of firm-level internationalisation.

In this chapter I conduct a longitudinal study of the internationalisation of US firms between 1996 and 2010 to provide unique insights into how firm internationalisation is changing over time. I analyse the constituent firms of the Russell 1000 index using three measures of firm-level internationalisation; percentage foreign sales, the number of geographic segments in which a firm reports material sales, and the number of regions of the world in which those sales are located. By classifying firms using three measures, I capture different aspects of how the firms internationalise over time. I study the changes in each measure over time, and compare the measures to see if they are consistent with each other. The period analysed encompasses two crisis periods, the dotcom bubble of 1999/2000 and the credit crisis of 2007/2008. I further analyse these measures within categories of age, industry and size. This provides an in-depth classification of US firms by their level of internationalisation over a 15 year period. My longitudinal dataset allows me to contribute to the literature on the evolution of firm internationalisation, to the regionalisation/globalisation debate, to the literature on de-internationalisation, and on the internationalisation of firms by age, size and industry.

My findings are as follows. I find that the average level of internationalisation of firms increased steadily using all three measures over the 15 year period, consistent with the increasing globalisation of world markets. Given the financial crises which occurred within the period 1996 to 2010, unstable domestic conditions may have incentivised firms to increase their level of internationalisation to diversify earnings. When analysing changes in internationalisation over sub-periods, I find that most firms experienced an increase in the number of segments and number of regions between 1996 and 2002, while most firms increased their foreign sales in the subsequent period 2003 to 2007. Firms appear to expand into new regions and increase their foreign sales in those regions in subsequent years. Although the overall average levels of internationalisation continued to increase following the 2007/08 credit crisis, more than half of MNCs experienced a decrease in foreign sales in this period, with relatively few decreases in the other two measures of internationalisation. I find significant differences in the levels of internationalisation when firms are categorised by industry and size but not by age. Non-service industries, Basic Materials and Technology are the most international, and service industries Telecommunications, Financials and Utilities the least. Large firms are found to have greater levels of internationalisation, but small firms had the greatest increase in internationalisation over the sample period.

The remainder of this chapter is structured as follows. In Section 4.2 I describe the different measures of internationalisation used to categorise the firms. In Section 4.3 I detail the results of my longitudinal analysis of firms. In Section 4.4 I list the results when firms are further categorised by age, industry and size. In Section 4.5 I summarise the chapter and describe my conclusions.

4.2 Measures of Internationalisation

The aggregate market in any country comprises domestic firms and internationalised firms that range in their degrees of internationalisation. The definition of internationalisation is a complex multidimensional concept, and can be measured in a number of different ways, each capturing different aspects of each firm's internationalisation. Ideally a classification system should

encompass the important dimensions of internationalisation while at the same time being intuitive and easy to use, which may involve a trade-off between accuracy and simplicity.

Zahra & George (2002) conduct a review of the literature in international entrepreneurship between 1988 and 2000 and note that firm internationalisation is measured in three ways; extent, speed and scope. They note that extent is typically measured by a firm's percentage foreign sales. Scope is measured by the number of countries or regions in which the firm has foreign sales. Speed is measured by the time between when a firm is created and the first year of foreign sales. They find that, of 21 papers that employ a measure of internationalisation, only 2 studies use the number of regions and only 3 use the number of countries to measure internationalisation. They note that the majority of studies focus on the extent of the firm's internationalisation.

Casillas & Acedo (2013) further discuss the extent, scope and speed of internationalisation with regards to the relationship between firm internationalisation and performance/diversification benefits. They define extent as a firm's percentage foreign sales or foreign subsidiaries. They note that Sullivan's (1994) uses both of these measures in his Degree of Internationalisation (DOI) scale. The second measure they discuss is the scope or breadth of a firm's internationalisation, and note that this could be measured by the number of countries to which a firm exports its products, the number in which it owns subsidiaries, and the physical and/or cultural distance between those countries where it is active. The third dimension of internationalisation that they discuss is speed, which they define as the rate of change in either of the two previous measures.

I use three measures of firm-level internationalisation; percentage foreign sales, the number of geographic segments in which a firm reports foreign sales, and the number of regions of the world in which those segments are located. A firm's foreign sales as a percentage of its total sales is the most commonly used method to select firms to test for diversification benefits (Fatemi, 1984, Qian, 1996, Antoniou et al., 2010). It is a reliable quantitative measure of foreign involvement. However, it gives no information on how many markets the foreign sales occur in or the location of those markets. A US firm, for example, may have a high percentage of foreign sales but those sales may be spread across many countries or all occur in a neighbouring country. For example, in 2010, Applied Materials, a Californian company that manufactures

semiconductors, has 69 percent foreign sales spread across Taiwan, South Korea, China, Europe, Japan and other Asia Pacific. An oil and gas company, Forest Oil, has 74 percent foreign sales, but they all occur in Canada. Rugman & Verbeke (2004) find that a high proportion of the Fortune 500 firms' foreign sales is regional rather than global. A high level of foreign sales does not necessarily imply that firms are operating in a wide geographic scope.

My second measure of internationalisation is to count the number of geographical segments in which a firm reports material foreign sales, which overcomes some of the limitations of using percentage foreign sales as a measure of internationalisation.[15] Counting the number of geographic segments disclosed provides useful information on the dispersion of a firm's sales. Contractor (2007) notes that a firm derives advantages of being geographically diversified by operating in countries whose business cycles are not highly correlated. The greater the number of countries in which a firm operates, the greater its likelihood of lowering the correlation with its domestic market. However, in some cases it can be misleading, given that a firm can choose to specify a single country or an entire continent as one of its segments. For example, in 2010 Gilead Sciences, a biotech company from California, lists eight geographical segments; United States, France, Switzerland, Spain, United Kingdom, Italy, Germany, Other Europe. In contrast Avnet, a technology company from Arizona, lists just three; Americas, EMEA, and Asia Pacific, despite covering a much greater geographic area.

For my third measure I count the number of regions of the world in which the firm's reported geographic segments are located. The importance of taking the location of the segments in which the firms reports sales into account is implied by the findings by Baxter & Kouparitsas (2005) that correlations of business cycles decrease with distance. Driessen & Laeven (2007) find that most of the benefits of diversification are gained from investment outside the region in which each country is located. I categorise firms by the number of regions in which their sales occur as follows. Following Aggarwal et al. (2011) I divide the world into six regions: Africa,

[15] For my measures of internationalisation I only use sales data to categorise firm internationalisation. As well as sales data, other accounting variables are listed by geographic segment in the Form 10-K; they are assets, operating income, capital expenditure and depreciation. Berrill (2009) categorises each firm on the Fortune 500 List in 2005 using these five accounting variables. Her results show that in most cases, firms list the same geographic segments for each of the five variables. Therefore I concluded that adding further accounting variables to sales data would add little to the analysis.

Asia, Europe, North America, Oceania and South America. The countries included in each region are listed in Panel A of Table 4.1. If a firm has no foreign sales it is given a score of 0 (domestic), if it has sales outside of the US but only in North America, it is given a number of score of 1 (regional), if it has sales in North America plus one other region it receives a score of 2, if it has sales in North America plus two other regions it is given a score of 3 and so on until a maximum score of 6 (global), which indicates that a firm has sales in every region. Panel B of Table 4.1 lists this scoring system, and Figure 4.1 gives a graphical depiction of the classification system. For each time period, and for each firm, I examine the location of the geographic segments disclosed by the firm and classify their sales into one of seven categories ranging from domestic (0) to global (6).[16]

My longitudinal dataset of firm-level internationalisation, using three measures of internationalisation can be related back to the three measures recommended by Casillas & Acedo (2013). My measure of percentage foreign sales relates to their definition of the extent of internationalisation, the number of segments and number of regions relate to their definition of the scope or breadth of the internationalisation of the firm. My longitudinal dataset of each of these measures over a 15 year period allows me to measure the changes in the extent and scope of firms' internationalisation between 1996 and 2010, which relates to their third dimension of internationalisation, speed.

4.3 Longitudinal analysis of the internationalisation of MNCs

For each measure of internationalisation I create a number of categories. For each year I count how many firms fall into each category, which portrays the changing patterns of internationalisation over the 15 year period. Starting with percentage foreign sales I count the number of firms with no foreign sales, less than 25 percent foreign sales, between 25 and 50 percent and greater than 50 percent. I count the number of firms reporting sales in each number

[16] Following the system used by Aggarwal et al. (2011), some firms use classifications such as EMEA (Europe, Middle-East and Africa), which I classify as three regions, or Asia-Pacific which I classify as two. Many firms also create a category 'Other foreign' or 'Rest of the World' to include all remaining items after the most significant areas have been detailed in the accounts. When this occurs, I add one region. If a firm for example, has sales in the categories North America, Europe and 'Other', I give it a number of regions score of 3.

Table 4.1 Regional Definitions

Panel A: Regions of the World	
	Countries included
North America	Canada, Mexico, US and Central American countries
South America	All countries on the continent
Europe	All in continent as far east as Armenia, Azerbaijan, Belarus, Ukraine
Asia	Includes Middle East, Russian Federation and Turkey
Oceania	Australia, New Zealand, Pacific Islands
Africa	All countries on the continent
Panel B: Number of Regions Score	
0	US only
1	US and other countries in North America
2	North America plus one other region
3	North America plus 2 other regions
4	North America plus 3 other regions
5	North America plus 4 other regions
6	all 6 regions

Notes: Panel A shows the countries included in each of the 6 regions of the world. Panel B lists a score from 0 to 6 for classifying firms by number of regions in which they report sales

Figure 4.1 Number of Regions Measure of Internationalisation

Notes: This figure illustrates the 6 regions into which the countries of the world are grouped, and an example of the scoring system for the number of regions measure for US firms. For example, a firm with sales only in the US will have a score of 0, a firm with sales in North America will have a score of 1, a firm with sales in North and South America will have a score of 2, and so on. A firm with sales in all 6 regions of the world will have a score of 6.

of geographic segments from 1 to 10, and I count the number of firms with sales in each number of regions ranging from domestic (0) to global (6). The results are presented in Table 4.2. Panel A divides firms into categories based on their percentage of foreign sales. Of the 396 firms for which full data is available, in every year between 111 and 129 firms have no foreign sales. The number decreases over time, but only moderately. The numbers of firms with less than 25 and between 25 and 50 percent foreign sales decrease, mostly after 2001. The number of firms with over 50 percent foreign sales increases every year from 46 in 1996 to 125 in 2010, with the exception of 1999 to 2000, when the number fell from 56 to 52, coinciding with the end of the dotcom bubble. The 2007/08 credit crisis had no impact on the numbers of firms with over 50 percent foreign sales, increasing from 112 to 120 in that year. The final row in Panel A show a steady increase in the average foreign sales of all firms in each year. The average level increases from 20.44 percent in 1996 to 30.98 percent in 2010.

Panel B categorises firms by the number of geographic segments in which they report material foreign sales. The number of firms reporting 1 or 2 segments falls gradually. The number of firms reporting 5 to 9 segments varies from year to year, but there is no decline in the total number of firms reporting 5 segments and over in any year. The dispersion of firms' sales increases every year. The average number of segments for all firms increases from 2.25 in 1996 to 3.33 in 2010.

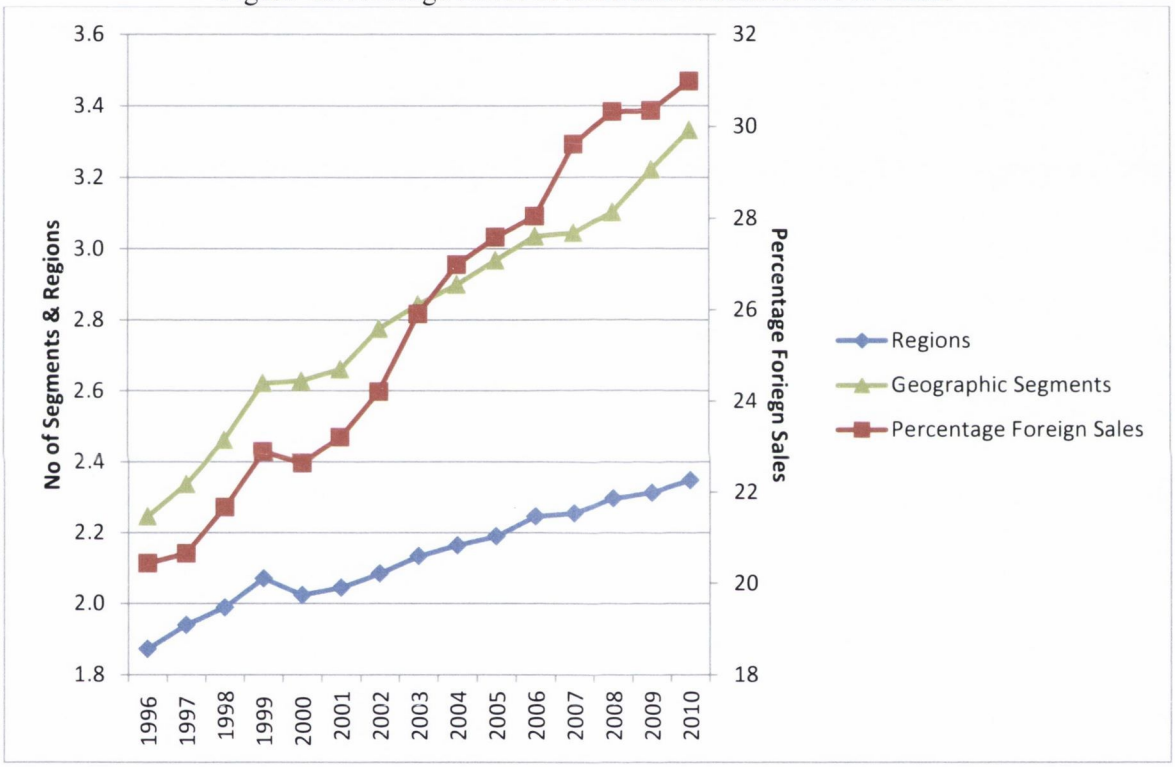
Panel C categorises firms by the number of regions in which their reported segments are located. The number of firms with sales in 4, 5 and 6 regions has increased significantly since 1996. 41 firms had sales in 4 regions in 1996, which rises to 73 in 2010. For firms with sales in 5 regions the number increases from 24 to 58, and for 6 regions from 4 to 16. Very few internationalised firms only have sales in North America; the maximum was 8 in any year. This contrasts with the findings by Rugman & Verbeke (2004) that the sales of most MNCs occur within their home region. The average number of regions for all firms increases from 1.87 in 1996 to 2.35 in 2010. The average level of each measure over time is graphed in Figure 4.2. There is an increase in every year apart from in 2000 and 2007, coinciding with the end of the dot-com bubble and the credit crisis. Between 1999 and 2000, the average foreign sales of all firms decreased slightly from 22.88 to 22.63 percent and the average number of regions decreased from 2.07 to 2.02. This concurs with the observation by Benito & Welch (1997) that firms experience periods of

Table 4.2 Number of Firms by Measure of Internationalisation

Number of firms	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
Panel A: % Foreign Sales															
No foreign sales	129	126	123	119	120	118	116	116	115	114	114	111	111	112	113
Over 0% and under 25%	101	107	91	84	86	90	82	73	75	68	67	63	57	58	55
Over 25% and under 50%	120	117	134	137	138	126	125	125	115	118	118	110	108	104	103
Over 50%	46	46	48	56	52	62	73	82	91	96	97	112	120	122	125
Total	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
% Foreign Sales	20.44	20.65	21.66	22.88	22.63	23.19	24.20	25.90	26.98	27.58	28.04	29.61	30.32	30.34	30.98
Panel B: Number of Geographic Segments															
1	131	127	123	119	120	118	116	116	116	114	113	111	112	112	113
2	79	77	80	75	72	79	72	72	66	64	59	62	59	56	55
3	105	97	77	70	78	71	71	55	53	53	55	58	57	50	46
4	56	60	72	75	65	61	57	65	69	66	67	58	53	60	50
5	18	27	23	31	32	36	47	49	52	52	46	50	55	49	52
6	6	5	15	8	11	12	9	15	17	19	22	29	28	22	26
7	1	2	3	10	10	9	10	10	6	12	17	10	9	20	23
8	0	0	2	4	3	3	3	4	5	5	7	4	8	7	8
9	0	1	1	2	3	3	6	5	6	3	2	4	5	8	6
10	0	0	0	2	2	4	5	5	6	8	8	10	10	12	17
Total	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
Number of Segments	2.25	2.34	2.46	2.62	2.63	2.66	2.78	2.84	2.90	2.97	3.04	3.04	3.10	3.22	3.33
Panel C: Number of Regions															
Domestic US only (0)	130	126	123	119	120	117	116	117	116	115	114	112	113	113	114
North America (1)	5	6	4	4	5	6	6	8	7	6	7	8	8	8	6
2 Regions (2)	88	81	86	82	81	84	77	70	68	70	63	67	64	60	66
3 Regions (3)	104	108	99	93	96	95	100	91	89	88	84	79	79	79	63
4 Regions (4)	41	42	47	59	63	61	61	67	75	68	78	76	67	68	73
5 Regions (5)	24	28	32	31	27	26	28	34	30	39	36	42	48	55	58
Global (6)	4	5	5	8	4	7	8	9	11	10	14	12	17	13	16
Total	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
Number of Regions	1.87	1.94	1.99	2.07	2.02	2.04	2.08	2.13	2.16	2.19	2.25	2.25	2.30	2.31	2.35

Notes: This table shows how many firms are in each category in each year for the 3 measures of internationalisation. Panel A counts the number of firms in each category of percentage foreign sales, followed by the average foreign sales of all firms in each year. Panel B counts the firms with each number of geographic segments reported by the firm, followed by the average number of segments reported by all firms in each year. Panel C counts the number of firms with sales in each number of regions, followed by the average number of regions of all firms in each year. For example in 1996 129 firms have no foreign sales, while the average percentage sales of all 396 firms is 20.44%.

Figure 4.2 Average Level of Internationalisation of All Firms



Notes: This chart shows the average number of segments and regions on the left axis and the average percentage foreign sales on the right axis. It can be seen that all measures increase every year apart from in 2000 and 2007.

de-internationalisation. Between 2006 and 2007 the average number of geographic segments and regions remained unchanged at 3.04 and 2.25. Overall, I find a very steady increase in the level, dispersion and location of foreign sales of MNCs over the sample period.

I next examine the changes in firm internationalisation over time. I count the number of firms that experienced no change, increased in every year and decreased in every year in each measure. I subsequently count the number of firms that increased overall, decreased overall and stayed over certain thresholds in every year in each measure. Table 4.3 details the results. Panel A lists the results for percentage foreign sales. Only 5 firms, Borgwarner, an automotive company, Celgene, a biotechnology company, Royal Caribbean Cruises, a tourism company, Williams-Sonoma, a homeware retail company, and Yum! Brands, a fast-food restaurant business, had increasing foreign sales in every year and only 1 firm, Frontier Oil, a Texan energy company, had decreasing foreign sales in every year. The only firms with no change were those which had no foreign sales in any year. I count how many firms' foreign sales increased by up to 80 percent and decreased by up to 50 percent between 1996 and 2010, and firms with foreign sales over thresholds of up to 70 percent in every year.[17] 234 firms experienced an overall increase in their percentage foreign sales, while only 52 experienced an overall decrease. 2 firms increased by over 80 percent, Popular Inc., a financial services company, increased its foreign sales from 0 percent in 1996 to 88 percent in 2010. Schlumberger, an oilfield services company, increased from 0 in 1996 to 81 percent in 2010. 2 firms decreased by over 50 percent; Forest Oil decreased from 73 percent in 1996 to 17 percent in 2010 and Altria, a tobacco company, decreased by 56 percent in 1996 to 0 in 2010. 3 firms had over 70 percent foreign sales in every year, Exxon, an oil company, Manpower Group, a human resource consulting-services company, and Expeditor International, a courier company.

Panel B lists the results for the number of segments reported by each firm. 138 firms experienced no change in the number of segments. 72 firms increased in every year, and 20 decreased in every year. 184 firms increased overall between 1996 and 2010, while 33 decreased overall. The firm with the largest increase was Gilead Sciences, a biotechnology

[17] For changes in the level of internationalisation I used an absolute change, rather than a percentage change. For example if a firm had percentage foreign sales of 20% in 1996 and 40% in 2010, I counted this as a change of 20%. This was done so as not to distort the results. I regarded this to be a better method than the percentage change which would rank a firm with a change from 5% to 7.5% equally with a firm with a change from 50% to 75%.

Table 4.3 Longitudinal Patterns of Internationalisation

Changes in Internationalisation	*No of Firms*	*Decreases in Internationalisation*	*No of Firms*	*Thresholds in Every Year*	*No of Firms*
Panel A: Foreign Sales					
No change (from 0%)	107				
Only increased	5				
Only decreased	1				
> 0% Increase Overall	234	> 0% Decrease Overall	52	> 0%	289
> 10% Increase Overall	171	> 10% Decrease Overall	21	> 10%	212
> 20% Increase Overall	101	> 20% Decrease Overall	9	> 25%	128
> 30% Increase Overall	57	> 30% Decrease Overall	5	> 50%	26
> 40% Increase Overall	36	> 40% Decrease Overall	3	> 60%	7
> 50% Increase Overall	21	> 50% Decrease Overall	2	> 70%	3
> 60% Increase Overall	11				
> 70% Increase Overall	2				
> 80% Increase Overall	2				
Panel B: Number of Segments					
No change	138				
Only increased	72				
Only decreased	20				
>= 1 segment increase	184	>= 1 segment decrease	33	>= 2 segments	257
>= 2 segment increase	125	>= 2 segment decrease	8	>= 3 segments	147
>= 3 segment increase	72	>= 3 segment decrease	1	>= 4 segments	48
>= 4 segment increase	51			>= 5 segments	12
>= 5 segment increase	34			>= 6 segments	4
>= 6 segment increase	19				
>= 7 segment increase	15				
>= 8 segment increase	8				
>= 9 segment increase	1				
Panel C: Number of Regions					
No change	152				
Only increased	69				
Only decreased	25				
>= 1 region increase	150	>= 1 region decrease	45	>= 1 regions	256
>= 2 region increase	79	>= 2 region decrease	15	>= 2 regions	249
>= 3 region increase	31	>= 3 region decrease	3	>= 3 regions	129
>= 4 region increase	7			>=4 regions	29
				>=5 regions	8
				=6regions	1

Notes: This table shows the changes in each measure of firm internationalisation. Panel A counts the number of firms with no change and several levels of increases and decreases in foreign sales over the period. It also counts the firms which have foreign sales over a number of thresholds in every year. For example 2 firms had an increase of 80% in foreign sales from 1996 to 2010 while 3 firms had foreign sales of over 70 percent in every year. Panel B counts the number of firms with increases, decreases and which stay above thresholds in every year for the number of segments. Panel C repeats the same for the number of regions.

company, it increased by 9 segments overall, from 1 in 1996 to 10 in 2010. The largest decrease was 3 segments; Foot Locker, a retail company, fell from 5 segments in 1996 to 2 in 2010. 4 firms reported at least 6 segments in every year; the aerospace company, Boeing, Expeditor International, Mc Dermott Inc., an oil and gas engineering firm, and Shaw Group, a construction company. Panel C lists the results for the number of regions in which each firm's sales are located. 152 firms had no change, 69 increased in every year and 25 decreased in every year. 150 firms had an increase of at least 1 region between 1996 and 2010, while 45 decreased by at least 1 region. 7 firms had the largest increase of 4 regions; Apache Corp, an oil and gas company, Biogen, a biotechnology company, Constellation, a beverages company, Franklin Resources, a financial services company, Omicom, an advertising company, Oshkosh, an automotive company, and Rowan, an oil and gas drilling company. 3 firms had a fall of 3 regions; Altria and E.I. Du Pont de Nemours, a chemicals company, fall from 3 to 0 regions and Proctor and Gamble, a consumer goods company, fell from 5 to 2 regions. Diamond Offshore Drilling reported sales in all 6 regions of the world every year between 1996 and 2010.

By all three measures of internationalisation more firms increased than decreased in internationalisation; almost 5 times as many firms in percentage foreign sales, 6 times as many in the number of segments and 3 times as many in the number of regions. In each case the greatest increase in each measure is larger than the greatest decrease. For percentage foreign sales, the greatest increase is 88 percent and the greatest decrease 57 percent. For the number of segments the greatest increase is 9 and the greatest decrease is 3. For the number of regions, the greatest increase is 4 and the greatest decrease is 3. This confirms an overall pattern of increasing internationalisation for firms as a whole, consistent with the increasing average levels of each measure in Table 4.2.

In Table 4.4, I compare the averages of the three measures of internationalisation on an annual basis to check their consistency with each other. Panel A shows the average percentage foreign sales in each year for firms with each number of regions. Panel B shows the average number of geographic segments in each year for each number of regions. Panel C shows the average percentage sales for firms with each number of geographic segments (excluding domestic firms with only one segment). In Panel A and Panel C, the average percentage foreign sales do not consistently increase with a greater number of segment or regions. In Panel A, the average

Table 4.4 Comparing Measures of Firm Internationalisation

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Panel A: Average Percentage Foreign Sales for each Number of Regions															
North America (1)	18	17	16	16	14	12	9	11	12	16	15	15	13	12	10
2 Regions (2)	25	25	26	26	27	27	27	30	30	28	28	29	32	30	32
3 Regions (3)	32	34	36	38	38	38	39	41	44	44	46	48	49	50	48
4 Regions (4)	40	36	36	38	37	40	44	46	46	49	48	51	51	51	53
5 Regions (5)	52	47	46	43	45	43	46	45	50	52	50	55	53	52	56
Global (6)	38	40	35	46	45	41	39	42	45	44	45	49	52	54	51
Panel B: Average Number of Geographic Segments for each Number of Regions															
North America (1)	1.8	2.0	1.8	1.8	2.0	1.7	1.9	2.0	1.9	1.8	2.0	2.0	2.0	2.0	1.8
2 Regions (2)	2.2	2.2	2.2	2.2	2.2	2.1	2.2	2.1	2.1	2.2	2.2	2.3	2.3	2.3	2.5
3 Regions (3)	3.3	3.3	3.5	3.6	3.8	3.7	3.7	3.9	4.0	4.1	4.1	3.9	3.9	4.0	4.1
4 Regions (4)	3.9	4.0	4.4	4.5	4.6	4.8	4.9	5.0	4.8	4.9	5.0	5.2	5.4	5.6	5.6
5 Regions (5)	4.4	4.6	4.9	5.3	5.6	5.7	5.9	5.6	6.0	6.0	5.9	5.9	5.9	5.9	6.1
Global (6)	5.3	6.2	5.8	6.8	7.3	7.0	7.8	7.4	7.3	6.5	6.6	6.6	6.5	7.2	7.2
Panel C: Average Percentage Foreign Sales for Each Number of Segments															
2	22	21	24	26	26	26	25	28	28	29	28	28	31	29	31
3	34	35	34	35	36	37	37	38	40	38	39	42	42	42	42
4	41	39	41	38	37	36	39	41	43	41	42	46	46	48	47
5	47	40	42	40	39	44	43	44	45	47	50	52	51	50	49
6	41	31	38	43	42	45	58	55	55	56	53	51	55	51	58
7	45	58	41	48	49	46	47	53	61	68	54	59	60	63	55
8			22	39	22	42	27	33	47	38	53	68	54	51	59
9		64	14	20	57	48	47	48	52	47	47	48	45	47	66
10				55	42	41	46	49	54	56	58	61	65	64	64

Notes: This table compares the three measures of internationalisation. Panel A shows the average percentage foreign sales of firms with each number of regions in each year. For example, for global firms in 1996, the average percentage foreign sales are 35%. Panel B shows the average number of geographic segments for firms with each number of regions. Panel C shows the average percentage foreign sales for firms with each number of geographic segments.

foreign sales increase in most years for up to 5 regions. For 12 of the 15 years the average foreign sales are lower for firms with sales in 6 regions than for those with sales in 5 regions. In Panel C, average foreign sales increase as the number of segments increases in most cases up to 6 regions. For firms reporting 7 to 10 regions, foreign sales do not consistently increase for 12 of the 15 years. This highlights that percentage foreign sales are not necessarily higher for firms with greater numbers of segments or regions, and that the measures are capturing different aspects of internationalisation. The average number of segments does consistently increase with the number of regions in Panel B. The number of segments and number of regions are consistent with each other at an aggregate level.

When firms are ranked by the different measures, there is little overlap in the highest ranked firms. The firms with no foreign sales in any year and the firms that are ranked in the highest categories of each measure are listed in Appendices A.2 to A.4. For example, Popular Inc. and Schlumberger Ltd. have the greatest increases of over 80 percent in foreign sales but not in either of the other two measures. Of the 21 firms with an increase of over 50 percent in foreign sales, only 5 of them also have the greatest increases in either of the other two measures (Apache, Atmel, Corning, Jabil Circuit Inc., and Maxim Integrated Products). Of the 26 firms which always have over 50 percent foreign sales, only 2 of those firms also always have sales in at least 5 geographic segments (Applied Materials, Expeditor International) and only 6 always have sales in at least 4 regions (3M, the Coca-Cola Co, Colgate-Palmolive, Expeditor International, Pall Corp, Lubrizol Co.). There is only one firm, Rowan Co, which features in the sample of firms with the greatest increase in the number of segments (6 and over) and in the sample of firms with the greatest increase in the number of regions (3 and over). Therefore, although the number of segments and regions are consistent at an aggregate level, at a firm level this is not the case.

4.4 Sub-period Analysis

In order to analyse the impact of crisis periods on patterns of internationalisation, I repeat the analysis of the changes in internationalisation in Table 4.3 for three sub-periods, selected as described in Section 3.7; 1996 to 2002, 2003 to 2007 and 2008 to 2010. The results for the three sub-periods are detailed in Tables 4.5, 4.6 and 4.7. Panel A of each table lists the results for

Table 4.5 Patterns of Internationalisation 1996 to 2002

1996 to 2002					
Changes in Internationalisation	*No of Firms*	*Decreases in Internationalisation*	*No of Firms*	*Thresholds in Every Year*	*No of Firms*
Panel A: Foreign Sales					
No change (from 0%)	114				
Only increased	14				
Only decreased	4				
> 0% Increase Overall	185	> 0% Decrease Overall	97	> 0%	265
> 10% Increase Overall	81	> 10% Decrease Overall	29	> 10%	225
> 20% Increase Overall	39	> 20% Decrease Overall	5	> 25%	132
> 30% Increase Overall	22	> 30% Decrease Overall	4	> 50%	29
> 40% Increase Overall	13	> 40% Decrease Overall	2	> 60%	10
> 50% Increase Overall	5	> 50% Decrease Overall	2	> 70%	3
> 60% Increase Overall	3				
> 70% Increase Overall	1				
> 80% Increase Overall	0				
Panel B: Number of Segments					
No change	227				
Only increased	94				
Only decreased	35				
>= 1 segment increase	130	>= 1 segment decrease	39	>= 2 segments	263
>= 2 segment increase	65	>= 2 segment decrease	9	>= 3 segments	152
>= 3 segment increase	31	>= 3 segment decrease	2	>= 4 segments	55
>= 4 segment increase	17			>= 5 segments	15
>= 5 segment increase	10			>= 6 segments	4
>= 6 segment increase	9				
>= 7 segment increase	7				
>= 8 segment increase	3				
>= 9 segment increase	0				
Panel C: Number of Regions					
No change	249				
Only increased	44				
Only decreased	74				
>= 1 region increase	94	>= 1 region decrease	53	>= 1 regions	262
>= 2 region increase	45	>= 2 region decrease	12	>= 2 regions	257
>= 3 region increase	15	>= 3 region decrease	1	>= 3 regions	137
>= 4 region increase	3			>=4 regions	39
				>=5 regions	9
				=6regions	1

Notes: This table shows the changes in firm internationalisation by each measure in the first sub-period 1996 to 2002. Panel A counts the number of firms with no change, increases and decreases in foreign sales over the period. It also counts the firms which have foreign sales over a number of thresholds in every year. For example 1 firm had an increase of 70% in foreign sales from 1996 to 2002 while 3 firms had foreign sales of over 70 percent in every year. Panel B counts the number of firms with increases, decreases and which stay above thresholds in every year for the number of segments. Panel C repeats the same for the number of regions.

Table 4.6 Patterns of Internationalisation 2003 to 2007

2003 to 2007					
Changes in Internationalisation	*No of Firms*	*Decreases in Internationalisation*	*No of Firms*	*Thresholds in Every Year*	*No of Firms*
Panel A: Foreign Sales					
No change (from 0%)	110				
Only increased	69				
Only decreased	3				
> 0% Increase Overall	228	> 0% Decrease Overall	58	> 0%	278
> 10% Increase Overall	55	> 10% Decrease Overall	12	> 10%	249
> 20% Increase Overall	14	> 20% Decrease Overall	4	> 25%	196
> 30% Increase Overall	7	> 30% Decrease Overall	0	> 50%	74
> 40% Increase Overall	5	> 40% Decrease Overall	0	> 60%	44
> 50% Increase Overall	3	> 50% Decrease Overall	0	> 70%	20
> 60% Increase Overall	1				
> 70% Increase Overall	0				
> 80% Increase Overall	0				
Panel B: Number of Segments					
No change	278				
Only increased	76				
Only decreased	26				
>= 1 segment increase	85	>= 1 segment decrease	33	>= 2 segments	278
>= 2 segment increase	32	>= 2 segment decrease	11	>= 3 segments	200
>= 3 segment increase	16	>= 3 segment decrease	5	>= 4 segments	139
>= 4 segment increase	4			>= 5 segments	71
>= 5 segment increase	3			>= 6 segments	27
>= 6 segment increase	0				
>= 7 segment increase	0				
>= 8 segment increase	0				
>= 9 segment increase	0				
Panel C: Number of Regions					
No change	297				
Only increased	23				
Only decreased	41				
>= 1 region increase	70	>= 1 region decrease	29	>= 1 regions	278
>= 2 region increase	16	>= 2 region decrease	8	>= 2 regions	270
>= 3 region increase	5	>= 3 region decrease	2	>= 3 regions	189
>= 4 region increase	0			>=4 regions	91
				>=5 regions	29
				=6regions	7

Notes: This table shows the changes in firm internationalisation by each measure in the first sub-period 2003 to 2007. Panel A counts the number of firms with no change, increases and decreases in foreign sales over the period. It also counts the firms which have foreign sales over a number of thresholds in every year. For example 1 firm had an increase of 60% in foreign sales from 2003 to 2007 while 20 firms had foreign sales of over 70 percent in every year. Panel B counts the number of firms with increases, decreases and which stay above thresholds in every year for the number of segments. Panel C repeats the same for the number of regions.

