International Diversification and the Home Bias Puzzle: The Role of Multinational Companies (MNCs)

By

Jenny Berrill[1] and Colm Kearney[2]

Abstract

By investing in internationalised firms that are listed on the exchanges in their home countries, investors can reap the benefits of diversification without directly incurring the costs and risks associated with internationalisation at the level of the firm. The observed 'home bias' phenomenon can thus be consistent with optimal international diversification. To demonstrate this, we construct a multi-country, firm-level sample of 1,289 firms from 7 countries, we classify their internationality from the geographical spread of their sales and subsidiaries, and we measure their performance using daily firm-level and market-level data from January 1999 to June 2007. Applying mean variance spanning and Sharpe ratio tests to determine and measure the statistical and economic significance of the diversification benefits of investing in MNCs, we show that there are benefits to both domestic and international diversification and that the types of firm that provide these benefits varies between countries. When we combine across all countries, we get strong and robust results that MNCs with global sales and subsidiaries provide the largest benefits to diversification. Overall, our work contributes to understanding the dimensions of, and resolving the 'home bias' puzzle.

Keywords
MNCs, international portfolio diversification, home bias, mean variance spanning

JEL Classification
F21, F23, G11

Contact Details
[1]Institute for International Integration Studies, Trinity College, Dublin 2, Ireland. Tel: 353-1-896-3888. Fax: +353-1-896-3939, Email: berrilj@tcd.ie

[2]School of Business Studies and Institute for International Integration Studies, Trinity College Dublin, Ireland. Tel: 353-1-8961774, Email: colm.kearney@tcd.ie, Homepage: www.internationalbusiness.ie

1. Introduction

Enhanced integration throughout the world's commodity, service and financial sectors has created expanding opportunities for both firms and investors to reap the synergistic gains from internationalisation. Firms have responded by internationalising their activities across greater geographical and cultural distances by trading, forming alliances, licensing, joint venturing and foreign direct investment (FDI). Given their financial, knowledge and management resources, they choose the patterns of internationalisation that maximize their risk-adjusted expected returns net of expected costs (see Caves (1971) and Dunning (1980, 1988)). The extent to which firms create value by successful internationalisation remains a controversial issue, with many studies finding contradictory results (see Doukas and Lang (2003) for a review). Investors have responded by holding greater proportions of more geographically and culturally distant foreign assets in their portfolios. In a world with perfect markets, the international capital asset pricing model (ICAPM) of Sharpe (1964) and Linter (1965) predicts that investors will hold the world market portfolio. Interestingly, however, the extent to which investors diversify internationally remains significantly less than many financial analysts and researchers believe should be observable. This is the so-called 'international diversification puzzle', also called the 'home-bias puzzle'. It arises because although the benefits of international portfolio diversification are significantly positive, and although the costs and risks associated with achieving them appear small relative to those associated with internationalising at the level of the firm, investors continue to hold the majority of their financial portfolios in domestic rather than international assets.

The observed home bias of portfolio investors appears to be inefficient, but the literature offers a variety of explanations for the phenomenon including transaction costs, taxes, information asymmetries, currency risk, legal restrictions, political risk and other controls. For example, French and Poterba (1991) show that investors in Japan and the United States exhibit home bias by expecting domestic returns to exceed those on a diversified portfolio. Tesar and Werner (1995) show that geographical proximity, language compatibility and trade links are more important than correlation structures for international portfolio

investors. Baxter and Jermann (1997) attribute home bias to investors hedging the risks associated with their non-traded human capital. Coval and Moskowitz (1999) demonstrate 'local bias' amongst United States investment managers. Hasan and Simaan (2000) and Ahearne, Griever and Warnock (2004) show how home bias results from poor or costly information and/or information asymmetries. Overall, it is widely agreed that home bias continues to exist despite the benefits of international diversification, and that it results from investor preferences at least as much as from market imperfections (see *inter alia*, French and Poterba (1991), Cooper and Kaplanis (1994) and Tesar and Werner (1995), Portes and Rey (1998, 2005), Wei (2000), Portes, Rey *et al* (2001), Karolyi and Stulz (2002), Guerin (2006), and Rosati and Secola (2006)).

In this paper, we consider an alternative explanation of the observed home bias puzzle. Combining the resources of Datastream, Dunn and Bradstreet's Who Owns Whom, and the Worldscope databank, we construct a sample of 1,289 firms from Britain, Canada, France, Germany, Italy, Japan and the United States. Our sample comprises all firms listed on the countries' exchanges (the FTSE 100, the TSX 60, the SBF 120, the HDAX 110, the MIB-SGI 174, the Nikkei 225 and the S&P 500). We provide a detailed classification of the multinationality of these firms' operations from the geographical spread of their sales and their subsidiaries, and we measure their performance using 2217 observations of daily firm-level and market-level data from 1 January 1999 to 30 June 2007. Using this multi-country, firm-level dataset, we examine the extent to which investors can gain international diversification without having to invest in foreign markets. By investing in internationalised firms that are listed on the exchanges in their home countries, investors may be able to 'free ride' the costs and risks associated with internationalisation at the level of the firm by reaping the benefits directly from internationalised firms. Both Dahlquist and Robertson (2001) and Cai and Warnock (2004) show that investors tend to favour large internationalised firms. The literature on whether investing in multinational companies (MNCs) yields investors the benefits of international portfolio diversification, however, produces mixed results. Hughes, Logue and Sweeney (1975), Agmon and Lessard (1977), Mikhail and Shawky (1979), Logue (1982), Errunza, Hogan and Hull (1999) and Cai and

Warnock (2004) all conclude that investing in MNCs can yield international diversification benefits to domestic investors. By way of contrast, however, Jacquillat and Solnik (1978), Senchack and Beedles (1980), Brewer (1981), Fatemi (1984), Michel and Shaked (1986), Mathur, Singh and Gleason (2001), Salehizadeh (2003) and Rowland and Tesar (2004) all conclude the opposite. We show that these conflicting results are due to inconsistencies in how researchers have classified MNCs in their empirical studies. Building on Aggarwal, Berrill and Kearney (2007), we provide a robust classification of the firms in our sample that allows us to examine how domestic investors can reap the benefits of international diversification in a manner that is consistent with the observed home bias phenomenon being part of an optimal investment strategy.

Our paper has a number of novel features. *First*, our classification of the degree of multinationality of MNCs allows us to provide a deeper analysis than has appeared in the literature to date of the types of firm that provide diversification benefits to investors. Classifying the firms in our sample as 'domestic', 'regional', 'trans-regional' or 'global', we construct investment portfolios from the firm-level characteristics that allow us to examine the benefits of diversification at various degrees of internationality. *Second*, existing studies of the diversification benefits of investing in MNCs (such as Huberman and Kandel (1987), Bekaert and Urias (1996) and Errunza, Hogan and Hull (1999)) typically examine the question from a United States perspective. The United States has one of the most diversified economies and one of the most developed stock markets in the world, and is unlikely to yield results that apply to representative investors in other countries. Following Rowland and Tesar (2004) who take the viewpoint of investors in each of the G7 countries, we also apply our methodology to the perspective of investors in each country. *Third*, using mean variance spanning tests to calculate the statistical significance of differences in portfolio performance, and using changes in Sharpe ratios to measure the economic significance of such differences, we examine the diversification benefits to investing in various types of MNC, considering in turn the case of frictionless markets in which investors can short sell assets without costs, and the case where there are short selling constraints. Although it is likely that short selling restrictions are relevant in this

context, previous studies have not considered how the introduction of short selling constraints affects their results. *Finally*, unlike previous studies that have focussed exclusively on the advantages of international diversification by using some market index or a sample of arbitrarily defined domestic firms to represent the domestic market, our approach allows us to establish and test a richer set of hypotheses about the extent to which the benefits of diversification are consistent across countries at the 'regional', 'trans-regional' and 'global' levels of internationality, and whether investors in one country can obtain better diversification benefits by investing in 'domestic' of international firms in other countries.

