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MULTINATIONALS AND THE GAINS FROM INTERNATIONAL DIVERSIFICATION

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ABSTRACT

One possible explanation for home bias is that investors may obtain indirect international diversification benefits by investing in multinational firms rather than by investing directly in foreign markets. This paper employs mean-variance spanning tests to examine the diversification potential of multinational firms and foreign market indices for investors domiciled in Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. We find that in most countries and most time periods, the portfolio of domestic stocks spans the risk and return opportunities of a portfolio that includes domestic and multinational stocks. However, there is weak evidence that U.S. multinationals provided global diversification benefits in the full 1984-92 sample and in the post-1987 subsample. We also find that the addition of foreign market indices to a domestic portfolio - inclusive of multinationals - provides diversification benefits. The economic importance of the shift of the portfolio frontier - measured as the utility gain from diversification - varies considerably from market to market and often reflects the benefits of large short positions in certain markets.

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1. Introduction

For decades economists have argued that there are substantial benefits to holding an internationally-diversified investment portfolio. Nearly thirty years ago, Grubel (1968) and Levy and Sarnat (1970) demonstrated that, given the relatively low correlation of equity returns across markets, investors could increase the return on their portfolios while minimizing risk by holding a combination of domestic and foreign market indices. The potential benefits from investing abroad have become even more compelling over time as the pool of international investment opportunities has expanded to include emerging markets and newly privatized firms in Asia, Europe and Latin America.

Despite the benefits of global diversification, evidence on home bias suggests that investors in industrialized countries have been reluctant to hold more than a fraction of their wealth in foreign assets (French and Poterba (1991) and Tesar and Werner (1995)). While investors have increased their holdings of foreign stocks in recent years, the fraction of the portfolio invested abroad remains far less than the share implied by standard models of optimal portfolio choice. At the end of 1996, the share of national equity portfolios invested in foreign stocks was 11.2 percent in Canada, 5.3 percent in Japan, 18.2 percent in Germany, 22.5 percent in the United Kingdom and 10 percent in the United States (Tesar and Werner (1997)). The extent of home bias in bond portfolios tends to be even larger than in equity portfolios.[1]

One possible explanation for home bias is that investors obtain indirect international diversification benefits by investing in multinational firms. Previous studies have generally concluded that multinational firms do not provide diversification benefits. Jacquillat and Solnik (1978) regressed the returns of multinationals from nine countries on the set of market indices and found that multinational returns tended to covary most with the firm's home market. Senchack and Beedles (1980) contrasted the risk, returns and betas of portfolios of multinationals with portfolios of domestic and international stocks and found that multinationals did not deliver diversification benefits. These studies presume that the appropriate domestic benchmark is the market portfolio. While in theory the value-weighted index of domestic stocks should reflect the full benefits of investing in the home market, the construction of a fully efficient market index is problematic (Roll (1977)).

In this paper, we employ mean-variance spanning techniques to test whether the addition of multinationals and international equities to a broad-based portfolio of domestic stocks significantly shifts the portfolio frontier. This method imposes no restriction on the asset weights in either the domestic portfolio or the portfolio of domestic and international equities. The extent to which the set of domestic assets spans the set of international investment opportunities could fall along a continuum of possibilities. At one extreme, maximum diversification benefits could be achieved without holding any international assets if the set of domestic assets completely spans the set of international assets. At the other extreme, if the set of domestic assets spans an insignificant portion of the set of international assets, then international diversification is required to obtain maximum diversification benefits. The central question considered in this paper is the extent to which a portfolio of domestic equities can provide the potential benefits of holding international equity.

We make three contributions to the literature on the benefits of global diversification. First, we test whether the addition of multinationals (headquartered in the investor's country of origin) to the set of domestic equities provides diversification benefits, controlling for the effects of industry classification and firm size. We examine this hypothesis from the perspective of investors in Canada, France, Germany, Italy, Japan, the United Kingdom and the United States over the 1984-1992 time period. We split the time period into two subsamples to control for possible effects due to the October 1987 market crash. In general we find that we cannot reject the null hypothesis that the addition of multinational corporations to the benchmark set of domestic assets fails to shift the portfolio frontier, confirming the findings of the literature. There is weak evidence that U.S. multinationals may have provided diversification benefits in the full sample and the post-1987 subsample. Thus, some home bias due to indirect diversification through multinationals could possibly be rationalized for the United States.