Table 4.7 Patterns of Internationalisation 2008 to 2010

2008 to 2010					
Changes in Internationalisation	*No of Firms*	*Decreases in Internationalisation*	*No of Firms*	*Thresholds in Every Year*	*No of Firms*
Panel A: Foreign Sales					
No change (from 0%)	112				
Only increased	57				
Only decreased	15				
> 0% Increase Overall	148	> 0% Decrease Overall	136	> 0%	283
> 10% Increase Overall	18	> 10% Decrease Overall	16	> 10%	260
> 20% Increase Overall	9	> 20% Decrease Overall	4	> 25%	221
> 30% Increase Overall	6	> 30% Decrease Overall	0	> 50%	110
> 40% Increase Overall	3	> 40% Decrease Overall	0	> 60%	66
> 50% Increase Overall	2	> 50% Decrease Overall	0	> 70%	35
> 60% Increase Overall	2				
> 70% Increase Overall	1				
> 80% Increase Overall	0				
Panel B: Number of Segments					
No change	292				
Only increased	82				
Only decreased	23				
>= 1 segment increase	81	>= 1 segment decrease	23	>= 2 segments	282
>= 2 segment increase	23	>= 2 segment decrease	2	>= 3 segments	221
>= 3 segment increase	10	>= 3 segment decrease	1	>= 4 segments	165
>= 4 segment increase	7			>= 5 segments	108
>= 5 segment increase	3			>= 6 segments	53
>= 6 segment increase	2				
>= 7 segment increase	1				
>= 8 segment increase	0				
>= 9 segment increase	0				
Panel C: Number of Regions					
No change	335				
Only increased	21				
Only decreased	23				
>= 1 region increase	40	>= 1 region decrease	21	>= 1 regions	281
>= 2 region increase	6	>= 2 region decrease	5	>= 2 regions	273
>= 3 region increase	3	>= 3 region decrease	1	>= 3 regions	205
>= 4 region increase	0			>=4 regions	128
				>=5 regions	53
				=6regions	9

Notes: This table shows the changes in firm internationalisation by each measure in the first sub-period 2008 to 2010. Panel A counts the number of firms with no change, increases and decreases in foreign sales over the period. It also counts the firms which have foreign sales over a number of thresholds in every year. For example 1 firm had an increase of 70% in foreign sales from 2008 to 2010 while 35 firms had foreign sales of over 70 percent in every year. Panel B counts the number of firms with increases, decreases and which stay above thresholds in every year for the number of segments. Panel C repeats the same for the number of regions.

percentage foreign sales. The largest number of firms with an overall increase in foreign sales occurs in the second sub-period. 228 firms experienced an increase in their foreign sales between 2003 and 2008, while 185 and 148 firms had increasing foreign sales in the first and last sub-periods. However, the largest increases occur in the first sub-period, 81 firms have increases of over 10 percent, this falls to 55 and 18 in the latter periods. Most of the increases in the second period are less than 10 percent. As well as having the greatest number of firms with an overall increase in foreign sales, the second sub-period also has the lowest number of firms with a decrease in foreign sales. The third period has the lowest number of firms with an increase in foreign sales, and the highest number of firms with a decrease, 136 firms record decreasing foreign sales in the third period compared to 97 and 58 in the first two periods. Authors such as Benito & Welch (1997) and Crick & Jones (2000) recognise that, contrary to some theories of internationalisation that suggest a process where firms become incrementally more internationalised over time, firms also experience periods of de-internationalisation as part of this process. My longitudinal study provides evidence of this; although there is an upward trend in internationalisation for MNCs on the whole, individual firms experience periods of falling levels of internationalisation.

When considering the thresholds, the number of firms above each threshold increases as time progresses. 10 firms have sales of over 60 percent between 1996 and 2002, this rises to 44 between 2003 and 2007 and 66 between 2008 and 2010. The number of firms with foreign sales of over 70 percent rises from 3 to 20 to 35. These increases occur despite the fact that the number of firms which have foreign sales does not change substantially, 265 to 278 to 283. Therefore, although the number firms with some foreign sales changes very little, the level of foreign sales of those firms increases dramatically.

Panel B and Panel C of each table list the results for the number of segments and number of regions. The results for the changes in these measures differ to those for percentage foreign sales. The number of firms with either an increase or a decrease in either measures falls as time progresses. The number of firms with an increase in the number of segments falls from 130 to 85 to 81 from the first to the third period, and the number of firms with a decrease falls from 39 to 33 to 23. Likewise for the number of regions, the numbers of firms with an increase falls from 94 to 70 to 40 and the numbers with a decrease from 53 to 29 to 21. The largest changes in

either measure occur in the first period, 7 firms experience an increase of 7 segments in the first period, with 0 and 1 in the latter periods. 15 firms record an increase of 3 regions in the first period, with 5 and 3 in the latter periods.

For the threshold levels for number of segments and number of regions, the pattern is similar to that for foreign sales; the number of firms above each threshold increases as time progresses. For the number of segments, just 4 firms had sales in 6 or more segments in every year between 1996 and 2002, this increased to 27 firms in 2003 to 2007 and 53 firms in 2008 to 2010. Likewise the number of firms reporting at least 4 segments increases from 55 to 139 to 165. For the number of regions, the number of firms with sales in 5 or more regions in every year increases from 9 to 29 to 53. One firm, Diamond Offshore Drilling, has sales in every region of the world in every year between 1996 and 2002, this increases to 7 firms between 2003 and 2007 and 9 firms between 2008 and 2010. By the last sub-period almost three-quarters of MNCs have sales in at least 3 regions, and almost half of the MNCs have sales in at least 4 regions.

The sub-period analysis of the changes in firm-level internationalisation provides some interesting insights. The greatest changes, either increases or decreases, in the number of segments and the number of regions occur in the first period. Fewer firms experience a change in these measures in the second and third periods. The highest number of firms with increases in percentage foreign sales and the lowest number with decreases occur in the second period. The pattern that emerges is that firms expand into new markets initially and increase sales in those new regions in subsequent years. A further insight is the impact of periods of volatility, the dotcom bubble and the credit crisis, on the changes in firms' internationalisation. The number of firms with falling foreign sales is 97 between 1996 and 2002 and 136 in 2008 and 2010, compared to 58 between 2003 and 2007. The number of firms with increasing foreign sales is 185 in the first period, nearly double the number with falling foreign sales. In the second period, the number of firms with increasing sales is nearly 4 times those with decreasing foreign sales. In the last period, the numbers with increasing and decreasing foreign sales are almost equal. Significantly more firms experience a decrease in foreign sales after the credit crisis than after the dotcom bubble. On the other hand, less firms experience a change in the number of segments or number of regions during the credit crisis than in the other two periods, these measures are relatively unaffected by the credit crisis. More than half of all MNCs experience a decrease in

foreign sales between 2008 and 2010, while less than 10 percent of MNCs experience a decrease in either the number of segments or the number of regions.

4.5 Analysis of Age, Industry and Size

I next examine the levels of internationalisation of the firms within categories of firm age, industry and size. Traditional theories on the stages of firm internationalisation, such as the stages model of internationalisation and the network perspective, assume that firms become gradually and incrementally more international over time with large firms taking larger internationalisation steps than small firms (Johanson & Vahlne, 1990; Leonidou et al., 2007), implying that older and larger firms will be more international. The phenomenon of born-global firms, where firms are highly internationalised at an early stage in their development, challenges these traditional theories (Sheth & Malhotra, 2010). Calof & Beamish (1995) argue that size is not necessarily a barrier to internationalisation, while Bonaccorsi (1992) and Casseres (1997) report that small and medium sized firms have created unique methods to overcome size as a potential obstacle to internationalisation. Others consider the variation in internationalisation by industry (Boter & Holmquist, 1996; Fernhaber, McDougall, & Oviatt, 2007), arguing that the process of internationalisation must be understood within the context of the firm's industry category, while Javalgi, Griffith, & White (2003) report that the internationalisation of service firms is expanding rapidly. I investigate the impact of age, size, industry on the level of internationalisation of the firms in my dataset.

I begin by analysing firm age. The oldest date of incorporation is 1852 for Stanley Black and Decker, a hardware company, followed by the Travelers Company, an insurance company, in 1865, Tiffany and Company, a jewellers, in 1868 and Patterson, a medical supplies company, in 1877. Altogether 16 firms date from 1850 to 1900. The newest firm is Mednax, a health services company, in 2007, preceded by UDR, a property company, and Crown Holdings, a packaging company, in 2003. Table 4.8 divides firms into 11 categories of age, by their date of incorporation, ranging from 1850 to 2010. It lists the average of each level of internationalisation over the 15 year period for each category of firm age. The average levels are

Table 4.8 Internationalisation of Firms by Age

Age	*1850-1900*	*1900-1920*	*1920-1930*	*1930-1940*	*1940-1950*	*1950-1960*	*1960-1970*	*1970-1980*	*1980-1990*	*1990-2000*	*2000-2010*
Average FS	22	26	31	21	27	24	16	18	20	24	28
Average Segments	2.3	2.3	2.8	1.9	2.8	2.2	1.8	2.0	2.3	2.6	3.1
Average Regions	2.2	1.8	2.6	1.7	2.1	1.9	1.4	1.5	1.7	2.1	2.3

Notes: This table shows the average level of each measure of internationalisation by firm age. For example firms which were incorporated between 2000 and 2010 have an average of 28% foreign sales over the period 1996 to 2010.

slightly higher for firms incorporated before 1950, however, the differences are small and it would be difficult to draw any strong conclusions from these results. In Table 4.9 I list the number of firms in each age category with an average of each level of internationalisation over the 15 year period. The largest number of firms were incorporated between 1980 and 2000, 93 between 1980 and 1990 and 72 between 1990 and 2000. The least number, 10 firms, date from 2000 to 2010. In panel B, the numbers of firms are expressed as percentages. There is no strongly discernible pattern with regards to age and firm-level internationalisation; therefore I conclude that the age of a firm has little impact on its level of internationalisation for the MNCs analysed in this time period.

I next categorise firms by their industry classification. The Industry Classification Benchmark (ICB) is an industry classification taxonomy developed by Dow Jones and FTSE. It is used to segregate markets into sectors within the macroeconomy, and uses a system of 10 industries. I assign each firm to one of those ten industries. For the firms in each industry I calculate the average percentage foreign sales, number of geographic segments and number of regions for each year, to analyse the changing levels of internationalisation of each industry. The results are presented in Table 4.10. From this table it is evident that there are large differences in the level of internationalisation of different industries. The most domestic industries, using all three measures, are Financials, Telecommunications and Utilities, while the most international are Basic Materials, Technology and Oil and Gas. Of the 7 firms classified as Telecommunications, only one has foreign sales in each year. The largest increases overall in internationalisation occurred in 1999, as well as large increases in average foreign sales in 2003.

In the final two columns I list the average level of internationalisation over the 15 year period for the firms in each industry and the change in internationalisation between 1996 and 2010. Technology and Basic Materials have high average levels of percentage foreign sales, 50 and 41 percent. Technology firms have the highest average level in all three measures, with 4.2

Table 4.9 Number and Percentages of Firms by Age

Age	*1850-1900*	*1900-1920*	*1920-1930*	*1930-1940*	*1940-1950*	*1950-1960*	*1960-1970*	*1970-1980*	*1980-1990*	*1990-2000*	*2000-2010*
					Panel A: Numbers of Firms						
Percentage Foreign Sales											
0%	4	9	7	5	5	5	15	13	27	17	2
Less than 25%	3	11	12	4	4	6	8	7	21	16	4
Between 25 and 50%	6	12	6	4	10	6	9	12	22	24	2
Over 50%	3	3	6	1	2	5	8	10	23	15	2
Number of Segments											
1	4	9	7	5	6	5	15	13	29	18	2
2	4	7	5	3	2	3	5	6	12	10	1
3	2	7	6	1	5	5	5	6	12	14	2
4	6	7	5	2	3	4	7	9	18	15	2
5		3	5	1	2	5	6	3	11	10	3
6		1	2		1		2	4	4	1	
7			1	2					2	2	
8		1			1			1	5	1	
9					1					1	
10											
Number of Regions											
Domestic US only (0)	6	11	8	6	8	6	17	13	35	22	2
North America (1)		3	3	1	2	1	2		3	4	1
2 Regions (2)	5	8	8	2	4	4	6	9	20	13	4
3 Regions (3)	3	10	6	4	3	5	10	15	23	23	1
4 Regions (4)	2	3	5	1	3	6	5	5	8	8	1
5 Regions (5)			1		1				3	2	1
Global (6)									1		
Total Firms	16	35	31	14	21	22	40	42	93	72	10
					Panel B: Percentages of Firms						
Percentage Foreign Sales											
0%	25%	26%	23%	36%	24%	23%	38%	31%	29%	24%	20%
Less than 25%	19%	31%	39%	29%	19%	27%	20%	17%	23%	22%	40%
Between 25 and 50%	38%	34%	19%	29%	48%	27%	23%	29%	24%	33%	20%
Over 50%	19%	9%	19%	7%	10%	23%	20%	24%	25%	21%	20%
Number of Segments											
1	25%	26%	23%	36%	29%	23%	38%	31%	31%	25%	20%
2	25%	20%	16%	21%	10%	14%	13%	14%	13%	14%	10%
3	13%	20%	19%	7%	24%	23%	13%	14%	13%	19%	20%
4	38%	20%	16%	14%	14%	18%	18%	21%	19%	21%	20%
5		9%	16%	7%	10%	23%	15%	7%	12%	14%	30%
6		3%	6%		5%		5%	10%	4%	1%	
7			3%	14%					2%	3%	
8		3%			5%			2%	5%	1%	
9					5%					1%	
10											
Number of Regions											
Domestic US only (0)	38%	31%	26%	43%	38%	27%	43%	31%	38%	31%	20%
North America (1)									1%		
2 Regions (2)		9%	10%	7%	10%	5%	5%		3%	6%	10%
3 Regions (3)	31%	23%	26%	14%	19%	18%	15%	21%	22%	18%	40%
4 Regions (4)	19%	29%	19%	29%	14%	23%	25%	36%	25%	32%	10%
5 Regions (5)	13%	9%	16%	7%	14%	27%	13%	12%	9%	11%	10%
Global (6)			3%		5%				3%	3%	10%

Notes: This table categorises firms by age with an average of each measure of internationalisation over the 15 year period. Panel A lists the number of firms in each category. For example, 3 firms had on average over 50% foreign sales between 1996 and 2010. In Panel B the numbers are expressed as percentages. For example, 25% of firms incorporated between 1850 and 1900 have no foreign sales.

Table 4.10 Industry Analysis of Internationalisation

	Number of Firms	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*Average*	*Change*
Panel A: Percentage Foreign Sales																		
Basic Materials	21	30	33	35	36	38	36	39	43	44	44	45	47	48	49	50	41	20
Consumer Goods	43	31	29	29	29	30	30	32	35	37	38	39	42	40	39	40	35	9
Consumer Services	47	11	11	10	11	10	10	10	10	10	11	12	13	14	14	16	12	5
Health Care	34	26	25	25	29	27	27	25	27	29	30	31	32	34	33	35	29	9
Industrials	83	27	28	30	31	31	32	34	37	38	39	40	43	44	44	43	36	16
Financials	67	8	7	8	9	9	8	10	11	11	11	10	12	12	11	12	10	4
Oil & Gas	31	30	33	37	39	34	37	40	40	41	41	39	41	43	46	46	39	16
Technology	43	37	38	39	42	43	47	48	50	53	55	56	58	58	59	61	50	24
Telecommunications	7	4	4	5	4	3	3	4	6	5	4	4	4	5	5	4	4	0
Utilities	20	3	3	4	4	3	3	3	3	4	5	7	4	4	3	3	4	0
Panel B: No of Segments																		
Basic Materials	21	2.95	3.05	3.10	3.38	3.52	3.57	4.05	4.14	3.86	3.90	4.29	4.52	4.14	4.33	4.62	3.8	1.7
Consumer Goods	43	2.74	2.86	2.91	3.02	2.95	2.95	3.23	3.28	3.40	3.60	3.67	3.67	3.63	3.86	4.14	3.3	1.4
Consumer Services	47	1.79	1.77	1.96	2.04	2.00	2.04	2.02	2.11	2.06	2.13	2.13	2.15	2.32	2.23	2.30	2.1	0.5
Health Care	34	2.65	2.74	2.59	3.06	3.03	3.00	3.00	3.29	3.41	3.50	3.68	3.71	3.74	3.76	3.94	3.3	1.3
Industrials	83	2.90	3.05	3.48	3.61	3.55	3.63	3.75	3.80	3.88	3.87	3.92	3.95	4.16	4.33	4.36	3.7	1.5
Financials	67	1.54	1.60	1.64	1.73	1.72	1.75	1.91	1.87	1.87	1.87	1.88	1.93	1.94	1.94	1.93	1.8	0.4
Oil & Gas	31	3.03	3.39	3.06	3.39	3.77	3.71	3.77	3.90	4.16	4.35	4.61	4.19	4.19	4.68	4.90	3.9	1.9
Technology	43	3.05	3.12	3.51	3.72	3.77	3.91	4.05	4.19	4.40	4.56	4.51	4.60	4.81	5.07	5.33	4.2	2.3
Telecommunications	7	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.00	1.14	1.14	1.14	1.14	1.14	1.14	1.1	-
Utilities	20	1.50	1.50	1.50	1.60	1.50	1.50	1.45	1.45	1.45	1.45	1.50	1.50	1.45	1.45	1.45	1.5	-0.1
Panel C: Number of Regions																		
Basic Materials	21	2.90	3.00	2.90	3.10	3.24	3.10	3.33	3.43	3.33	3.38	3.67	3.62	3.48	3.52	3.67	3.3	0.8
Consumer Goods	43	2.70	2.79	2.81	2.88	2.70	2.60	2.77	2.74	2.81	2.86	2.93	2.98	2.91	2.93	2.93	2.8	0.2
Consumer Services	47	1.06	1.09	1.21	1.32	1.23	1.30	1.26	1.30	1.28	1.30	1.32	1.34	1.47	1.43	1.49	1.3	0.4
Health Care	34	2.38	2.47	2.21	2.35	2.32	2.32	2.24	2.56	2.65	2.76	2.91	2.85	3.00	2.94	2.94	2.6	0.6
Industrials	83	2.67	2.76	3.04	3.08	2.96	3.05	3.08	3.14	3.18	3.23	3.25	3.29	3.36	3.49	3.51	3.1	0.8
Financials	67	0.76	0.81	0.85	0.87	0.87	0.90	0.97	0.96	0.96	0.96	0.99	1.03	1.04	0.97	0.99	0.9	0.2
Oil & Gas	31	2.48	2.68	2.71	2.81	2.87	2.97	3.03	3.10	3.16	3.23	3.39	3.10	3.26	3.32	3.45	3.0	1.0
Technology	43	3.07	3.09	3.09	3.28	3.33	3.33	3.35	3.40	3.51	3.44	3.44	3.58	3.63	3.65	3.72	3.4	0.7
Telecommunications	7	0.29	0.29	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.0	-0.3
Utilities	20	2.90	3.00	2.90	3.10	3.24	3.10	3.33	3.43	3.33	3.38	3.67	3.62	3.48	3.52	3.67	0.5	-0.1

Notes: This table shows the average level of each measure of internationalisation by industry in each year. For example, the 26 Utilities firms have on average 9% foreign sales in 1996. The final two columns list the average level and the change in internationalisation for each industry over the period 1996 to 2010.

segments and 3.4 regions. Basic Materials, Oil and Gas and Industrials have the next highest average levels. Technology has the greatest change in foreign sales and number of segments, 24 percent and 2.3. Basic Materials and Industrials have the greatest change in the number of regions, 0.8. The least internationalised industries are; Telecommunications, Utilities and Financials, with an average of less than 10 percent foreign sales, 2 segments and 1 region. The findings for Technology, Basic Materials, Oil & Gas and Industrial firms are consistent with findings by Rugman & Verbeke (2008) that non-service firms are more international, and the findings for Telecommunications, Utilities and Financials are consistent with their finding that service industries are less international. The changes in internationalisation are higher for non-service industries. Of the service industries, Consumer Services and Healthcare experience significant increases in internationalisation as found by Javalgi, Griffith, & White (2003) but compared to non-service industries, those increases appear relatively low.

To analyse firms by size, I divide them into small, medium and large firms. I obtained the net sales or revenues for each firm for each year. I divided the firms into three groups by the 0.33 and 0.66 percentiles of the total sales of all firms in that year. I calculate the average of each measure of internationalisation for each size of firm in each year. The results are listed in Table 4.11. There is a very clear pattern between size and internationalisation. For the number of segments and number of regions large firms are more international than medium firms which are more international than small firms, in every year. The pattern is the same for percentage foreign sales, except for in 3 years, 2006, 2009 and 2010, when small and medium firms are equal. For all firm sizes the level of internationalisation rises steadily over time. However, small firms have the greatest average increase in all three levels of internationalisation between 1996 and 2010. They increase by 15 percent in foreign sales, versus a 9 percent increase for medium and large firms. They increase by 1.3 segments, versus a 0.9 and 1.1 increase for medium and large firms, and they increase by 0.8 regions versus 0.6 and 0.4 for medium and large firms. In 1999 and 2000 small and large firms experience a fall in average foreign sales, medium and large firms experience a fall in the average number of regions. In 2008/09 medium and large firms experience a fall in average foreign sales, while small firms' average foreign sales increase. Size does not appear to be a barrier to increasing internationalisation, as suggested by Calof & Beamish (1995).

Table 4.11 Firm Size and Firm Internationalisation

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Panel A: Foreign Sales															
Small	15	15	17	20	19	20	23	24	26	27	28	28	29	30	30
Medium	21	22	23	24	24	25	25	27	27	28	28	30	31	30	30
Large	29	29	29	28	28	29	29	31	32	32	33	35	37	36	38
Panel B: Number of Segments															
Small	1.9	1.9	2.2	2.4	2.5	2.5	2.6	2.7	2.8	3.0	3.1	3.0	3.0	3.2	3.2
Medium	2.4	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.1	3.1	3.2	3.2	3.3	3.4	3.5
Large	2.9	3.0	3.0	3.2	3.2	3.2	3.3	3.3	3.4	3.5	3.5	3.6	3.7	3.8	4.0
Panel C: Number of Regions															
Small	1.4	1.4	1.5	1.7	1.7	1.7	1.9	1.9	2.0	2.0	2.1	2.1	2.0	2.1	2.2
Medium	1.9	2.1	2.1	2.2	2.1	2.2	2.2	2.3	2.3	2.3	2.4	2.4	2.5	2.5	2.5
Large	2.6	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.8	3.0

Notes: This table shows the average level of each measure of internationalisation for firms divided into small, medium and large by their total net sales. For example small firms had on average 15 percent foreign sales in 1996.

In Table 4.12 I count the number of firms in each category of internationalisation for each firm size for each year. Although larger firms have a greater average level of internationalisation, this table shows that a significant proportion of medium and large firms are purely domestic. When the numbers of firms are expressed as percentages in Table 4.13, it is evident that there is a pattern with regards to firm size. As firm size increases, a larger proportion of firms have higher foreign sales, with more segments, in more regions. For small firms, a larger proportion are domestic. However, in every year between 15 and 22 percent of large firms are purely domestic, with a further 40 to 60 percent with mid-range levels of internationalisation. Therefore although there is a positive relationship between firm size and internationalisation, selecting firms by size alone, would by no means ensure a high level of internationalisation.

4.6 Conclusion

In this chapter I conducted a detailed longitudinal study of the internationalisation of US firms which provides unique insights into the changing levels of internationalisation over time. I analysed the changing patterns of internationalisation using three measures, the percentage foreign sales, the number of segments and the number of regions in which the firm has sales. By all three measures, I find a substantial increase in the level of internationalisation of MNCs between 1996 and 2010, while the number of firms with no foreign activity remains relatively constant. I find that while the measures are in some cases consistent on an aggregate level, there is little overlap in the firms with the highest ranking in each measure.

When the time period is divided into sub-periods I find that more firms experienced an increase in the number of regions and number of segments in the period 1996 to 2002, while more firms had increasing foreign sales in the period 2003 to 2007. This suggests a path of internationalisation where firms expand into new markets and increase foreign sales in those markets in subsequent years. My sub-period analysis allows me to examine the impact of periods of crisis on the three measures of internationalisation. Although the overall average foreign sales of all firms was not affected by the credit crisis of 2007/08, more than half of all MNCs experienced a fall in foreign sales in that period. In contrast, less than 10 percent of MNCs recorded a decrease in the number of segments or regions; the credit crisis had little

Table 4.12 Number of Firms by Firm Size

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Panel A: Percentage Foreign Sales															
Small															
0% FS	70	74	66	64	61	61	57	56	55	53	51	50	54	53	52
Less than 25%	30	29	31	22	28	28	20	23	21	19	23	25	21	19	20
Between 25 and 50%	31	29	35	39	40	36	40	35	35	34	35	30	26	29	29
Over 50%	11	10	10	17	13	17	25	28	31	36	33	37	41	41	41
Medium															
0% FS	48	44	47	43	44	41	42	41	43	42	42	42	40	41	43
Less than 25%	36	43	31	33	33	35	35	28	28	27	24	19	18	22	19
Between 25 and 50%	48	41	49	48	48	44	41	47	42	44	46	50	49	44	49
Over 50%	11	15	16	19	18	23	25	27	30	30	31	32	36	36	32
Large															
0% FS	25	22	23	24	27	28	28	30	28	30	32	30	29	30	30
Less than 25%	44	44	40	38	35	36	35	29	32	28	26	26	21	21	20
Between 25 and 50%	47	53	57	59	59	53	53	53	50	50	48	39	45	43	37
Over 50%	27	24	23	22	22	26	27	31	33	35	37	48	48	49	56
Panel B: Number of Segments															
Small															
1	71	75	67	65	61	61	57	56	56	53	51	50	54	53	52
2	27	27	27	21	27	27	25	26	23	19	21	21	18	16	20
3	30	26	27	26	24	22	22	20	17	20	22	23	23	18	15
4	11	7	12	21	17	16	18	17	20	20	13	15	14	21	19
5	1	5	3	1	4	6	11	13	14	14	14	14	11	13	13
6	2	1	2	-	1	1	-	-	1	3	7	7	10	6	4
7	-	1	2	2	2	3	3	4	3	6	8	5	4	6	8
8	-	-	1	3	2	2	-	-	2	1	2	2	3	3	3
9	-	-	1	1	3	3	5	4	3	2	1	1	1	2	2
10	-	-	-	2	1	1	1	2	3	4	3	4	4	4	6
Medium															
1	48	44	47	42	44	41	42	41	43	42	42	42	41	40	42
2	27	24	23	26	25	28	26	24	22	23	18	20	19	21	18
3	45	44	29	28	27	27	25	21	22	21	23	25	25	22	21
4	15	20	27	24	25	21	21	22	22	23	23	17	20	20	21
5	4	8	8	12	12	16	15	19	18	16	18	21	19	15	14
6	4	2	10	6	4	6	8	11	10	10	9	10	10	7	9
7	-	-	-	4	5	2	2	2	1	4	6	3	1	9	9
8	-	-	-	-	-	-	-	-	-	2	-	-	3	3	3
9	-	1	-	1	-	-	1	1	3	-	1	2	3	3	1
10	-	-	-	-	1	2	3	2	2	2	3	3	2	3	5
Large															
1	26	22	22	24	27	28	28	30	28	30	31	30	29	30	30
2	32	34	36	35	28	32	30	31	27	28	26	26	26	23	20
3	37	33	28	22	31	24	28	16	15	14	13	14	15	14	14
4	32	35	35	32	25	28	21	28	34	28	36	32	24	26	17
5	14	15	14	21	19	17	24	21	25	25	16	17	26	23	28
6	1	3	5	3	8	7	1	7	7	9	7	13	10	11	14
7	1	1	1	4	3	4	6	4	2	3	6	4	4	6	8
8	-	-	1	2	1	1	3	4	3	2	5	2	3	1	2
9	-	-	-	-	-	-	-	-	-	1	-	1	1	3	3
10	-	-	-	-	1	2	2	2	2	3	3	4	5	6	7
Panel C: Number of Regions															
Small															
Domestic US only (0)	70	74	67	65	61	60	58	57	56	54	52	51	55	54	53
North America (1)	4	3	2	2	2	3	2	2	2	-	2	3	2	2	2
2 Regions (2)	24	24	28	24	28	27	23	24	22	22	21	23	20	16	22

3 Regions (3)	31	27	26	26	26	28	29	30	28	32	31	26	30	28	21
4 Regions (4)	9	10	13	17	16	16	21	19	24	25	27	28	24	27	27
5 Regions (5)	2	2	5	4	6	5	7	6	5	5	3	7	6	13	13
Global (6)	2	2	1	4	3	3	2	4	5	4	6	4	5	2	4
Medium															
Domestic US only (0)	48	44	47	43	45	42	42	41	43	42	42	42	41	39	42
North America (1)	-	1	1	-	1	1	1	2	2	3	1	-	1	3	1
2 Regions (2)	37	33	27	31	28	32	33	28	26	27	24	27	26	26	26
3 Regions (3)	39	42	40	34	37	35	38	36	34	33	31	30	29	29	28
4 Regions (4)	11	13	15	24	24	22	18	21	24	21	24	25	23	20	19
5 Regions (5)	7	8	12	10	8	10	8	13	11	13	15	15	18	22	23
Global (6)	1	2	2	1	-	1	3	2	3	4	6	4	5	4	4
Large															
Domestic US only (0)	26	22	22	23	26	27	27	30	28	30	31	30	29	31	30
North America (1)	1	2	1	2	2	2	3	4	3	3	4	5	5	3	3
2 Regions (2)	34	32	38	35	33	33	31	27	26	27	24	22	23	22	23
3 Regions (3)	41	45	38	37	39	39	38	30	33	28	27	30	28	30	20
4 Regions (4)	23	21	23	23	28	27	28	33	34	29	33	29	25	26	31
5 Regions (5)	17	20	18	20	14	12	13	16	15	22	20	22	26	23	26
Global (6)	1	1	2	3	1	3	3	3	4	4	4	5	7	8	10

Notes: This table shows the number of firms in each category of each measure of internationalisation divided into small, medium and large firms each year. For example of the large firms in 2010, 10 are global.