Amongst our main findings are the following. *First*, domestic diversification has varying benefits across countries that have been neglected heretofore in the home bias literature. In Britain, France and Germany, for example, domestically quoted firms have lower correlations with each other than the domestic market index has with foreign market indices. Our results from 174 mean variance spanning tests on domestic diversification fail to reject spanning in only 7 of these tests, confirming the existence of domestic diversification benefits in almost all cases. *Second*, when we classify all firms on a scale of 'domestic', 'regional', 'trans-regional' and 'global', the types of firms that provide diversification benefits vary across countries. *Third*, when we combine each category of firm across all countries, however, we find that firms with global sales and global subsidiaries provide the largest benefits to diversification. This finding is both intuitive and robust, and it demonstrates that when the empirical analysis is done methodically in a way that recognises differences in multinationality across firms and countries, investors can indeed exhibit home bias while reaping the benefits from international diversification.

The remainder of this paper is structured as follows. We outline our system for measuring the degree of multinationality in section 2. In section 3, we describe our dataset and methodology. We present our results in section 4. Finally section 5 summarises our argument and draws together our main conclusions.

2. Measuring the degree of internationality

Previous researchers on whether MNCs provide the benefits to international portfolio diversification have adopted pragmatic approaches to creating their empirical MNC samples, depending on the specific enquiry, past usage and data availability. MNCs have consequently been defined in empirical studies on the basis of characteristics such as the level (or percentage relative to total) of foreign assets, foreign investments, foreign production and foreign sales, to name but a few. A wide variety of different types of firm have therefore been included in their samples, and this has caused confusion in interpreting the results. This in turn has led to confusion over the nature and extent of the 'home bias' puzzle in international portfolio investment allocation studies.

Building on Aggarwal, Berrill and Kearney (2007), we use 6 high-level categories to describe the characteristics of any firm. These are as follows (with a suggested measure or nomenclature in brackets):

1. Legal type (public, private listed, private unlisted),
2. Industry (NAICS codes),
3. Age (date of incorporation),
4. Size (assets, employees, revenue, sales),
5. Location (country of headquarters), and
6. Dispersion of operations (number of countries and/or regions).

We focus on the sixth and final category here. To create our classification system, we use two dimensions of multinationality: *breadth* and *depth*. In order to implement our *breadth* dimension of multinationality, we divide the world into regions. We use 6 regions, based on the inhabited continents: Africa, Asia, Europe, North America, Oceania and South America. Any division of the world into regions will be to some extent arbitrary, but we argue that a regional definition based on the continents is the best approach. It includes all countries in the world, and is based on the geographical rather than the political map of the world, because political boundaries and groupings change over time. We measure the *breadth* of multinationality as the extent of geographical spread across the world using 4

broad categories: domestic, regional, trans-regional and global. An activity associated with a corporation that takes place entirely within the home country is referred to as domestic (*D*). An activity that takes place within the region in which the firm is headquartered is referred to as regional (*R*). For example, a British corporation that is headquartered in London and sells its products throughout Europe is classified as *R*. We further delineate *R* into 3 categories, *R1* (less than one-third of the countries in a region), *R2* (between one-third and two-thirds of the countries in a region) and *R3* (more than two-thirds of the countries in a region). If our British corporation sells its products in one or two countries in Europe, its sales would be classified as *R1*, but if it exports throughout Europe (and not elsewhere), it would be classified as *R3*. This scale of regionality could be more or less finely delineated, and our 3-point inter-regional divide is designed to be a sensible and workable compromise between simplicity and complexity. An activity associated with a firm that takes place in more than one region (but not fully global) is defined as trans-regional (*T*), and this category is further subdivided into *T2* (two regions), *T3* (three regions), *T4* (four regions) and *T5* (five regions). Finally, an activity that takes place in all six regions of the world is classified as 'global' (*G*).

We measure the *depth* of multinationality by focussing on the various contractual arrangements that firms commonly engage in as they internationalize. Traditional theories of the internationalisation process describe the stages of a firm's expansion into foreign markets. This process is typically described as a large, well-established domestic firm that begins its internationalisational process by exporting, followed by the development of a foreign division and perhaps the establishment of a fully global firm (see, for example, Aharoni (1966), Bilkey and Tesar (1977), Stopford and Wells (1972)). Our measure of the depth of multinationality uses three broad categories of depth: *trading*, *alliances* and *investments*. *Trading* involves sales and purchases made by the firm. At this relatively 'shallow' level, firms have some degree of exposure to foreign markets, but overall penetration is limited. *Alliances*, such as licensing and franchising, involve a greater depth of engagement in foreign markets insofar as firms engaging in these activities have made a greater commitment to a foreign country, usually by engaging agents to operate on their

behalf. *Investments*, such as joint ventures and subsidiaries, entail a deep engagement with foreign markets and a high exposure to other countries' business, economic and political risks.

Combining the breadth and depth dimensions of multinationality yields a *3 x 9* matrix (presented in Table 1) that allows us to classify any type of MNC in terms of the breadth and depth of the multinationality of its operations. In our alpha-numeric shorthand for classifying firms the depth dimension comes first, with *T* denoting trading, *A* alliances and *I* investments. The breadth dimension comes second, with *D* denoting domestic, *R* regional, *T* trans-regional, and *G* global. Our *3 x 9* matrix of multinationality thus allows us to classify a large number of firms, ranging from purely domestic firms (*TD-AD-ID*) that carry out all their trading activities, alliances and investments entirely within their home countries, to deeply global MNCs (*TG-AG-IG*) that have trading activities, alliances and subsidiaries in all regions of the world. For ease of exposition, and for consistency with our application of the taxonomy to our analysis, we simplify our *3 x 9* matrix of multinationality in Table 1. We first simplify the breadth measure by combining the three 'within-region' decompositions (*R1*, *R2* and *R3*) and the 4 trans-regional groups (*T2*, *T3*, *T4* and *T5*) to reduce the breadth categories from 9 to 4; *D*, *R*, *T* and *G*. We then remove the 'alliances' depth of engagement and focus only on the two depths of engagement, *T* and *I*. This results in the 2 *x 4* matrix of multinationality shown below.

	Breadth of Geographical Spread			
Depth of Engagement	*Domestic*	*Regional*	*Trans-regional*	*Global*
Trading	*TD*	*TR*	*TT*	*TG*
Investments	*ID*	*IR*	*IT*	*IG*

This *2 x 4* matrix allows us to classify 16 different types of firm in terms of their multinationality, ranging from purely domestic firms (*TD-ID*) that carry out all their trading activities and investments entirely within their home countries, to deeply global MNCs (*TG-IG*) that have trading activities and subsidiaries in all regions of the world. In between

these extremes, we can classify 14 types of firm in terms of the breadth and depth of their multinationality. These are presented in Table 2, which describes eight types of regional and trans-regional firms (numbered 2 to 9) and seven types of global corporation (numbered 10 to 16).

Looking first at the eight regional and trans-regional firms numbered 2 to 9 in Table 2 we can differentiate between firms that have increasingly broad but shallow patterns of internationalisation (firms 2 – 3), and those that are more deeply engaged with foreign markets (firms 4 – 9). One would not expect a type 4 firm (*TD-IR*) with domestic trading and regional investments to deliver the same international diversification benefits as a type 9 firm (*TT-IT*) with trans-regional sales and subsidiaries. But this is precisely what many researchers assume when they combine these firms in their data sets - along with purely domestic firms (*TD-ID*) and deeply global MNCs (*TG-IG*)! Looking next at the seven global MNCs numbered 10 to 16 in Table 2, they can be global in their trading (firms 10 – 12), their investments (firms 13 – 15), or both (firm 16). Firm 10 (*TG-ID*) is shallowly global and deeply domestic, whereas firm 12 (*TG-IT*) is shallowly global and deeply trans-regional. Once again, the main point is that even global MNCs can be very different. It is possible that a type 10 firm (*TG-ID*) could be a relatively small and young born global or International New Venture (INV), but it is unlikely that this type of firm would be found amongst the deeply global firms of type 13 – 16.