Our second contribution is to examine whether the addition of international stock market indices shifts the portfolio frontier that is comprised of both domestic and multinational equities. In contrast to the findings for multinationals, we find that in most countries and in most time periods the addition of an international market index to the set of domestic stocks -- inclusive of multinationals -- significantly shifts the portfolio frontier. While this result may not come as a surprise to those who believe in the benefits of diversification, our findings contradict the notion that investors from industrialized countries must turn to emerging markets to capture substantial gains from investing internationally (De Santis (1993)).

Our third contribution is to quantify which markets have, ex post, provided the largest marginal diversification benefits from the perspective of investors in each of the seven countries in our sample. While the mean-variance tests provide information about the statistical significance of the shift in the portfolio

[1] The exception is the United Kingdom with foreign bond holdings at 37.5 percent of the portfolio in 1995. The allocation of bonds to "foreign" and "domestic" categories is particularly problematic for the United Kingdom due to the location of the eurobond market in London.

frontier as assets are added to the benchmark set, the tests do not provide information about magnitude of the shift in an economic sense. To give some economic content to the magnitude of the shift in the efficiency frontier, we calculate the percentage change in consumption required to make the investor indifferent between holding the utility-maximizing portfolio based on the benchmark set of domestic assets and the utility-maximizing portfolio based of the set of domestic and international equities. We find that in some cases there are sizable utility gains from adding foreign markets to the set of domestic assets, though *which* market provides the largest benefits changes depending on the investor's country of residence. We also find that capturing the largest gains from diversification often involves holding a short position in some available assets and a long position in the other assets. Finally, we find that the utility gains from international diversification for U.S. investors are surprisingly small, again helping to rationalize home bias in U.S. investment portfolios.

Section 2 discusses the generalized method of moments mean-variance spanning tests. The utility metric used to quantify the economic benefits of diversification is presented in Section 3. Section 4 discusses our data set. Our results on the diversification benefits of multinational firms is presented in Section 5 and the results on the marginal benefits of adding country indices are presented in Section 6. Section 7 concludes.

2. Generalized Method of Moments Mean-Variance Spanning Test

Throughout, we will refer to the set of domestic equities as the “benchmark" assets and the set of expanded investment opportunities as the “extended-set" of assets. We perform mean-variance spanning tests to determine if the portfolio frontier of the combination of the benchmark and extended-set assets is statistically different from the portfolio frontier of the benchmark assets. In particular, the test asks whether the inclusion of assets in the extended-set into the full set of assets restricts the set of discount factors that "price" the benchmark assets alone (Hansen and Jagannathan (1991)). The advantage of the spanning test is that it does not require specification of a risk-free rate of return. The disadvantage, however, is that rejection of the null hypothesis that the portfolio frontiers are equivalent does not imply that the marginal diversification benefits are economically significant. We will address this problem in Section 3 by providing a utility measure of the benefits of an outward shift of the portfolio frontier.

We follow the methodology described in De Santis (1993) and Bekaert and Urias (1996) to test for mean-variance spanning. Assuming frictionless markets, a common restriction on asset pricing models is

$$E\left[R_{t+1} m_{t+1}\right] = \iota \qquad (2.1)$$

where R_{t+1} is a n-dimensional vector of gross asset returns, m_{t+1} is a random variable and ι is a vector of ones of dimension n x 1.[2] Explicit assumptions regarding the parameterization of m_{t+1} gives equation (2.1) an economic interpretation. For example, specifying the random variable m_{t+1} as a linear function of the return on the market portfolio yields the Capital Asset Pricing Model. Alternatively, if m_{t+1} is specified as the intertemporal marginal rate of substitution, the consumption CAPM is obtained.

Following De Santis and Bekaert-Urias, let m_{t+1} be a candidate discount factor for R_{t+1} and assume m_{t+1} is a linear projection onto R_{t+1} such that

(2.2) $$m_{t+1} = c + \left[R_{t+1} - E(R_{t+1})\right]' \beta + \varepsilon_{t+1}$$

where c is a constant, ε_{t+1} is the error term of the regression and is uncorrelated with R_{t+1} by assumption. In general, β cannot be estimated because m_{t+1} is unobserved. Nevertheless, if m_{t+1} is required to price R_{t+1}, then substitution of equation (2.2) into equation (2.1) yields the unconditional asset pricing restriction.