Table 4.13 Percentages of Firms by Size

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Panel A: Percentage Foreign Sales															
Small															
0% FS	49%	52%	46%	45%	43%	43%	40%	39%	39%	37%	36%	35%	38%	37%	37%
Less than 25%	21%	20%	22%	15%	20%	20%	14%	16%	15%	13%	16%	18%	15%	13%	14%
Between 25 and 50%	22%	20%	25%	27%	28%	25%	28%	25%	25%	24%	25%	21%	18%	20%	20%
Over 50%	8%	7%	7%	12%	9%	12%	18%	20%	22%	25%	23%	26%	29%	29%	29%
Medium															
0% FS	34%	31%	33%	30%	31%	29%	29%	29%	30%	29%	29%	29%	28%	29%	30%
Less than 25%	25%	30%	22%	23%	23%	24%	24%	20%	20%	19%	17%	13%	13%	15%	13%
Between 25 and 50%	34%	29%	34%	34%	34%	31%	29%	33%	29%	31%	32%	35%	34%	31%	34%
Over 50%	8%	10%	11%	13%	13%	16%	17%	19%	21%	21%	22%	22%	25%	25%	22%
Large															
0% FS	17%	15%	16%	17%	19%	20%	20%	21%	20%	21%	22%	21%	20%	21%	21%
Less than 25%	31%	31%	28%	27%	24%	25%	24%	20%	22%	20%	18%	18%	15%	15%	14%
Between 25 and 50%	33%	37%	40%	41%	41%	37%	37%	37%	35%	35%	34%	27%	31%	30%	26%
Over 50%	19%	17%	16%	15%	15%	18%	19%	22%	23%	24%	26%	34%	34%	34%	39%
Panel B: Number of Segments															
Small															
1	50%	53%	47%	46%	43%	43%	40%	39%	39%	37%	36%	35%	38%	37%	37%
2	19%	19%	19%	15%	19%	19%	18%	18%	16%	13%	15%	15%	13%	11%	14%
3	21%	18%	19%	18%	17%	15%	15%	14%	12%	14%	15%	16%	16%	13%	11%
4	8%	5%	8%	15%	12%	11%	13%	12%	14%	14%	9%	11%	10%	15%	13%
5	1%	4%	2%	1%	3%	4%	8%	9%	10%	10%	10%	10%	8%	9%	9%
6	1%	1%	1%	0%	1%	1%	0%	0%	1%	2%	5%	5%	7%	4%	3%
7	0%	1%	1%	1%	1%	2%	2%	3%	2%	4%	6%	4%	3%	4%	6%
8	0%	0%	1%	2%	1%	1%	0%	0%	1%	1%	1%	1%	2%	2%	2%
9	0%	0%	1%	1%	2%	2%	4%	3%	2%	1%	1%	1%	1%	1%	1%
10	0%	0%	0%	1%	1%	1%	1%	1%	2%	3%	2%	3%	3%	3%	4%
Medium															
1	34%	31%	33%	29%	31%	29%	29%	29%	30%	29%	29%	29%	29%	28%	29%
2	19%	17%	16%	18%	17%	20%	18%	17%	15%	16%	13%	14%	13%	15%	13%
3	31%	31%	20%	20%	19%	19%	17%	15%	15%	15%	16%	17%	17%	15%	15%
4	10%	14%	19%	17%	17%	15%	15%	15%	15%	16%	16%	12%	14%	14%	15%
5	3%	6%	6%	8%	8%	11%	10%	13%	13%	11%	13%	15%	13%	10%	10%
6	3%	1%	7%	4%	3%	4%	6%	8%	7%	7%	6%	7%	7%	5%	6%
7	0%	0%	0%	3%	3%	1%	1%	1%	1%	3%	4%	2%	1%	6%	6%
8	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	2%	2%
9	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%	1%	1%	2%	2%	1%
10	0%	0%	0%	0%	1%	1%	2%	1%	1%	1%	2%	2%	1%	2%	3%
Large															
1	18%	15%	15%	17%	19%	20%	20%	21%	20%	21%	22%	21%	20%	21%	21%
2	22%	24%	25%	24%	20%	22%	21%	22%	19%	20%	18%	18%	18%	16%	14%
3	26%	23%	20%	15%	22%	17%	20%	11%	10%	10%	9%	10%	10%	10%	10%
4	22%	24%	25%	22%	17%	20%	15%	20%	24%	20%	25%	22%	17%	18%	12%
5	10%	10%	10%	15%	13%	12%	17%	15%	17%	17%	11%	12%	18%	16%	20%
6	1%	2%	4%	2%	6%	5%	1%	5%	5%	6%	5%	9%	7%	8%	10%
7	1%	1%	1%	3%	2%	3%	4%	3%	1%	2%	4%	3%	3%	4%	6%
8	0%	0%	1%	1%	1%	1%	2%	3%	2%	1%	3%	1%	2%	1%	1%
9	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	1%	2%	2%
10	0%	0%	0%	0%	1%	1%	1%	1%	1%	2%	2%	3%	3%	4%	5%
Panel C: Number of Regions															
Small															
Domestic US only (0)	49%	52%	47%	46%	43%	42%	41%	40%	39%	38%	37%	36%	39%	38%	37%
North America (1)	3%	2%	1%	1%	1%	2%	1%	1%	1%	0%	1%	2%	1%	1%	1%
2 Regions (2)	17%	17%	20%	17%	20%	19%	16%	17%	15%	15%	15%	16%	14%	11%	15%

3 Regions (3)	*22%*	*19%*	*18%*	*18%*	*18%*	*20%*	*20%*	*21%*	*20%*	*23%*	*22%*	*18%*	*21%*	*20%*	*15%*
4 Regions (4)	6%	7%	9%	12%	11%	11%	15%	13%	17%	18%	19%	20%	17%	19%	19%
5 Regions (5)	1%	1%	4%	3%	4%	4%	5%	4%	4%	4%	2%	5%	4%	9%	9%
Global (6)	1%	1%	1%	3%	2%	2%	1%	3%	4%	3%	4%	3%	4%	1%	3%
Medium															
Domestic US only (0)	34%	31%	33%	30%	31%	29%	29%	29%	30%	29%	29%	29%	29%	27%	29%
North America (1)	0%	1%	1%	0%	1%	1%	1%	1%	1%	2%	1%	0%	1%	2%	1%
2 Regions (2)	26%	23%	19%	22%	20%	22%	23%	20%	18%	19%	17%	19%	18%	18%	18%
3 Regions (3)	27%	29%	28%	24%	26%	24%	27%	25%	24%	23%	22%	21%	20%	20%	20%
4 Regions (4)	8%	9%	10%	17%	17%	15%	13%	15%	17%	15%	17%	17%	16%	14%	13%
5 Regions (5)	5%	6%	8%	7%	6%	7%	6%	9%	8%	9%	10%	10%	13%	15%	16%
Global (6)	1%	1%	1%	1%	0%	1%	2%	1%	2%	3%	4%	3%	3%	3%	3%
Large															
Domestic US only (0)	18%	15%	15%	16%	18%	19%	19%	21%	20%	21%	22%	21%	20%	22%	21%
North America (1)	1%	1%	1%	1%	1%	1%	2%	3%	2%	2%	3%	3%	3%	2%	2%
2 Regions (2)	24%	22%	27%	24%	23%	23%	22%	19%	18%	19%	17%	15%	16%	15%	16%
3 Regions (3)	29%	31%	27%	26%	27%	27%	27%	21%	23%	20%	19%	21%	20%	21%	14%
4 Regions (4)	16%	15%	16%	16%	20%	19%	20%	23%	24%	20%	23%	20%	17%	18%	22%
5 Regions (5)	12%	14%	13%	14%	10%	8%	9%	11%	10%	15%	14%	15%	18%	16%	18%
Global (6)	1%	1%	1%	2%	1%	2%	2%	2%	3%	3%	3%	3%	5%	6%	7%

Notes: This table shows the percentage of firms in each category of each measure of internationalisation divided into small, medium and large firms each year. For example of the large firms in 2010, 7% are global.

impact on either of these two measures. In the final sub-period, 2008 to 2010, I find that almost 75 percent of MNCs are at least semi-global, with sales in at least 3 of the 6 regions of the world while almost 50 percent have sales in at least 4 regions. This challenges the findings by Rugman and others that most of the activity of MNCs occurs within their home region. I find the opposite. I find that the level and scope of firm internationalisation is increasing over time with some periods of more rapid internationalisation, with the majority of MNCs pursuing at least a semi-global strategy, as suggested by Stevens & Bird (2004) and Osegowitsch & Sammartino (2008).

Finally, I find that age has little impact on firm internationalisation, but that industry and firm size do. Non-service industries Basic Materials and Technology are the most internationalised industries, while service sector industries, Financials, Telecommunication and Utilities are the least. Larger firms have on average higher levels of internationalisation but small firms had the greatest increase. Although the dotcom bubble impacted the foreign sales of firms of all sizes, the credit crisis only caused a decrease for medium and large firms, the foreign sales of small firms increased in this period. In the next chapter I use this longitudinal dataset of the three measures of internationalisation to investigate the indirect international diversification benefits of MNCs to a US investor.

Chapter 5 An Investigation into the International Diversification Benefits of US MNCs

5.1 Introduction

Having conducted an in-depth longitudinal investigation into the internationalisation of US firms, in this chapter I investigate whether MNCs provide an indirect method of obtaining the benefits of international diversification to US investors. If they do yield benefits this provides an explanation for the home bias puzzle, investors may not be forgoing the benefits of investing overseas by being overweight in domestic equities.

Using the longitudinal dataset and three measures of internationalisation from the previous chapter, I investigate whether there is an optimal method by which to select MNCs. I compare portfolios of MNCs to test which yield the greatest diversification benefits to US investors. I rank firms using three measures of internationalisation; percentage foreign sales, the number of geographic segments in which a firm reports sales, and the number of regions in which those sales are located. I initially calculate the preliminary statistics of portfolios of firms on an annual basis. I form portfolios of firms with the greatest changes and firms with the consistently highest levels in the three measures of internationalisation. I use Mean-Variance Spanning and Sharpe ratios to test the statistical and economic benefit of adding different portfolios of MNCs to a benchmark portfolio of domestic firms with no overseas activity.

The contributions of this chapter are as follows. No previous study compares the diversification benefits of portfolios of firms selected using three measures of internationalisation. Different selection methods have been used in different studies, but none directly compares methods to investigate which yields the greatest diversification benefits for a given time period. Most prior studies select their sample of MNCs only using measures such as percentage foreign sales or number of foreign subsidiaries, making no differentiation between, for example, an American firm with 50 percent of its sales in Canada, and another with 50 percent of its sales spread across Asia, Australia and Europe. I question the usefulness of these approaches, given the findings of Baxter & Kouparitsas (2005) that correlations of business cycles decrease with distance. With

the exception of Omer et al. (1998),[18] previous studies select firms based on criteria at one point in time, either at the start or the end of the period analysed. My dataset allows me to form portfolios of firms with the greatest changes and the highest levels of internationalisation over the period selected, as well as firms with the highest level of internationalisation at a single point in time. To ensure the robustness of my Mean-Variance Spanning results, I conduct joint and step-down Wald tests and perform the tests using OLS and GMM estimation. This follows Berrill & Kearney (2010). Errunza et al. (1999), Rowland & Tesar (2004), Antoniou et al. (2010) use OLS and GMM estimation for their MVS tests but do not perform step-down Wald tests.

My results provide strong evidence that the benefits of indirect diversification can be gained via investment in MNCs, which concurs with the findings for US MNCs by Qian (1996), Rowland & Tesar (2004) and Berrill & Kearney (2010). For equally weighted portfolios, I find that MNCs reporting sales in the largest number of segments or in the greatest number of regions provide greater diversification benefits than those with the highest foreign sales. When no short sales are permitted, I find that firms that remain over thresholds of internationalisation for the entire period provide greater diversification benefits than those which increase the most in internationalisation. I find that selecting firms which remain over thresholds in *every year* is superior to firms selected at either the start or the end of the period. This highlights the importance of using a longitudinal dataset.

The remainder of this chapter is structured as follows. Section 5.2 details the preliminary statistics of firms ranked by the different measures of internationalisation in each year. Section 5.3 details the construction of longitudinal MNC portfolios. Section 5.4 describes the results of tests for diversification benefits of the portfolios. Section 5.5 concludes the chapter.

5.2 Preliminary Statistics

I initially calculate the preliminary statistics of firms categorised by the different measures of internationalisation in each year. I create equally weighted portfolios for each category. I calculate the correlation of the returns of portfolios of internationalised firms with the returns of

[18] Firms that have a foreign tax liability in each of 6 years are selected.

firms with no foreign activity in each year. The results are listed in Table 5.1. In Panel A the correlation with the benchmark portfolio decreases as the percentage of foreign sales increases. Overall the correlation of MNCs with domestic firms decreases as their level of foreign sales increases. This is as expected as firms diversify into foreign markets. In some years the correlation is the same for under and over 25 percent foreign sales, but in every year the correlation is lower for firms with over 50 percent foreign sales. In Panel B the correlations decrease overall as the number of segments increases. In almost every year the correlations for firms with at least 6 segments are lower than those for firms with over 50 percent foreign sales. In Panel C, the correlations are lower in many cases for firms with sales in one region than for firms with sales in greater numbers of regions. However, this result may be distorted by the fact that there are only between 4 and 8 firms with sales in one region in any year. Apart from this the correlations with the benchmark portfolio decrease overall as the number of regions increases. As for the number of regions measure, the correlations for global firms are lower in every year than the correlation for firms with over 50 percent foreign sales. Firms with the highest number of segment or regions are less correlated with domestic firms than firms with the highest percentage foreign sales. The highest average correlations across all measures are in 2002 and in 2008, 2009 and 2010. This may be due to the downturn after the credit crisis of 2007/08, consistent with the well documented observation that correlations tend to rise during market downturns (Longin & Solnik, 1995; Karolyi & Stulz, 1996; Asness et al., 2011).

In Table 5.2 I list the annualised mean, standard deviation and return per unit of risk of each portfolio of firms. In Panel A, it can be seen that almost all of the portfolio returns were negative in 2002 and 2008, with some negative returns in 1999, 2001 and 2007. In some years the return increases as the level of internationalisation increases. In 1996, 2007, 2009 and 2010 many of the portfolios of MNCs have higher returns than the domestic firms. Overall however, the results are mixed, with little discernible pattern between internationalisation and average returns in other years. In Panel B, up to 2006 and in 2010 most of the portfolios of MNCs have a higher standard deviation than the portfolio of domestic firms.

Table 5.1 Correlations of Portfolios of Firms

	1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
Panel A: Percentage Foreign Sales															
Under 25%	87%	89%	95%	84%	82%	81%	96%	95%	90%	89%	91%	89%	94%	95%	95%
Over 25% and under 50%	86%	88%	93%	86%	68%	73%	95%	93%	85%	88%	91%	91%	95%	94%	95%
Over 50%	78%	78%	89%	78%	50%	53%	87%	89%	77%	83%	84%	89%	91%	92%	93%
Panel B: Number of Geographic Segments															
2 segments	86%	90%	95%	84%	82%	81%	96%	95%	90%	91%	94%	93%	96%	95%	96%
3 segments	84%	83%	92%	83%	61%	66%	91%	93%	83%	85%	87%	89%	95%	96%	92%
4 segments	84%	86%	90%	84%	69%	70%	94%	92%	83%	83%	92%	87%	94%	94%	94%
5 segments	76%	82%	91%	72%	76%	69%	92%	91%	83%	82%	84%	86%	91%	90%	93%
6 segments	73%	66%	88%	72%	38%	30%	82%	80%	64%	77%	83%	88%	90%	91%	91%
7 segments	37%	63%	82%	63%	39%	64%	79%	72%	60%	83%	77%	80%	78%	89%	93%
8 segments			72%	48%	51%	33%	79%	77%	76%	71%	71%	75%	86%	86%	85%
9 segments		41%	66%	34%	23%	60%	72%	79%	76%	68%	68%	77%	80%	91%	90%
10 segments				39%	5%	38%	73%	73%	70%	76%	78%	91%	85%	91%	91%
Panel C: Number of Regions															
North America (1)	49%	69%	80%	48%	63%	57%	90%	88%	82%	72%	77%	85%	92%	88%	87%
2 Regions (2)	87%	90%	95%	82%	82%	81%	96%	95%	90%	89%	91%	93%	96%	95%	95%
3 Regions (3)	81%	81%	93%	82%	58%	65%	92%	93%	82%	86%	89%	87%	94%	95%	93%
4 Regions (4)	83%	89%	91%	87%	71%	67%	90%	91%	80%	86%	89%	91%	93%	91%	93%
5 Regions (5)	87%	85%	88%	79%	57%	58%	91%	88%	80%	82%	88%	85%	90%	92%	93%
Global (6)	27%	50%	74%	48%	32%	55%	88%	78%	78%	72%	70%	82%	84%	90%	90%

Notes: This table shows the correlation of the firms in each category of internationalisation with the firms with no foreign sales in each year. For example firms with over 50 percent foreign sales in 1996 have a correlation of 82% with domestic firms.

Table 5.2 Risk and Return of Portfolios of Firms

	1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
							Panel A: Annualised Return								
Domestic	0.15	0.34	0.13	-0.07	0.20	0.13	-0.03	0.28	0.19	0.12	0.15	-0.11	-0.66	0.31	0.13
Under 25%	0.21	0.21	0.08	-0.04	0.12	0.07	-0.17	0.32	0.20	0.13	0.14	-0.04	-0.74	0.46	0.17
Over 25% and under 50%	0.24	0.22	0.01	0.15	-0.02	0.09	-0.18	0.31	0.16	0.11	0.14	0.09	-0.59	0.32	0.16
Over 50% FS	0.21	0.13	-0.04	0.35	0.04	-0.14	-0.24	0.33	0.12	0.12	0.14	0.13	-0.71	0.44	0.23
2 segments	0.24	0.23	0.08	-0.04	0.18	0.07	-0.15	0.27	0.19	0.11	0.11	0.00	-0.66	0.44	0.20
3 segments	0.20	0.19	0.05	0.09	-0.03	0.01	-0.27	0.37	0.14	0.06	0.13	0.12	-0.67	0.32	0.18
4 segments	0.23	0.16	-0.04	0.24	-0.09	0.11	-0.13	0.34	0.16	0.06	0.15	-0.04	-0.58	0.38	0.19
5 segments	0.26	0.20	0.00	0.16	0.00	0.00	-0.17	0.27	0.16	0.23	0.16	0.15	-0.59	0.33	0.16
6 segments	0.39	0.30	-0.07	0.36	-0.01	-0.05	-0.21	0.35	0.15	0.15	0.12	0.12	-0.82	0.45	0.24
7 segments	0.32	0.19	-0.14	0.59	0.17	-0.14	-0.32	0.42	-0.01	0.19	0.10	0.13	-0.54	0.52	0.16
8 segments			0.22	0.29	0.31	-0.46	0.01	0.42	0.16	0.28	0.06	0.22	-1.08	0.40	0.22
9 segments		0.18	0.29	-0.51	0.55	0.28	-0.25	0.30	0.20	0.20	0.68	0.35	-0.64	0.30	0.19
10 segments				-0.24	0.09	-0.17	-0.39	0.42	0.12	0.15	0.38	0.25	-0.85	0.59	0.32
North America (1)	0.20	0.23	0.14	-0.15	0.13	0.07	-0.12	0.26	0.17	0.09	0.10	-0.02	-0.55	0.34	0.15
2 Regions (2)	0.23	0.22	0.03	-0.03	0.15	0.09	-0.14	0.27	0.21	0.10	0.11	0.00	-0.64	0.36	0.16
3 Regions (3)	0.20	0.18	0.07	0.15	-0.06	0.06	-0.21	0.37	0.13	0.10	0.17	0.03	-0.65	0.37	0.11
4 Regions (4)	0.26	0.23	-0.07	0.24	0.02	0.06	-0.20	0.33	0.12	0.13	0.11	0.13	-0.67	0.42	0.31
5 Regions (5)	0.25	0.16	0.08	0.26	-0.04	-0.20	-0.26	0.33	0.20	0.16	0.18	0.15	-0.65	0.40	0.48
Global (6)	0.62	0.14	-0.57	0.18	0.38	-0.06	-0.10	0.13	0.24	0.23	0.21	0.30	-0.74	0.43	0.85
							Panel B: Annualised Risk								
Domestic	0.10	0.13	0.21	0.14	0.16	0.13	0.22	0.14	0.12	0.11	0.10	0.17	0.44	0.41	0.18
Under 25%	0.15	0.15	0.30	0.21	0.23	0.21	0.28	0.16	0.14	0.12	0.12	0.16	0.34	0.43	0.21
Over 25% and under 50%	0.14	0.18	0.26	0.16	0.17	0.18	0.25	0.16	0.14	0.11	0.11	0.15	0.38	0.40	0.17
Over 50% FS	0.15	0.21	0.29	0.18	0.23	0.23	0.31	0.20	0.18	0.14	0.16	0.16	0.39	0.36	0.14
2 segments	0.14	0.18	0.27	0.15	0.16	0.17	0.26	0.16	0.13	0.11	0.11	0.15	0.39	0.39	0.22
3 segments	0.14	0.20	0.29	0.18	0.22	0.24	0.31	0.18	0.17	0.12	0.15	0.17	0.38	0.38	0.24
4 segments	0.14	0.19	0.26	0.17	0.21	0.21	0.31	0.20	0.17	0.13	0.12	0.16	0.36	0.35	0.21
5 segments	0.18	0.18	0.26	0.18	0.17	0.21	0.31	0.17	0.14	0.14	0.15	0.16	0.35	0.32	0.21
6 segments	0.22	0.31	0.32	0.19	0.32	0.31	0.40	0.19	0.17	0.15	0.16	0.18	0.42	0.39	0.20
7 segments	0.20	0.33	0.50	0.23	0.32	0.27	0.26	0.25	0.15	0.18	0.19	0.21	0.39	0.41	0.26
8 segments				0.25	0.34	0.37	0.34	0.23	0.23	0.17	0.15	0.22	0.51	0.49	0.24
9 segments			0.47	0.45	0.46	0.40	0.39	0.31	0.21	0.19	0.41	0.25	0.40	0.45	0.30
10 segments				0.49	0.32	0.32	0.47	0.28	0.21	0.14	0.16	0.20	0.45	0.43	0.25
North America (1)	0.15	0.15	0.30	0.21	0.23	0.21	0.28	0.16	0.14	0.12	0.12	0.16	0.34	0.43	0.21
2 Regions (2)	0.14	0.18	0.26	0.16	0.17	0.18	0.25	0.16	0.14	0.11	0.11	0.15	0.38	0.40	0.17
3 Regions (3)	0.15	0.21	0.29	0.18	0.23	0.23	0.31	0.20	0.18	0.14	0.16	0.16	0.39	0.36	0.14
4 Regions (4)	0.16	0.18	0.27	0.18	0.19	0.22	0.33	0.20	0.16	0.13	0.13	0.17	0.37	0.34	0.37
5 Regions (5)	0.15	0.18	0.26	0.16	0.20	0.20	0.32	0.16	0.14	0.12	0.13	0.17	0.35	0.38	0.51
Global (6)	0.23	0.31	0.42	0.25	0.36	0.26	0.32	0.21	0.16	0.16	0.22	0.21	0.43	0.43	1.16
							Panel C: Return per Unit of Risk								
Domestic	1.54	2.63	0.61	-0.51	1.25	1.01	-0.16	2.00	1.55	1.11	1.47	-0.68	-1.51	0.75	0.68
Under 25%	1.45	1.35	0.26	-0.18	0.53	0.35	-0.61	1.99	1.41	1.10	1.24	-0.22	-2.20	1.09	0.81
Over 25% and under 50%	1.71	1.22	0.03	0.95	-0.09	0.49	-0.71	1.97	1.17	1.04	1.28	0.62	-1.53	0.80	0.95
Over 50% FS	1.41	0.63	-0.14	1.93	0.16	-0.61	-0.78	1.66	0.69	0.88	0.90	0.80	-1.83	1.23	1.67
2 segments	1.73	1.32	0.31	-0.24	1.14	0.44	-0.56	1.66	1.40	0.97	1.06	-0.02	-1.71	1.14	0.90
3 segments	1.37	0.97	0.19	0.51	-0.13	0.04	-0.88	1.99	0.85	0.49	0.85	0.75	-1.76	0.84	0.75
4 segments	1.64	0.86	-0.17	1.40	-0.44	0.54	-0.43	1.69	0.97	0.50	1.19	-0.27	-1.61	1.09	0.91
5 segments	1.46	1.12	-0.01	0.90	-0.03	0.02	-0.54	1.58	1.11	1.64	1.06	0.93	-1.68	1.02	0.76
6 segments	1.81	0.98	-0.21	1.86	-0.03	-0.17	-0.52	1.88	0.86	0.99	0.73	0.70	-1.94	1.15	1.17
7 segments	1.60	0.55	-0.29	2.56	0.54	-0.52	-1.24	1.71	-0.09	1.06	0.53	0.62	-1.38	1.28	0.61
8 segments				1.15	0.91	-1.27	0.04	1.83	0.71	1.66	0.40	1.00	-2.11	0.83	0.92
9 segments			0.63	-1.12	1.20	0.69	-0.64	0.98	0.97	1.04	1.68	1.43	-1.60	0.68	0.64
10 segments				-0.49	0.30	-0.54	-0.83	1.46	0.58	1.05	2.37	1.24	-1.88	1.37	1.28
North America (1)	1.34	1.50	0.46	-0.71	0.58	0.33	-0.44	1.66	1.18	0.72	0.89	-0.09	-1.62	0.79	0.72
2 Regions (2)	1.64	1.22	0.10	-0.22	0.92	0.53	-0.54	1.73	1.52	0.91	1.02	0.03	-1.67	0.92	0.92
3 Regions (3)	1.30	0.89	0.24	0.86	-0.27	0.25	-0.70	1.88	0.75	0.74	1.09	0.20	-1.68	1.03	0.77
4 Regions (4)	1.63	1.25	-0.26	1.30	0.10	0.29	-0.61	1.66	0.75	0.97	0.83	0.76	-1.81	1.23	0.83
5 Regions (5)	1.61	0.87	0.31	1.63	-0.22	-0.97	-0.81	2.06	1.41	1.27	1.36	0.91	-1.83	1.07	0.95
Global (6)	2.71	0.45	-1.35	0.74	1.05	-0.24	-0.32	0.59	1.53	1.44	1.00	1.42	-1.70	0.98	0.73

Notes: This table shows the annualised return, risk and return per unit of risk in each year for each category of firm. For example, the return per unit of risk is 1.65 for the portfolio of domestic firms in 1996.

This runs contrary to previous studies that suggest that firm internationalisation reduces the risk of the firm (Hughes, Logue, & Sweeney, 1975; Fatemi, 1984). Portfolios of MNCs only have lower standard deviations in 2007, 2008 and 2009. Less exposure to the US market may have reduced the risk of MNCs during the credit crisis. In Panel C I list the return per unit of risk for each portfolio. Portfolios of MNCs outperform domestic firms in 1996, 2007, 2009 and 2010. In other years the results are mixed, with domestic firms outperforming MNC portfolios in many instances. The results for 2007 and 2009 coincide with lower risk for MNC portfolios, and for 1996 and 2010 with higher returns for MNCs.

In Table 5.3 I list the return, risk and risk-adjusted return for firms in each year by each industry category. In Panel A, on average, Healthcare, Industrials and Oil & Gas had the highest annual return. Healthcare was one of the least internationalised industries while Industrials and Oil & Gas had high levels of internationalisation. This confirms the mixed findings in the previous table with regards to internationalisation and returns. In Panel B, Utilities have the lowest average standard deviation, while Technology and Consumer Services have the highest. There is also little pattern between risk and internationalisation, as Technology and Consumer Services are among the industries with the highest and the lowest levels of internationalisation. The highest average risk-adjusted returns are for Utilities, Oil & Gas and Healthcare. Utilities and Healthcare are two of the least international industries. Higher risk-adjusted return does not appear to be linked to higher levels of internationalisation over this period.

5.3 Portfolio Construction

My longitudinal dataset affords two methods to form portfolios; firms with the greatest change in the measures of internationalisation, which I term the fastest internationalisers; and firms that remain above a certain threshold of internationalisation in every year, which I term the most consistently international firms. To select the fastest internationalising firms I calculate the change in each measure between 1996 and 2010. To select the most consistently international firms I apply thresholds in every year for each measure. In Table 4.3 the number of firms with each increase and decrease in each measure and above thresholds for each measure are listed. I

Table 5.3 Risk and Return of Firms by Industry

	1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*Average*
							Panel A: Annualised Return									
Basic Materials	22%	9%	-20%	11%	-4%	8%	-2%	31%	20%	7%	21%	13%	-71%	52%	23%	22%
Consumer Goods	22%	25%	12%	-8%	3%	17%	-7%	31%	17%	1%	11%	-4%	-63%	45%	22%	22%
Consumer Services	14%	34%	31%	6%	-8%	19%	-24%	35%	7%	5%	13%	-23%	-70%	56%	21%	14%
Financials	25%	35%	5%	-7%	23%	10%	-6%	31%	16%	10%	12%	-18%	-62%	19%	12%	25%
Health Care	11%	16%	27%	4%	42%	8%	-13%	29%	8%	11%	7%	5%	-39%	31%	9%	11%
Industrials	17%	23%	-9%	9%	-3%	9%	-16%	39%	24%	17%	14%	17%	-71%	41%	22%	17%
Oil & Gas	36%	24%	-53%	23%	32%	-6%	-15%	28%	29%	46%	16%	33%	-82%	46%	16%	36%
Technology	26%	13%	31%	59%	-36%	-4%	-48%	50%	2%	8%	5%	-4%	-68%	52%	13%	26%
Telecommunications	8%	25%	27%	52%	-39%	-25%	-39%	18%	19%	5%	19%	-4%	-71%	26%	18%	8%
Utilities	4%	21%	14%	-19%	32%	-3%	-11%	24%	16%	14%	15%	8%	-32%	16%	8%	4%
							Panel B: Annualised Standard Deviation									
Basic Materials	25%	27%	39%	41%	43%	37%	41%	27%	25%	25%	25%	27%	57%	55%	32%	25%
Consumer Goods	27%	30%	39%	37%	44%	33%	37%	28%	24%	22%	22%	25%	56%	53%	30%	27%
Consumer Services	37%	37%	48%	50%	56%	47%	49%	36%	30%	26%	25%	33%	60%	57%	32%	37%
Financials	22%	26%	36%	31%	37%	28%	33%	22%	21%	18%	17%	27%	73%	70%	34%	22%
Health Care	35%	38%	45%	51%	54%	41%	39%	29%	28%	23%	23%	24%	41%	36%	24%	35%
Industrials	30%	34%	45%	43%	51%	44%	49%	35%	29%	26%	29%	28%	56%	55%	33%	30%
Oil & Gas	31%	40%	54%	53%	48%	48%	49%	31%	29%	32%	35%	32%	63%	56%	36%	31%
Technology	53%	53%	62%	59%	77%	64%	67%	43%	37%	30%	30%	29%	52%	46%	32%	53%
Telecommunications	24%	32%	37%	36%	49%	39%	58%	35%	25%	20%	22%	25%	55%	42%	25%	24%
Utilities	18%	17%	21%	23%	33%	29%	37%	21%	15%	15%	14%	19%	32%	33%	18%	18%
							Panel C: Return/Risk									
Basic Materials	0.86	0.33	(0.51)	0.26	(0.08)	0.23	(0.06)	1.15	0.86	0.80	0.27	0.85	0.48	(1.26)	0.94	0.70
Consumer Goods	0.82	0.84	0.31	(0.22)	0.08	0.52	(0.19)	1.11	0.82	0.71	0.03	0.48	(0.15)	(1.13)	0.85	0.76
Consumer Services	0.38	0.91	0.65	0.13	(0.15)	0.40	(0.50)	0.98	0.38	0.24	0.19	0.54	(0.69)	(1.16)	0.99	0.65
Financials	1.18	1.33	0.13	(0.23)	0.63	0.37	(0.19)	1.41	1.18	0.75	0.56	0.69	(0.65)	(0.84)	0.28	0.35
Health Care	0.30	0.42	0.59	0.08	0.78	0.20	(0.34)	0.98	0.30	0.29	0.46	0.29	0.22	(0.95)	0.85	0.39
Industrials	0.58	0.69	(0.20)	0.22	(0.06)	0.21	(0.33)	1.09	0.58	0.82	0.64	0.48	0.60	(1.26)	0.75	0.65
Oil & Gas	1.16	0.60	(0.97)	0.43	0.67	(0.12)	(0.31)	0.89	1.16	1.02	1.44	0.46	1.05	(1.31)	0.83	0.45
Technology	0.49	0.25	0.50	0.99	(0.47)	(0.07)	(0.72)	1.17	0.49	0.05	0.27	0.16	(0.13)	(1.30)	1.13	0.41
Telecommunications	0.34	0.79	0.73	1.44	(0.78)	(0.65)	(0.67)	0.51	0.34	0.75	0.23	0.85	(0.17)	(1.30)	0.62	0.72
Utilities	0.24	1.21	0.69	(0.84)	0.98	(0.09)	(0.29)	1.15	0.24	1.03	0.92	1.07	0.39	(1.00)	0.49	0.46

Notes: This table shows the annualised return, standard deviation and return per unit of risk for each industry in each year. For example, the average return of basic materials firms in 1996 was 20%

select firms with the greatest increases and the highest thresholds in each measure while ensuring enough firms in each portfolio. The portfolios are as follows.

Benchmark Portfolio

The benchmark portfolio is comprised of 104 firms which have no foreign sales in any year. They are listed in Appendix A.2. I list the number of firms in each industry category in Table 5.4. The firms are not significantly concentrated in any one industry category.

Fastest internationalisers – Type 1 Portfolios

I create six portfolios of the fastest internationalising firms, firms whose level of internationalisation has increased the most between 1996 and 2010, which I term Type 1 portfolios. They are; firms with an increase of 40 and 50 percent in foreign sales, firms with an increase of 5 and 6 in the number of geographic segments, and firms with an increase of 2 and 3 in the number of regions. I test whether these portfolios are spanned by the benchmark portfolio. The following null hypotheses state how the diversification benefits of MNCs will be tested.

Hypothesis 1a: A portfolio of firms whose foreign sales have increased by over 40 (and over 50) percent between 1996 and 2010 is spanned by the benchmark portfolios of firms with no foreign sales in any year.

Hypothesis 1b: A portfolio of firms whose number of geographic segments has increased by 5 or more (and by 6 or more) between 1996 and 2010 is spanned by the benchmark portfolios of firms with no foreign sales in any year.

Hypothesis 1c: A portfolio of firms whose number of regions has increased by 2 or more (and by 3 or more) between 1996 and 2010 is spanned by the benchmark portfolios of firms with no foreign sales in any year.

Most consistently international firms – Type 2 Portfolios

I create two thresholds for the firms for each measure of internationalisation; firms that have above 25 and 50 percent foreign sales in every year, firms that report at least 4 and 5 geographic.

Table 5.4 Industrial Composition of Benchmark Portfolio

Industry	*Number of Firms*
Basic Materials	1
Consumer Goods	6
Consumer Services	23
Financials	41
Health Care	6
Industrials	2
Oil & Gas	6
Technology	0
Telecommunications	6
Utilities	13
TOTAL	104

Notes: This table lists the number of firms in each industry category in the benchmark portfolio.

segments in every year and firms that have sales in at least 3 and 4 regions in every year.[19] This leads to the following null hypotheses

Hypothesis 2a: A portfolio of firms with foreign sales greater than 25 percent (and greater than 50 percent) in every year is spanned by the benchmark portfolios of firms with no foreign sales in any year.

Hypothesis 2b: A portfolio of firms with sales in at least 4 (and in at least 5) geographic segments in every year is spanned by the benchmark portfolios of firms with no foreign sales in any year.

Hypothesis 2c: A portfolio of firms with sales in at least 3 regions (and at least 4) in every year is spanned by the benchmark portfolios of firms with no foreign sales in any year.

The firms in each Type 1 and Type 2 portfolio are listed in Appendices A.3 and A.4. None of the portfolios are significantly concentrated in any one industry. The number of firms in each portfolio is listed in Table 5.5. I create an equally weighted benchmark portfolio and equally weighted Type 1 and Type 2 portfolios.

All previous studies that test the diversification benefits of portfolios of MNCs use either value-weighted portfolios (Shaked, 1986; Cai & Warnock, 2004; Berrill & Kearney, 2010) or equally-weighted portfolios (Mikhail & Shawky, 1979; Fatemi, 1984; Michel & Shaked, 1986; Omer et al., 1998; Salehizadeh, 2003; Filat & Garetto, 2012). Optimally-weighted portfolios have been used in studies of international diversification benefits (Eun & Resnick, 1994; Christoffersen et al., 2012) and the diversification benefits of exchange-traded funds, iShares and CCFs (Miffre, 2007; Huang & Lin, 2011). Optimal weights calculate the maximum attainable Sharpe ratio of a portfolio but these weights can only be known ex-post. Equally-weighted or value-weighted portfolios represent a more realistic scenario. Optimal weights may allow or disallow short selling. As many portfolio managers are restricted to being only long assets, optimal weights with no short sales calculates the maximum Sharpe ratio possible in this scenario. In addition to equally weighted portfolios, I create optimally weighted portfolios where the weight of each MNC in the portfolio is optimised with and without short sales. I do this for three Type 1 and

[19] The thresholds were chosen to ensure sufficient firms in each portfolio.