3. Data and Methodology

We use daily firm level data from 1 January 1999 to 30 June 2007, for all firms listed on the following indices in the G7 countries – the S&P 500, the FTSE 100, the Nikkei 225, the TSX 60, the HDAX 110, the SBF 120 and the MIB Storcio General Index (174 firms). We use data on the geographical breakdown of each firm's sales and subsidiaries to classify firms using our system. The sales data is obtained from the Worldscope databank and the subsidiary data is obtained from Who Owns Whom by Dunn and Bradstreet. We gather daily data on the market value of each firm from Datastream. We use our sales and

subsidiary categorisations to create market capitalisation weighted indices of firms in each category. We calculate market capitalisation indices using a similar methodology to that of the S&P 500 and the FTSE 100. The value of the index each day is calculated using the following formula:

$$IndexValue = \frac{\sum_{i=1}^{n} MV_{it}}{\sum_{i=1}^{n} MV_{ib}} \times 100 \qquad (1)$$

where MV_{it} is the market value of firm *i* at time *t*, MV_{ib} is the market value of firm *i* at the base year and *n* is the number of firms in the index. This leads to the creation of up to 8 indices in each country (domestic, regional, trans-regional and global in terms of sales and domestic, regional, trans-regional and global in terms of subsidiaries). We also create aggregate market value weighted indices of *all* domestic, *all* regional, *all* trans-regional and *all* global firms (from all of the G7 countries combined together) in each currency. We analyse the sales and subsidiary indices separately. We use the index values to calculate the daily returns for each index. Any firm with missing market value data is excluded from the index calculation. We use 3-month Treasury Bill rates as the risk free rate in each country.

Several methods have been used within the literature to assess how useful MNCs are in providing the benefits to international portfolio diversification. These methods include using the (international) market model to investigate the influence of domestic and foreign market indices on individual shares, comparing the risk adjusted performance of MNCs and domestic firms, comparing firms on the basis of returns, standard deviations, betas, coefficients of variation, and performance measures such as the Sharpe, Treynor and Jensen measures, and more recently, mean variance spanning tests. We first analyse both the statistical and economic significance of the diversification benefits. We use mean variance spanning tests to calculate the statistical significance. In doing this, we use the regression tests for mean variance spanning developed by Huberman and Kandel (1987), De Roon, Nijman and Werker (2001) and De Roon and Nijman (2001).

To construct the mean variance spanning tests, we examine whether adding *n* new assets to a given set of *k* benchmark assets leads to a significant shift in the mean-variance frontier. In the case of frictionless markets, the test can be performed using the following regression

$$r_{t+1} = \alpha + \beta R_{t+1} + \varepsilon_{t+1} \tag{2}$$

with the usual distribution assumptions. These assumptions include that returns are independent and identically distributed. In equation (2), r_{t+1} is an *n*-dimensional column vector with *n* returns on the additional assets, R_{t+1} is a *k*-dimensional return vector for the *k* benchmark assets, α is an *n*-dimensional constant term, β is an *n* x *k* matrix of slope coefficients, and ε_{t+1} is an *n*-dimensional vector with zero expectation error terms. In this case, the null hypothesis that the *k* benchmark assets span the entire market of all *k* + *n* assets is equivalent to the joint restriction that:

$$\alpha = 0 \text{ and } \beta\iota_k = \iota_n \tag{3}$$

where ι_k is *k*-dimension vector of ones and ι_n is an *n*-dimensional vector of ones. If (3) holds, the return on each additional asset can be decomposed into the return on a portfolio of benchmark assets plus a zero-expectation error term that is uncorrelated with the benchmark portfolio return. Thus, in the case of mean variance spanning, such an additional asset can only add to the variance of the portfolio return and not to the expected return, and investors will not include the additional asset in their portfolio. This implies that, if the spanning hypothesis holds, the optimal mean-variance portfolio consists of only the *k* benchmark assets. We estimate equation (2) using OLS and the *2n* restrictions in equation (3) are tested using a Wald test. When short selling constraints are introduced, similar regression equations to (2) and (3) are used, but with inequality constraints. We follow the approach of De Roon, Nijman and Werker (2001). In the case of short selling constraints,

the power of the spanning test may be low in small samples. We use 8.5 years of daily data in order to minimise these small sample problems.

The null hypothesis is that the mean variance portfolio frontiers coincide at all points. If the null hypothesis of spanning is rejected, however, this does not provide information about the magnitude of the shift in the efficiency frontier. We measure the economic significance of the diversification benefits using changes in the Sharpe (1966) ratio of the optimal portfolios. We 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), both in the case of frictionless markets and in the case of short selling constraints. The efficient portfolio is identified by solving the following maximisation problem:

$$Max\theta \equiv \frac{\overline{R_P} - R_f}{\sigma_P} = \sum_{i=1}^{N} x_i \left(\overline{R_i} - R_f\right) \Bigg/ \left[\sum_{i=1}^{N}\sum_{j=1}^{N} x_i x_j \sigma_{ij}\right]^{1/2}$$

$$\text{subject to } \sum_{i=1}^{N} x_i = 1 \text{ (and } x_i > 0 \text{ when short sales are not allowed)} \qquad (4)$$

where x_i = the fraction of the portfolio invested in the *ith* index,

$\overline{R_i}$ = the expected return on the *ith* index,

$\overline{R_P}$ = the expected return on the portfolio,

R_f = the risk-free rate,

σ_{ij} = the covariance of returns between the *ith* and *jth* index,

σ_P = the standard deviation of returns on the portfolio.

Note that θ in equation (4) is the ex ante Sharpe (1966) ratio. As shown by Tobin (1958), the composition of the tangency portfolio is independent of investors' preference structure. A difference between the Sharpe ratios of the benchmark and extended set assets indicates

that investors can increase their risk-return trade off by investing in the *n* additional assets. If there is spanning, then there is no improvement in the Sharpe ratio possible by including the additional assets in the portfolio.

4. Results

Preliminary analysis

We classify each firm from the G7 market indices in terms of the multinationality of their sales and subsidiary data. Table 3 shows the number of firms from each market index falling into each category in terms of their sales data (Panel A) and their subsidiary data (Panel B). The percentage of firms classified as purely domestic in terms of their sales data ranges from 5% of German firms to 30% of Italian firms. The percentage of firms classified as purely domestic in terms of their subsidiaries ranges from 5% of German firms to 36% of Italian firms. In the US, 29% of firms are classified as domestic in terms of their sales and 18% in terms of their subsidiaries. These market indices are commonly used in empirical analysis to represent domestic firms and the domestic economy. The amount of firms classified as purely domestic in sales and subsidiaries are low, however, with on average 20% of firms classified as domestic in terms of sales and 17% in terms of subsidiaries. These data suggest that while market indices are a good measure of the domestic stock market, they may not be a good measure of the domestic economy and economic activity within the domestic market. They also show that each market index differs in how appropriately it represents domestic factors. At the other end of the spectrum, Germany has the highest percentage of global firms (27%) using subsidiary data, followed by the UK (21%). Canada has the lowest at 2%. In terms of the sales classifications, the percentage of global firms ranges from 8% for the UK to zero for Canada and Japan. In all indices, with the exception of the MIB subsidiary classifications, the majority of firms are classified as trans-regional – on average 73% of firms across the 7 indices are classified as trans-regional in their sales and 59% are classified as trans-regional in their subsidiaries. These data demonstrate that domestic market indices and domestically quoted firms are exposed to international influences.

The percentage of firms classified as global in terms of their subsidiaries is higher in all countries than the percentage of firms classified as global in terms of their sales data. This likely points to limitations in the accounting (sales) data which may fail to adequately capture the breadth of multinationality. Most firms use arbitrarily defined geographical areas when classifying accounting variables, including categories such as 'Other' and 'Rest of the World'. Accounting data, therefore, may not detail activity in all geographical regions. The subsidiary data provide a better measure of the breadth of multinationality. The subsidiary data, however, categorise firms based on the existence of a subsidiary in a region regardless of the size or activity levels of that subsidiary. Both sets of data, therefore, are subject to limitations. This is unavoidable as any variable used to measure a firms' multinationality is subject to similar shortcomings. Our matrix of multinationality uses both accounting and non-accounting data in an attempt to address this issue.