Table 5.5 Longitudinal Portfolios of MNCs

	Mean	*StDev*	*Return/Risk*	*No of firms*	*Correlation with Domestic firms*	*Correlation with S&P500*
S&P500	6.53%	19.84%	0.33		87%	
Domestic in All Years	8.21%	21.54%	0.39	104		87%
Panel A: Type 1 Portfolios : Fastest Internationalisers						
>=40% increase in FS	9.52%	29.19%	0.33	36	74%	84%
>=50% increase in FS	8.00%	31.20%	0.26	21	70%	82%
>=increase of 5 segments	8.34%	26.16%	0.32	34	82%	89%
>= increase of 6 segments	9.89%	27.67%	0.36	19	78%	87%
>= increase of 2 regions	8.54%	23.96%	0.36	79	88%	92%
>= increase of 3 regions	9.47%	24.60%	0.38	31	86%	90%
Panel B: Type 2 Portfolios : Most consistently international						
>=25% FS in all years	7.86%	21.77%	0.36	128	86%	93%
>=50% FS in all years	5.17%	23.76%	0.22	26	81%	86%
>=4 segments in all years	8.85%	22.14%	0.40	48	83%	90%
>=5 segments in all years	12.08%	25.36%	0.49	12	78%	81%
>=3 regions in all years	8.21%	22.89%	0.36	129	86%	92%
>=4 regions in all years	10.70%	22.14%	0.49	29	85%	90%

Notes: This table shows the risk, return and correlations of equally weighted portfolios of firms. The portfolios in Panel A have the greatest increases in percentage foreign sales, number of segments and number of regions between 1996 and 2010. In Panel B, the results are listed for firms which remain above thresholds of foreign sales, segments and regions in every year between 1996 and 2010.

three Type 2 portfolios with the highest levels of internationalisation. They are; firms with at least a 50 percent increase in foreign sales, an increase of at least 6 segments and at least 3 regions; and firms with always over 50 percent foreign sales, at least 5 segments and 4 regions. All of these portfolios contain 31 firms or less.

As almost all previous studies select firms based on criteria at one point in time, I compare my longitudinal selection of MNCs to when firms are statically selected. I form portfolios of firms selected by each measure of internationalisation in 1996 and in 2010. Most prior studies categorise firms at the end of the period, and some at the start; I do both.

5.4 Results

5.4.1 Preliminary Statistics of Longitudinal Portfolios

I calculate the annualised mean, standard deviation, return per unit of risk, correlation with the S&P500 and correlation with domestic firms for each portfolio.[20] The results are listed in Table 5.5. The S&P500 contains both domestic and internationalised firms. The return per unit of risk is 0.33 for the S&P500 and 0.39 for the portfolio of domestic firms, consistent with the findings in Section 5.2, that in many cases there is little discernible pattern between the risk-adjusted return of the portfolio and the level of internationalisation of the firms in the portfolio. While the returns for the two portfolio types are mixed, the risk of Type 2 portfolios are lower than Type 1. Three portfolios have a higher risk-adjusted return than the S&P500. Three Type 2 portfolios have a higher risk-adjusted return than domestic firms; 0.40 for firms with at least 4 segments every year, 0.49 for at least 5 segments, and 0.49 for at least 5 regions in every year, and 5 are higher than the S&P500. The correlation of all of the portfolios is lower with domestic firms than with the S&P500. For each measure of internationalisation, the correlation decreases in every case as the level of internationalisation increases. I next examine the diversification benefits of the portfolios of MNCs.

[20] Although the numbers in each portfolio vary and it could be argued that diversification benefits will accrue to those with larger numbers of firms, this is not borne out as the portfolio with the highest return per unit of risk has one of the smallest numbers of firms.

5.4.2 Diversification Benefits

I use Mean-Variance Spanning tests to investigate whether US investors can gain international diversification benefits by investing in home-based internationalised firms. I test whether the extended portfolio of the benchmark portfolio plus the test assets is spanned by the benchmark portfolio. I conduct Mean-Variance Spanning tests as detailed in Section 3.6.1, with

$$R_{MNC,t} = \alpha + \beta R_{D,t} + \varepsilon_t \tag{5.1}$$

where $R_{MNC,t}$ are the returns of a portfolio of MNCs and $R_{D,t}$ are the returns of a portfolio of domestic firms. In Table 5.6 I report the F-statistics and p-values from the Wald tests. The p-value represents the probability of not rejecting the null hypothesis of spanning, that the benchmark portfolio spans the extended set of the benchmark plus the test assets. The results are listed firstly for the joint hypothesis of spanning, and subsequently for the step-down tests, where α=0 and β=1 are tested separately, for both OLS and GMM estimation. In Panel A both the joint spanning and the step-down spanning results for OLS and GMM estimation indicate that I do not reject the null hypothesis for all of the Type 1 portfolios. The addition of portfolios of the fastest internationalising firms does not shift the mean-variance efficient frontier of the portfolio of domestic firms. Firms with rapidly expanding operations overseas do not provide international diversification benefits to domestic investors, when portfolios are equally weighted.

The results for joint spanning for OLS and GMM estimation in Panel B indicate that I do reject the null hypothesis for almost all of the portfolios of the most consistently international MNCs. The exception is for firms with over 50 percent foreign sales and over 3 regions, for which I do not reject spanning at the 10 percent critical level using GMM estimation. There is a clear difference in the results for $\alpha = 0$ and $\beta = 1$. For the step-down test for $\alpha = 0$, I do not reject the null hypothesis that the tangency point of the extended set is not statistically different to the tangency point of the benchmark portfolio of domestic firms. The results for $\beta = 1$ suggest that the minimum variance portfolio of the extended set is statistically different from the benchmark portfolio. This would suggest that the diversification benefits of the Type 2 portfolios are due to the risk reduction that they provide to the benchmark portfolio. In order to calculate the

Table 5.6 MVS Tests and Sharpe Ratio Results for Equally Weighted Portfolios

	OLS						*GMM*								
	$\alpha = 0, \beta = 1$		$\alpha = 0$		$\beta = 1$		$\alpha = 0, \beta = 1$		$\alpha = 0$		$\beta = 1$				
	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	Sharpe ratio	% change	Sharpe ratio - no short sales
All Domestic Firms													0.24		
Panel A: Type 1: Fastest internationalisers															
>=40% increase in FS	0.09	0.91	0.05	0.81	0.12	0.72	0.05	0.95	0.06	0.82	0.13	0.84			
>=50% increase in FS	0.21	0.80	0.01	0.94	0.42	0.51	0.08	0.92	0.01	0.94	0.42	0.69			
>=increase of 5 segments	0.06	0.93	0.01	0.98	0.13	0.71	0.07	0.98	0.00	0.99	0.13	0.84			
>= increase of 6 segments	0.12	0.88	0.12	0.72	0.13	0.70	0.13	0.92	0.13	0.74	0.13	0.79			
>= increase of 2 regions	0.15	0.79	0.16	0.81	0.14	0.66	0.15	0.89	0.14	0.78	0.14	0.81			
>= increase of 3 regions	0.07	0.92	0.15	0.69	0.01	0.96	0.08	0.92	0.09	0.69	0.01	0.93			
Panel B: Type 2: Most consistently international															
>25%	24	0.00	0.04	0.84	48	0.00	2.76	0.06	0.04	0.85	7.79	0.02	0.24	0%	0.24
>50%	10	0.00	0.45	0.50	21	0.00	1.40	0.12	0.42	0.52	3.75	0.05	0.30	24%	0.24
>=4 segments	26	0.00	0.30	0.58	52	0.00	4.40	0.01	0.27	0.60	8.05	0.01	0.26	9%	0.26
>=5 segments	5.58	0.00	1.33	0.25	10	0.00	7.49	0.02	1.25	0.26	3.46	0.06	0.36	50%	0.36
>=3 regions	9.6	0.00	0.04	0.83	18	0.00	2.23	0.19	0.04	0.85	3.27	0.07	0.24	1%	0.24
>=4 regions	22	0.00	1.38	0.24	43	0.00	4.72	0.00	1.22	0.26	10.5	0.00	0.36	48%	0.36

Notes: This table shows the results for the Mean-Variance Spanning Tests and changes in the Sharpe Ratios, for the addition of equally weighted portfolios of MNCs to the benchmark portfolio, all domestic firms. The F-statistics and p-values from the Wald test of the joint coefficient restrictions and for the step-down coefficient restrictions are listed, for both OLS and GMM estimation. The p-value is the probability of not rejecting the null hypothesis, that the benchmark portfolio of all domestic firms spans the extended set of MNCs plus the benchmark portfolio. The Sharpe ratio of the benchmark portfolio and the extended set is listed both allowing and restricting short sales in each.

economic magnitude of the shift in the mean-variance efficient frontier, I calculate the Sharpe ratio of the extended set of the benchmark portfolio plus the MNC portfolio by optimising the weight in the benchmark portfolio and in the MNC portfolio. I calculate the change from the Sharpe ratio of the benchmark portfolio. Bekaert & Urias (1996) suggest that only Sharpe ratio changes of above 0.057 are significant. The Sharpe ratio changes are only significant for those firms with the highest levels of internationalisation for each measure. For firms that have over 50 percent foreign sales in every year the Sharpe ratio increase is 24 percent. For firms with sales in at least 5 geographic segments every year, the increase is 50 percent. And for firms with sales in at least 4 regions every year, the increase is 48 percent.

In some cases the optimal weighting in the test portfolio is negative, which may not be realistic for investors for whom short selling is restricted. I recalculate the Sharpe ratio of the extended sets, but restrict short selling. The weights in each portfolio are positive apart from a negative weighting in MNCs with over 50 percent foreign sales. When short sales are restricted there is no increase in the Sharpe ratio of the extended set of domestic firms plus MNCs with over 50 foreign sales, as the optimal weightings become 100 percent in domestic firms and 0 percent in MNCs. In the case of the other Type 2 portfolios, short sales restrictions do not change the result, as the optimal weights are all positive. The addition of portfolios of the most consistently international firms does shift the mean-variance frontier of the portfolio of domestic firms. Firms that are the most consistently international do provide significant diversification benefits to domestic investors. Overall, for equally weighted portfolios, I find that firms which are consistently the most international, with sales in the greatest number of geographic segments or across the most regions provide the greatest diversification benefit to a US investor.

In Table 5.7 I repeat the diversification tests where the weight of each MNC in the portfolios of the most internationalised firms is optimised, with and without short sales. In all cases p-values of between 0 and 0.04 lead me to reject spanning, that is, that the benchmark portfolio does not span the extended portfolio. There are very substantial increases in the Sharpe ratios of between 100 and 373 percent. Both Type 1 and Type 2 portfolios of MNCs provide diversification benefits to US investors when portfolio weights are optimised. When short sales are not permitted, the increases are larger for Type 2 portfolios, those of the most consistently international MNCs. When short sales are permitted, the increases are greater for Type 1

Table 5.7 MVS Tests and Sharpe Ratio Results for Optimally Weighted Portfolios

	Portfolio Description	*OLS*		*GMM*		*Sharpe ratio*	*% change*
		F-stat	p-value	F-stat	p-value		
	All domestics					0.24	
	Panel A: Test portfolios – Type 1: Fastest Internationalisers						
No Short Sales	> 50% Increase	10	0.01	7	0.02	0.48	100%
	>= change of 6 segments	31	0.00	12	0.00	0.53	121%
	>= change of 3 regions	38	0.00	10	0.00	0.58	141%
Short Sales	> 50% Increase	16	0.00	16	0.00	0.80	233%
	>= change of 6 segments	33	0.00	21	0.00	0.89	271%
	>= change of 3 regions	29	0.00	21	0.00	1.14	373%
	Panel B: Test portfolios – Type 2: Highest levels of internationalisation						
No Short Sales	> 50% Foreign Sales	20	0.00	17	0.00	0.60	150%
	>= 5 segments	3	0.04	7	0.02	0.58	142%
	>= 4 regions	11	0.00	8	0.00	0.62	158%
Short Sales	> 50% Foreign Sales	27	0.00	22	0.00	1.08	350%
	>= 5 segments	5	0.00	3	0.07	0.67	179%
	>= 4 regions	14	0.00	12	0.00	1.01	321%

Notes: This table shows F-statistics and p-values of the Wald tests for Mean-Variance Spanning for both OLS and GMM estimation. It also lists the Sharpe ratio increases when portfolio of MNCs with optimised weights are added to a portfolio of domestic firms. In Panel A, weights of MNCs with the greatest increases in internationalisation are optimised, firstly restricting and then allowing short sales. In Panel B weights of MNC which are consistently the most international are optimised with and without short sales.

portfolios in 2 out of 3 cases. When short sales are not permitted, the most consistently international firms outperform the fastest internationalisers. When short sales are permitted, the fastest internationalisers outperform as poorly performing firms can be shorted. The inferior performance of the fastest internationalising firms may be due to the costs of rapid internationalisation, which may initially outweigh the benefits of internationalisation. When firms have established a high level of internationalisation, the diversification benefits increase.

As a robustness test, I compare my longitudinal selection of MNCs to when firms are selected based on criteria at one point in time. I list the results for portfolios of firms which are selected at one point in time, either in 1996 or 2010 in Table 5.8. I firstly list the Sharpe ratio of each portfolio and of the extended set of the portfolio of domestic firms and MNCs, and the results of Mean-Variance Spanning tests. When compared to the results in Table 5.6, the Sharpe ratio of the longitudinal portfolios for each measure is the same or greater than the Sharpe ratios in Table 5.8 in all cases. For the MVS results, I do not reject spanning for two of the 1996 portfolios and for any of the 2010 portfolios using GMM estimation. I conclude that static firm selection is inferior to longitudinal selection.

5.5 Conclusion

The purpose of the investigation in this chapter is to contribute to the literature on the indirect international diversification benefits of investing in MNCs. I compare the diversification benefits of portfolios when firms are chosen by the level, dispersion or location of their overseas activities. I test whether firms which are consistently the most international or whose level of internationalisation has increased the most offer the best diversification opportunities.

Using a richer dataset than exists in the literature I find that portfolios of MNCs provide the benefits of international diversification to US investors. My results show that when portfolios are equally weighted, greater benefits can be gained by selecting firms with the greatest dispersion and widest location of sales than by the level of foreign sales. Frankel & Rose (1998) find that as trade decreases with distance, so too does business cycle correlation, therefore firms operating far from their domestic market could be expected to deliver greater diversification

Table 5.8 Static Firm Selection

	Sharpe ratio	*SR Extended Set*	*No of firms*	*OLS*		*GMM*	
1996				F-stat	p-value	F-stat	p-value
>=25%	0.22	0.24	163	11.23	0.00	2.39	0.09
>=50%	0.14	0.24	46	6.47	0.00	1.85	0.15
>=4 segments	0.21	0.24	79	21	0.00	4.52	0.01
>=5 segments	0.25	0.26	25	13	0.00	3.17	0.04
>=3 regions	0.22	0.24	170	9.98	0.00	2.30	0.10
>=4 regions	0.23	0.24	28	21	0.00	4.80	0.01
2010							
>25%	0.22	0.24	225	6.49	0.00	1.22	0.23
>50%	0.21	0.24	125	6.02	0.00	0.56	0.56
>=4 segments	0.22	0.24	180	7.73	0.00	2.05	0.16
>=5 segments	0.26	0.26	130	6.42	0.00	1.41	0.22
>=3 regions	0.22	0.24	207	5.71	0.00	1.06	0.27
>=4 regions	0.25	0.25	74	2.27	0.10	1.85	0.13

Notes: This table lists results for portfolios of firms selected by criteria in either 1996 or 2010. It lists Sharpe ratios of the portfolio and of the extended set and the F-statistics and p-values from the Wald tests for both OLS and GMM Mean-Variance Spanning tests. For example, for the 163 firms which had more than 25% foreign sales in 1996, the Sharpe ratio is 0.22 and 0.24 of the extended set. The p-values for OLS and GMM leads me to reject the null hypothesis that they are spanned by the benchmark portfolio of domestic firms.

benefits. When no short sales are permitted, firms which are consistently the most international rather than those which increase the most in internationalisation provide greater diversification benefits. Firms which are *already* international provide greater benefits than those which *have become* more international. This may be due to the costs of rapid internationalisation which can erode and in some cases outweigh the diversification benefits. I find that a longitudinal selection method is superior to selection at one point in time.

Most prior studies select MNCs by the level of their foreign sales at a single point in time, (Fatemi, 1984; Qian, 1996; Antoniou et al., 2010); I find greater benefits when firms are selected based on measures of internationalisation observed over time and using measures other than percentage foreign sales. As argued by Aharoni (2006), by not using longitudinal data, the research fails to capture the dynamics of firm internationalisation. This study addresses that gap in the literature. My results demonstrate that portfolios of US MNCs offer significant home-based international diversification benefits. Investors can free ride the benefits of internationalisation without incurring the costs and risks of investing abroad. It can be concluded that, as suggested by Cai & Warnock (2012), the home bias observed in equity portfolios may be overstated when the indirect international exposure available via internationalised firms is not included. My next chapter incorporates the results of this study and compares the diversification benefits of MNCs to other equity types and to direct international investment.

Chapter 6 A Comparison of the Indirect Diversification Benefits of US Equity Investments

6.1 Introduction

In Chapter 1 I introduced five different US equity types that may provide the benefits of international diversification, Industry Indices, US Multinational Corporations (MNCs) with substantial foreign activities, foreign company shares which trade on US exchanges as American Depository Receipts (ADRs) and country specific exchange-traded funds; iShares and Closed-End Country Funds (CCFs). Having investigated how best to select MNCs for the purpose of diversification benefits in Chapter 5, in this chapter I investigate whether each of these five equity types provide diversification benefits, how they compare to each other and how they compare to direct investment in benchmark foreign country indices. Investments in MNCs and US Industry Indices represent investments in US headquartered companies which may provide indirect foreign exposure. Investments in ADRs, iShares and CCFs represent exposure to foreign market stocks in a domestic setting.

I compare the indirect international diversification benefits of five US-traded equity types to each other and to direct international diversification, measured as investing in foreign country indices. I form five portfolios of Industry Indices, MNCs, ADRs, iShares and CCFs and portfolios of foreign country indices. I weight the portfolios in three ways; equal weights, optimal weights without short sales and optimal weights with short sales, forming 24 portfolios comprised of equities and equity indices covering 37 countries. Using Mean-Variance Spanning I test the diversification benefits of the portfolios to a US investor between 1996 and 2011 and in 3 sub-periods.

The contributions of this chapter are as follows. Firstly, I provide a more detailed investigation into the indirect diversification benefits of US equity products than exists in the literature to date. Many studies examine the international diversification benefits of one type of US equity product, while a few studies compare two (Coe, 2002; Pennathur, Delcoure and Anderson, 2002; Harper, Madura and Schnusenberg, 2006). I am unaware of any previous study that directly compares

the benefits of these 5 US-traded equity products.[21] Secondly, using the results from the previous chapter I use a novel and robust method to compile my MNC sample. Given that correlations of business cycles are found to decrease with distance (Baxter & Kouparitsas, 2005), selecting firms by the location of their sales is more robust than by the level of their foreign sales. Thirdly, in my Mean-Variance Spanning tests for diversification benefits I perform joint and step-down Wald tests, using both Ordinary Least Squares (OLS) and Generalised Method of Moments (GMM) estimation. Fourthly, I divide the fifteen year time period into three sub-periods, two of which encompass financial crises, the 1999/2000 dotcom bubble and the 2007/2008 credit crisis, to test if my findings are robust to variance in the performance and volatility of the US market relative to other markets.

My findings are as follows. For the full period, 1996 to 2011, I find that the benefits of international diversification exist for all three types of portfolio weighting, and that portfolios of ADRs and MNCs yield the greatest diversification benefits, in some cases, exceeding those of direct investment in foreign markets. Investments in Industry Indices, iShares and CCFs offer some benefits to a US investor but fall short of those available via ADRs or MNCs. When broken into sub-periods, international diversification benefits vary between different periods. They are greatest when the S&P500 is the least volatile between 2003 and 2007. The findings for ADRs and MNCs are robust across sub-periods. However, their relative benefits are least pronounced between 2003 and 2007, and most pronounced before 2003 when the benefits of direct international diversification are at their lowest. iShares and CCFs are of relatively more benefit between 2003 and 2007. Industry Indices are of less benefit than the other US-traded products in all sub-periods. I conclude that it is possible to reap the benefits of international diversification via US-traded equity products, but that the benefits vary significantly by equity type.

The remainder of the chapter is structured as follows. Section 6.2 describes the construction of the diversification portfolios. Section 6.3 presents the results of the study, while in Section 6.4 I summarise the chapter and present my conclusions.

[21] Studies by Errunza, Hogan, & Hung (1999) and Antoniou et al.(2010) combine four equity products to replicate the foreign indices of individual countries; this study takes a different approach and compares the diversification benefits of different equity types.

6.2 Portfolio Construction

Given that the analysis is from the perspective of a US investor, I convert the MSCI country indices into US dollars using weekly bilateral exchange rates. All of the MSCI indices are denominated in their local currencies with the exception of Argentina, Brazil, Chile, Colombia, Israel and Mexico which are denominated in US Dollars. I form portfolios of all 37 foreign country indices, and of the 22 developed market indices and 15 emerging market indices, to investigate the diversification benefits of investing directly overseas.

I form portfolios of the five types of US-traded equity products. I use 10 S&P Industry Indices; Consumer Discretionary, Consumer Staples, Energy, Financials, Healthcare, Industrials, Information Technology, Materials, Telecommunications and Utilities. Based on the results in Chapter 5, I select MNCs which consistently have sales in the greatest number of regions, that is, those which have sales in at least four continents in every year between 1996 and 2010. 29 firms have sales in at least four regions (including North America) in every year. Where several ADRs exist for one country, I select the one most correlated with the relevant foreign country index. This allows me to construct portfolios of 10 Industry Indices, 29 MNCs, 26 ADRs, 17 iShares and 19 CCFs. The MNCs are listed in Table 6.1 and the ADRs in Table 6.2. The iShares and CCFs are listed in Table 3.1. The components of the MNC and ADR portfolios are static over the time period, whereas by their nature, the underlying components of foreign country indices, Industry Indices, iShares and CCFs are dynamic.

I create 3 portfolios of foreign country indices (All, Developed and Emerging) and 5 of US-traded equity products (Industry Indices, MNCS, ADRs, iShares and CCFs). Each of these 8 portfolios is constructed with equal weights, optimal weights without short sales and optimal weights with short sales. Optimising weights with short sales measures the maximum diversification benefits possible. However, given restrictions on short sales that are applied at both a company and a country level, I consider portfolios which are optimally weighted with no short sales to be a more realistic scenario, as many pension and investment fund managers are permitted only to take long positions in equities. Short selling restrictions can also be imposed

Table 6.1 List of MNCs

Firms with Sales in at least 4 regions in every year between 1996 and 2010
3M Company
Abbott Laboratories
Air Products.& Chemicals Inco.
Alcoa Incorporated
Autodesk Inco.
Bank of NY.Mellon Corp.
Campbell Soup
Colgate-Palmolive
Corning Inco.
Cytec Industries Inco.
Diamond Offshore Drilling
Dover Corporation
EMC Corporation
Estee Lauder
Expeditor International of Washington
Interpublic Group
Oceaneering International Inco.
Oracle Corporation
Pall Corporation
Praxair Inco.
Rockwell Automation Inco.
Shaw Group Inco.
Stryker Corporation
Tetra Technologies Inco.
The Boeing Company
The Coca Cola Company
The Lubrizol Corporation
Trimble Navigation Ltd.
United Techs.Corporation

Notes: This table lists the MNCs used in this chapter. 29 MNCs have sales in at least 4 regions in every year from 1996 to 2010.

Table 6.2 List of ADRs

Country	*ADR*
Argentina	Telecom Argentina
Australia	BHP Billiton
Brazil	Companhia Energetica de Minas Gerais-CEMIG
Chile	Endesa-Empresa Nacional de Electricidad
China	Sinopec Shanghai Petrochemical
Colombia	Bancolombia - Pref
Denmark	Novo Nordisk
Finland	Nokia
France	TOTAL
Germany	Siemens
Indonesia	Telekomunikasi Indonesia
Ireland	CRH
Israel	Teva Pharmaceutical Industries
Italy	Eni
Japan	Canon
Korea	POSCO
Mexico	Telefonos de Mexico - Series L
Netherlands	ING Groep
New Zealand	Telecom Corporation of New Zealand
Philippines	Philippine Long Distance Telephone
Portugal	Portugal Telecom
South Africa	Sasol
Spain	Banco Bilbao Vizcaya Argentaria
Sweden	Ericsson
Switzerland	Credit Suisse
UK	HSBC

Notes: This table lists the ADRs used in this chapter. Where several ADRs exists, the ADR with the highest correlation with the foreign country index is selected.

by regulators, as in the US, the UK, Australia and Spain in September 2008, in Germany in June 2010 and in August 2011, France, Italy, Spain, Belgium and South Korea banned all short selling in their financial stocks. I also form equally weighted portfolios as optimal weights cannot be known ex-ante. To test the robustness of my results I divide the time period into three sub-periods as described in Chapter 3; March 1996 to December 2002, January 2003 to December 2007 and January 2008 to June 2011.

6.3 Results

6.3.1 Preliminary Statistics

Before comparing the diversification benefits of foreign country indices and of US equity products I examine their correlations and portfolio risk-adjusted return. Panel A of Table 6.3 shows a summary of the correlations of each equity product individually with the foreign country indices. Panel B shows a summary of their correlations with the S&P500. MNCs and Industry Indices are more highly correlated with the S&P500 than with foreign country indices. The average correlation of an MNC is 27 percent with a foreign country index and 53 percent with the S&P500. The average correlation of an industry index with a foreign country index is 35 percent and 75 percent with the S&P500. Given that these portfolios are comprised of US headquartered firms, it is not surprising that they are more correlated with their domestic index. Both ADRs and iShares are more correlated with their foreign country index than with the S&P500; for ADRs the average is 53 percent versus 47 percent and for iShares 72 percent versus 67 percent. For the 11 countries for which both an iShare and an ADR exist, iShares have a higher correlation with the foreign country index. The average correlation of a CCF with its foreign country index is lower than with the S&P500, 45 percent versus 55 percent. Previous studies found that CCFs behave more like the US market than the country they are designed to represent due to the effect of demand and supply on the price of the fund (Bodurtha et al., 1995; Chang et al., 1995). Panel C and D divide countries into developed and emerging markets, and show that all of the products are more correlated with developed markets than with emerging markets. The average correlation of the S&P500 with developed market indices is 51 percent

Table 6.3 Summary of Product Correlations

Panel A: Correlations with foreign country indices						
	ADRs	MNCs	iShares	CCFs	Industries	
Max	70%	61%	85%	76%	62%	
Min	30%	3%	44%	17%	10%	
Average	53%	27%	72%	45%	35%	
Panel B: Correlations with the S&P500						
	ADRs	MNCs	iShares	CCFs	Industries	
Max	66%	68%	79%	74%	91%	
Min	29%	36%	38%	38%	58%	
Average	47%	53%	67%	55%	75%	
Panel C: Correlations with Developed Markets (22)						
	ADRs	MNCs	iShares	CCFs	Industries	S&P500
Max	70%	61%	85%	76%	62%	65%
Min	35%	6%	49%	24%	14%	31%
Average	56%	31%	74%	49%	40%	51%
Panel D: Correlations with Emerging Markets (15)						
	ADRs	MNCs	iShares	CCFs	Industries	S&P500
Max	54%	52%	71%	63%	55%	59%
Min	30%	3%	44%	17%	10%	19%
Average	49%	21%	58%	42%	27%	34%

Notes: Panels A and B of this table show a summary of the products' correlations with the foreign market indices and with the US market. For example, iShares are on average 72% correlated with the country they represent, and 67% with the S&P500. Panels C and D compare all US products' correlations with developed and emerging markets, including the S&P500. For example the S&P500 is on average 51% correlated with developed markets and 34% correlated with emerging markets.

and with emerging markets 34 percent. Developed markets have often been found to have lower correlations with emerging markets than with other developed markets (Driessen and Laeven, 2007). That ADRs, iShares and CCFs are more correlated with developed markets than emerging markets, may be due to the fact that they are affected by the US market, which in turn is more correlated with developed markets than emerging markets.

To evaluate the market-based performance of the portfolios of US-traded equity products and foreign country indices I calculate the annualised mean and standard deviation of the returns. The first three columns of Table 6.4 list the annualised mean and standard deviation for individual MSCI country indices. Ireland has the lowest return of -2.2 percent and Colombia the highest, 19.2 percent. The US has the lowest standard deviation of 18.9 percent and Turkey the highest, 57.3 percent. Of developed market countries, Canada and Denmark have the highest risk-adjusted return of 0.49 while the highest emerging market risk-adjusted return Colombia's of 0.61. The last four columns list the weights of optimised portfolios of country indices with and without short sales, for all countries and for developed and emerging market portfolios individually. When no short sales are allowed, the portfolio of all countries is weighted in three developed markets, Canada, Denmark and Israel, and three emerging markets, Colombia, India and the Philippines. When short sales are allowed, many countries have a negative weighting.

Table 6.5 lists the risk and return for three portfolios of foreign country indices and for five portfolios of US-traded products. Panel A lists the results for equally weighted portfolios, Panel B for optimal weights with no short sales and Panel C for optimal weights with short sales. The equally weighted portfolio of emerging market countries does not outperform the S&P500 (a risk-adjusted return of 0.32 versus 0.33). The higher risk of the portfolio is not adequately compensated for by higher return. The portfolios of all countries and of developed markets have higher risk-adjusted returns and outperform the S&P500, 0.36 and 0.35. For equally weighted portfolios of US-traded products, MNCs have the highest risk-adjusted return, 0.45.[22] Industry Indices, MNCs and ADRs outperform both the S&P500 and foreign country indices, while iShares and CCFs outperform neither. For optimal weights with no short sales, ADRs and

[22] Although the portfolio of MNCs used in this chapter is the same as the portfolio of firms with sales in 4 regions or more in the last chapter, the results are slightly different due to the different time periods. The time period in Chapters 4 and 5 is January 1996 to December 2010, while in Chapters 6 and 7 it is March 1996 to June 2011. The reasons for this are explained in Section 3.3.

Table 6.4 Preliminary Statistics

Developed Markets	*Mean*	*StDev*	*Return/Risk*	*Optimal Weights in All Countries*	*No Short Sales All Countries*	*Optimal Weights in DM countries*	*No Short Sales DM*
Argentina	7.90%	39.20%	0.20	-0.28		-0.13	
Australia	10.20%	23.70%	0.43	0.69		1.00	0.08
Austria	5.40%	28.00%	0.19	-0.08		-0.30	
Belgium	4.70%	24.00%	0.19	-0.17		-0.08	
Canada	11.40%	23.60%	0.49	0.52	0.13	0.74	0.33
Denmark	11.50%	23.50%	0.49	1.00	0.16	1.00	0.40
Finland	10.80%	34.30%	0.31	0.13		0.10	
France	7.70%	23.80%	0.32	0.69		0.14	
Germany	7.40%	25.70%	0.29	-0.85		-0.56	
Hong Kong	6.20%	26.60%	0.23	-0.01		-0.10	
Ireland	-2.20%	28.30%	-0.08	-0.96		-0.94	
Israel	8.10%	23.90%	0.34	0.32	0.12	0.42	0.18
Italy	5.70%	26.30%	0.22	-1.19		-1.01	
Japan	-0.90%	21.30%	-0.04	-0.63		-0.68	
Netherlands	6.40%	24.30%	0.26	0.12		0.03	
New Zealand	4.90%	22.30%	0.22	-0.32		-0.19	
Portugal	6.50%	22.60%	0.29	-0.18		-0.16	
Singapore	4.80%	26.50%	0.18	-0.01		-0.09	
Spain	10.70%	26.30%	0.41	0.89		1.00	0.01
Sweden	10.40%	29.00%	0.36	-0.11		0.05	
Switzerland	8.20%	21.40%	0.38	0.86		1.00	
UK	6.20%	20.50%	0.30	-0.62		-0.24	
US	6.10%	18.90%	0.33				
Emerging Markets						*Optimal Weights in EM countries*	*No short sales EM*
Brazil	15.10%	40.40%	0.37			0.06	
Chile	10.40%	25.40%	0.41	0.40		0.33	
China	4.20%	37.00%	0.11	-0.22		-0.15	
Colombia	19.20%	31.30%	0.61	0.84	0.44	0.68	0.57
India	11.50%	30.00%	0.38		0.10	0.20	0.19
Indonesia	5.80%	48.80%	0.12	-0.05		-0.03	
Malaysia	4.10%	29.00%	0.14	0.12		0.08	
Mexico	14.20%	30.50%	0.47	0.21		0.21	
Philippines	-1.20%	30.90%	-0.04	0.55	0.05	0.53	0.24
Russia	6.80%	70.90%	0.10	-0.47		-0.41	
South Africa	8.20%	29.50%	0.28	-0.19		-0.16	
South Korea	7.90%	41.70%	0.19	0.03		-0.04	
Taiwan	4.30%	28.70%	0.15	0.07		-0.08	
Thailand	-0.20%	41.30%	0.00	-0.05		-0.19	
Turkey	12.10%	57.30%	0.21	-0.04		-0.06	

Notes: The first three columns of this table list the preliminary statistics for each MSCI country index. The final four columns show the optimal portfolio weights in each country with and without short sales, for all countries and for developed and emerging markets separately. For example, when no short sales are allowed, there is a 13% weighting in Canada for the portfolio of all countries.

Table 6.5 Portfolio Summary Preliminary Statistics

		Annualized Mean	*Annualized StDev*	*Return/Risk*
	S&P500	6%	19%	0.33
Panel A: Equally weighted portfolios				
Country Portfolios	All countries	7%	21%	0.36
	DM countries	7%	20%	0.35
	EM countries	8%	25%	0.32
US-traded Product Portfolios	Industry Indices	7%	18%	**0.37
	MNCs	9%	21%	**0.45
	ADRs	9%	23%	**0.37
	iShares	6%	21%	0.30
	CCFs	6%	25%	0.25
Panel B: Optimally weighted portfolios with no short sales				
Country Portfolios	All countries	15%	21%	0.71
	DM countries	11%	20%	0.54
	EM countries	17%	24%	0.68
US-traded Product Portfolios	Industry Indices	9%	16%	*0.55
	MNCs	16%	21%	**0.75
	ADRs	17%	21%	**0.84
	iShares	11%	23%	*0.48
	CCFs	11%	22%	*0.48
Panel C: Optimally weighted portfolios with short sales				
Country Portfolios	All countries	58%	43%	1.33
	DM countries	41%	41%	0.99
	EM countries	26%	30%	0.86
US-traded Product Portfolios	Industry Indices	12%	18%	*0.69
	MNCs	32%	30%	*1.08
	ADRs	27%	24%	*1.11
	iShares	34%	44%	*0.77
	CCFs	51%	54%	*0.94

Notes: This table lists the risk and return of 3 portfolios of foreign country indices; all countries, developed markets and emerging markets, and 5 portfolios of US-traded products; Industry Indices, MNCs, ADRs, iShares, and CCFs. In Panel A, portfolios are equally weighted, in Panel B, optimally weighted with no short sales, and in Panel C optimally weighted with short sales. The S&P500 is included for comparative purposes. One star indicates that the US product portfolios outperform either the S&P500 or the country portfolios, while two stars indicate that they outperform both.

MNCs outperform both the S&P500 and foreign country indices, while Industry Indices, iShares and CCFs outperform the S&P500 but not foreign country indices. For optimal weights with short sales, all of the portfolios of US products outperform the S&P500 with MNCs and ADRs having the highest risk-adjusted return. Portfolios of MNCs and ADRs are the best performing US-traded products for all three portfolio weightings.

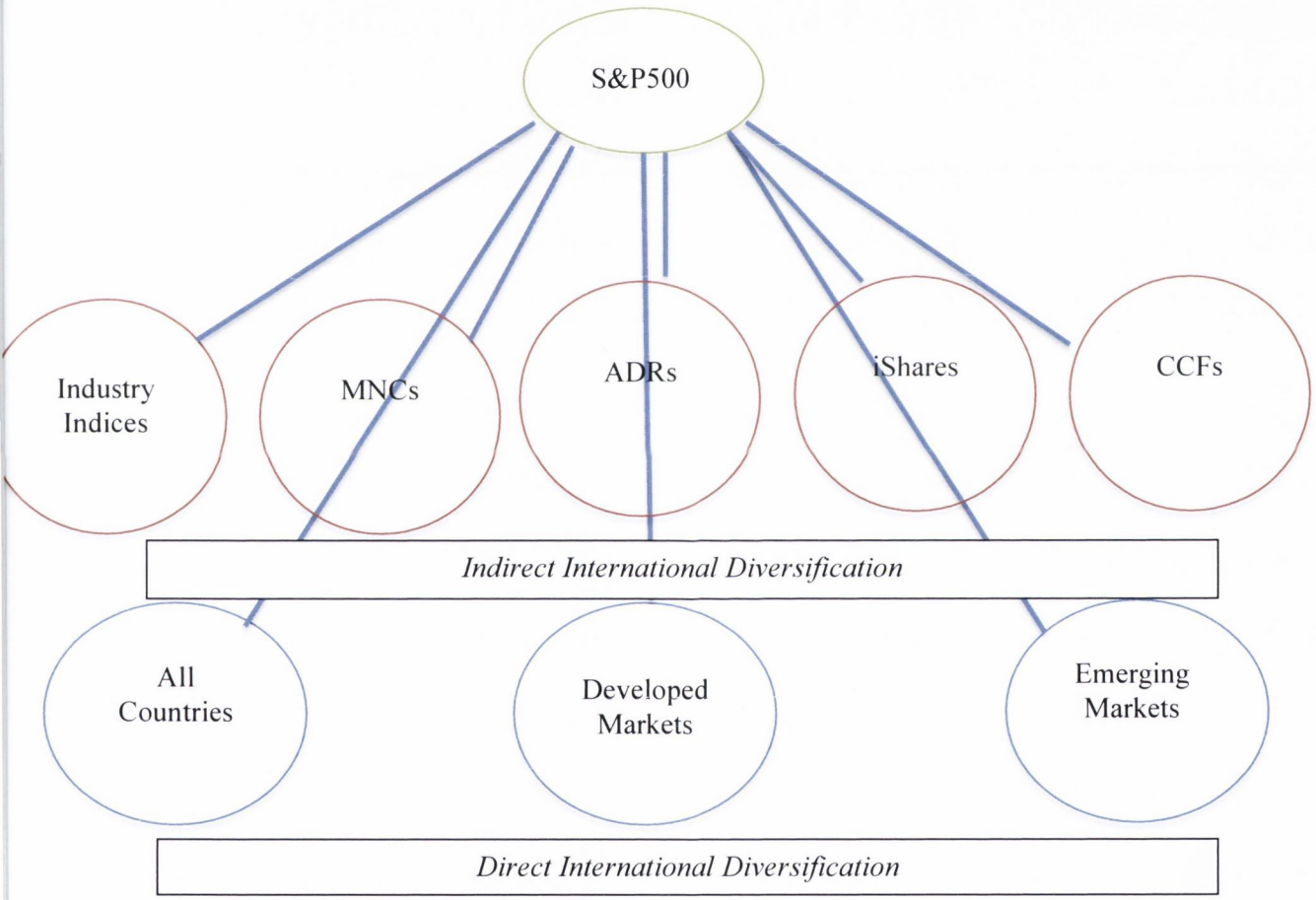
6.3.2 Diversification Benefits

I next test whether the portfolios of equity products provide diversification benefits to US investors. Adding portfolios of foreign country indices to the S&P500 measures the diversification benefits of *direct* investment for a US investor. Adding portfolios of US-traded equity products to the S&P500 measures the *indirect* diversification benefits that can be achieved by investing in US-traded products. This is depicted graphically in Figure 6.1. To test these benefits I use Mean-Variance Spanning to test whether the mean-variance efficient frontier of the S&P500 is shifted by the addition of portfolios of other equity products. I conduct Mean-Variance Spanning tests as detailed in Section 3.6.1, with

$$R_{PF,t} = \alpha + \beta R_{S\&P500,t} + \varepsilon_t \tag{6.1}$$

where $R_{PF,t}$ are the returns of a portfolio of foreign country indices or US-traded products, and $R_{S\&P500,t}$ are the returns of the S&P500. I use the Wald test to test the coefficient restrictions $\alpha=0$ and $\beta=1$. The F-statistics and p-values from the Wald tests are listed in Table 6.6. The p-value represents the probability that the S&P500 spans the extended set of the S&P500 plus the test portfolio. The results are listed firstly for the joint hypothesis of spanning, and subsequently for the step-down tests, where $\alpha=0$ and $\beta=1$ are tested separately, for both OLS and GMM estimation. While the Wald test will inform us as to whether the shift is significant, it does not give an idea of the economic magnitude of the shift. This can be measured as the difference between the Sharpe ratio of the S&P500 and the Sharpe ratio of the test portfolio and the S&P500.

Figure 6.1 Portfolio Construction



Notes: Portfolios of US-traded equity products and foreign country indices are added to the S&P500 to test for diversification benefits.

Table 6.6 MVS Test Results and Sharpe Ratios

	Wald (OLS)						*Wald (GMM)*							
	$\alpha = 0, \beta = 1$		$\alpha = 0$		$\beta = 1$		$\alpha = 0, \beta = 1$		$\alpha = 0$		$\beta = 1$		Sharpe ratio	% increase
	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value		
Benchmark - S&P500													0.17	
Panel A: Equally weighted portfolios														
All countries	53	0	0.59	0.44	106	0	8	0	0.57	0.45	15	0	0.21	24%
DM countries	61	0	0.69	0.48	122	0	8	0	0.56	0.45	16	0	0.20	18%
EM countries	33	0	0.53	0.47	65	0	7	0	0.43	0.52	12	0	0.20	18%
Industry Indices	74	0	1	0.32	147	0	10	0	0.93	0.33	20	0	*0.19	12%
MNCs	1	0.35	2	0.17	0.2	0.65	1	0.33	2	0.19	0.52	0.47	**0.31	76%
ADRs	0.42	0.65	0.5	0.48	0.33	0.57	0.35	0.71	0.49	0.48	0.2	0.73	**0.24	41%
iShares	8	0	0.05	0.83	16	0	2	0.16	0.05	0.82	4	0.06	0.17	
CCFs	0.18	0.84	0	0.98	0.34	0.56	0.03	0.97	0	0.98	0.07	0.79	0.17	
Panel B: Optimally weighted portfolios with no short sales														
All countries	86	0	6	0.01	165	0	14	0	4.63	0.03	25	0	0.56	229%
DM countries	63	0	2.87	0	124	0	8	0	3	0.07	14	0	0.39	129%
EM countries	52	0	6	0	97	0	10	0	4	0	15	0	0.56	229%
Industry Indices	150	0	3.5	0.06	295	0	25	0	4	0.05	49	0	*0.36	112%
MNCs	15	0	10	0	20	0	11	0	11	0	13	0	**0.61	259%
ADRs	67	0	10	0	123	0	27	0	14	0	43	0	**0.70	312%
iShares	1	0.33	2	0.14	0.01	0.92	1	0.26	2	0.12	0.23	0.63	*0.35	106%
CCFs	8	0	2	0.16	13	0	1.7	0.18	2	0.16	2	0.19	*0.34	100%
Panel C: Optimally weighted portfolios with short sales														
All countries	20	0	25	0	15	0	22	0	31	0	13	0	1.28	653%
DM countries	10	0	13	0	6	0.01	10	0	17	0	2	0.14	0.92	441%
EM countries	21	0	10	0	32	0	8	0	10	0	7	0	0.81	376%
Industry Indices	159	0	6	0	311	0	29	0	8	0	51	0	*0.64	276%
MNCs	37	0	16	0	56	0	17	0	19	0	15	0	*0.94	529%
ADRs	100	0	17	0	178	0	49	0	21	0	80	0	*1.03	506%
iShares	8	0	10	0	11	0	9	0	12	0	5	0	*0.71	318%
CCFs	6	0	12	0	0.93	0.33	8	0	14	0	2	0.34	*0.89	424%

Notes: For each portfolio, this table shows the MVS results, which tests if the addition of a portfolio of assets to the S&P500 shifts the mean-variance efficient frontier. The F-statistics and p-values from the Wald tests of the joint hypothesis that $\alpha = 0$ and $\beta = 1$ are listed, and of the step down tests of $\alpha = 0$ and $\beta = 1$ individually for both OLS and GMM estimation. The last two columns list the Sharpe ratio of the extended set and the change in the Sharpe ratio. The difference between the Sharpe ratio of the extended set and of the benchmark measures the economic magnitude of a shift in the mean-variance efficient frontier. In Panel A, equally weighted portfolios are added to the S&P500, in Panel B, optimally weighted with no short sales, and in Panel C optimally weighted with short sales. One star indicates that the US product portfolios have a higher Sharpe ratio than the S&P500 or the country portfolios, while two stars indicate a Sharpe ratio higher than both.

For the portfolios of foreign country indices, I reject the null hypothesis of joint spanning in all cases for OLS and GMM estimation and for all three portfolio weightings. Adding portfolios of foreign country indices to the S&P500 significantly shifts the mean-variance efficient frontier. However, for equally weighted portfolios, I do not reject spanning for the step-down test of $\alpha = 0$ with p-values of between 0.44 and 0.52. The tangency points of the portfolios are not significantly different to that of the S&P500. In addition, the increases in the Sharpe ratios for the equally weighted portfolios of country indices are not larger than 0.057 and so cannot be considered significant. When weights are optimised, spanning is rejected and the Sharpe ratios increases are significant in all cases. Therefore, benefits of direct international diversification exist when weights are optimised but the benefits are not significant when portfolios are equally weighted.

For the portfolios of US-traded products, OLS and GMM joint spanning is not rejected for the equally weighted portfolios, with the exception of Industry Indices, despite there being significant increases in the Sharpe ratios for the equally weighted portfolios of ADRs and MNCs. The Sharpe ratio increase for Industry Indices is not significant. When weights are optimised, joint spanning is rejected at a 10 percent critical level in all cases, with the exception of iShares and CCFs when short sales are restricted. For the other equity types, when short sales are restricted, ADRs and MNCs outperform all other portfolios of US-traded products and of foreign country indices; the Sharpe ratios of the extended set are 0.70 and 0.61 respectively. The next highest Sharpe ratio is 0.56 for the portfolio of all country indices. When short sales are not restricted, ADRs and MNCs outperform all other portfolios apart from that of all country indices. The Sharpe ratio when ADRs are added to the S&P500 is 1.03, MNCs 0.94 and 1.28 for all foreign country indices.

While ADRs may represent a limited portion of a country's stock market, an investment in iShares or CCFs would be expected to deliver a broader representation of a country's economic performance. However, ADRs are often issued by large, mature firms that differ from the typical firms in their respective countries and may outperform their local equity index. Jiang (1998) finds that ADRs often outperform the broad based national index of the country from which they originate. My findings for ADRs concur with findings by Officer & Hoffmeister (1987), Wahab & Khandwala (1993), Peterson & O'Shaughnessy (2000), Fang & Loo (2002) and Kabir et al.

(2011) that ADRs offer excellent diversification benefits. In Chapter 5 I found that selecting MNCs by the location rather than the level of their foreign sales is preferable for the purpose of providing diversification benefits. In an era of increasing correlation between countries (Goetzmann, Li & Rouwenhorst, 2001) selecting firms by the level of their foreign activity only, fails to differentiate between firms operating in countries that highly correlated with their home market and those operating in countries with asynchronous business cycles. My findings for MNCs concur with findings by Mikhail & Shawky (1979) and Berrill & Kearney (2010) that firms selected by the scope of their internationalisation offer diversification benefits. Portfolios of ADRs and MNCs are found to outperform portfolios of foreign country indices in almost all cases. This is a strong result for indirect international diversification as foreign country indices may overstate the benefits of direct international investment. Grubel (1968) asserts that the diversification gains from investing in foreign country indices are theoretical as in reality no one can hold all of the shares in each foreign index due to transaction costs, indivisibilities and limited portfolio sizes. Phengpis & Swanson (2004) point out that using foreign indices to measure diversification may be overstating the benefits as it is not possible to replicate many foreign country indices and even where possible the transaction costs of holding each component of the index can be prohibitive. Barari, Lucey, & Voronkova (2008) also note that using foreign market indices to measure diversification may overestimate the benefits.

Industry Indices offer limited diversification benefits which is consistent with recent findings that the growing importance of industrial diversification relative to country diversification was a temporary phenomenon (Bekaert et al., 2009). Portfolios of iShares and CCFs underperform portfolios of foreign country indices which they claim to replicate, and when equally weighted also underperform the S&P500. However, iShares exist for only 17 and CCFs for only 19 of the 37 countries included. In previous studies Miffre (2007) and Huang & Lin (2011) compare only optimised portfolios of iShares to the S&P500. Phengpis & Swanson (2009) report that while assets in an iShares fund are expected to mirror the underlying market index using 'representive sampling', actual returns may differ if securities which are held by the fund but are not in the underlying index behave differently from what was expected. CCFs have a low risk-adjusted return and relatively low correlation with foreign country indices, which may be due to the effect of demand and supply on their price (Bodurtha et al., 1995; Chang et al., 1995).

6.3.3 Sub period analysis

In order to test the robustness of my results, I repeat my analysis using three sub-periods, March 1996 to December 2002, January 2003 to December 2007 and January 2008 to June 2011. These sub-periods were selected as described in Section 3.7. The risk, return and risk-adjusted return of each portfolio for each sub-period are listed in Table 6.7. The risk-adjusted return of the portfolios of foreign country indices differ substantially in different periods. In the second sub-period, 2003 to 2007, the risk-adjusted returns are substantially higher than in the other two sub-periods. In this period, all foreign country portfolios outperform the S&P500. Between 1996 and 2002, none of the equally weighted portfolios of foreign country indices in Panel A outperform the S&P500, while between 2008 and 2011 only emerging markets outperform the S&P500. For optimised weights, all of the portfolios of foreign country indices outperform the S&P500, apart from emerging markets in the first sub-period when short sales are not permitted.

The risk-adjusted returns of portfolios of US-traded products also vary between the three sub-periods. All portfolios outperform the S&P500 between 2003 and 2007. Although iShares and CCFs underperform the other products for the full period, they outperform the S&P500, Industry Indices and MNCs in some cases between 2003 and 2007. However, CCFs do not outperform the S&P500 before 2003 except when short sales are permitted and iShares when weights are optimised, and are of less benefit than ADRs and MNCs after 2007. When weights are optimised, ADRs and MNCs are the best performing US-traded product before 2003 and after 2007. Industry Indices have the least variation in their Sharpe ratio, being at least as good as the S&P500 in all sub-periods, with all portfolio weightings, but have the lowest risk-adjusted returns in 2003 to 2007. Overall, portfolios of ADRs and MNCs outperform the other equity types.

I conduct Mean-Variance Spanning tests using OLS estimation to test the diversification benefits in the sub-periods. In Table 6.8 I list the F-statistic and the p-value of the Wald tests of joint spanning. I list the Sharpe ratio of the optimal combination of the S&P500 and each equity portfolio. The null hypothesis that the S&P500 spans the test portfolios is rejected in most cases apart for some equally weighted portfolios in the sub-period 2008 to 2011. Mean-Variance spanning tests do not constrain the weights of assets in the tangency portfolio to be positive. The

Table 6.7 Sub-period risk-adjusted returns

	Mar 1996 – Dec 2002			*Jan 2003- Dec 2007*			*Jan 2008 to June 2011*		
	Return	Risk	Return/Risk	Return	Risk	Return/Risk	Return	Risk	Return/Risk
Benchmark : S&P500	6%	19%	0.31	12%	12%	1.03	-2%	25%	-0.09
Panel A: Equally weighted portfolios									
All countries	-3%	19%	-0.14	28%	14%	1.97	-3%	30%	-0.10
DM countries	1%	17%	0.08	24%	13%	1.82	-6%	28%	-0.23
EM countries	-9%	27%	-0.32	34%	17%	1.98	3%	30%	0.10
Industry Indices	5%	17%	**0.32	14%	12%	*1.18	-2%	25%	*-0.07
MNCs	6%	20%	*0.31	19%	14%	*1.33	2%	30%	*0.07
ADRs	2%	22%	*0.10	29%	17%	*1.67	-7%	32%	-0.23
iShares	-1%	19%	-0.04	23%	14%	*1.61	-4%	30%	-0.15
CCFs	-7%	23%	-0.29	30%	20%	*1.52	-3%	34%	*-0.08
Panel B: Optimally weighted portfolios with no short sales									
All countries	11%	22%	0.50	0.32	0.13	2.45	0.19	0.28	0.68
DM countries	9%	19%	0.47	0.26	0.12	2.20	0.01	0.21	0.05
EM countries	4%	14%	0.27	0.36	0.15	2.33	0.19	0.28	0.68
Industry Indices	10%	19%	**0.52	0.58	0.35	*1.64	-0.01	0.32	*-0.03
MNCs	27%	28%	**0.98	0.26	0.15	*1.80	0.26	0.34	**0.77
ADRs	19%	20%	**0.94	0.31	0.13	*2.31	0.19	0.27	**0.69
iShares	7%	20%	*0.32	0.26	0.14	*1.92	0.07	0.21	*0.35
CCFs	1%	7%	0.19	0.33	0.17	*1.94	0.09	0.31	*0.30
Panel B: Optimally weighted portfolios with short sales									
All countries	90%	53%	1.70	0.55	0.17	3.23	1.29	0.40	3.18
DM countries	75%	60%	1.26	0.43	0.16	2.72	1.12	0.58	1.95
EM countries	57%	48%	1.19	0.65	0.25	2.64	0.45	0.28	1.63
Industry Indices	32%	48%	*0.66	0.23	0.11	*2.04	0.28	0.26	*1.10
MNCs	99%	69%	*1.43	0.64	0.27	*2.36	0.83	0.34	*2.43
ADRs	145%	85%	**1.71	1.01	0.42	*2.42	1.63	0.73	*2.24
iShares	53%	49%	*1.08	0.69	0.33	*2.12	0.37	0.26	*1.43
CCFs	60%	47%	*1.28	0.96	0.45	*2.15	0.72	0.50	*1.43

Notes: This table shows the risk-adjusted return of each portfolio in 3 sub- periods; 1996 to 2002, 2003 to 2007 and 2008 to 2011. In Panel A, the portfolios are equally weighted portfolios, in Panel B, optimally weighted with no short sales, and in Panel C optimally weighted with short sales. One star indicates that the US product portfolios have a higher risk-adjusted return than the S&P500 or the country portfolios, while two stars indicate a risk-adjusted return higher than both.

Table 6.8 Diversification Benefits in Sub-Periods

		Mar 1996 – Dec 2002				*Jan 2003- Dec 2007*			*Jan 2008 to June 2011*			
		F-Stat	P-Value	SR	SR No Short Sales	F-Stat	P-Value	SR	F-Stat	P-Value	SR	SR No Short Sales
S&P500				0.08				0.73			- 0.10	
		Panel A: Equally weighted portfolios										
Country Portfolios	All countries	86	0	0.28	0.08	10	0	1.73	0	0.99	-0.07	-0.10
	DM countries	112	0	0.08		12	0	1.54	0.7	0.5	0.06	-0.10
	EM countries	43	0	0.32	0.08	8	0	1.78	0.35	0.7	0.07	
US-traded Product Portfolios	Industry Indices	76	0	0.11		10	0	0.91	2.7	0.07	-0.10	
	MNCs	8	0	0.13		5	0	1.06	20	0	0.05	
	ADRs	9	0	0.21	0.08	16	0	1.44	7	0	0.10	-0.10
	iShares	31	0	0.23	0.08	9	0	1.35	2	0.13	-0.02	-0.10
	CCFs	11	0	0.48	0.08	9	0	1.28	10	0	-0.07	
		Panel B: Optimally weighted portfolios with no short sales										
Country Portfolios	All countries	10	0	0.31		39	0	2.22	48	0	0.66	
	DM countries	6	0	0.31		32	0	1.95	18	0	0.03	
	EM countries	8	0	0.10		16	0	2.14	52	0	0.66	
US-traded Product Portfolios	Industry Indices	23	0	0.30		64	0	1.56	65	0	-0.03	
	MNCs	8	0	0.72		19	0	1.60	69	0	0.76	
	ADRs	14	0	0.83		14	0	2.09	20	0	0.67	
	iShares	5	0	0.11		12	0	1.71	86	0	0.33	
	CCFs	9	0	0.08		12	0	1.77	19	0	0.30	
		Panel C: Optimally weighted portfolios with short sales										
Country Portfolios	All countries	17	0	1.62		28	0	3.05	12	0	3.19	
	DM countries	15	0	1.91		31	0	2.54	67	0	1.94	
	EM countries	22	0	1.06		17	0	2.52	12	0	1.70	
US-traded Product Portfolios	*Industry Indices*	22	0	0.67		78	0	1.94	5	0	1.17	
	MNCs	6	0	1.36		6	0	2.52	6	0	2.53	
	ADRs	26	0	1.82		25	0	2.47	10	0	2.23	
	iShares	22	0	1.02		8	0	2.17	55	0	1.42	
	CCFs	61	0	1.25		8	0	2.26	19	0	1.44	

Notes: This table shows the F-statistics and p-values for OLS MVS tests when the test assets are added to the benchmark, the S&P500 in 3 sub- periods; 1996 to 2002, 2003 to 2007 and 2008 to 2011. In Panel A, equally weighted portfolios are added to the S&P500, in Panel B, optimally weighted with no short sales, and in Panel C optimally weighted with short sales. The p-value measures the probability that the S&P500 spans the test assets. I list the optimised Sharpe ratio of the extended set of the test assets plus the S&P500. For many of the equally weighted portfolios, the optimal Sharpe ratio includes a short position in the test assets. Where this is the case I list the Sharpe ratio of the optimal combination of the S&P500 and the test assets when short sales are restricted.

rejection of spanning for some of the equally weighted portfolios in the first and last sub-period relies on a negative weighting in that portfolio. Results based on these portfolios may suggest diversification benefits that are not available when shorting is not permitted. Where the weight in the test portfolio is negative, I also calculate the optimal weight in the S&P500 and the test portfolio restricting short sales.

For the portfolios of country indices, spanning is rejected in all cases with the exception of equally weighted portfolios in the period 2008 to 2011. Where spanning is rejected, there is a significant increase in the Sharpe ratio in all cases in the second and third sub-period but not in all cases in the first sub-period. There is no increase for equally weighted developed markets in the period 1996 to 2002. There is for emerging markets, but only when a negative weighting is allowed in the emerging market portfolio. There is also no significant increase for emerging markets when weights are optimised but no short sales are allowed. When the Sharpe ratio is calculated allowing no short sales in the test portfolio, there is no significant increase for any equally weighted country portfolio in the first and last sub-period. The first and last sub-periods include periods of financial crisis, the dotcom bubble of 1999/2000 and the credit crisis of 2007/2008. I find international diversification benefits to be lower in these sub-periods. Driessen & Laeven (2007) find that the benefits of international diversification are reducing over time between 1985 and 2002 and Charitou et al. (2006) find no significant international diversification benefits for a US investor investing in 8 developed and 15 emerging markets between 1993 and 2002. I suggest that diversification benefits can vary substantially over short time periods, with reduced benefits during crisis periods. De Santis & Gerard (1997) investigate diversification benefits over the period 1970 to 1994. They find that although contagion occurs in times of financial crises, the long-term gains from international diversification are substantial and not decreasing. Asness et al. (2011) come to a similar conclusion regarding the long-term benefits of international diversification using data from 1950 to 2008. They find that although financial crises can cause spillover effects in the short term, country-specific performance is the dominant factor in the long run.

For the portfolios of US-traded products, in the first sub-period, equally weighted portfolios of Industry Indices and MNCs and optimally weighted portfolios of iShares and CCFs do not have significant Sharpe ratio increases of over 0.057. When Sharpe ratios are calculated with no short

sales in the test portfolio, no equally weighted portfolios in the first sub-period cause a significant increase in the Sharpe ratio. In the middle period 2003 to 2007, spanning is rejected in all cases and the Sharpe ratio increases are significant in all cases. For equally weighted portfolios, adding ADRs to the S&P500 has the highest Sharpe ratio of 1.44, followed by iShares with 1.35 and CCFs with 1.28. In the third sub-period, equally weighted portfolios of Industry Indices and CCFs do not have a significant Sharpe ratio increase, -0.10 and -0.07 versus -0.10 for the S&P500. The increase for ADRs and iShares, of 0.10 and -0.02, relies on a short weight in the test portfolio. Only MNCs cause a significant increase in the Sharpe ratio with and without short selling in the test portfolio, 0.05 versus -0.10 for the S&P500. When weights are optimised, portfolios of ADRs and MNCs have the highest Sharpe ratios in almost every case in each sub-period. Although there is more variation in the results, when the period is sub-divided, overall the results stand that of the US-traded products, ADRs and MNCs offer the greatest diversification benefits. iShares and CCFs offer greater benefits in the period 2003 to 2007, but in the other sub-periods a short weighting is required in several cases to achieve a significant Sharpe ratio increase. In addition, that increase is lower than for ADRs and MNCs apart from a few exceptions. Industry Indices do not offer greater diversification benefits than other US-traded products in any case, and almost never offer greater benefits than those of the foreign country indices.

6.4 Conclusion

In this chapter I compare the international diversification benefits of 5 US-traded equity products, Industry Indices, MNCs, ADRs, iShares and Closed-End Country Funds. I compare their diversification benefits to each other and to direct investment, measured as the benefit to a US investor of investing in 37 foreign country indices. I conduct a more in-depth study of the comparative international diversification benefits of US-traded equity products than exists in the literature to date. I rigorously test my findings by weighting the portfolios in three ways, and by conducting the analysis for a full 15 year period and for 3 sub-periods.

Within the period examined, contrary to previous findings (Goetzmann, Li & Rouwenhorst, 2001), I do not find that most of the benefits of direct international diversification are due to investment in emerging market countries, or that international diversification benefits are

decreasing over time. When I divide the period into sub-periods, international diversification benefits are strongly evident between 2003 and 2007, but are much reduced outside of this period. This concurs with findings by Arshanapalli & Doukas (1993) that diversification benefits are time dependent, and are reduced in times of crisis.

When comparing the indirect international diversification of US-traded products I find that optimally weighted portfolios of ADRs and MNCs capture most and in some cases more of the benefits of direct investment in times of high and low volatility of US market returns. I suggest that the wider availability and idiosyncratic nature of ADRs contribute to these results. The longitudinal study of MNCs in Chapter 4 demonstrates that US MNCs have experienced a dramatic increase in their level of internationalisation in the last two decades. This, coupled with the selection of MNCs by the location rather than level of their foreign sales, I believe explains the results for the MNC portfolio. The diversification benefits of iShares and CCFs vary between sub-periods. In times of high volatility in the US they offer either no benefit or less than other products, whereas in times of low volatility, and when diversification benefits are greatest, they are of greater benefit. Both products are available for fewer countries than ADRs. Industry Indices capture some of the benefits of diversification but lag behind those of ADRs and MNCs and foreign country indices. Investors are not forgoing the benefits of international diversification by investing in US-traded products. Using foreign country indices to measure the benefits of international diversification without taking account of transaction costs may overstate the benefits of direct international diversification. US-traded products offer a more convenient and cost-effective method of achieving the benefits of international diversification. Having compared the diversification benefits of the different types of US equity products, in the next chapter I investigate whether the benefits of international diversification can be exhausted by combining US-traded products to form portfolios which aim to mimic foreign country returns.

Chapter 7 Does home-based investing in the US make sense?

7.1 Introduction

In the previous chapter I compare the diversification benefits of portfolios of five different types of equity products to each other and to investing directly in foreign country indices to ascertain which type of product provides the greatest diversification benefits to a US investor. In this chapter I combine the available equity products for each country to examine whether it is possible to exhaust the benefits of international diversification by investing in domestically-traded products, thereby negating the need to invest overseas. Using stepwise regression I create three types of replicating portfolios for each country, the first of US Industry Indices, the second of Industry Indices, the Russell 1000 and MNCs, and the third of Industry Indices, the Russell 1000, MNCs, ADRs, iShares and CCFs. I test the diversification benefits of these portfolios over a 15 year period from 1996 to 2011 and in three sub-periods.

The contributions of this study are as follows. A study of the indirect international diversification benefits of US-traded equity products between 1976 and 1993 was conducted by Errunza, Hogan, & Hung (1999). I extend and update that study, during a period in which the US saw two booms and busts, the dotcom bubble of 1999/2000 and the credit crisis of 2007/2008. There have been a number of developments which warrant a more recent investigation of this topic. Firstly, since that study, there is a greater availability of US-traded products which offer foreign exposure, for a greater number of countries, allowing an increase of the number of countries included in the study from 16 to 37. Secondly, as was evident in Chapter 4, a very substantial increase has occurred in the internationalisation of US MNCs, as firms increase their foreign operations. The Errunza, Hogan, & Hung (1999) study selects the largest MNCs ranked by total sales in 1976, making the assumption that the firms which have the greatest total sales are also the firms with the greatest level of internationalisation. Using the results from Chapter 5, I select MNCs using a more robust method, selecting those firms which consistently have foreign sales in at least four regions in each of the 15 years from 1996 to 2010. Thirdly, the growing relative importance of industrial versus country diversification since the early 1990s has been highlighted in many studies (Baca et al., 2000; Cavaglia et al., 2000; Serra,

2000), which may alter the relative importance of Industry Indices as diversification tools. Fourthly, iShares were introduced in 1996, and have experienced huge growth since their inception. Given these changes, I investigate whether the results of the Errunza et al., (1999) study have changed substantially.

My findings are as follows. For the full period and for two sub-periods, I find that the benefits of international diversification can be comprehensively exhausted via all of the replicating portfolios. Despite lower covariance with foreign country indices, portfolios of Industry Indices and MNCs provide diversification benefits. However, when all products are included, ADRs, iShares or CCFs have the largest weighting for 31 of the 37 countries. The correlations of foreign country indices with the US market increase over time for all countries. Prior to 2003, the US outperforms almost all foreign country indices. In the period 2003 to 2007, the US underperforms most foreign country indices and in the period after 2007, developed markets underperform and emerging markets outperform the US. When the US underperforms foreign country indices between 2003 and 2007, portfolios which do not include ADRs, iShares and CCFs do not exhaust the benefits of diversifying internationally. Portfolios which include ADRs, iShares and CCFs span the foreign market indices in almost all cases. My results suggest that US-traded products provide an excellent source of foreign equity exposure and that trading overseas is no longer necessary. While the Errunza et al. (1999) study finds that the diversification benefits can be exhausted domestically for 11 of 16 countries I find that they can be exhausted for all 37 countries in my sample.

The remainder of this chapter is structured as follows. In Section 7.2 I describe how I construct the replicating portfolios. In Section 7.3 I present my results and in Section 7.4 I summarise my findings and describe my conclusions.