The performance of each category of firm is compared using Sharpe (1966) ratios in each currency. Using the sales categorisations, although the ordering varies, the 5 best performing indices in each currency are the Canadian Domestic, French Domestic, Canadian Regional, French Regional and Canadian Trans-regional firms. With the subsidiary data, the best performing index in each currency is the German Domestic index, followed by the French Regional index. Other subsidiary indices that feature within the top 5 lists are the Canadian Domestic, Canadian Trans-regional, Canadian Global, Italian Regional, UK Regional and French Domestic indices. The Sharpe ratios of the market indices corroborate these results. The TSX index has the highest Sharpe ratio (0.02785), followed by the SBF (0.01786), HDAX (0.0178), Nikkei (0.01539), MIB (0.01172), S&P (0.00563) and the FTSE (-0.00108). The FTSE has a negative Sharpe ratio as its return over the period was less than the risk-free rate. In all countries, the 5 best performing individual indices have higher Sharpe ratios than any of the market indices used in the analysis. No clear pattern emerges, however, in terms of the best performing category of firms (domestic, regional, trans-regional or global) across the G7 countries. To further investigate the issue, we calculate the Sharpe ratios in each currency for the aggregate indices (indices of *all* domestic, *all* regional, *all* trans-regional and *all* global firms from each of the G7

countries combined). In all 5 currencies, the best performing aggregate sales index is the global index, followed by the domestic, trans-regional and regional indices. The best performing aggregate subsidiary index in 4 out of 5 currencies is the regional index, followed by the domestic, trans-regional and global indices (this ordering changes to domestic, regional, trans-regional and global in yen).

The benefits to portfolio diversification are initially analysed using correlation structures. We calculate the correlation coefficient (in each domestic currency) between each market index and the other 6 markets and get the average of these figures. These correlations are detailed in Table 4. The average correlation between the Nikkei 225 and the other 6 market indices is 0.2019. The average correlations with the foreign market indices in our sample for the other market indices are as follows: Nikkei 225 (0.2019), S&P 500 (0.3468), TSX 60 (0.3621), MIB Storcio General (0.5043), FTSE 100 (0.5355), HDAX 110 (0.5833) and SBF 120 (0.608). The Nikkei index is the least correlated with the other indices suggesting that Japanese investors benefit most from diversification within the G7 countries. European investors benefit least from international diversification within the G7 countries. The individual correlations in Table 4 suggest that geographical proximity has a strong influence on the relationship between markets. The US and Canada have the highest correlations with each other while European markets are also highly correlated with each other. Japan has the lowest correlation with each of the other countries, apart from Italy, which is least correlated with the S&P 500.

The correlations between each category of firm (domestic, regional, trans-regional and global) and each foreign market index appear in Table 4. We also show the average correlation of each category of firm with the 6 foreign indices in the sample. Looking at the sales indices, the trans-regional firms in all countries are the most highly correlated with the foreign market indices. Domestic firms are the least correlated with foreign market indices in all countries except the US and Italy. Italy provides an unusual case in that global firms are the least correlated with foreign market indices. With the subsidiary indices, the Italian global index is again the least correlated with foreign markets. In Canada and the US, the

domestic index is the least correlated with foreign markets while in all other markets, the regional index is the least correlated with foreign markets. Global firms are the most highly correlated with foreign market indices in both Japan and Germany, while in all other countries trans-regional firms are the most highly correlated with the foreign markets. Table 4 also illustrates the correlations between each category of firm and its domestic market index. Results in this area need to be interpreted with caution, however, as each category of firm is a subset of its domestic market index, with trans-regional firms making the largest subsets in most countries. The trans-regional sales index is the most highly correlated with the domestic market index in all countries. The trans-regional subsidiary index is the most highly correlated with the domestic market index in the US, Canada, Japan and the UK. The global subsidiary index is the most highly correlated with the domestic market index in Germany and France and in Italy the regional index is most highly correlated with the domestic market index. In all countries, all categories of firms are more highly correlated with the domestic index than with any foreign index, with the following exceptions: the German domestic, French regional and all Italian sales indices and the German regional, and all Italian subsidiary indices.

We initially investigate the benefits from domestic diversification by comparing domestic and international correlation coefficients. We calculate the average correlation coefficient between the domestic, regional trans-regional and global indices in each country (separately for both sales and subsidiary indices). This gives an indication of the diversification benefits available in domestic markets as it measures the relationship between different categories of firms quoted domestically. We compare the average correlation coefficient between each category of domestically quoted firm with the international market correlations. In the US and Japan, domestically quoted firms (in both sales and subsidiaries) have lower correlations with the international market indices than with each other, suggesting that the benefits to domestic diversification for US and Japanese investors are limited. The average correlation of domestically quoted firms (within each market) classified by sales is lower than the average correlation of the domestic market index with the other G7 market indices in the UK, France, Germany and Italy. The average correlation

of domestically quoted firms classified by subsidiaries is lower than the average correlation of the domestic market index with the other G7 market indices in the UK, Canada, France and Germany. These preliminary results imply that there are benefits to domestic diversification and MNCs are useful in providing these benefits.

Mean-Variance Spanning Tests of Domestic Diversification

Mean variance spanning tests typically involve using domestic firms as the benchmark set and MNCs as the extended set. In our analysis, we perform several tests using our various categories of firms. We begin by analysing the types of domestically quoted firms that provide diversification benefits to investors in each of the G7 countries. We run up to 32 tests on domestic diversification (16 using sales and 16 using subsidiary indices) in each country. We first use our index of domestic firms as the benchmark set and perform tests using regional, trans-regional, global, and various combinations of these firms as the extended sets. We also perform tests using regional and trans-regional firms as the benchmark sets and in each case, use the remaining indices and combinations of these indices as the extended sets. In total, we perform 174 mean variance spanning tests on domestic diversification. We reject spanning in all tests, with the following 7 exceptions. In the US, we fail to reject spanning in 4 cases using our indices classified on the basis of sales data. We fail to reject spanning in tests where domestic firms are used as the benchmark set and regional firms, global firms and a portfolio of regional and global firms are the extended set. We also fail to reject spanning when the benchmark portfolio contains domestic and regional firms and the extended set contains global firms. When US firms are classified based on subsidiary data, we fail to reject spanning when domestic and regional firms comprise the benchmark set and trans-regional firms the extended set. In the case of French subsidiary indices, we fail to reject the hypothesis that global firms span a portfolio of domestic and regional firms and that global firms span a portfolio of domestic, regional and trans-regional firms. In all other tests for all countries, we reject spanning for all hypothesis using both sales and subsidiary indices.

In cases where we reject spanning, we use changes in the Sharpe ratio of the optimal portfolios as a measure of the benefits from diversification. We rank tests based on improvements in the Sharpe ratios for investors in each of the G7 countries. No clear patterns emerge, however, in terms of the types of firms that provide the greatest benefits to domestic diversification. To further investigate the issue, we use the aggregate index of all domestic firms (from all the G7 countries combined) as the benchmark portfolio and the remaining aggregate indices as the extended sets. We perform tests from the point of view of investors in each country and analyse the sales and subsidiary indices separately. In the case of frictionless markets, we reject the hypothesis of spanning in most tests with the following exceptions. In the case of the US and the UK, we fail to reject the hypothesis that all trans-regional firms (in terms of their subsidiaries) span all domestic firms. In the case of Japan and France, we fail to reject the hypothesis that all trans-regional firms and all global firms (in terms of their subsidiaries) span all domestic firms. For all other tests, we reject the hypothesis of spanning. The Sharpe ratio tests produce consistent results across all countries. In all countries, when short sales are not allowed, the global sales index is the only index with a non-zero increase in Sharpe ratio. When short sales are allowed, the global sales index shows the largest increase in Sharpe ratio, followed by the regional sales index and the trans-regional sales index in all countries. When short sales are allowed, the subsidiary indices show similar results. The global subsidiary index (from all the G7 countries combined) is the best performing index in all countries, followed by the trans-regional and regional indices. When short sales are not allowed, the regional subsidiary index is the only index with a non-zero increase in Sharpe ratio in all countries. These results show that firms with global sales and global subsidiaries (when short sales are allowed) provide the greatest benefits to diversification.

Mean-Variance Spanning Tests of International Diversification

We next turn to the issue of international portfolio diversification. We first test the benefits from international diversification for an investor in each of the G7 countries. We use the domestic market index as the benchmark portfolio and individual international market indices as the extended sets. In the UK, we fail to reject the hypothesis that the HDAX

spans the FTSE index. In all other tests, however, we reject spanning confirming that the benefits to international diversification exist for investors within the G7 countries. The Sharpe ratio tests show that in all countries except Canada, the TSX provides the greatest benefits both when short sales are and are not allowed. In Canada, when no short sales are allowed, there are no improvements in the Sharpe ratios by adding any of the other foreign market indices, again pointing to the strong performance of the TSX index. The HDAX and SBF are strong performers in all markets, with the exception of Canada. In Japan, the US and the UK, the 4 best performing indices, both with and without short sales, are the TSX, SBF, HDAX and MIB indices.

In order to provide a more in-depth analysis of where these benefits lie, we test the types of firms that provide diversification benefits to investors in each country. We again use the domestic market index as the benchmark portfolio. The extended sets consist of domestic, regional, trans-regional and global portfolios from each country (classified individually using sales and subsidiaries). We perform 306 mean variance spanning tests. We reject spanning in all tests with the following 10 exceptions. In the case of the UK, we fail to reject the hypothesis that the German Trans-regional and French Trans-Regional firms (in terms of sales) span the FTSE and that German Trans-regional, German Global and French Trans-regional firms (in terms of subsidiaries) span the FTSE. In the case of France, we fail to reject the hypothesis that German Trans-regional firms (in terms of sales) span the SBF and that German Trans-regional and German Global firms (in terms of subsidiaries) span the SBF. In the case of Italy, we fail to reject the hypothesis that French Global firms (both in terms of sales and subsidiaries) span the MIB index. In all other tests for all countries, we reject spanning.

We measure diversification benefits based on changes in the Sharpe ratios of the optimal portfolios. Table 5 details results from the US perspective. To conserve space, results for the other G7 countries are omitted here but are available from the authors upon request. Results for the US sales indices show that US investors attain the highest benefits by investing in domestic Canadian firms. High benefits are also achieved by investing in

regional and trans-regional Canadian firms and domestic and regional French firms. In terms of the subsidiary indices, US investors achieve the highest benefits by investing in domestic German firms, regional French and regional UK firms. Sharpe ratio tests for Canadian investors show that, with no short sales, combining any of the other 6 foreign market indices with the TSX index does not lead to an improvement in economic performance. There are benefits to be achieved, however, not by investing in foreign market indices but rather by distinguishing different types of firms internationally. The greatest increase in Sharpe ratio is obtained by including French firms with domestic sales in a portfolio with the TSX. French regional and German domestic firms also provide large benefits. The subsidiary analysis shows that the greatest benefits are achieved by including German firms with domestic subsidiaries in a portfolio with the TSX. French and UK regional firms also perform strongly. When short sales are allowed, results are similar. The most notable difference is the S&P500 index, which provides no economic benefits in the absence of short sales but significant benefits when short sales are allowed.

Tests using market indices show that German investors benefit most by investing in Canadian and French markets when no short sales exist and Canadian and UK markets when short sales are allowed. The firm level analysis supports these results. In terms of the sales indices, German investors benefit most by investing in French domestic and regional firms and all Canadian firms. Canadian firms do not perform as strongly using subsidiary data, with results suggesting that German investors can benefit most by investing in French and Italian regional firms. The results for French investors show that the TSX and the HDAX are the only market indices to show benefits with no short sales. Using the sales indices, Canadian firms perform strongly, with German and Italian domestic sales indices also providing large benefits. The subsidiary data show that French investors can benefit most by investing in German domestic and Italian regional firms. In terms of the sales data, Italian investors attain the greatest benefits by investing in French domestic and Canadian domestic firms. The subsidiary data show that the greatest benefits are achieved by investing in German domestic and French regional firms.

The results for Japanese investors show that Canadian firms, categorised based on sales, perform well with the TSX the strongest performing market index and Canadian domestic firms, the best performing sales indices. When subsidiary indices are used German domestic indices are the best performers followed by French and UK regional firms. In this case, both with and without short sales, all market indices lead to an improvement in the Sharpe ratio when combined with the Nikkei, with the TSX providing the largest benefits and the S&P500 the lowest in each case. The FTSE 100 index provides an unusual case as a benchmark asset in that it has a negative Sharpe ratio. UK investors benefit by investing in all market indices, with the exception of the S&P500 when no short sales are allowed. In terms of the sales indices, the French domestic and regional indices and the Canadian indices perform well. The German domestic index is the best performer in terms of subsidiary data.

Some caution in interpreting our results is warranted as some of the indices providing the largest benefits are created using very few firms. Sales indices created using less than 5 firms are the German domestic index (2 firms), the French domestic index (3 firms) and the French regional index (3 firms). Subsidiary indices created using less than 5 firms are the Canadian domestic index (1 firm), the Canadian global index (1 firm) and the German domestic index (3 firms). These indices are among the best performing indices in our tests, suggesting that some caution should be exercised when interpreting our results.

Our results emphasise the advantages of using our classification system to categorise firms when analysing the benefits from international portfolio diversification. Several examples illustrate this point. The TSX and the HDAX are the only market indices to show benefits for French investors. French investors can achieve diversification benefits, however, by investing in specific categories of firms in other markets. In particular, most Italian and UK firms provide benefits, although the market analysis suggests that they would not. From the point of view of Canadian investors, the individual French sales indices (domestic, regional, trans-regional and global) are among the best performers, although the SBF index does not perform well. The individual Italian indices all outperform the MIB as investment

opportunities for Canadian investors. In the US, UK global sales firms and UK regional subsidiary firms perform well above the FTSE index. Although the S&P500 index leads to the least benefits for Japanese investors, US firms with domestic and global sales and US firms with domestic subsidiaries perform well. These examples all highlight the importance of distinguishing between different categories of firms in order to achieve the greatest benefits from international portfolio diversification.

As a robustness test, we measure the size of firms in each category using sales data from 2005. In analysing the subsidiary indices several patterns emerge. In Germany, France, the US and Canada, the ranking of indices in terms of size, from smallest to largest, is domestic, regional, trans-regional and global. In Italy, the UK and Japan, this ranking changes to regional, domestic, trans-regional and global. The ranking in terms of sales indices is less standardised. Domestic firms are the smallest in Germany, Italy, the US, Japan and Canada and ranked second in the other countries. Global firms are ranked largest or second largest in all countries. The ranking of regional and trans-regional firms is less straightforward. Regional firms are the smallest firms in France and the UK but the largest firms in Italy and Canada. Trans-regional firms are ranked second smallest in Germany, Italy, Canada and the US but largest in the UK and Japan. This may again point to limitations in the accounting data. The subsidiary data suggest a positive relationship between multinationality and size. This relationship is not so evident when firms are categorised using sales data.

Corporate Internal Diversification

In previous sections, we analyse the categories of firms (domestic, regional, trans-regional and global) that provide diversification benefits. We find some evidence that global firms provide the largest benefits to diversification. These results suggest that internal corporate diversification may be reflected in the share price of firms. This issue has yet to be resolved within the literature. Most studies in this area, (see, for example, Cai and Warnock (2004)), use an international market model to regress a firm's return on a domestic market index and a foreign (or world) index. The domestic market index, however, is not a truly domestic

factor in that it is compiled of firms with international activities and structures. We use our categorisation of firms to provide an alternative analysis in this area. We estimate regressions using indices of each category of firm (domestic, regional, trans-regional and global) from each country as the dependent variables and aggregate indices of all domestic, all regional, all trans-regional and all global firms (from all 7 markets combined) as the independent variables. We regress each category of firm individually on each aggregate index. All indices are calculated in local currency values. We run a total of 204 regressions – 96 using sales indices and 108 using subsidiary indices. In all 204 regressions, the p-value associated with the slope coefficient is zero, rejecting the hypothesis of a zero coefficient.

Looking first at the subsidiary data, the aggregate domestic factor is the most influential factor on the individual domestic indices in 5 out of the 7 markets (Canada, France, Japan, the US and the UK), the aggregate regional index is the most influential factor on regional firms in all 6 markets with regional firms (no firms on the TSX are classified as regional in their subsidiaries), the aggregate trans-regional factor is the most influential factor on trans-regional firms in 3 out of 7 markets (Canada, Japan and the US) and the aggregate global factor is the most influential factor on global firms in 4 out of 7 markets (France, Germany, the US and the UK). The results using the sales indices are more ambiguous. The US is the only market where the domestic factor is most influential on domestic firms. The aggregate regional factor is the most influential factor on regional firms in 2 out of 5 markets (the US and the UK), the aggregate trans-regional factor is most influential on trans-regional firms in 3 out of 7 markets (Canada, Japan and the US) and the aggregate global factor is most influential on global firms in 4 out of 7 markets (France, Germany, Italy and the UK). These results provide limited support for the hypothesis that internal corporate diversification is reflected in the share price of firms and suggest that the geographical dispersion of a firms sales is more influential on the firm's share price than the geographical dispersion of its subsidiaries.