7.2 Portfolio Construction

I create a pool of assets for each country, which contains the relevant iShare and CCF as listed in Table 3.1, the ADRs, which are listed in Appendix A.1, the 29 MNCs with sales in at least 4 regions in every year, as listed in Table 5.1, 10 US Industry Indices and the Russell 1000. The UK has the largest pool containing 56 assets, while 14 countries have the lowest number of 41

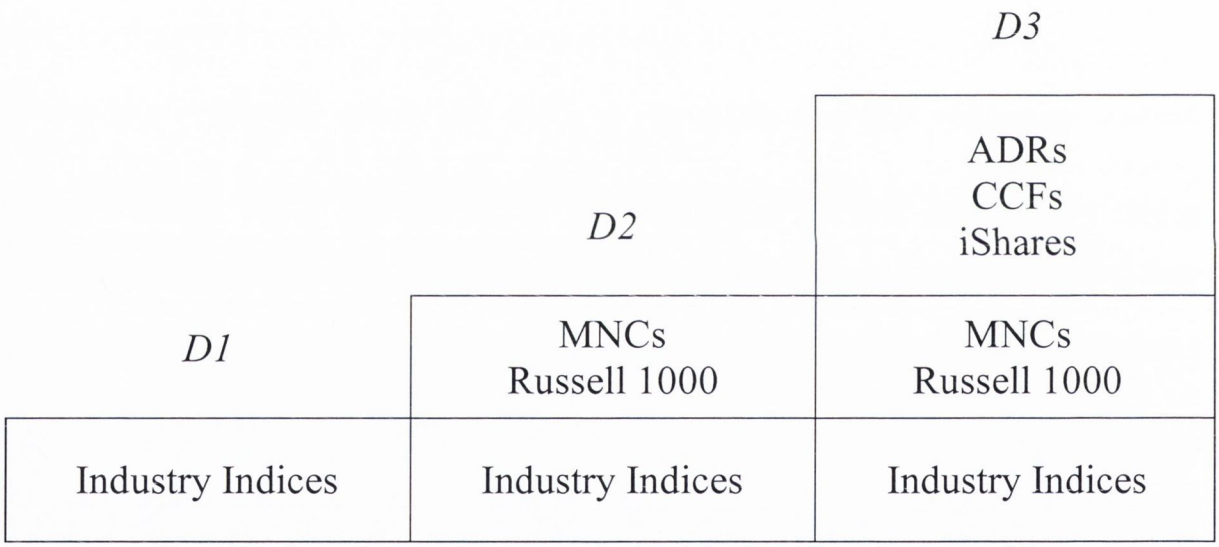
assets. From these assets I create portfolios for each country which aim to replicate its foreign country index.

Using stepwise regression as described in Chapter 3, I create three types of replicating portfolios. Firstly, an industry portfolio (D1) is created to investigate if a foreign country index can be replicated by US Industry Indices. Secondly, a portfolio is created from Industry Indices, the Russell 1000 and MNCs (D2) to investigate if portfolios of US companies only can replicate foreign market indices. Thirdly, a portfolio of all US-traded equity products is formed from Industry Indices, Russell 1000, MNCS, ADRs, iShares and CCFs available for that country (D3) to investigate if US-traded products can replicate the foreign country index. This is illustrated in Figure 7.1. D1 and D2 contain only firms that are headquartered in the US and are counted as domestic equity. An increase in the holding of these products and a decrease in foreign holdings would cause an increase in the recorded home bias. D3 portfolios include ADRs, CCFs and iShares, which are counted as foreign holdings.[23] Although they are domestically-traded products, an increase in their holdings and a decrease in domestic holdings would cause a decrease in home bias. D1 and D2 portfolios attempt to replicate foreign markets using US-traded domestic equity only. D3 portfolios attempt to replicate foreign markets using a combination of US-traded domestic and foreign equity holdings.

I use a forward p-value of 0.05 for the stepwise regression selection procedure. The numbers in the D1 portfolio range from 1 for the Philippines to 6 for Canada, Denmark, France, Germany, the Netherlands, Spain, Sweden and the UK. In the D2 portfolios the number of assets ranges from 2 for the Philippines and Colombia to 11 for Canada and Mexico. For the D3 portfolios the number of assets ranges from 3 for Colombia and the Philippines to 13 for Brazil, Chile, Spain and the UK. Using a threshold of 0.20, Errunza et al. (1999) reduce the number of assets from 45 to between 2 and 16, while Antoniou et al. (2010) reduce the number of assets from approximately 40 to between 4 and 14. Both of these studies used an 'augmented' portfolio

[23] Report on U.S. Portfolio Holdings of Foreign Securities. Department of the Treasury Federal Reserve Bank of New York, Board of Governors of the Federal Reserve System.

Figure 7.1 Replicating Portfolios



Notes: This figure illustrates the components of the D1, D2 and D3 replicating portfolios.

approach, where replicating portfolios are sequentially augmented with MNCs, ADRs and CCFs. The weights of each replicating portfolio are fixed before new assets are added. Rather than fixing the weights, I allowed the regression to choose the optimal combination of assets for each replicating portfolio. However, I initially used both approaches to create the D3 portfolios for a number of countries and found that the correlations, risk-adjusted returns and MVS results were almost identical. To test the robustness of my results I divide the time period into three sub-periods as described in Chapter 3; March 1996 to December 2002, January 2003 to December 2007 and January 2008 to June 2011. For replicating portfolios which do not span the relevant foreign country index I repeat the stepwise regressions using a p-value threshold of 0.20 and using OLS regression including all assets.

7.3 Results

7.3.1 Portfolio Composition

In Table 7.1 I list the average compositions of the replicating portfolios for developed and emerging markets. The largest weighting of the D1 portfolios for both developed and emerging markets is in Materials, 34 and 64 percent. Energy has the second highest weighting for developed markets, 18 percent, and Information Technology has the second highest weighting for emerging markets, 24 percent. The largest average weighting in the D2 portfolios is in Industries, 47 percent for developed and 49 percent for emerging markets. The weightings in the Russell 1000 and MNCs are similar at between 24 to 29 percent. In the D3 portfolios, ADRs, iShares and CCFs account for approximately 75 percent of the portfolios of both emerging and developed markets. iShares have a larger weighting for developed markets, likely due to their greater availability for developed markets. Emerging markets are most heavily weighted in ADRs and CCFs. The Russell 1000 has a negligible average weighting, while MNCs and Industries form a modest proportion of the portfolios on average, of between 9 and 15 percent.

Table 7.2 shows the composition of the D1 portfolio for each country individually. Only one country, Ireland, has a weighting in the Consumer Discretionary index. Industrials, Healthcare and Consumer Staples have a weighting for only four countries, of which some are negative weightings. Energy, Financials, I.T., Materials, Telecommunications and Utilities all have

Table 7.1 Average Compositions of Replicating Portfolios

	Developed Markets	*Emerging Markets*
	D1	
Industry Index		
Consumer Discretionary	-5%	0%
Consumer Staples	1%	0%
Energy	18%	8%
Financials	16%	2%
Healthcare	0%	4%
I.T.	15%	24%
Industrials	0%	-10%
Materials	34%	64%
Telcommunications	9%	4%
Utilities	13%	4%
	D2	
Industries	47%	49%
Russell 1000	24%	25%
MNCs	29%	26%
	D3	
Industries	15%	9%
Russell 1000	-5%	3%
MNCs	12%	14%
ADRs	22%	29%
CCFs	7%	38%
iShares	49%	7%

Notes: This table shows the average weighting in each asset type in the replicating portfolios, D1, D2 and D3 for developed and emerging markets. For example iShares have an average weighting of 49% in developed market D3 portfolios and 7% in emerging market D3 portfolios

Table 7.2 D1 Portfolio Composition by Country

Countries	*Consumer Discretionary*	*Consumer staples*	*Energy*	*Financials*	*Healthcare*	*I.T.*	*Industrials*	*Materials*	*Telecommunications*	*Utilities*
Developed Markets										
Argentina			46%		-22%			42%	34%	
Australia			28%	10%		11%		41%	10%	
Austria		-30%	50%	36%				43%		
Belgium				32%				51%		17%
Canada		-18%	34%	19%		20%		29%		16%
Denmark		-28%	24%	20%				46%	20%	17%
Finland						42%		44%	13%	
France			18%	14%		16%		26%	9%	16%
Germany			11%	11%		18%		31%	11%	18%
Hong Kong			19%			16%		43%	23%	
Ireland	28%		14%	14%				18%		25%
Israel						61%				39%
Italy			20%	20%		16%		26%		18%
Japan			26%			36%		38%		
Netherlands			18%	15%		11%		28%	9%	18%
New Zealand			21%	39%		21%	-38%	57%		
Portugal			12%	11%			28%	25%	23%	
Singapore								100%		
Spain			19%	25%		13%			23%	20%
Sweden		-44%		24%		35%		59%		26%
Switzerland				26%	30%	11%				33%
UK			28%	26%		10%			14%	23%
Emerging Markets										
Brazil			14%					43%	29%	14%
Chile				14%				37%	16%	33%
China			32%			29%		39%		
Colombia								55%		45%
India					21%	28%		51%		
Indonesia								100%		
Korea						47%		81%		-28%
Malaysia						30%		70%		
Mexico			18%	23%		10%		32%	17%	
Philippines								100%		
Russia			42%		33%	25%				
South Africa			19%			16%		64%		
Taiwan						69%	-39%	71%		
Thailand						66%	-112%	146%		
Turkey						34%		66%		

Notes: This table shows the composition of the D1 Portfolio for each country. For example, the D1 portfolio for Turkey is comprised of 34% in I.T. and 66% in Materials.

weightings for at least 14 countries and all but one are positive weightings. The Materials index has a weighting in the largest number of countries, 32, followed by I.T. with a weighting in 25 countries. These results concur with the findings in Chapter 4, that Basic Materials and Technology were the most internationalised industries, including companies such as US Steel, and Alcoa, an aluminium producing company; Unisys and Verisign, an internet services company. However, the least international industries were found in that case to be Telecommunications, Utilities and Financials, including companies such as US Cellular, Excel Energy and Washington Mutual, but they have weightings for between 14 and 16 countries. Table 7.3 shows the D2 portfolio for each country individually. Canada, Mexico and Chile have the highest weightings in the Russell 1000, 86, 95 and 101 percent respectively. These countries are geographically close the US, and have high correlations with the Russell 1000, as seen in Table 7.5. Italy and China have no weighting in Industry Indices, while Japan and Taiwan have the highest weighting of 139 percent. The weightings in MNCs vary widely; the highest weighting is 131 percent for Thailand, while Taiwan has no weighting in MNCs.

Table 7.4 shows the D3 portfolio for each country individually. For all except 6 countries the largest weighting is in ADRs, iShares or CCFs. iShares have the largest weighting for the 17 countries for which they exist. 6 countries have the largest weighting in CCFs, 8 countries have the largest weighting in ADRs. Of the 6 countries that do not have the largest weighting in iShares, CCFs or ADRs; Finland, Portugal and Colombia have the largest weighting in industries, of between 55 and 105 percent, but each have just one ADR, with at least a 45 percent weighting. Brazil has its largest weighting in industries, 65 percent, but also has a 56 percent weighting in ADRs. China has the largest weighting in MNCs, 42 percent, but 58 percent in ADRs and CCFs combined. Hong Kong has its largest weighting in MNCs, 38 percent, a 32 percent weighting in the Russell 1000 and a 30 percent weighting in CCFs. The results in Table 6.3 show that iShares have the highest average correlation with foreign country indices, followed by ADRs and CCFs. More of the emerging market portfolios are weighted in CCF and ADRs and more of the developed market portfolios are weighted in iShares, due to a lower availability of iShares for the emerging market countries in the sample.

Table 7.3 D2 Portfolio Composition by Country

Countries	*Industry Indices*	*Russell 1000*	*MNCs*
Developed Markets			
Argentina	71%		29%
Australia	27%	51%	22%
Austria	118%		-18%
Belgium	57%		43%
Canada	3%	86%	11%
Denmark	17%	58%	25%
Finland	79%		21%
France	13%	59%	29%
Germany	13%	50%	38%
Hong Kong	55%		45%
Ireland	39%		61%
Israel	86%		14%
Italy		67%	33%
Japan	139%		-39%
Netherlands	16%	50%	34%
New Zealand	69%		31%
Portugal	22%	50%	29%
Singapore	55%		45%
Spain	14%	48%	38%
Sweden	45%		55%
Switzerland	72%		28%
UK	33%		67%
Emerging Markets			
Brazil	96%		4%
Chile	-25%	101%	24%
China		83%	17%
Colombia	85%		15%
India	9%	79%	12%
Indonesia	71%		29%
Korea	59%		41%
Malaysia	107%		-7%
Mexico	3%	95%	2%
Philippines	57%		43%
Russia	61%		39%
South Africa	60%	51%	-11%
Taiwan	139%	-39%	
Thailand	-31%		131%
Turkey	42%		58%

Notes: This table shows the composition of the D2 Portfolio for each country. For example, the D2 portfolio for Argentina is comprised of 71% Industry Indices and 29% MNCs.

Table 7.4 D3 Portfolio Composition by Country

Countries	*Industries*	*Russell 1000*	*MNCs*	*ADRs*	*CCFs*	*iShares*
Developed Markets						
Argentina	35%		9%	56%		
Australia			-9%	12%	22%	75%
Austria	-44%	33%	11%			99%
Belgium	-15%		19%			96%
Canada	11%		20%			70%
Denmark	23%	27%	8%	42%		
Finland	105%	-102%	33%	64%		
France	13%		9%	-8%		85%
Germany	13%		10%			76%
Hong Kong		32%	38%		30%	
Ireland	1%		14%	60%	26%	
Israel	23%		13%	28%	35%	
Italy	7%		17%			76%
Japan	38%	-61%	16%	17%		90%
Netherlands	15%		-6%	11%		81%
New Zealand	19%		5%	76%		
Portugal	56%		-1%	45%		
Singapore			15%		31%	53%
Spain	38%	-47%	24%	36%		49%
Sweden	15%		9%			76%
Switzerland	12%		-4%	5%		87%
UK	-5%		18%	30%		56%
Emerging Markets						
Brazil	65%		-20%	56%		
Chile	13%		0%	56%	31%	
China			42%	20%	38%	
Colombia	55%			45%		
India	26%		11%		62%	
Indonesia	-26%		24%	82%	20%	
Korea	25%		2%	73%		
Malaysia	-16%		30%		31%	54%
Mexico	13%		17%		17%	53%
Philippines			31%	69%		
Russia	40%		8%		52%	
South Africa	35%	48%	-21%	38%		
Taiwan	19%		-10%		91%	
Thailand	-113%		77%		136%	
Turkey			21%		79%	

Notes: This table shows the composition of the D3 Portfolio for each country. For example, the D3 portfolio for Argentina is comprised of 35% Industry Indices, 9% MNCs and 56% ADRs.

7.3.2 Preliminary Statistics

Table 7.5 lists the correlations of the foreign country indices with the US market and with the replicating portfolios. I firstly list the correlations of the foreign country indices with an equally weighted portfolio of purely domestic US firms and then with the Russell 1000. Firms with no foreign activity should in theory have the lowest correlation with foreign market indices, and would not be expected to provide benefits of international diversification. The Russell 1000 is intended to be a broad representation of all US firms. The average correlation of emerging markets countries with the US market is lower than for developed markets, 34 percent versus 51 percent. The lowest correlations with emerging market countries are with Thailand, Malaysia and Indonesia at between 16 and 23 percent. The lowest correlation with a developed market is with Japan at 27 percent. The highest correlation with an emerging market country is 61 percent with Mexico and with developed markets with Canada, the UK, France and Germany between 61 and 65 percent. The countries closest to the US; Mexico and Canada are amongst those countries with the highest correlation while those with the lowest correlation are geographically distant. This concurs with previous findings that business cycles correlations decrease with distance (Baxter & Kouparitsas, 2005).

Subsequent columns list the correlations of the replicating portfolios with the foreign country indices. Starting with D1, the changes from the correlations with the domestic portfolio are modest, increasing by approximately 5 percent for most countries. The lowest correlations are with Indonesia, Malaysia, Philippines and Thailand at between 24 and 27 percent. The average increase from the correlations with the domestic portfolio to the correlations with D2 is 9 percent and the lowest correlation is 31 percent with Indonesia. For the D3 portfolios, there is a substantial increase in the correlations. The average increase in correlation is 23 percent, substantially higher than for the other two portfolio types. The lowest correlation is 43 percent with China, while the highest is 88 percent with Australia. The addition of ADRs, iShares and CCFs has a large impact on the correlation of the replicating portfolio with the relevant foreign country index.

I next analyse the performance of each foreign country index and its replicating portfolios. The risk and return for each foreign country index and its 3 replicating portfolios are listed in Table 7.6. Emerging markets have a higher average return than developed markets, 8.2 percent versus

Table 7.5 Correlations with Foreign Country Indices

Country Indices	*Domestic Firms*	*Russell 1000*	*D1*	*D2*	*D3*
Developed Markets					
Argentina	37%	37%	44%	47%	63%
Australia	59%	59%	66%	70%	88%
Austria	55%	48%	58%	63%	84%
Belgium	58%	53%	57%	61%	78%
Canada	64%	66%	72%	75%	80%
Denmark	55%	53%	59%	62%	71%
Finland	45%	50%	54%	57%	74%
France	63%	66%	69%	71%	81%
Germany	61%	65%	69%	70%	81%
Hong Kong	36%	38%	41%	45%	47%
Ireland	54%	49%	53%	57%	77%
Israel	29%	40%	47%	48%	57%
Italy	56%	58%	61%	63%	75%
Japan	27%	31%	36%	41%	71%
Netherlands	60%	61%	65%	68%	82%
New Zealand	44%	42%	48%	52%	68%
Portugal	43%	43%	47%	50%	62%
Singapore	39%	39%	43%	45%	60%
Spain	55%	55%	59%	60%	79%
Sweden	58%	63%	67%	69%	80%
Switzerland	55%	54%	58%	60%	77%
UK	65%	64%	69%	72%	84%
Average	51%	51%	56%	59%	74%
Emerging Markets					
Brazil	49%	51%	57%	60%	74%
Chile	43%	45%	49%	53%	72%
China	28%	30%	32%	37%	43%
Colombia	32%	27%	32%	33%	48%
India	33%	37%	40%	44%	59%
Indonesia	23%	23%	25%	31%	58%
Korea	33%	35%	43%	48%	61%
Malaysia	18%	22%	24%	34%	53%
Mexico	61%	60%	63%	68%	76%
Philippines	25%	24%	27%	32%	48%
Russia	29%	29%	31%	37%	45%
South Africa	50%	50%	57%	60%	67%
Taiwan	30%	34%	40%	44%	60%
Thailand	16%	19%	27%	34%	44%
Turkey	33%	31%	33%	40%	57%
Average	34%	34%	39%	44%	58%

Notes: This table shows the pairwise correlation of each foreign country index with a portfolio of domestic US firms, with the Russell 1000, with D1 comprised of Industry Indices, with D2 comprised of the Russell 1000, MNCs and Industry Indices, and D3 comprised of the Russell 1000, MNCs, Industry Indices, ADRs, iShares and CCFs.

Table 7.6 Risk-adjusted Return

	Country indices			*D1*			*D2*			*D3*		
Developed Markets	*Return*	*Risk*	*Return /Risk*	*Return*	*Risk*	*Return /Risk*	*Return*	*Risk*	*Return /Risk*	*Return*	*Risk*	*Return/ Risk*
Argentina	7.9%	39.2%	0.20	7.9%	17.2%	0.46	7.9%	18.5%	0.43	7.9%	24.5%	0.32
Australia	10.2%	23.7%	0.43	10.2%	15.6%	0.65	10.2%	16.6%	0.61	10.2%	20.9%	0.49
Austria	5.4%	28.0%	0.19	5.2%	16.1%	0.32	5.2%	17.7%	0.29	5.2%	23.4%	0.22
Belgium	4.7%	24.0%	0.20	3.3%	13.7%	0.24	3.5%	14.6%	0.24	3.2%	18.7%	0.17
Canada	11.4%	23.6%	0.48	5.7%	16.9%	0.34	3.9%	17.8%	0.22	7.1%	18.7%	0.38
Denmark	11.5%	23.5%	0.49	3.6%	14.0%	0.26	4.0%	14.4%	0.28	7.5%	16.6%	0.45
Finland	10.8%	34.3%	0.31	5.1%	18.5%	0.27	5.2%	19.5%	0.27	5.7%	25.2%	0.23
France	7.7%	23.8%	0.32	5.2%	16.6%	0.31	4.7%	16.7%	0.28	4.9%	19.2%	0.25
Germany	7.4%	25.7%	0.29	5.7%	17.7%	0.32	5.2%	18.1%	0.29	4.8%	20.8%	0.23
Hong Kong	6.2%	26.6%	0.23	3.6%	10.8%	0.33	3.8%	12.1%	0.32	3.8%	12.6%	0.30
Ireland	-2.2%	28.3%	-0.08	5.2%	15.1%	0.34	3.2%	16.2%	0.20	3.5%	21.6%	0.16
Israel	8.1%	23.9%	0.34	3.4%	11.2%	0.31	3.3%	11.5%	0.29	5.9%	13.7%	0.43
Italy	5.7%	26.3%	0.22	5.2%	16.0%	0.32	4.6%	16.6%	0.28	3.7%	19.5%	0.19
Japan	-0.9%	21.3%	-0.04	2.8%	7.9%	0.35	0.2%	8.6%	0.02	-2.3%	15.1%	-0.15
Netherlands	6.4%	24.3%	0.26	5.2%	15.9%	0.33	4.4%	16.4%	0.27	3.0%	19.8%	0.15
New Zealand	4.9%	22.3%	0.22	2.7%	10.6%	0.26	1.2%	11.5%	0.10	1.8%	15.1%	0.12
Portugal	6.5%	22.6%	0.29	3.0%	10.6%	0.28	2.3%	11.3%	0.20	3.9%	13.9%	0.28
Singapore	4.8%	26.5%	0.18	3.2%	11.3%	0.28	3.3%	12.0%	0.28	1.9%	15.9%	0.12
Spain	10.7%	26.3%	0.41	4.8%	15.9%	0.30	4.1%	15.9%	0.26	7.1%	20.7%	0.34
Sweden	10.4%	29.0%	0.36	3.9%	19.5%	0.20	4.9%	20.0%	0.25	7.1%	23.4%	0.31
Switzerland	8.2%	21.4%	0.38	3.9%	12.3%	0.32	2.7%	12.8%	0.21	4.1%	16.4%	0.25
UK	6.2%	20.5%	0.30	4.7%	14.2%	0.33	3.1%	14.4%	0.22	4.4%	17.1%	0.26
Average	6.9%	25.7%	0.27	4.7%	14.4%	0.32	4.1%	15.1%	0.26	4.7%	18.8%	0.25
Emerging Markets												
Brazil	15.1%	40.4%	0.37	10.4%	30.3%	0.34	6.4%	30.3%	0.21	11.4%	30.3%	0.38
Chile	10.4%	25.4%	0.41	3.5%	12.3%	0.28	2.9%	13.6%	0.22	7.4%	18.2%	0.40
China	4.2%	37.0%	0.11	4.5%	12.0%	0.37	2.5%	13.6%	0.18	4.8%	15.9%	0.31
Colombia	19.2%	31.3%	0.61	3.1%	10.0%	0.31	2.6%	10.4%	0.25	5.2%	15.0%	0.35
India	11.5%	30.0%	0.38	0.4%	12.0%	0.03	0.4%	13.2%	0.03	0.6%	17.7%	0.03
Indonesia	5.8%	48.8%	0.12	3.0%	12.3%	0.24	5.0%	15.0%	0.33	3.8%	28.5%	0.13
Korea	4.1%	29.0%	0.14	4.2%	17.8%	0.23	3.5%	19.9%	0.18	4.1%	25.6%	0.16
Malaysia	14.2%	30.5%	0.47	1.9%	7.0%	0.27	2.6%	9.7%	0.27	0.8%	15.4%	0.05
Mexico	-1.2%	30.9%	-0.04	5.2%	19.2%	0.27	6.4%	20.7%	0.31	8.5%	23.1%	0.37
Philippines	6.8%	70.9%	0.10	2.0%	8.4%	0.24	3.0%	9.7%	0.31	2.9%	14.4%	0.20
Russia	8.2%	29.5%	0.28	9.4%	22.4%	0.42	9.2%	26.0%	0.35	5.1%	31.6%	0.16
South Africa	7.9%	41.7%	0.19	5.5%	16.8%	0.32	3.6%	17.7%	0.21	4.6%	19.7%	0.24
Taiwan	4.3%	28.7%	0.15	2.9%	11.5%	0.25	1.7%	12.8%	0.14	1.3%	17.2%	0.08
Thailand	-0.2%	41.3%	0.00	2.1%	11.1%	0.19	0.8%	13.9%	0.06	-2.4%	18.0%	-0.13
Turkey	12.1%	57.3%	0.21	5.2%	19.0%	0.27	5.0%	22.9%	0.22	6.4%	32.7%	0.20
Average	8.2%	38.2%	0.23	4.2%	14.8%	0.27	3.7%	16.6%	0.22	4.3%	21.6%	0.20

Notes: This table shows the annualised return and annualised standard deviation of the MSCI index of each country and of each of the replicating portfolios, D1, D2 and D3.

6.9 percent. Emerging markets also have higher volatility on average, 38.2 percent, while the average for developed markets is 25.7 percent. However, the average return per unit of risk is lower for emerging markets than developed markets, 0.23 versus 0.27. The risk of the replicating portfolios is lower than the risk of the foreign country indices in almost every instance, apart from the D3 portfolio for Russia. For every country the risk of the D3 portfolio is greater than that of the D2 portfolio, and D2 greater than D1. The returns of the replicating portfolios are mostly lower than those of the foreign country indices, for 30 D1, 32 D2 and 33 D3 portfolios. The return per unit of risk for the replicating portfolios is lower than the foreign country index for 14 D1, 19 D2 and 25 D3 portfolios. Stepwise regression selects assets to maximise the correlation of the portfolio with the country index, but as the correlations increase improved performance does not necessarily follow.

7.3.3 Diversification Benefits

I next investigate the benefit of adding the foreign country indices to the replicating portfolios. I investigate whether the benefits of international diversification can be exhausted using domestically-traded products by adding the foreign country index to the replicating portfolio and testing whether the foreign country index is spanned by the replicating portfolio. That is, does the addition of the foreign country index shift the mean-variance efficient frontier of the replicating portfolio and are there addition diversification benefits to be gained by investing in the foreign country index beyond those available via investment in US-traded equity products? The null hypothesis can be stated as follows, the MSCI index for each country is spanned by the replicating portfolios of US-traded equity products for that country. I test this using Mean-Variance Spanning tests as described in Chapter 3. The F-statistics and p-values from the Wald test of the joint coefficient restrictions are presented in Table 7.7.

The p-values represent the probability of not rejecting the null hypothesis that the benchmark asset, the replicating portfolio, spans the test asset, the foreign country index. If the benchmark asset spans the test asset, the addition of the foreign country index does not shift the mean-variance efficient frontier of the replicating portfolio and does not yield additional diversification

Table 7.7 MVS Test Results

	D1		*D2*		*D3*	
Developed Markets	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value
Argentina	0.03	0.97	0.06	0.94	0.11	0.89
Australia	0.43	0.57	1.95	0.15	1.54	0.23
Austria	0.01	0.99	0.08	0.92	0.11	0.89
Belgium	0.04	0.96	0.03	0.97	0.07	0.93
Canada	0.53	0.38	2.05	0.17	0.75	0.49
Denmark	1.52	0.26	1.50	0.28	0.43	0.63
Finland	0.28	0.74	0.28	0.74	0.39	0.67
France	0.12	0.88	0.25	0.79	0.29	0.73
Germany	0.02	0.98	0.11	0.89	0.22	0.8
Hong Kong	0.09	0.91	0.08	0.92	0.08	0.92
Ireland	0.76	0.48	0.40	0.66	0.77	0.47
Israel	0.37	0.69	0.39	0.67	0.09	0.91
Italy	0.01	0.99	0.02	0.98	0.09	0.91
Japan	0.25	0.77	0.02	0.98	0.07	0.93
Netherlands	0.02	0.98	0.08	0.92	0.41	0.65
New Zealand	0.08	0.91	0.27	0.75	0.26	0.76
Portugal	0.23	0.79	0.35	0.70	0.17	0.85
Singapore	0.03	0.97	0.03	0.97	0.16	0.86
Spain	0.45	0.55	0.77	0.47	0.37	0.69
Sweden	0.75	0.49	0.41	0.59	0.27	0.75
Switzerland	0.43	0.63	0.78	0.46	0.49	0.51
UK	0.08	0.92	0.35	0.71	0.19	0.83
Emerging Markets						
Brazil	0.40	0.66	0.43	0.57	0.10	0.9
Chile	0.77	0.47	0.51	0.39	0.22	0.8
China	0.01	0.99	0.02	0.98	0.01	0.99
Colombia	2.48	0.09	2.50	0.08	1.97	0.14
India	0.44	0.56	0.47	0.53	0.38	0.68
Indonesia	0.03	0.97	0.01	0.99	0.02	0.98
Korea	0.07	0.93	0.11	0.89	0.10	0.9
Malaysia	0.04	0.96	0.02	0.98	0.15	0.87
Mexico	0.53	0.36	0.51	0.39	0.47	0.53
Philippines	0.09	0.91	0.14	0.86	0.18	0.84
Russia	0.01	0.99	0.01	0.99	0.01	0.99
South Africa	0.09	0.91	0.26	0.76	0.21	0.81
Taiwan	0.02	0.98	0.07	0.93	0.12	0.88
Thailand	0.02	0.98	0.01	0.99	0.03	0.97
Turkey	0.11	0.89	0.13	0.87	0.10	0.9

Notes: For each portfolio, this table shows the F-statistic and p-values from the Wald tests of Mean-Variance Spanning, which tests if the addition of the foreign country index to the replicating portfolio shifts the mean-variance efficient frontier. If spanning is not rejected, the addition of the foreign country index does not shift the mean-variance efficient frontier and there is no significant diversification benefit to be gained by investing overseas.

benefits. Using OLS estimation I find that the p-values for all of the replicating portfolios are above 0.23 for 36 countries, leading me to not reject spanning for 36 of the 37 countries. The replicating portfolios span 36 foreign country indices. The exception is Colombia which has p-values of 0.09 and 0.08 for its D1 and D2 portfolios, for which I reject the null hypothesis of spanning at the 10 percent critical level. It does however have a p-value of 0.14 for its D3 portfolio. These results are considerably stronger than those of Errunza et al. (1999). For 16 countries between 1976 and 1993, the replicating portfolios span 5 emerging market and 6 developed market indices.

As a further test which incorporates measures of skew and excess kurtosis in portfolio returns, I calculate the modified Value-at-Risk of the foreign country indices and the replicating portfolios. Standard measures of Value-at-Risk (VAR) calculate the maximum expected loss of a portfolio for a given confidence level for a specified period of time. Modified VAR (mVAR) incorporates skew and kurtosis into the calculation of the maximum expected loss for a $100 portfolio over a period of one week. The results are presented in Table 7.8. I calculate the mVAR for each portfolio for 95 and 99 percent confidence level, or -1.96 and -2.33 standard deviations. In every case the maximum expected loss of the replicating portfolio is lower than the maximum expected loss of the corresponding country index. The maximum loss decreases from D1 to D2 to D3. This further strengthens the results for the replicating portfolios.

7.3.4 Sub period analysis

To test the robustness of my results over time, I divide my data period into sub-periods, March 1996 to December 2002, January 2003 to December 2007 and January 2008 to June 2011, selected as described in Section 3.7. In Table 7.9 I list the correlations of the foreign country indices with domestic firms and with the three replicating portfolios for the three sub-periods. As for the full period, the average correlations of developed markets with the US market are higher than the average emerging market correlations. What is striking is the increase in correlations from the first to the last sub-period; the correlations increase steadily for all

Table 7.8 MVaR Results

	Country Indices		*D1*		*D2*		*D3*	
	1.96 σ	2.33 σ	1.96 σ	2.33 σ	1.96 σ	2.33 σ	1.96 σ	2.33 σ
Developed Markets								
Argentina	17.27	31.16	6.66	11.20	7.60	13.24	10.19	17.64
Australia	12.20	23.80	6.04	10.19	7.53	13.68	9.47	16.81
Austria	14.24	27.11	6.21	10.63	8.16	15.12	10.87	19.43
Belgium	10.29	17.62	5.23	8.95	6.34	11.54	8.28	14.42
Canada	9.86	17.71	6.65	11.23	7.94	14.33	8.31	15.18
Denmark	10.29	18.49	5.47	9.35	6.54	11.86	7.31	13.51
Finland	11.73	19.68	6.48	10.06	6.81	10.51	8.71	13.53
France	9.68	16.92	6.59	11.33	7.58	13.81	8.62	15.91
Germany	10.20	17.69	6.94	11.73	7.71	13.66	8.82	15.76
Hong Kong	12.69	26.59	4.11	6.80	4.68	7.77	5.47	9.12
Ireland	14.65	27.88	6.28	11.14	7.67	14.31	10.28	19.40
Israel	7.83	13.65	3.99	6.24	4.00	6.20	4.71	7.34
Italy	10.67	19.42	6.42	11.06	7.69	14.19	9.17	16.86
Japan	7.13	11.41	2.85	4.58	3.21	5.21	5.36	8.78
Netherlands	11.30	21.02	6.46	11.21	7.53	13.83	9.16	16.77
New Zealand	9.20	15.64	4.12	7.12	5.40	10.10	7.01	13.41
Portugal	8.96	15.45	4.19	7.35	5.28	9.94	6.47	12.22
Singapore	10.51	19.32	4.02	6.42	4.30	6.95	5.86	9.40
Spain	11.06	19.73	6.28	10.95	6.83	12.27	8.88	16.01
Sweden	10.79	18.18	7.00	11.27	7.16	11.59	8.28	13.45
Switzerland	9.68	18.13	4.96	8.53	6.39	12.28	7.92	15.95
UK	9.85	18.90	5.83	10.23	7.05	13.26	8.21	15.54
Emerging Markets								
Brazil	17.76	31.55	9.15	15.66	8.92	14.89	11.26	18.74
Chile	14.22	29.09	4.96	8.54	6.79	13.11	9.07	17.49
China	15.12	30.58	4.54	7.38	5.56	9.32	6.12	10.65
Colombia	12.99	24.78	3.83	6.28	4.05	6.72	5.59	9.49
India	10.31	16.80	4.30	6.81	5.04	8.19	6.38	10.61
Indonesia	22.64	42.37	4.24	6.65	5.22	8.05	9.52	14.77
Korea	17.05	37.11	6.08	9.27	6.95	10.77	8.33	13.03
Malaysia	13.91	30.57	2.46	3.82	3.34	5.04	4.72	7.15
Mexico	13.44	25.05	7.53	13.09	8.03	13.75	9.15	15.47
Philippines	13.08	24.72	2.90	4.54	3.72	6.17	5.58	9.32
Russia	60.71	150.24	8.55	14.18	9.51	15.56	11.80	19.12
South Africa	11.69	21.24	6.12	9.80	6.53	10.63	7.12	11.67
Taiwan	9.69	16.30	3.97	5.99	4.30	6.48	5.65	8.52
Thailand	19.06	38.18	3.70	5.50	6.02	10.55	7.26	13.33
Turkey	27.75	59.36	6.64	10.31	7.72	11.93	11.54	17.61

Notes: This table shows the maximum expected loss over a period of one week for a $100 portfolio calculated using the modified Value-at-Risk (mVAR). The mVAR is calculated for the foreign country indices and for the 3 replicating portfolios for each country using 1.96 and 2.33 standard deviations.