5. Summary and Conclusions

In this paper, we analyse the types of firms that provide diversification benefits using mean variance spanning and Sharpe ratio tests. The mean variance spanning tests show that there are benefits to domestic diversification in the G7 countries. Our results highlight the importance of domestic portfolio diversification, a topic that is neglected in the literature to date, and provide an alternative justification for a home biased attitude to international investing. Our results also provide support for our classification system as they show that there is benefit to be derived from analysing different categories of firm rather than arbitrarily creating samples of domestic firms and MNCs for empirical analysis on diversification benefits. The Sharpe ratio tests show that the types of firms that provide the greatest benefits differ between countries. In our analysis of individual markets, no clear pattern emerges in terms of the types of firms that provide the greatest benefits. When the analysis is performed by combining each category of firm across all markets, results indicate that firms with global sales provide the largest benefits to diversification. Firms with global subsidiaries show the greatest benefits when short sales are allowed. When short sales are not allowed, firms with regional subsidiaries show the greatest benefits in all countries. These results provide a preliminary analysis of the types of firms that provide diversification benefits. Further regression based tests find limited support for the hypothesis that internal corporate diversification is reflected in the share price of firms. Future research in this area will consider the industrial diversification of firms in each index in order to provide a robustness analysis.

References

Aggarwal, R., Berrill, J. and Kearney, C. (2007). A Taxonomy of Multinationality: Towards a Classification System for MNCs. Research Paper, IIIS Trinity College Dublin. Presented to AIB Conference, Beijing, 2006, Global Finance Conference, Melbourne, 2007.

Agmon, T. and Lessard, D. (1977). Investor Recognition of Corporate International Diversification. *Journal of Finance,* 32(4): 1049-1055.

Aharoni, Y. 1966. *The Foreign Investment Decision Process*, Division of Research, Graduate School of Business Administration, Boston: Harvard University.

Aherne, A., Griever, W. and Warnock, F. (2004). Information Costs and Home Bias: An Analysis of US Holdings of Foreign Equities. *Journal of International Economics,* 62(2): 313-336.

Baxter, M. and Jermann, U. (1997). The International Diversification Puzzle is Worse Than You Think. *American Economic Review*, 8(1): 170-80.

Bekaert, G. and Urias, M. (1996). Diversification, Integration and Emerging Market Closed-End Funds. *Journal of Finance*, 51(3): 835-869.

Bilkey, W.J., and Tesar, G. (1977). The Export Behavior of Smaller Sized Wisconsin Manufacturing Firms. *Journal of International Business Studies*, 8(1): 93–98.

Brewer, H. (1981). Investor Benefits from Corporate International Diversification. *Journal of Financial and Quantitative Analysis*, 16(1): 113-26.

Cai, F. and Warnock, F. (2004). International Diversification at Home and Abroad. Board of Governors of the Federal Reserve System, *International Finance Discussion Papers* No. 793.

Caves, R.E. (1971). Industrial Corporations: The Industrial Economics of Foreign Investment. *Economica*, 38(1): 1–27.

Cooper, I. and Kaplanis, E. (1994). Home Bias in Equity Portfolios, Inflation Hedging and International Capital Market Equilibrium. *Review of Financial Studies,* 7(1): 45-60.

Coval, J. and Moskowitz, T. (1999). Home Bias at Home: Local Equity Preference in Domestic Portfolios. *Journal of Finance*, 54(6): 2045-2073.

Dahlquist, M., and Robertsson, G. (2001). Direct Foreign Ownership, Institutional Investors, and Firm Characteristics. *Journal of Financial Economics,* 59(3): 413-440.

De Roon, F. and Nijman, T. (2001). Testing for Mean Variance Spanning: A Survey. *Journal of Empirical Finance*, 8(2): 111-156.

DeRoon, F. Nijman, T. and Werker, B. (2001). Testing for Mean Variance Spanning with Short Sales Constraints and Transactions Costs: The Case of Emerging Markets. *Journal of Finance,* 56(2): 721-742.

Doukas, J. and Lang, LHP. (2003). Foreign Direct Investment, Diversification and Firm Value. *Journal of International Business Studies*, 34(2): 153-172.

Dunning, J. (1980). Toward an Eclectic Theory of International Production: Some Empirical Tests. *Journal of International Business Studies,* 11(1): 9-31.

Dunning, J. 1988. The Eclectic Paradigm of International Production: A Restatement and some Possible Extensions. *Journal of International Business Studies,* 19(1): 1-32.

Errunza, V. Hogan, K. and Hung, M. (1999). Can the Gains from International Diversification be Achieved without Trading Abroad? *Journal of Finance*, 54(6): 2075-2107.

Fatemi, A. (1984). Shareholder Benefits from Corporate International Diversification. *Journal of Finance*, 39(5): 1325-1344.

French, K., and Poterba, J. (1991). Investor Diversification and International Equity Markets. *American Economic Review,* 81: 222–226.

Guerin, S.S. (2006). The Role of Geography in Financial and Economic Integration: A Comparative Analysis of Foreign Direct Investment, Trade and Portfolio Investment Flows. *World Economy*, 29(2): 189-209.

Hasan, I. and Simaan, Y. (2000). A Rational Explanation for Home Country Bias. *Journal of International Money and Finance*, 19(3): 331-61.

Huberman, G. and Kandel, S. (1987). Mean-Variance Spanning. *Journal of Finance*, 42(4): 873-888.

Hughes, J. Logue, D. and Sweeney, R. (1975). Corporate International Diversification and Market Assigned Measures of Risk and Diversification. *Journal of Financial and Quantitative Analysis*, 10(4): 627-637.

Jacquillat, B. and Solnik, B. (1978). Multinationals are Poor Tools for Diversification. *Journal of Portfolio Management*, 4(2): 8-12.

Karolyi, G. and Stulz, R. (2002). Are Financial Assets Priced Locally or Globally? *National Bureau of Economic Research Working Paper* No. 8992.

Lintner, J. (1965). The Valuation of Risky Assets and the Selection of Risky Investment in Stock Portfolio and Capital Budgets. *Review of Economics and Statistics*, 47: 103–124.

Logue, D. (1982). An Experiment in International Diversification. *Journal of Portfolio Management*, 9(1): 22-27.

Mathur, I. and Hanagan, K. (1983). Are Multinational Corporations Superior Investment Vehicles for Achieving International Diversification?. *Journal of International Business Studies*, 14(3): 135-46.

Mathur, I. Singh, M. and Gleason, K. (2001). The Evidence from Canadian Firms on Multinational Diversification and Performance. *Quarterly Review of Economics and Finance*, 41(4): 561-578.

Michel, A. and Shaked, I. (1986). Multinational Corporations versus Domestic Corporations: Financial Performance and Characteristics'. *Journal of International Business Studies*, 17(3): 89-100.

Mikhail, A. and Shawky H. (1979). Investment Performance of US based Multinational Corporations. *Journal of International Business Studies*, 10(1): 53-66.

Morck, R. and Yeung, B. (1991). Why Investors Value Multinationality. *Journal of Business*, 64(2): 165-187.

Portes, R. and Rey, H. (1998). The Euro and International Equity Flows. *Journal of the Japanese and International Economies*, 12(4): 406-423.

Portes, R. and Rey, H. (2005). The Determinants of Cross-Border Equity Flows. *Journal of International Economics,* 65(2): 269-296.

Portes, R., Rey, H. *et al*. (2001). Information and Capital Flows: The Determinants of Transactions in Financial Assets. *European Economic Review,* 45(4): 783-796.

Rosati, S. and Secola, S. (2006). Explaining Cross-Border Large-Value Payment Flows: Evidence from TARGET and EURO1 Data. *Journal of Banking and Finance,* 30(6): 1753-1782.

Rowland, P. and Tesar, L. (2004). Multinationals and the Gains from International Diversification. *Review of Economic Dynamics*, 7(4): 789-826.

Salehizadeh, M. (2003). U.S. Multinationals and the Home Bias Puzzle: An Empirical Analysis. *Global Finance Journal,* 14(3): 303-318.

Senchack, A. and Beedles, W. (1980). Is Indirect International Diversification Desirable?. *Journal of Portfolio Management*, 6(2): 49-57.

Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium under the Condition of Risk. *Journal of Finance,* 19(3): 425–442.

Sharpe, W. (1966). Mutual Fund Performance. *Journal of Business,* A Supplement 1, Part 2: 119-138.

Stopford, J.M., and Wells, L.T. (1972). *Managing the Multinational Enterprise*. New York: Basic Books.

Tesar, L. and Werner, I. (1995). Home Bias and High Turnover. *Journal of International Money and Finance*, 14(4), 467–492

Tobin, J. (1958). Liquidity Preference as Behaviour Towards Risk. *Review of Economic Studies,* 25(2): 65-86.

Wei, S. (2000). How Taxing is Corruption on International Investors? *Review of Economics and Statistics*, 82(1): 1-11.

Table 1
Matrix of Multinationality

Depth of engagement		**Breadth of geographical spread**								
		Domestic	*Regional*			*Trans-regional*				*Global*
		D	*R1*	*R2*	*R3*	*T2*	*T3*	*T4*	*T5*	*G*
Trading	*T*	*TD*	*TR1*	*TR2*	*TR3*	*TT2*	*TT3*	*TT4*	*TT5*	*TG*
Alliances	*A*	*AD*	*AR1*	*AR2*	*AR3*	*AT2*	*AT3*	*AT4*	*AT5*	*AG*
Investments	*I*	*ID*	*IR1*	*IR2*	*IR3*	*IT2*	*IT3*	*IT4*	*IT5*	*IG*

Notes: The *depth* of engagement associated with a firm's activities appears in the rows of the matrix. *Trading* involves sales and/or purchases made by the firm, a*lliances* includes licensing and franchising, and *investments* includes joint ventures and subsidiaries. The *breadth* of geographical spread of a firm's activities appears in the columns of the matrix. It is measured using a 9 point scale with 4 main categories: from 'domestic', 'regional', 'trans-regional' and 'global'. 'Regional' is further divided into 3; firms in *R1* have activities in one-third of the countries of their home region. For firms in *R2* the proportion is between one-third and two-thirds, and firms in *R3* are active in more than two-thirds of the countries in their region. A firm is classified as T2 if it has activities in one region in addition to its home region (thus in two regions of the world). It is classified as T3 if it operates in two regions outside its home region, T4 if it operates in 3 regions outside its home region, and T5 if it operates in 4 regions outside its home region. If a firm operates in 5 regions outside its home region – that is, in all 6 regions of the world – it is classified as G (global).

Table 2
Taxonomy of Internationalisation

	Symbol	MNC type
		Purely domestic firm
1	*TD-ID*	Domestic trading, domestic investments
		Regional and trans-regional firms
2	*TR-ID*	Regional trading, domestic investments
3	*TT-ID*	Trans-regional trading, domestic investments
4	*TD-IR*	Domestic trading, regional investments
5	*TR-IR*	Regional trading, regional investments
6	*TT-IR*	Trans-regional trading, regional investments
7	*TD-IT*	Domestic trading, trans-regional investments
8	*TR-IT*	Regional trading, trans-regional investments
9	*TT-IT*	Trans-regional trading, trans-regional investments
		Global firms
10	*TG-ID*	Global trading, domestic investments
11	*TG-IR*	Global trading, regional investments
12	*TG-IT*	Global trading, trans-regional investments
13	*TD-IG*	Domestic trading, global investments
14	*TR-IG*	Regional trading, global investments
15	*TT-IG*	Trans-regional trading, global investments
16	*TG-IG*	Global trading, global investments

Notes. This Table uses a simplified matrix of our two-dimensional measure of multinationality to describe 16 types of MNC, ranging from a purely domestic firm to a fully global corporation. It is derived from Table 1 by *first* removing the 'alliances' depth of engagement and focusing only on the two depths of engagement, trading (*T*) and investments (*I*) and *second*, by combining the three 'within-region' decompositions (*R1*, *R2* and *R3*) and the 4 trans-regional groups (*T2*, *T3*, *T4* and *T5*) to reduce the breadth categories from 9 to 4; domestic (*D*), regional (*R*), trans-regional (*T*) and global (*G*),

Table 3
International Classification of Firms

Panel A: Sales

	S&P 500	FTSE 100	Nikkei 225	TSX 60	HDAX 110	SBF 120	MIB 174	Sum
D	**136 (29)**	**7 (8)**	**16 (9)**	**13 (23)**	**5 (5)**	**6 (6)**	**46 (30)**	**229 (20)**
R1	**10 (2)**	**5 (6)**		**7 (12)**	**3 (3)**	**8 (7)**	**7 (5)**	**40 (4)**
T2	110 (23)	22 (24)	33 (20)	17 (30)	26 (27)	16 (15)	37 (24)	261 (23)
T3	78 (17)	16 (18)	45 (27)	10 (18)	19 (19)	23 (21)	16 (11)	207 (18)
T4	78 (17)	19 (21)	49 (29)	7 (12)	15 (15)	27 (25)	20 (13)	215 (19)
T5	48 (10)	14 (15)	25 (15)	3 (5)	24 (24)	21 (20)	17 (11)	152 (13)
T	**314 (67)**	**71 (78)**	**152 (91)**	**37 (65)**	**84 (85)**	**87 (81)**	**90 (59)**	**835 (73)**
G	**10 (2)**	**7 (8)**			**7 (7)**	**6 (6)**	**9 (6)**	**39 (3)**
Total	*470*	*90*	*168*	*57*	*99*	*107*	*152*	*1143*

Panel B: Subsidiaries

	S&P 500	FTSE 100	Nikkei 225	TSX 60	HDAX 110	SBF 120	MIB 174	Sum
D	**87 (18)**	**6 (7)**	**20 (9)**	**5 (12)**	**5 (5)**	**19 (18)**	**50 (36)**	**192 (17)**
R1	34 (7)	13 (15)	6 (3)		13 (13)	20 (20)	31 (23)	117 (10)
R2					3 (3)	1 (1)	4 (3)	8 (1)
R	**34 (7)**	**13 (15)**	**6 (3)**		**16 (16)**	**21 (21)**	**35 (26)**	**125 (11)**
T2	75 (16)	11 (12)	29 (14)	16 (37)	19 (19)	9 (9)	19 (14)	178 (15)
T3	70 (15)	12 (14)	58 (28)	11 (25)	17 (17)	15 (15)	13 (10)	196 (17)
T4	67 (14)	14 (16)	53 (25)	8 (19)	9 (9)	14 (14)	6 (4)	171 (15)
T5	85 (18)	13 (15)	28 (13)	2 (5)	7 (7)	5 (5)	4 (3)	144 (12)
T	**297 (63)**	**50 (57)**	**168 (80)**	**37 (86)**	**52 (52)**	**43 (42)**	**42 (31)**	**689 (59)**
G	**58 (12)**	**19 (21)**	**16 (8)**	**1 (2)**	**26 (27)**	**19 (19)**	**10 (7)**	**149 (13)**
Total	*476*	*88*	*210*	*43*	*99*	*102*	*137*	*1155*

Notes: This Table categorises each firm from the G7 market indices using our classification system. The left column lists our scale on the breadth of multinationality. The 4 main categories: domestic, regional, trans-regional and global appear in bold. Sub categories are also listed. Each category is as defined in Table 1. The Table shows the number of firms falling into each category in terms of their sales data (Panel A) and their subsidiary data (Panel B). Figures in parentheses are the percentage of firms in each category. The total figures are the number of firms for which data are available. For example, sales information is available for 168 firms on the Nikkei index – 16 firms (9%) are classified as domestic and 49 firms (29%) as T4. The column on the right shows the total number of firms in each category summed across all indices.

Table 4
Correlation Structures

	Market Index	**Sales Indices**				**Subsidiary Indices**			
US	S&P	Domestic	Regional	Trans-regional	Global	Domestic	Regional	Trans-regional	Global
S&P	1.000	0.849	0.663	0.988	0.771	0.825	0.757	0.980	0.954
TSX	0.631	0.466	0.388	0.629	0.497	0.441	0.487	0.635	0.572
Nikkei	0.065	0.016	0.054	0.067	0.062	0.007	0.053	0.070	0.050
FTSE	0.366	0.312	0.225	0.355	0.315	0.302	0.326	0.349	0.346
HDAX	0.466	0.393	0.323	0.455	0.410	0.386	0.394	0.454	0.436
SBF	0.370	0.304	0.239	0.362	0.315	0.296	0.314	0.358	0.347
MIB	0.182	0.129	0.139	0.176	0.177	0.118	0.162	0.177	0.167
Average	*0.347*	*0.270*	*0.228*	*0.341*	*0.296*	*0.258*	*0.289*	*0.340*	*0.320*
Canada	TSX								
TSX	1.000	0.463	0.481	0.962		0.310		0.933	0.354
S&P	0.604	0.275	0.342	0.578		0.234		0.538	0.308
Nikkei	0.104	0.056	0.028	0.098		0.070		0.086	0.082
FTSE	0.376	0.232	0.223	0.350		0.215		0.329	0.222
HDAX	0.438	0.214	0.236	0.406		0.253		0.379	0.268
SBF	0.408	0.217	0.202	0.384		0.235		0.360	0.244
MIB	0.242	0.118	0.107	0.232		0.124		0.211	0.157
Average	*0.362*	*0.185*	*0.190*	*0.341*		*0.189*		*0.317*	*0.213*
Japan	Nikkei								
Nikkei	1.000	0.608		0.949		0.683	0.563	0.944	0.848
S&P	0.137	0.083		0.161		0.088	0.045	0.134	0.170
TSX	0.178	0.117		0.204		0.121	0.090	0.182	0.208
FTSE	0.195	0.134		0.208		0.140	0.111	0.187	0.215
HDAX	0.176	0.130		0.189		0.132	0.107	0.173	0.179
SBF	0.207	0.128		0.220		0.140	0.104	0.204	0.216
MIB	0.319	0.198		0.336		0.204	0.164	0.309	0.328
Average	*0.202*	*0.132*		*0.220*		*0.138*	*0.103*	*0.198*	*0.219*
UK	FTSE								
FTSE	1.000	0.690	0.612	0.944	0.632	0.687	0.581	0.876	0.860
S&P	0.463	0.295	0.275	0.442	0.267	0.328	0.232	0.400	0.399
TSX	0.464	0.263	0.304	0.432	0.292	0.356	0.223	0.415	0.368
Nikkei	0.199	0.094	0.152	0.172	0.145	0.177	0.123	0.165	0.146
HDAX	0.729	0.477	0.475	0.679	0.479	0.526	0.429	0.656	0.594
SBF	0.804	0.510	0.542	0.749	0.523	0.605	0.452	0.717	0.654
MIB	0.554	0.346	0.421	0.514	0.338	0.457	0.332	0.503	0.428
Average	*0.536*	*0.331*	*0.362*	*0.498*	*0.341*	*0.408*	*0.298*	*0.476*	*0.431*

Ger	HDAX								
HDAX	1.000	0.296		0.979	0.724	0.377	0.338	0.881	0.960
S&P	0.566	0.175		0.557	0.430	0.181	0.186	0.478	0.562
TSX	0.522	0.202		0.515	0.368	0.185	0.172	0.456	0.508
FTSE	0.731	0.233		0.727	0.568	0.320	0.287	0.651	0.712
Nikkei	0.220	0.171		0.206	0.195	0.145	0.126	0.157	0.220
SBF	0.854	0.320		0.849	0.656	0.358	0.350	0.772	0.826
MIB	0.606	0.319		0.591	0.489	0.347	0.301	0.535	0.575
Average	*0.583*	*0.237*		*0.574*	*0.451*	*0.256*	*0.237*	*0.508*	*0.567*
France	SBF								
SBF	1.000	0.302	0.318	0.972	0.797	0.695	0.598	0.917	0.942
S&P	0.513	0.118	0.088	0.501	0.422	0.345	0.251	0.485	0.482
TSX	0.515	0.135	0.143	0.504	0.369	0.368	0.311	0.478	0.476
FTSE	0.806	0.251	0.274	0.778	0.658	0.553	0.462	0.764	0.736
Nikkei	0.258	0.109	0.117	0.250	0.188	0.196	0.181	0.257	0.218
HDAX	0.854	0.264	0.256	0.823	0.697	0.592	0.500	0.776	0.804
MIB	0.702	0.285	0.337	0.661	0.582	0.537	0.491	0.644	0.625
Average	*0.608*	*0.194*	*0.203*	*0.586*	*0.486*	*0.432*	*0.366*	*0.567*	*0.557*
Italy	MIB								
MIB	1.000	0.548	0.624	0.690	0.378	0.658	0.675	0.632	0.464
S&P	0.355	0.293	0.400	0.429	0.299	0.405	0.387	0.421	0.314
TSX	0.392	0.325	0.369	0.409	0.296	0.377	0.379	0.415	0.295
FTSE	0.586	0.447	0.620	0.646	0.483	0.633	0.583	0.650	0.459
Nikkei	0.385	0.165	0.174	0.210	0.083	0.172	0.201	0.175	0.173
HDAX	0.606	0.513	0.665	0.702	0.474	0.684	0.634	0.686	0.451
SBF	0.702	0.554	0.716	0.769	0.518	0.730	0.696	0.759	0.507
Average	*0.504*	*0.383*	*0.491*	*0.528*	*0.359*	*0.500*	*0.480*	*0.518*	*0.367*

Notes: This Table shows the correlation coefficients (in local currencies) between each category of firm and each market index. The Average figures calculate the average correlation coefficient between each category of firm and the 6 foreign market indices in our sample (the correlation coefficient between the individual index and the domestic market index is not included in the average figures). Columns are empty if no firms exist within that specific category.

Table 5
International Diversification Benefits for US Investors

Panel A				Panel B			
Sales Indices (No Short Sales)		Sales Indices (Short Sales)		Subsidiary Indices (No Short Sales)		Subsidiary Indices (Short Sales)	
CD	0.062025	CD	0.064146	GD	0.054059	GD	0.054059
FD	0.058048	CR	0.058872	FR	0.042386	FR	0.042391
CR	0.056009	FD	0.058048	UKR	0.03784	TSX	0.042096
FR	0.052149	FR	0.052149	CT	0.035426	CT	0.041102
CT	0.040239	CT	0.048481	TSX	0.034684	UKR	0.037854
UKG	0.034703	TSX	0.042096	IR	0.034021	IR	0.034243
TSX	0.034684	UKG	0.034836	FD	0.033431	FD	0.033574
GD	0.03374	GD	0.03374	CD	0.03244	CD	0.032763
ID	0.031703	FG	0.031962	CG	0.031371	CG	0.0322
FG	0.031343	ID	0.031708	GR	0.029829	GR	0.029829
IT	0.029377	IT	0.029795	IG	0.029319	IG	0.029378
IG	0.027401	IG	0.027408	IT	0.027978	IT	0.028274
GG	0.024331	GG	0.024659	FT	0.02442	FT	0.024875
FT	0.022928	FT	0.023406	UKG	0.023877	UKG	0.024079
UKT	0.019902	UKT	0.020135	FG	0.02138	FG	0.021784
JT	0.019694	JT	0.019694	JG	0.017847	JG	0.017847
UKR	0.015695	UKR	0.015695	JT	0.017336	JT	0.017336
HDAX	0.014641	HDAX	0.015096	UKT	0.016533	UKT	0.016609
SBF	0.014625	SBF	0.014725	JD	0.014947	HDAX	0.015096
JD	0.013211	JD	0.013211	HDAX	0.014641	JD	0.014947
GT	0.012279	GT	0.01253	SBF	0.014625	SBF	0.014725
MIB	0.009462	MIB	0.009462	GG	0.014279	GG	0.0147
FTSE	0.004645	FTSE	0.004645	UKD	0.013229	UKD	0.013229
IR	0.004373	IR	0.004373	ID	0.011938	ID	0.011938
Nikkei	0.003174	Nikkei	0.003174	MIB	0.009462	MIB	0.009462
UKD	0.002017	UKD	0.002017	GT	0.008832	GT	0.008833
				FTSE	0.004645	FTSE	0.004645
				JR	0.003605	JR	0.003605
				Nikkei	0.003174	Nikkei	0.003174

Notes: This Table ranks changes in the Sharpe ratios of the optimal mean variance portfolios when each of the indices above is added to the S&P500 index. Panel A shows results when firms are categorised based on sales data and Panel B shows results when firms are categorised based on subsidiary data. We include results both when short sales are allowed and when short sales are not permitted.