Table 7.9 Correlations for sub-periods

	1996-2002				*2003-2007*				*2008-2011*			
Developed Markets	*Domestic Firms*	*D1*	*D2*	*D3*	*Domestic Firms*	*D1*	*D2*	*D3*	*Domestic Firms*	*D1*	*D2*	*D3*
Argentina	11%	16%	20%	39%	41%	57%	58%	79%	60%	70%	75%	85%
Australia	23%	41%	44%	65%	46%	65%	67%	95%	76%	86%	87%	97%
Austria	14%	15%	15%	42%	44%	57%	62%	95%	72%	80%	84%	96%
Belgium	31%	27%	32%	50%	58%	65%	69%	93%	72%	75%	79%	93%
Canada	35%	45%	49%	49%	57%	79%	79%	98%	81%	94%	96%	99%
Denmark	28%	31%	35%	43%	44%	60%	67%	78%	73%	80%	84%	88%
Finland	24%	39%	42%	55%	51%	66%	67%	95%	72%	79%	80%	94%
France	37%	43%	46%	56%	68%	80%	83%	96%	77%	87%	89%	98%
Germany	37%	45%	47%	55%	67%	79%	85%	97%	78%	88%	90%	99%
Hong Kong	18%	19%	31%	31%	42%	52%	52%	60%	60%	67%	70%	75%
Ireland	26%	27%	31%	50%	53%	57%	61%	93%	65%	70%	70%	92%
Israel	23%	46%	46%	51%	45%	56%	56%	78%	38%	46%	49%	63%
Italy	30%	35%	40%	44%	62%	72%	74%	96%	73%	83%	84%	98%
Japan	-1%	19%	19%	57%	38%	49%	51%	93%	52%	61%	69%	88%
Netherlands	36%	39%	46%	60%	64%	77%	80%	95%	76%	85%	88%	98%
New Zealand	10%	26%	26%	43%	29%	37%	42%	82%	73%	79%	80%	88%
Portugal	15%	24%	30%	36%	35%	45%	56%	76%	63%	72%	77%	84%
Singapore	14%	20%	26%	33%	45%	56%	61%	89%	64%	70%	75%	95%
Spain	31%	34%	41%	46%	54%	67%	74%	97%	69%	77%	79%	98%
Sweden	32%	52%	52%	60%	63%	73%	77%	96%	77%	84%	85%	98%
Switzerland	30%	30%	36%	53%	58%	68%	76%	93%	74%	82%	86%	96%
UK	35%	36%	41%	52%	64%	77%	79%	95%	78%	87%	90%	97%
Average	24%	32%	36%	49%	51%	63%	67%	90%	69%	77%	80%	92%
Emerging Markets												
Brazil	19%	28%	29%	54%	62%	75%	79%	92%	75%	87%	91%	95%
Chile	18%	20%	34%	38%	51%	60%	66%	92%	57%	72%	80%	95%
China	8%	12%	14%	22%	32%	52%	61%	78%	57%	67%	70%	85%
Colombia	11%	9%	11%	25%	29%	39%	47%	65%	61%	65%	74%	85%
India	6%	21%	25%	35%	34%	50%	58%	72%	55%	63%	73%	87%
Indonesia	8%	13%	23%	51%	26%	42%	54%	84%	53%	53%	73%	88%
Korea	7%	28%	32%	51%	48%	60%	62%	74%	63%	69%	76%	85%
Malaysia	12%	14%	23%	41%	27%	34%	41%	89%	41%	52%	62%	93%
Mexico	26%	29%	44%	50%	69%	74%	76%	97%	85%	90%	93%	98%
Philippines	4%	12%	22%	31%	31%	45%	51%	71%	50%	56%	59%	75%
Russia	17%	16%	17%	26%	26%	52%	53%	71%	61%	71%	78%	85%
South Africa	20%	31%	33%	38%	52%	65%	67%	78%	70%	79%	83%	91%
Taiwan	11%	26%	36%	48%	38%	52%	52%	81%	54%	64%	67%	86%
Thailand	2%	12%	13%	28%	18%	36%	36%	64%	44%	58%	67%	88%
Turkey	17%	17%	27%	42%	34%	41%	52%	75%	69%	70%	74%	86%
Average	12%	19%	26%	39%	38%	52%	57%	79%	60%	68%	75%	88%

Notes: This table shows the correlation of each foreign country index with the domestic firms, and the replicating portfolios D1, D2 and D3 in the 3 sub-periods.

countries as time progresses. This is consistent with the observed increases in interdependence between countries' equity markets (Buraschi, Porchia, & Trojani, 2010). The greatest differences between the correlation of the domestic firms with the foreign indices and the replicating portfolios with the foreign indices occur in the first two periods. Developed country indices have an average of 24 and 51 percent correlation with domestic firms in the first two sub-periods, and an average of 49 and 90 percent correlation with the D3 portfolios. Emerging market indices have an average of 12 and 38 percent correlation with domestic firms in the first two sub-periods and an average 39 and 79 percent correlation with the D3 portfolios. These increases become less pronounced in the last sub-period, where developed market indices are 69 percent correlated with domestic firms and 92 percent correlated with the D3 portfolios, and emerging market indices are 60 percent correlated with domestic firms and 88 percent correlated with the D3 portfolios.

Table 7.10 lists the risk-adjusted returns for the three sub-periods for the foreign country indices and for the replicating portfolios. The performance of the US market is included for comparative purposes. The risk-adjusted returns are highest for both developed and emerging markets in the period 2003 to 2007. The average risk-adjusted return of both DM and EM countries outperform the US in this period, which was characterised by low volatility in the US and strong performance of most foreign country indices in the absence of any major financial crises. In the period 1996 to 2002, the risk-adjusted performance of either the S&P500 or Russell 1000 was better than all but one country, Finland. Emerging market returns are mostly negative in this period. In the period 2008 to 2011, the US and most of the developed markets experience negative returns, while emerging markets have proportionally more countries with positive returns. The average risk-adjusted return for emerging markets is 0.12 in this period, compared to -0.19 for developed markets and -0.17 for the S&P500. When comparing the replicating portfolios to the foreign country indices, the developed market portfolios have on average a lower risk-adjusted return than the foreign country indices in the first two sub-periods and an equal or better performance between 2008 and 2011. For emerging markets, the portfolios on average outperform the foreign country indices between 1996 and 2002, and underperform the foreign country indices in the other two sub-periods.

Table 7.10 Risk-adjusted return for sub-periods

	1996-2002				2003-2007				2008-2011			
Developed Markets	*Country Indices*	*D1*	*D2*	*D3*	*Country Indices*	*D1*	*D2*	*D3*	*Country Indices*	*D1*	*D2*	*D3*
Argentina	-0.27	-1.66	-1.35	-0.71	1.38	2.44	2.39	1.75	0.03	0.04	0.04	0.04
Australia	0.13	0.32	0.30	0.20	1.62	1.14	1.00	1.42	0.01	0.01	0.01	0.01
Austria	-0.06	-0.38	-0.38	-1.34	1.66	1.32	1.52	1.49	-0.42	-0.54	-0.50	-0.44
Belgium	0.12	0.24	0.30	0.05	1.36	0.85	0.97	1.31	-0.47	-0.15	-0.02	-0.04
Canada	0.29	0.21	0.33	0.43	1.69	1.22	1.28	1.56	0.01	-0.19	-0.26	-0.04
Denmark	0.27	0.13	0.06	0.37	1.76	1.37	1.26	1.50	-0.08	-0.02	0.03	0.29
Finland	0.46	0.16	0.15	0.52	0.88	1.15	1.03	0.73	-0.56	-0.13	-0.32	-0.76
France	0.22	0.22	0.22	0.11	1.37	1.22	1.08	1.27	-0.19	-0.13	-0.09	-0.26
Germany	-0.04	-0.08	0.23	-0.08	1.49	1.15	1.09	1.45	-0.17	-0.03	-0.04	-0.19
Hong Kong	-0.10	0.24	0.17	0.17	1.43	1.10	1.36	1.32	-0.05	-0.06	-0.24	-0.36
Ireland	0.03	0.03	0.18	0.33	0.94	0.84	0.84	0.97	-0.79	0.11	0.03	-0.31
Israel	0.00	0.08	0.07	0.29	1.28	0.93	0.94	1.38	0.05	-0.03	0.13	0.07
Italy	0.22	0.14	0.15	0.18	1.44	1.24	1.12	1.32	-0.42	-0.16	-0.23	-0.54
Japan	-0.42	0.17	0.17	-0.55	0.77	0.98	0.84	0.61	-0.25	-0.02	-0.36	-0.45
Netherlands	0.14	0.11	0.18	0.12	1.22	1.26	0.98	1.10	-0.23	-0.06	0.03	-0.29
New Zealand	-0.14	0.12	-0.03	-0.12	1.24	1.32	0.96	0.92	-0.12	-0.19	-0.30	-0.30
Portugal	0.15	0.00	0.07	0.08	1.72	1.45	1.56	1.45	-0.42	-0.02	-0.21	-0.17
Singapore	-0.32	0.04	0.18	-0.19	1.47	1.04	1.02	1.37	0.11	0.03	-0.04	0.00
Spain	0.33	0.16	0.01	0.18	1.80	1.30	1.15	1.71	-0.23	-0.08	-0.10	-0.25
Sweden	0.09	0.02	0.10	-0.04	1.38	1.09	1.02	1.24	0.07	-0.13	-0.03	0.02
Switzerland	0.18	0.19	0.16	0.03	1.30	1.21	0.82	1.18	0.07	-0.12	-0.04	0.03
UK	0.22	0.22	0.19	0.29	1.31	1.33	1.11	1.21	-0.19	-0.14	-0.14	-0.24
Average	0.07	0.03	0.07	0.01	1.39	1.22	1.15	1.28	-0.19	-0.09	-0.12	-0.19
Emerging Markets												
Brazil	-0.07	0.01	0.20	0.25	1.58	1.36	1.36	1.39	0.00	-0.06	-0.28	-0.06
Chile	-0.28	-0.41	-0.13	-0.28	1.66	0.91	0.96	1.56	0.43	-0.01	-0.04	0.46
China	-0.45	0.18	-0.22	-0.44	1.53	0.87	0.79	1.02	-0.04	0.00	-0.25	-0.24
Colombia	-0.06	-0.04	0.23	-0.41	1.69	1.35	1.37	1.77	0.68	0.03	-0.14	0.42
India	0.00	0.05	0.70	0.39	1.74	1.37	1.31	1.28	-0.20	0.08	0.03	-0.22
Indonesia	-0.39	0.04	0.21	-0.19	1.49	1.20	1.27	1.14	0.29	0.00	-0.10	0.11
Korea	-0.05	0.12	0.11	-0.09	1.02	0.97	0.87	1.05	0.04	-0.03	0.01	-0.20
Malaysia	-0.27	0.04	0.01	-0.23	1.48	0.99	1.48	1.17	0.39	-0.07	0.15	0.33
Mexico	0.27	0.24	0.32	0.07	1.45	1.08	1.05	1.40	0.06	-0.08	-0.16	0.00
Philippines	-0.80	0.17	0.03	-0.46	1.35	0.72	0.95	1.75	0.08	0.01	-0.22	-0.18
Russia	-0.06	0.17	0.30	0.09	1.34	1.49	1.37	1.41	-0.31	-0.02	-0.15	-0.26
South Africa	-0.16	0.12	-0.13	-0.07	1.17	1.23	1.08	0.91	0.11	-0.04	0.06	0.22
Taiwan	-0.10	0.17	-0.16	-0.24	0.70	1.35	1.34	0.66	0.15	-0.03	-0.05	-0.12
Thailand	-0.51	0.04	-0.15	-0.71	1.17	1.30	1.23	0.84	0.31	-0.02	-0.11	-0.16
Turkey	-0.01	0.18	0.11	-0.03	1.07	1.34	1.18	1.23	-0.13	-0.18	-0.06	-0.14
Average	-0.20	0.07	0.09	-0.14	1.36	1.19	1.18	1.24	0.12	-0.03	-0.09	0.00
S&P500	0.23				0.87				-0.17			
Russell 1000	0.30				1.06				-0.06			

Notes: This table shows the annualised return per unit of risk for the MSCI index of each country and for the replicating portfolios D1, D2 and D3 for each sub-period.

Table 7.11 lists the Mean-Variance Spanning results for the three sub-periods for D1, D2 and D3 portfolios. In the first and last sub-periods, spanning is not rejected for any portfolio for any country at a 10 percent critical level, with the exception of Ireland between 2008 and 2011, with p values of 0.08 and 0.07 for its D1 and D3 portfolios. The results for the period 2003 to 2007 are mixed. Spanning is rejected in this period for 15 D1 portfolios, 16 D2 portfolios and 3 D3 portfolios. When ADRs, iShares and CCFs are included in the D3 portfolios, spanning is not rejected for 34 of the 37 foreign country indices. Without the inclusion of these products, the D1 and D2 portfolios do not replicate almost half of the foreign country indices. This result differs for the other two sub-periods, where for 36 of the 37 countries the replicating portfolios convincingly span the foreign country indices in all cases. When international diversification benefits are at their highest in 2003 to 2007, Industry Indices and MNCs do not exhaust the benefits of investing in the foreign index for all countries. ADRs, iShares and CCFs are essential in this period to adequately replicate investment in foreign country indices. This is consistent with the findings in Table 6.8 for this sub-period. Although MNCs, along with ADRs, offer the best diversification benefits overall, in the period 2003 to 2007, they have a Sharpe ratio of 1.06 compared to foreign country indices ranging from 1.54 to 1.78 for equally weighted portfolios. Likewise Industry Indices offer less benefit than the country portfolios in the second sub-period. Comprised of US headquartered companies, Industry Indices and MNC are more highly correlated with the US market than with foreign country indices. This has the greatest impact in the period 2003 to 2007 when the US underperforms foreign markets.

In order to test the robustness of my results, for the 16 D1 portfolios, 15 D2 portfolios and 3 D3 portfolios in the 2003 to 2007 period which do not span their corresponding foreign country index, I recreate the replicating portfolios. I use a 0.20 stepwise regression forward stopping value, which increases the number of independent variables included in the regression. I also create portfolios with weightings in all of the assets available for each country using a standard OLS regression. The results are in listed in Table 7.12. By increasing the threshold for stepwise regression there is in most cases no change in the spanning results. The results change for 2 of the 3 D3 portfolios, for 2 D2 portfolios and for 1 D1 portfolio, for which spanning is not rejected. For example for India, when using a 0.05 stopping value, spanning is rejected for its D1, D2 and D3 portfolios, with p-values of 0.02, 0.02 and 0.04. When I repeat the stepwise

Table 7.11 MVS Results for Sub-periods

	1996-2002						*2003-2007*						*2008-2011*					
Developed Markets	*D1*		*D2*		*D3*		*D1*		*D2*		*D3*		*D1*		*D2*		*D3*	
	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value
Argentina	0.25	0.78	0.28	0.75	0.05	0.95	1.50	0.28	1.57	0.23	0.66	0.51	0.01	0.99	0.10	0.90	0.06	0.94
Australia	0.03	0.97	0.07	0.93	0.10	0.90	2.97	0.04	4.04	0.02	1.97	0.14	0.04	0.96	0.83	0.41	0.19	0.83
Austria	0.02	0.98	0.02	0.98	0.01	0.99	2.97	0.04	2.04	0.13	1.57	0.21	0.42	0.64	0.81	0.43	0.28	0.74
Belgium	0.01	0.99	0.01	0.99	0.04	0.96	2.75	0.06	2.27	0.11	0.32	0.71	0.55	0.59	0.84	0.40	0.07	0.93
Canada	0.16	0.85	0.07	0.93	0.03	0.97	3.75	0.03	3.75	0.03	1.57	0.23	0.59	0.57	1.31	0.27	0.37	0.69
Denmark	0.19	0.83	0.24	0.79	0.04	0.96	3.75	0.03	2.97	0.04	2.04	0.12	0.02	0.98	0.05	0.95	0.80	0.43
Finland	0.63	0.53	0.64	0.52	0.14	0.86	0.17	0.85	0.17	0.85	0.75	0.49	0.53	0.38	0.42	0.64	0.29	0.73
France	0.06	0.94	0.05	0.95	0.11	0.89	1.04	0.35	2.05	0.17	0.74	0.50	0.04	0.96	0.10	0.90	0.17	0.84
Germany	0.04	0.96	0.09	0.91	0.01	0.99	2.27	0.11	0.87	0.06	0.36	0.69	0.17	0.85	0.17	0.84	0.02	0.98
Hong Kong	0.07	0.93	0.08	0.92	0.08	0.92	0.99	0.05	2.01	0.18	1.57	0.22	0.01	0.99	0.05	0.95	0.18	0.83
Ireland	0.01	0.99	0.01	0.99	0.08	0.92	0.78	0.46	0.75	0.49	0.03	0.97	0.98	0.08	2.27	0.11	1.03	0.07
Israel	0.01	0.99	0.01	0.99	0.10	0.90	2.04	0.13	2.04	0.13	0.22	0.80	0.01	0.99	0.01	0.99	0.01	0.99
Italy	0.11	0.89	0.10	0.90	0.08	0.92	1.57	0.22	1.97	0.14	0.83	0.41	0.43	0.63	0.29	0.73	0.55	0.61
Japan	0.7	0.49	0.71	0.49	0.05	0.95	0.26	0.76	0.38	0.68	0.63	0.53	0.17	0.85	0.01	0.99	0.18	0.84
Netherlands	0.04	0.96	0.02	0.98	0.03	0.97	0.37	0.68	1.22	0.28	0.78	0.46	0.21	0.81	0.55	0.59	0.09	0.91
New Zealand	0.10	0.90	0.07	0.93	0.03	0.97	1.59	0.21	2.04	0.12	0.55	0.16	0.01	0.99	0.07	0.93	0.15	0.86
Portugal	0.08	0.92	0.06	0.94	0.06	0.94	3.75	0.03	4.04	0.02	2.04	0.12	0.61	0.55	0.28	0.74	0.44	0.63
Singapore	0.38	0.68	0.45	0.61	0.26	0.77	3.75	0.03	0.56	0.06	0.68	0.50	0.03	0.97	0.07	0.93	0.23	0.79
Spain	0.28	0.75	0.38	0.65	0.26	0.77	4.80	0.01	3.75	0.03	0.79	0.45	0.12	0.88	0.11	0.89	0.01	0.99
Sweden	0.03	0.97	0.01	0.99	0.06	0.94	2.28	0.10	0.55	0.16	1.23	0.29	0.18	0.84	0.05	0.95	0.11	0.89
Switzerland	0.05	0.95	0.05	0.95	0.12	0.88	1.04	0.35	2.44	0.09	0.77	0.47	0.14	0.87	0.06	0.94	0.04	0.96
UK	0.08	0.92	0.08	0.92	0.02	0.98	0.45	0.61	1.23	0.29	0.75	0.49	0.03	0.97	0.04	0.96	0.05	0.95
Emerging Markets																		
Brazil	0.02	0.98	0.06	0.94	0.26	0.77	2.01	0.18	2.04	0.12	1.66	0.30	0.02	0.98	0.62	0.54	0.06	0.94
Chile	0.43	0.63	0.37	0.69	0.18	0.82	4.80	0.01	3.90	0.02	0.76	0.46	0.50	0.50	1.43	0.35	0.01	0.99
China	0.75	0.47	0.60	0.55	0.59	0.56	2.66	0.05	3.75	0.03	2.97	0.04	0.01	0.99	0.06	0.94	0.17	0.85
Colombia	0.01	0.99	0.02	0.98	0.01	0.99	4.04	0.02	0.99	0.03	1.65	0.30	1.50	0.28	2.27	0.10	0.66	0.52
India	0.01	0.99	0.1	0.90	0.07	0.93	4.04	0.02	4.04	0.02	2.97	0.04	0.18	0.83	0.18	0.83	0.01	0.99
Indonesia	0.56	0.59	0.65	0.51	0.38	0.68	3.75	0.03	2.48	0.09	2.48	0.09	0.20	0.82	0.44	0.62	0.76	0.47
Korea	0.03	0.97	0.03	0.97	0.01	0.99	0.73	0.49	0.84	0.41	0.34	0.72	0.01	0.99	0.01	0.99	0.25	0.77
Malaysia	0.26	0.77	0.27	0.76	0.12	0.88	3.75	0.03	2.04	0.12	2.27	0.11	0.41	0.65	0.24	0.78	0.07	0.93
Mexico	0.14	0.86	0.07	0.93	0.26	0.77	2.27	0.11	2.48	0.09	0.34	0.72	0.16	0.85	0.58	0.58	0.14	0.87
Philippines	2.28	0.10	2.27	0.10	1.58	0.21	2.87	0.08	2.97	0.04	0.05	0.95	0.01	0.99	0.11	0.89	0.19	0.83
Russia	0.03	0.97	0.05	0.95	0.03	0.97	1.04	0.35	1.50	0.28	0.59	0.57	0.28	0.74	0.15	0.86	0.05	0.95
South Africa	0.13	0.87	0.05	0.95	0.07	0.93	0.59	0.56	0.79	0.40	1.31	0.27	0.09	0.91	0.02	0.98	0.08	0.92
Taiwan	0.08	0.92	0.01	0.99	0.01	0.99	0.14	0.87	0.14	0.87	0.19	0.83	0.08	0.92	0.10	0.90	0.41	0.65
Thailand	0.85	0.40	0.82	0.43	0.35	0.70	1.52	0.25	1.54	0.23	1.84	0.19	0.27	0.76	0.43	0.63	1.66	0.20
Turkey	0.01	0.99	0.01	0.99	0.01	0.99	0.78	0.44	0.66	0.51	0.14	0.87	0.01	0.99	0.03	0.97	0.01	0.99

Notes: This table shows the F-statistics and p-values from the Wald tests for Mean-Variance Spanning to test the null hypothesis that the replicating portfolios, D1, D2 and D3 span the foreign country index for the three sub-periods. If spanning is not rejected, the addition of the foreign country index does not shift the mean-variance efficient frontier and there is no significant diversification benefit to be gained by investing overseas.

Table 7.12 Further MVS Results

	2003-2007											
	Stepwise 0.20 threshold						*OLS Regression*					
	D1		*D2*		*D3*		*D1*		*D2*		*D3*	
Developed Markets	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value
Australia	3.5	0.03	3.33	0.04			3.4	0.04	3.29	0.03		
Austria	2.96	0.05					2.96	0.05				
Belgium	1.94	0.15					1.68	0.19				
Canada	3.29	0.03	3.29	0.03			3.29	0.03	3.33	0.04		
Denmark	3.29	0.03	3.56	0.02			3.33	0.04	3.29	0.03		
Germany			2.79	0.06					2.79	0.06		
Hong Kong	2.46	0.07					2.42	0.09				
Portugal	3.28	0.03	2.49	0.08			3.33	0.04	2.49	0.08		
Singapore	3.27	0.03	2.79	0.06			2.79	0.06	2.79	0.06		
Spain	3.3	0.03	3.56	0.02			3.56	0.02	4.78	0.01		
Switzerland		2.79	0.06					2.61	0.07			
Emerging Markets												
Chile	4.78	0.01	4.78	0.01			4.78	0.01	4.78	0.01		
China	3.29	0.03	4.78	0.01	3.12	0.05	3.56	0.02	3.56	0.02	4.78	0.01
Colombia	3.29	0.03	3.33	0.04			3.56	0.02	2.49	0.08		
India	3.56	0.02	3.33	0.04	1.94	0.15	3.29	0.03	3.29	0.03	2.03	0.13
Indonesia	3.33	0.04	2.42	0.09		0.18	2.79	0.06	2.22	0.11	1.54	0.20
Korea												
Malaysia	3.56	0.02					3.29	0.03				
Mexico			2.49	0.08					1.77	0.16		
Philippines	3.33	0.04	2.79	0.06			3.33	0.04	2.49	0.08		

Notes: This table shows the p-values for the MVS tests for replicating portfolios created using firstly a 0.20 stopping threshold for stepwise regression and secondly using a standard OLS regression

regression using a stopping value of 0.20 and using no stopping value, the results for the D1 and D2 portfolios only increase to 0.03 and 0.04. The results for the D3 portfolio increase to 0.15 and 0.13. Therefore, the D3 portfolio spans the Indian index, but the result is unchanged for the D1 and D2 portfolios, spanning is rejected. By expanding the number of independent variables, the likelihood that the replicating portfolios span the foreign country indices is either unchanged or increased. There is no instance of a substantial reduction in the likelihood of spanning. This confirms my earlier assertion that a lower p-value represents a more stringent requirement for the construction of the replicating portfolios.

The D1 and D2 portfolios are comprised of Industry Indices, MNCs and the Russell 1000 index. All contain US headquartered companies only and are counted as domestic equity holdings. For the full period, these portfolios can replicate 36 of the 37 foreign country indices. This means that home bias, that is, holding domestic equity, is not sub-optimal over this period. However, in my sub-period analysis, the D1 and D2 portfolios do not replicate almost half of the foreign country indices in the period 2003 to 2007, demonstrating that home bias can be sub-optimal over shorter time horizons. However, the consistent results for the D3 portfolios should convince any investor that investing in US-traded products only is an adequate diversification strategy.

7.4 Conclusion

In this chapter I test whether US-traded equity products can replicate the returns of 37 foreign country indices, over the period 1996 to 2011. I form three types of replicating portfolios, the first of Industry Indices, the second of the Russell 1000, Industry Indices and MNCs and the third of Russell 1000, Industry Indices, MNCs, ADRs, iShares and CCFs. I examine the diversification benefits of these portfolios for the full period and three sub-periods, and test whether the benefits of investing overseas can be fully replicated using domestically-traded products.

For the full period my results are very conclusive, by investing in all three types of replicating portfolios investors can achieve most of the benefits of investing directly in foreign equity markets. When divided into sub-periods, the benefits of international diversification, as measured by investment in foreign country indices, are highest in the period between 2003 and

2007, when most foreign markets outperformed the US. In this period, the foreign country indices can be replicated for 36 of the 37 countries, but for nearly half of the countries the addition of ADRs, iShares or CCFs to the portfolio is essential. In the other sub-periods and in the full period, replicating portfolios comprised of Industry Indices only and of Industry Indices, MNCs and the Russell 1000 can replicate all of the foreign indices with or without the inclusion of ADRs, iShares and CCFs.

I contribute to the earlier findings by Errunza et al. (1999) using an expanded dataset which includes more products and countries. My results are more robust due to the greater role of industrial diversification, the increasing foreign exposure that can be provided by MNCs, the increase in the availability of ADRs and the introduction of iShares. US investors who invest only in US-traded products are not forgoing the benefit of international diversification. I find that those benefits can be exhausted domestically, negating the need to negotiate foreign equity markets.

Chapter 8 Conclusions, Limitations and Future Work

8.1 Introduction

The benefits of international diversification for portfolio investors have long been highlighted, as historically, low correlations among national stock markets allowed investors to reduce their risk for a given return. Despite the reduction of many previous barriers to foreign investment, the corresponding increase in international investing that would have been expected as a result, has failed to materialise. Investors have been found to be persistently overweight in domestic equities. This phenomenon is known as the home bias puzzle, and is found to exist in most countries. This thesis attempts to reconcile the persistent preference of investors to invest domestically despite the available benefits of investing overseas, by investigating the indirect international diversification benefits of domestically-traded equity products.

The primary contribution of this thesis is that it conducts a multi-faceted and in-depth investigation into the indirect diversification benefits of US-traded products over a fifteen year period between 1996 and 2011. Its four main contributions are as follows. Firstly, it provides a longitudinal analysis of firm-level internationalisation of US MNCs which has not been done previously. Using three measures of internationalisation and analysing the impact of age, industry and size, it provides unique insights into aspects and patterns of firm-level internationalisation in the US. Secondly, it rigorously compares the diversification benefits of US MNCs selected using measures of the extent, scope and speed of firm-level internationalisation. Thirdly, it compares the indirect international diversification benefits of several different equity types from the perspective of a US investor. It compares the diversification benefits of Multinational Corporations, Industry Indices, American Depository Receipts, Closed-End Country Funds and iShares. Fourthly, it investigates whether the benefits of investing overseas can be exhausted by investing in portfolios of US-traded equity products, which seek to replicate the returns of foreign country indices.

The remainder of this chapter is structured as follows. In Section 8.2 I draw together the main findings from the thesis and describe how they contribute to the existing literature. In Section

8.3 I describe the inevitable limitations of the studies and outline areas where further study would be beneficial, and finally in Section 8.4 I conclude this chapter and the thesis.

8.2 Main Findings and Literature Contributions

In Chapter 2 I reviewed the literature on international diversification in equity investments, the phenomenon of home bias, the measurement and degree of firm-level internationalisation, and the benefits of five types of equity investment which may offer foreign exposure in a domestic setting. It was evident from the very mixed findings on the indirect diversification benefits of MNCs that the results were difficult to compare as every study used a different method by which to select MNCs. A comparison of different selection methods was lacking. In addition, several studies recommended the use of a longitudinal dataset to capture the dynamic nature of firm internationalisation, as almost all previous studies use cross-sectional data. I also examined the literature on the diversification benefits of the other four equity types. Although a comprehensive literature exists regarding each product type individually, only a handful of studies compare two or three equity types. Finally, after reviewing the studies by Errunza et al. (1999) and Antoniou et al. (2010) which combine equity products into portfolios on an individual country basis, and given the increasing globalisation of firms and the continuing expansion of equity product availability, it was evident that a more recent study of this nature would provide further insights into the benefits of indirect international diversification

In Chapter 3 I described the research method of the thesis as positivist and discussed the suitability of the use of quantitative methods for the empirical studies which form the basis of the thesis. I detailed the empirical data and the methodologies used to test the hypotheses which were stated as my main research questions in Chapter 1.

In Chapter 4 I conducted a longitudinal study of US MNCs over a 15 year period from 1996 to 2010. I used three measures of internationalisation of a firm; its percentage foreign sales, the number of geographical segments in which it reports material sales, and the number of regions of the world in which those segments are located. Firms were also categorised by age, industry and size. The main findings are as follows. Firstly, I found that the level of internationalisation of MNCs increased steadily using all three measures over the 15 year period examined. When the

three measures of internationalisation were compared to each other, the number of geographic segments and the number of regions were consistent with each other at an aggregate level but not with the percentage foreign sales of firms. My sub-period analysis revealed that most firms increased their number of segments and number of regions in the first sub-period while most firms increased their foreign sales in the following period. The credit crisis of 2007/08 caused the foreign sales of over half of MNCs to fall, but had very little impact on the other two measures; only ten percent of MNCs experienced a fall in either the number of segments or regions in the same period. By the final period, 2008 to 2010, I found that almost 75 percent of MNCs had sales in three of the six regions of the world. This supports the theory that MNCs mostly pursue a semi-global strategy as suggested by Ghemawat (2003). Industry analysis revealed that industries differ substantially in their level of internationalisation. Analysis of firm size revealed that large firms have on average a larger level of internationalisation but small firms experienced the greatest increase in internationalisation over the sample period. The age of a firm was found to have little impact on its level of internationalisation in the period studied. Such an extensive study of the longitudinal internationalisation of MNCs has not appeared in the literature to date.

In Chapter 5, I compared the diversification benefits of portfolios of MNCs using a variety of methods. Using my longitudinal dataset I formed two types of portfolios; the fastest internationalising firms and the most consistently international firms. My findings were as follows. Firstly, my results provide strong evidence that the benefits of indirect diversification can be gained via investment in portfolios of MNCs. Secondly, I found that firms which are the most consistently international provide greater diversification benefits than those which increase the most in internationalisation. Thirdly, I found that MNCs with sales in the largest number of geographic segments or with segments in the greatest number of regions provide more diversification benefits than those with the highest foreign sales. Fourthly, I found that selecting firms which are consistently the most international in *every year* is superior to selection at either the start or at the end of the period analysed. Almost all previous studies select MNCs based only on criteria at one point in time, and do not select firms by their level of internationalisation over time. Many studies select firms using percentage foreign sales (Hughes, Logue, & Sweeney,1975; Agmon & Lessard, 1977; Fatemi, 1984; Qian, 1996), some by number of countries in which a firm has foreign sales (Mikhail & Shawky, 1979; Michel & Shaked, 1986)

and some by the location of those countries (Berrill & Kearney, 2010), but no study directly compares these three selection methods.

In Chapter 6 I compared the indirect international diversification benefits of 5 types of equity product to each other and to investing directly in foreign country indices over a 15 year period, using three methods of portfolio weighting; equally weighted, optimally weighted with short sales and optimally weighted with no short sales. I tested the robustness of my results by repeating the analysis over three sub-periods. I found that the benefits of international diversification exist for the full period, but vary substantially when broken into three sub-periods. My 15 year period incorporates two crises, the dotcom bubble of 1999/2000 and the credit crisis of 2007/08. International diversification benefits are strongly evident between 2003 and 2007, but are much reduced before and after this period, which concurs with findings by Arshanapalli & Doukas (1993) that diversification benefits are reduced in times of crisis. I found that ADRs and MNCs yield the greatest diversification benefits of the US-traded equity products, and in some cases, exceed those of direct investment in foreign country indices. The findings were robust across sub-periods. This is the first study of its kind to directly compare five equity types which may offer the benefits of indirect international diversification to each other and to direct international diversification.

In Chapter 7 I combined the different types of equity products to create portfolios which sought to replicate each foreign country index individually. I did this for a 15 year period and for three sub-periods. For the full period and for two sub-periods, I found that the benefits of international diversification can be comprehensively exhausted via all of the replicating portfolios. Despite lower correlation with foreign country indices, portfolios of Industry Indices and MNCs provide diversification benefits due to their higher risk-adjusted return. However, when all products are included, ADRs, iShares or CCFs have the largest weighting for nearly every country. When the US underperformed foreign country indices, portfolios of US Indices and MNCs did not exhaust the benefits of diversifying internationally. Portfolios which include ADRs, iShares and CCFs spanned the foreign market indices in almost all cases. My results suggest that US-traded products provide an excellent source of foreign equity exposure and that trading overseas is no longer necessary. While the Errunza et al. (1999) study finds that the diversification benefits can be exhausted domestically for 11 of 16 countries I find that the returns of all 37 foreign country

indices can be replicated using domestically-traded products. I contribute to the literature by updating and extending that study in a period in which there has been an increase in the number of US-traded products which may provide exposure to a greater number of countries, a substantial increase in the internationalisation of MNCs, and an increase in the importance of industrial diversification relative to country diversification.

This thesis finds that the extent and scope of internationalisation of US MNCs is increasing over time, and that investors in the US can reap the benefits of being internationally diversified by investing in US MNCs which have the consistently highest levels of internationalisation. MNCs which experience rapid increases in internationalisation offer fewer benefits as the costs in some cases outweigh the benefits of increasing internationalisation. ADRs and MNCs offer greater diversification benefits than Industry Indices, CCFs and iShares. When combined, portfolios of these products can mimic foreign market returns. Overall, US-traded products provide an excellent source of foreign equity exposure, and trading overseas is no longer necessary. Investors are not forgoing the benefits of international diversification by only investing in domestically-traded products.

8.3 Limitations of the Research and Future Work

In this section I detail the limitations of my research and suggestions for future research. As is the case with any empirical study, the results are based on past correlations, returns and standard deviations of returns. Any future predictions based on these results are dependent on the past being a good indicator of the future. However, by using sub-period analysis I attempted to test the results in varying market conditions to increase their applicability.

The study in Chapter 4 investigated the longitudinal patterns of firm internationalisation in the US, and the results in Chapter 5 revealed that US investors can substantially benefit from investing in MNCs which consistently have sales in the greatest number of geographic segments spread across the most regions. A recommendation for future study would be to extend my longitudinal study of the internationalisation of MNCs in other countries to investigate whether MNCs have increased in internationalisation to the same extent as in the US since the mid-nineties, and to test the indirect diversification benefits of MNCs outside the US. Doremus et al.

(1998) argue that MNCs internationalise differently depending on their nation of origin. Given that the US is the largest economy in the world, its MNCs may have internationalised faster and have greater global reach than others. Alternatively, given the large size of the domestic market in the US, other countries may have a lower percentage of firms with no activity outside of their domestic market.

In my measures of internationalisation I count the number of geographic segments in which a firm reports material sales, and the number of regions in which the segments are located. In neither case do I factor in what proportion of the firm's foreign sales occur in each segment or region. A recommendation for future study would be to use a more detailed approach to these measures of internationalisation by incorporating the proportion of a firm's sales that take place in each region and to rank them accordingly. This would further differentiate firms operating to the greatest extent beyond their domestic market. An analysis of this kind has been undertaken by Fillat et al. (2013) using data from the Bureau of Economic Analysis which provides firm-level data on the volume of foreign sales on a country-by-country basis. Future study will incorporate this data into a more detailed analysis of the diversification benefits of MNCs.

A firm can choose how to serve a foreign market, by exporting to that market or by engaging in foreign direct investment (FDI) in that market. My data on firm sales does not differentiate between firms which are purely exporting firms and firms which have foreign subsidiaries. Datastream states that its geographic segment data includes 'non-domestic operations and export sales which cannot be separated'. Fillat & Garetto (2012) use Compustat data which allows them to distinguish between firms engaging in FDI and purely exporting firms. They find that the returns of MNCs engaging in FDI are higher than those of exporting firms. They attribute this to the higher sunk costs of FDI relative to the costs of exporting. An area for future research would be to investigate the diversification benefits of MNCs involved in FDI and purely exporting firms.

In Chapter 6 I compare the indirect diversification benefits of five equity types. My study was focussed on the US due to the availability of data for a wide range of equity products. An area for future research would be to conduct a similar study in other G7 countries with sufficient data.

In Chapter 7 I investigate whether the benefits of investing in foreign country indices can be exhausted via investment in domestically-traded products for a US investor. A similar study was undertaken by Antoniou et al. (2010) in the UK using data from 1994 to 2003. This analysis could be extended to other countries with sufficient data, such as Eurozone countries or Japan, to test whether investing only in domestically-traded products is an optimal strategy in countries other than the US and the UK.

8.4 Conclusion

This thesis was organised into a number of core sections as outlined in Chapter 1. This included the identification of the research questions through a review of the literature (Chapter 2), a description of the research approach, data and methodology selected (Chapter 3), a longitudinal investigation of the internationalisation of US MNCs (Chapter 4), and three empirical studies of the indirect international diversification benefits of US-traded products (Chapters 5, 6 and 7). In this chapter I drew together the novel contributions and main conclusions from the thesis, their limitations and the resulting possibilities for future research.

The primary conclusion to emerge from the thesis is that US-traded products provide excellent exposure to foreign markets. Firstly, by creating a longitudinal dataset which categorised firms by three measures of internationalisation, I was able to conduct a more thorough investigation into the internationalisation of US MNCs than exists in the literature. I found that investors can obtain international diversification benefits via investment in MNCs. This implies that home bias in equity investments is not an irrational strategy, investors are not forgoing the benefits of investing overseas by holding domestic equity. Most previous studies select MNCs by their percentage foreign sales at one point in time, for which I found only marginal benefits. I used a richer dataset to study the diversification benefits of MNCs, using three measures of internationalisation over a fifteen year period.

Secondly, when direct and indirect international diversification are measured and compared, ADRs and MNCs provide greater diversification benefits than Industry Industries, iShares and CCFs over the full period and within sub-periods. These findings hold for three methods of portfolio weighting. ADRs are counted as foreign equity holdings and do not affect the recorded

measure of home bias. Compared to holding foreign equity indices, they are a more realistic and convenient method of internationally diversifying. Holding a portfolio of foreign country indices is not a realistic scenario for many investors due to transaction costs and portfolio size, and may overstate the benefits of direct international diversification.

Thirdly, I find that it is possible to replicate foreign returns using US-traded products which are counted as domestic equity holdings (MNCs and Industry Indices) or US-traded products which are counted as foreign equity holdings (ADRs, CCFs, iShares) in the full time period, and in the first and last sub periods. In the mid period 2003 to 2008, investment in domestic equity holdings alone did not exhaust the benefits of investing overseas, investment in ADRs, CCFs and iShares was necessary. Investing in foreign country indices was not necessary almost every case in all time periods to achieve the full benefits of international diversification. It was possible to exhaust the benefits of investing in foreign country indices for 37 countries by investing in US-traded equity products.

The findings of this thesis have practical as well as academic relevance. My longitudinal study of firm internationalisation addresses a gap in the academic literature highlighted by many authors such as Contractor (2007), Hennart (2007), Glaum & Oesterle (2007), Asmussen, Benito, & Petersen (2009) and Casillas & Acedo (2013). My findings on the benefits of indirect international diversification are of both academic and practical relevance, and should be of use to portfolio managers. Managers can accommodate investor preferences to trade locally without forgoing the benefits of international diversification. MNCs can provide indirect diversification benefits, but require more careful selection than has been previously used. ADRs provide excellent exposure to foreign equity markets. iShares and CCFs provide diversification benefits to US investors but less than ADRs and MNCs when considered individually. Industry Indices provide only limited diversification benefits, and almost always less than those of other US-traded products. The benefits of international diversification are available via investments in US-traded products and are more achievable than investing in foreign country indices. These products provide a more cost-effective and efficient way of achieving international diversification in equity investments.

Appendices

A.1 List of ADRs

Country Of Origin	*ADR*	*Country Of Origin*	*ADR*
Argentina	BBVA Banco Frances	Japan	Nomura Holdings
Argentina	Telecom Argentina	Japan	Panasonic
Argentina	Transportadora De Gas Del Sur	Japan	Toyota Motor
Argentina	YPF	Korea	Korea Electric Power
Australia	Alumina Limited	Korea	Posco
Australia	Bhp Billiton	Mexico	Telefonos De Mexico
Brazil	Eletrobras Pnb	Mexico	Coca-Cola Femsa
Brazil	Companhia Brasileira De Distribuicao	Mexico	Empresas Ica
Brazil	Compania Energetica De Minas Gerais	Mexico	Grupo Casa Saba
Brazil	Siderurgica Nacional On	Mexico	Grupo Radio Centro
Chile	Provida	Mexico	Grupo Televisa
Chile	Compania Cervecerias Unidas	Mexico	Grupo Tmm
Chile	Andina	Mexico	Telefonos De Mexico
Chile	Empresa Nacional De Electricidad	Netherlands	Asm International
Chile	Enersis	Netherlands	Aegon Nv
Chile	Sqm	Netherlands	Ing Groep
Chile	Vina Concha Y Toro	Netherlands	Koninklijke Philips
China	Huaneng Power	Netherlands	Reed Elsevier Nv
China	Sinopec Shanghai Petrochemical	Netherlands	Unilever
Colombia	Bancolombia	New Zealand	Telecom Corporation Of New Zealand
Denmark	Novo Nordisk	Philippines	Philippine Long Distance Telephone
Finland	Nokia	Portugal	Portugal Telecom
France	Alcatel-Lucent	South Africa	Drdgold
France	Total	South Africa	Anglogold Ashanti
Germany	SAP	South Africa	Gold Fields
Germany	Siemens	South Africa	Harmony Gold Mining Company
Indonesia	Indosat	South Africa	Sasol
Indonesia	Telekomunikasi Indonesia	Spain	Banco Bilbao Vizcaya Argentaria
Ireland	Trinity Biotech	Spain	Banco Santander
Ireland	Allied Irish Banks	Spain	Telefonica
Ireland	Cement Roadstone Holdings	Sweden	Ericsson 'B'
Ireland	Elan	Switzerland	Credit Suisse Group
Israel	Nice Systems	Switzerland	Novartis 'B'
Israel	Teva Pharmaceutical Industries	UK	Vodafone
Italy	Eni Spa	UK	WPP
Italy	Luxottica Group	UK	Astrazeneca
Italy	Natuzzi	UK	Barclays
Italy	STmicroelectronics	UK	BP
Japan	Makita	UK	BT Group
Japan	Canon	UK	Diageo
Japan	Hitachi	UK	Glaxosmithkline
Japan	Honda Motor	UK	HSBC Hdg
Japan	Kyocera	UK	Pearson Plc
Japan	Nippon Telegraph & Telephone Corporation	UK	Reed Elsevier
Japan	Sony	UK	Rio Tinto
		UK	Unilever

Notes: This table lists the Level 2 and Level 3 ADRs with full data between March 1996 and June 2011. These ADRs are used in Chapters 6 and

A.2 Domestic Portfolio

Domestic Firms – Firms with no foreign sales in any year 1996-2010	
Agl Res.Inco.	Intl.Speedway Corp.
Alliant Energy Corp.	Kilroy Realty Corp.
Ameren Corp.	Kohl's Corp.
Aqua America Inco.	Lamar Advr.Co.
Associated Banc-Corp	Lincare Holdings Inco.
AT&T Inco.	Lowe's Companies Inco.
Atmos Energy Corp.	Mack Cali Real.Corp.
Autozone Inco.	Marshall & Ilsley Corp.
Avalonbay Commns.Inco.	McClatchy Co.
BB&T Corp.	MDC Hdg.Inco.
Bed Bath & Beyond Inco.	Mednax Inco.
Bok Finl.Corp.	Mercury General Corp.
Brown & Brown Inco.	Nordstrom Inco.
Cablevision Sys.Corp.	NVR Inco.
Cabot Oil & Gas Corp.	NY.Cmty.Banc.Inco.
CBL & Assocs.Props.Inco.	O'Reilly Autv.Inco.
Centurylink Inco.	Pepco Holdings Inco.
Chico's Fas Inco.	Pinnacle West Cap.Corp.
Cincinnati Finl.Corp.	PNC Finl.Svs.Gp.Inco.
City National Corp.	Protective Life Corp.
Comcast Corp.	Range Res.Corp.
Commerce Bcsh.Inco.	Regency Centers Corp.
Commonwealth Reit	Regions Finl.Corp.
Cons.Edison Inco.	Rite Aid Corp.
Constellation En.Gpin.	Ross Stores Inco.
Cullen Fo.Bankers Inco.	Saks Inco.
CVS Caremark Corp.	Scana Corp.
DR Horton Inco.	Scripps E W Co.(The)
DDR Corp.	SLM Corp.
Dollar Tree Inco.	Southwest Airlines Co.
DPL Inco.	Sprint Nextel Corp.
DTE Energy Co.	Steel Dynamics Inco.
Eagle Materials Inco.	Suntrust Banks Inco.
Equifax Inco.	T Rowe Price Gp.Inco.
Exelon Corp.	Tel.& Data Sys.Inco.
Fannie Mae	Texas Insts.Inco.
Fed.Real.Inv.Tst.	The Cheesecake Fac.Inco.
First Ctzn.Bcsh.Inco.	The Macerich Co.
First Horizon Nat.Corp.	The Ryland Group Inco.
Forest City Ents.Inco.	Torchmark Corp.
Freddie Mac	Tractor Supply Co.
Frontier Comms Corp	UDR Inco.
Fulton Financial Corp.	Unvl.Health Svs.Inco.
General Gw.Props.Inco.	US Bancorp
Great Plains En.Inco.	US.Cellular Corp.
Hcp Inco.	Vornado Realty Tst.
Health Man.As.Inco.	Walgreen Co.
Health Net Inco.	Weingarten Realty Invrs.
Hollyfrontier Corp.	Wesco Financial Corp.
Hospitality Props.Tst.	Wilmington Tst.Corp.
Huntington Bcsh.Inco.	Xcel Energy Inco.
Humana	Zions Bancorporation

Notes: This table lists the firms which have no foreign sales in any year between 1996 and 2010. They form the domestic portfolio in Chapter 5.

A.3 Type 1 Portfolios: The Fastest Internationalisers

40% Foreign Sales Increase from 1996 to 2010	*50% Foreign Sales increase from 1996 to 2010*
Advd.Micro Devc.Inco.	Advd.Micro Devc.Inco.
Apache Corp.	Apache Corp.
Atmel Corp.	Atmel Corp.
Biogen Idec Inco.	Borgwarner Inco.
Borgwarner Inco.	Coca Cola Ents.Inco.
Caterpillar Inco.	Corning Inco.
Celgene Corp.	Ingram Micro Inco.
Coca Cola Ents.Inco.	Jabil Circuit Inco.
Constellation Bns.Inco.	Lam Research Corp.
Corning Inco.	Maxim Integ.Prds.Inco.
Diamond Offs.Drl.Inc	Memc Elt.Materials Inco.
Gilead Sciences Inco.	Nat.Oilwell Varco Inco.
Global Inds.Ltd.	Newmont Mining Corp.
Guess Inco.	Novellus Systems Inco.
Ingram Micro Inco.	Popular Inco.
Integrated Device Tech.	Qualcomm Inco.
Jabil Circuit Inco.	Schlumberger Ltd.
Lam Research Corp.	The Aes Corporation
Maxim Integ.Prds.Inco.	Western Digital Corp.
McDermott Intl.Inco.	Xilinx Inco.
Memc Elt.Materials Inco.	Zebra Techs.Corp.
Nat.Oilwell Varco Inco.	
Newmont Mining Corp.	
Novellus Systems Inco.	
Popular Inco.	
Qualcomm Inco.	
Royal Crbn.Cruises Ltd.	
Schlumberger Ltd.	
Tech Data Corp.	
The Aes Corporation	
The Manitowoc Co.Inco.	
Tidewater Inco.	
Weatherford Intl.Ltd.	
Western Digital Corp.	
Xilinx Inco.	
Zebra Techs.Corp.	

Notes: This table lists firms with an increase of over 40% and over 50% foreign sales between 1996 and 2010. These firms form the portfolios in Chapter 5. The firms underlined are those which appear both in this table in the table of firms with an increase of 6 segments or 3 regions.

5 Segment Increase from 1996 to 2010	*6 Segment Increase from 1996 to 2010*
Abbott Laboratories	Abbott Laboratories
Acxiom Corp.	Acxiom Corp.
Agco Corporation	Agco Corporation
Albemarle Corp.	Albemarle Corp.
Alcoa Incorporated	Alcoa Incorporated
Analog Devices Inco.	Analog Devices Inco.
Atmel Corp.	Atmel Corp.
Biogen Idec Inco.	Corning Inco.
Borgwarner Inco.	Cummins Inco.
Coca Cola Ents.Inco.	Ford Motor Co.
Constellation Bns.Inco.	Gilead Sciences Inco.
Corning Inco.	Idexx Laboratories Inco.
Cummins Inco.	Jabil Circuit Inco.
Ford Motor Co.	Maxim Integ.Prds.Inco.
Gilead Sciences Inco.	Occidental Ptl.Corp.
Global Inds.Ltd.	Perkinelmer Inco.
Harley-Davidson Inco.	Rowan Cos.Inco.
Idexx Laboratories Inco.	The Lubrizol Corp.
Illinois Tool Wks.Inco.	The Manitowoc Co.Inco.
Intel Corporation	
Jabil Circuit Inco.	
Leggett&Platt Inco.	
Maxim Integ.Prds.Inco.	
Memc Elt.Materials Inco.	
Motorola Solutions Inco.	
National Semicon.Corp.	
Newell Rubbermaid Inco.	
Occidental Ptl.Corp.	
Perkinelmer Inco.	
Rowan Cos.Inco.	
The Aes Corporation	
The Lubrizol Corp.	
The Manitowoc Co.Inco.	
Weyerhaeuser Co.	

Notes: This table lists firms with an increase of 5 and 6 segments or more between 1996 and 2010. These firms form portfolios in Chapter 5. The firms underlined also appear in the list of firms with an increase of 50 percent in foreign sales.

2 Region Increase From 1996 to 2010		*3 Region Increase From 1996 to 2010*
Abercrombie & Fitch Co.	Idexx Laboratories Inco.	*Abercrombie & Fitch Co.*
Acxiom Corp.	Illinois Tool Wks.Inco.	Agco Corporation
Adobe Systems Inco.	Ingram Micro Inco.	Albemarle Corp.
Agco Corporation	Jabil Circuit Inco.	Apache Corp.
Albemarle Corp.	Jacobs Engr.Gp.Inco.	Arch Cap.Gp.Ltd.
Alcoa Incorporated	Leggett&Platt Inco.	Avery Dennison Corp.
Analog Devices Inco.	Lexmark Intl.Inco.	Avnet Inco.
Apache Corp.	Lincoln Elec.Hdg.Inco.	Baker Hughes Inco.
Arch Cap.Gp.Ltd.	Mcafee Inco.	Biogen Idec Inco.
Arrow Electronics Inco.	Motorola Solutions Inco.	Celgene Corp.
Atmel Corp.	Newell Rubbermaid Inco.	Constellation Bns.Inco.
Autodesk Inco.	Newmont Mining Corp.	Copart Inco.
Avery Dennison Corp.	Novell Inco.	E*Trade Financial Corp.
Avis Budget Group Inco.	Omnicom Group Inco.	Flowserve Corp.
Avnet Inco.	Oshkosh Corp.	Foster Wheeler Ag
Baker Hughes Inco.	Perkinelmer Inco.	Franklin Resources Inco.
Be Aerospace Inco.	Popular Inco.	Gilead Sciences Inco.
Biogen Idec Inco.	R R Donnelley & Sons Co.	Harley-Davidson Inco.
C R Bard Inco.	Raytheon Co.	Mcafee Inco.
Cardinal Health Inco.	Rein.Gp.Of Am.Inco.	Motorola Solutions Inco.
Caterpillar Inco.	Rockwell Atmtn.Inco.	Newell Rubbermaid Inco.
Celgene Corp.	Rowan Cos.Inco.	Newmont Mining Corp.
Coca Cola Ents.Inco.	Royal Crbn.Cruises Ltd.	Omnicom Group Inco.
Conocophillips	Schlumberger Ltd.	Oshkosh Corp.
Constellation Bns.Inco.	Sealed Air Corp.	Rowan Cos.Inco.
Copart Inco.	Stericycle Inco.	Stericycle Inco.
Covanta Holding Corp.	Stnly.Blk.& Decker Inco.	Stnly.Blk.& Decker Inco.
Cummins Inco.	Teleflex Inco.	Textron Inco.
Dow Chemical Co.	Tetra Technologies Inco.	The Manitowoc Co.Inco.
E*Trade Financial Corp.	Textron Inco.	Weyerhaeuser Co.
Eaton Corp.	The Manitowoc Co.Inco.	Wiley John & Sons Inco.
Emerson Electric Co.	The Walt Disney Co.	
Flowserve Corp.	Transocean Ltd.	
Foster Wheeler Ag	Urs Corp.	
Franklin Resources Inco.	Vulcan Materials Co.	
Gilead Sciences Inco.	Weyerhaeuser Co.	
Global Inds.Ltd.	Wiley John & Sons Inco.	
Harley-Davidson Inco.	Williams Cos.Inco.(The)	
Hess Corp.	Williams-Sonoma Inco.	
	Zebra Techs.Corp.	

Notes: This table lists firms with an increase of 2 and 3 regions or more between 1996 and 2010. These firms form portfolios in Chapter 5. The firms underlined also appear in the list of firms with an increase of 50 percent in foreign sales.

A.4 Type 2 Portfolios: The Most Consistently International Firms

Over 25% Foreign Sales 1996-2010			*Over 50% Foreign Sales 1996-2010*
3M Co.	3M Co.	National Insts.Corp.	3M Co.
Abbott Laboratories	Aflac Inco.	National Semicon.Corp.	Aflac Inco.
Adobe Systems Inco.	Agco Corporation	Nike Inco.	Agco Corporation
Aflac Inco.	Applied Mats.Inco.	Novell Inco.	Applied Mats.Inco.
Agco Corporation	Baker Hughes Inco.	Oceaneering Intl.Inco.	Baker Hughes Inco.
Albemarle Corp.	Colgate-Palm.Co.	Omnicom Group Inco.	Colgate-Palm.Co.
Alcoa Incorporated	Crown Hdg.Inco.	Oracle Corp.	Crown Hdg.Inco.
Allergan Inco.	Dow Chemical Co.	Pall Corp.	Dow Chemical Co.
Amr Corp.	Eastman Kodak Co.	Pepsico Inco.	Eastman Kodak Co.
Analog Devices Inco.	Expeditor Intl.Of Wash.	Pfizer Inco.	Expeditor Intl.Of Wash.
Aon Corp.	Exxon Mobil Corp.	PPG Industries Inco.	Exxon Mobil Corp.
Apple Inco.	Foster Wheeler Ag	Praxair Inco.	Foster Wheeler Ag
Applied Mats.Inco.	Intel Corporation	Pride Intl.Inco.	Intel Corporation
Archer-Danls.-Midl.Co.	Intl.Bus.Mchs.Corp.	Qualcomm Inco.	Intl.Bus.Mchs.Corp.
Arrow Electronics Inco.	Intl.Flavors & Frag.Inco	Sara Lee Corp.	Intl.Flavors & Frag.Inco
Autodesk Inco.	Intl.Rectifier Corp.	Sealed Air Corp.	Intl.Rectifier Corp.
Avery Dennison Corp.	Kla Tencor Corp.	Sigma Aldrich Corp.	Kla Tencor Corp.
Avx Corp.	Manpowergroup	St.Jude Medical Inco.	Manpowergroup
Baker Hughes Inco.	Mcdonalds Corp.	Stnly.Blk.& Decker Inco.	Mcdonalds Corp.
Baxter Intl.Inco.	National Semicon.Corp.	Stryker Corp.	National Semicon.Corp.
Beckman Coulter Inco.	Pall Corp.	Symantec Corp.	Pall Corp.
Becton Dickinson & Co.	Pride Intl.Inco.	Synopsys Inco.	Pride Intl.Inco.
Bmc Software Inco.	The Coca Cola Co.	Techne Corp.	The Coca Cola Co.
Boston Scientific Corp.	The Lubrizol Corp.	Teleflex Inco.	The Lubrizol Corp.
Bristol Myers Squibb Co.	Transocean Ltd.	Terex Corp.	Transocean Ltd.
CA Inco.	Unisys Corp.	The AES Corporation	Unisys Corp.
Cabot Corp.	Johnson Controls Inco.	The Boeing Co.	
Cadence Design Sys.Inco.	Kellogg Co.	The Coca Cola Co.	
Cameron Intl.Corp.	Kimberly-Clark Corp.	The Goodyear Ti.& Rub.Co	
Campbell Soup Co.	Kla Tencor Corp.	The Lubrizol Corp.	
Chevron Corp.	Lexmark Intl.Inco.	The Procter & Gamble Co.	
Colgate-Palm.Co.	Lincoln Elec.Hdg.Inco.	Tidewater Inco.	
Crown Hdg.Inco.	LSI Corp.	Tiffany & Co	
Cummins Inco.	Manpowergroup	Transatlantic Hdg.Inco.	
Cytec Inds.Inco.	Marsh & Mclennan Cos.	Transocean Ltd.	
Diamond Offs.Drl.Inc	Mattel Inco.	Unisys Corp.	
Donaldson Co.Inco.	McDonalds Corp.	United Techs.Corp.	
Dow Chemical Co.	Medtronic Inco.	Varian Med.Sys.Inco.	
Eastman Kodak Co.	Memc Elt.Materials Inco.	Vishay Intecgy.Inco.	
Electronic Arts Inco.	Microsoft Corp.	Weatherford Intl.Ltd.	
Emc Corp.	Molex Inco.	Wiley John & Sons Inco.	
Emerson Electric Co.	Motorola Solutions Inco.	Xerox Corp.	
		Zebra Techs.Corp.	

Notes: This table lists firms with at least 25% and at least 50% foreign sales in every year between 1996 and 2010. These firms form portfolios in Chapter 5. The firms underlined also appear in the list of firms with at least 5 segments or 4 regions.

At Least 4 Segments In Every Year 1996-2010	*At Least 5 Segments In Every Year 1996-2010*
Abbott Laboratories	Applied Mats.Inco.
Altria Group Inco.	Conocophillips
AMR Corp.	Eaton Corp.
Aon Corp.	Edison Intl.
Apple Inco.	Expeditor Intl.Of Wash.
Arch Cap.Gp.Ltd.	Firstenergy Corp.
Archer-Danls.-Midl.Co.	Interpublic Gp.Of Cos.
Atmel Corp.	Mcdermott Intl.Inco.
Becton Dickinson & Co.	Oceaneering Intl.Inco.
Celgene Corp.	Rockwell Atmtn.Inco.
Centerpoint En.Inc	Shaw Group Inco.
Con-Way Inco.	The Boeing Co.
Copart Inco.	
Cummins Inco.	
Dell Inco.	
Delta Air Lines Inco.	
Diamond Offs.Drl.Inc	
Emerson Electric Co.	
Everest Re Gp.Ltd.	
Family Dollar Strs.Inco.	
Flowserve Corp.	
Graco Inco.	
Harman Intl.Inds.Inco.	
Harris Corp.	
Intl.Bus.Mchs.Corp.	
Intl.Rectifier Corp.	
Johnson & Johnson	
Kemper Corp.	
Lincoln Elec.Hdg.Inco.	
Maxim Integ.Prds.Inco.	
Mccormick & Co.Inco.	
Medtronic Inco.	
Nabors Inds.Ltd.	
Nat.Oilwell Varco Inco.	
Novell Inco.	
Novellus Systems Inco.	
Oceaneering Intl.Inco.	
Oracle Corp.	
Pride Intl.Inco.	
Rowan Cos.Inco.	
Royal Crbn.Cruises Ltd.	
Rpm Intl.Inco.	
Scien.Games Corp.	
Shaw Group Inco.	
St.Jude Medical Inco.	
The Clorox Co.	
The Toro Co.	
Trimble Navigation Ltd.	

Notes: This table lists firms with sales in at least 4 and 5 segments in every year between 1996 and 2010. These firms form portfolios in Chapter 5. The firms underlined also appear in the list of firms with at least 50 percent foreign sales in every year.

At Least 3 Regions In Every Year 1996-2010			*At Least 4 Regions In Every Year 1996-2010*
3m Co.	3M Co.	Nat.Oilwell Varco Inco.	3M Co.
Abbott Laboratories	Abbott Laboratories	National Semicon.Corp.	Abbott Laboratories
Adobe Systems Inco.	Air Prds.& Chems.Inco.	Nike Inco.	Air Prds.& Chems.Inco.
Advd.Micro Devc.Inco.	Alcoa Incorporated	Novell Inco.	Alcoa Incorporated
Air Prds.& Chems.Inco.	Autodesk Inco.	Novellus Systems Inco.	Autodesk Inco.
Alcoa Incorporated	Bank Of NY.Mellon Corp.	Oceaneering Intl.Inco.	Bank Of NY.Mellon Corp.
Allergan Inco.	Campbell Soup Co.	Oracle Corp.	Campbell Soup Co.
American Express Co.	Colgate-Palm.Co.	Owens Illinois Inco.	Colgate-Palm.Co.
Ametek Inco.	Corning Inco.	Pall Corp.	Corning Inco.
Amr Corp.	Cytec Inds.Inco.	Pentair Inco.	Cytec Inds.Inco.
Analog Devices Inco.	Diamond Offs.Drl.Inc	Pfizer Inco.	Diamond Offs.Drl.Inc
Aon Corp.	Dover Corp.	Ppg Industries Inco.	Dover Corp.
Apple Inco.	EMC Corp.	Praxair Inco.	EMC Corp.
Applied Mats.Inco.	Estee Lauder Cos.Inco.	Precn.Castparts Corp.	Estee Lauder Cos.Inco.
Arrow Electronics Inco.	Expeditor Intl.Of Wash.	Pride Intl.Inco.	Expeditor Intl.Of Wash.
Auto.Data Proc.Inco.	Interpublic Gp.Of Cos.	Rein.Gp.Of Am.Inco.	Interpublic Gp.Of Cos.
Autodesk Inco.	Oceaneering Intl.Inco.	Rockwell Atmtn.Inco.	Oceaneering Intl.Inco.
Avx Corp.	Oracle Corp.	Rpm Intl.Inco.	Oracle Corp.
Baker Hughes Inco.	Pall Corp.	Sara Lee Corp.	Pall Corp.
Bank Of Ny.Mellon Corp.	Praxair Inco.	Schlumberger Ltd.	Praxair Inco.
Baxter Intl.Inco.	Rockwell Atmtn.Inco.	Sealed Air Corp.	Rockwell Atmtn.Inco.
Beam Inco.	Shaw Group Inco.	Shaw Group Inco.	Shaw Group Inco.
Bemis Co.Inco.	Stryker Corp.	Stryker Corp.	Stryker Corp.
Borgwarner Inco.	Tetra Technologies Inco.	Synopsys Inco.	Tetra Technologies Inco.
Bristol Myers Squibb Co.	The Boeing Co.	Tcf Financial Corp.	The Boeing Co.
Cadence Design Sys.Inco.	The Coca Cola Co.	Terex Corp.	The Coca Cola Co.
Cameron Intl.Corp.	The Lubrizol Corp.	Tetra Technologies Inco.	The Lubrizol Corp.
Campbell Soup Co.	Trimble Navigation Ltd.	Textron Inco.	Trimble Navigation Ltd.
Colgate-Palm.Co.	United Techs.Corp.	The Aes Corporation	United Techs.Corp.
Compuware Corp.	Kla Tencor Corp.	The Boeing Co.	
Conocophillips	Lam Research Corp.	The Coca Cola Co.	
Corning Inco.	Lincoln Elec.Hdg.Inco.	The Lubrizol Corp.	
Crown Hdg.Inco.	Lsi Corp.	The Timken Co.	
Cummins Inco.	Manpowergroup	The Walt Disney Co.	
Cytec Inds.Inco.	Marathon Oil Corp.	Thermo Fisher Scien.Inco	
Danaher Corp.	Marsh & Mclennan Cos.	Thomas & Betts Corp.	
Diamond Offs.Drl.Inc	Maxim Integ.Prds.Inco.	Tiffany & Co	
Donaldson Co.Inco.	Mccormick & Co.Inco.	Transatlantic Hdg.Inco.	
Dover Corp.	Mcdermott Intl.Inco.	Transocean Ltd.	
Dow Chemical Co.	Mcdonalds Corp.	Trimble Navigation Ltd.	
Dst Sys.Inc	Medtronic Inco.	United Techs.Corp.	
Eastman Kodak Co.	Memc Elt.Materials Inco.	Vishay Intecgy.Inco.	
Eaton Corp.	Murphy Oil Corp.	Western Digital Corp.	

Notes: This table lists firms with sales in at least 3 and 4 regions in every year between 1996 and 2010. These firms form portfolios in Chapter 5. The firms underlined also appear in the list of firms with at least 50 percent foreign sales in every year.

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