(2.3) $$E\left\{R_{t+1}\left(\left[R_{t+1} - E(R_{t+1})\right]' \beta + c\right)\right\} - \iota = 0$$

Partition R_{t+1} such that $R_{t+1} \equiv \left[R'_{B,t+1}\ R'_{E,t+1}\right]$ and partition β such that $\beta \equiv \left[\beta'_B\ \beta'_E\right]$. The dimensions of R_B and R_E are (n_B x 1) and (n_E x 1), respectively.[3] The null hypothesis that R_{t+1} is priced by the subset of n_B assets in $R_{B,t+1}$ implies that $R_{E,t-1}$ is redundant for asset pricing. Therefore, under the null hypothesis, the coefficients in β_E are equal to zero and the unconditional asset pricing restriction may be rewritten as:

(2.4) $$m_{t+1} = c + \left[R_{B,t+1} - E(R_{B,t+1})\right]' \beta_B + \varepsilon_{t+1}$$

Conditional on a given value of c and that $R_{B,t+1}$ is a subset of R_{t+1}, the restriction in equation (2.4) implies that the portfolio frontier constructed from the benchmark assets is tangent to the portfolio frontier constructed from the benchmark assets and extended-set assets at the point corresponding to the highest Sharpe ratio.

The two-fund separation theorem states that any frontier portfolio can be obtained as a linear combination of any two distinct frontier portfolios. Therefore, if the portfolio frontiers implied by R_{t+1} and $R_{B,t+1}$ are tangent at two distinct points, then the two frontiers must coincide at all points. Let $h_T(\bar{\beta}_B)$ denote the $2n_B$ sample moment conditions that are obtained as a generalization of equation (2.4),

(2.5) $$h_T(\bar{\beta}_B) = E\left\{\begin{matrix} R_{t+1}\left[c_1 + \left[R_{B,t+1} - E(R_{B,t+1})\right]' \beta_{B,1}\right] \\ R_{t+1}\left[c_2 + \left[R_{B,t+1} - E(R_{B,t+1})\right]' \beta_{B,2}\right] \end{matrix}\right\} = \bar{0}$$

where $\bar{\beta}_B = \left[\beta'_{B,1}, \beta'_{B,2}\right]$. Denote $\bar{b}_B = \left[b'_{B,1}, b'_{B,2}\right]$ as the vector of estimators of $\bar{\beta}_B$ subject to the restriction that the coefficients corresponding to the extended-set assets are equal to zero. The vector $\bar{b}_B$ is the solution to

[2] The derivation of the theoretical bounds for the first two moments of m_{t+1} are presented in Hansen and Jagannathan (1991) and the computational steps are discussed in De Santis (1993).

[3] R_B and R_E correspond to the benchmark portfolio of n_B assets and the extended-set portfolio of n_E assets.

$$\text{(2.6)} \qquad \arg\min \bar{b}_B = \arg\min h_T(\beta)' W_T h_T(\beta) \quad \text{subject to } \bar{\beta}_E = 0$$

where $\bar{\beta}_E = [\beta'_{E,1}, \beta'_{E,2}]$ and W_T is an optimally chosen weighting matrix.[4] The null hypothesis is that the frontiers coincide at all points (i.e. $\bar{\beta}_E = \bar{0}$). Under the null hypothesis, the generalized method of moments (GMM) test of over-identifying restrictions has a chi-square distribution with $2n_E$ degrees of freedom. The order of the Newey-West correction used in the GMM algorithm is equal to $4(T/100)^{2/9}$ (Newey and West (1992)).

$$\text{(2.7)} \qquad T\left[h_T(\bar{b}_B)' W_T h_T(\bar{b}_B)\right] \sim \chi^2(2n_E)$$

The alternative hypothesis is that $\bar{\beta}_E \neq 0$. Rejection of the null hypothesis implies that the variation in the returns of the benchmark assets does not explain the variation of the returns of the benchmark and extended-set assets. Failure to reject the null hypothesis provides evidence that the benchmark set of assets spans the risk-return opportunities offered by the extended set of assets.

3. Measuring the Utility Gains from International Diversification

Rejection of the null hypothesis that the benchmark portfolio of domestic assets spans the extended-set portfolio does not provide information about the magnitude of the shift in the efficiency frontier, nor does it provide insight into whether the shift is economically significant. To give the shift in the portfolio frontier an economic interpretation, we calculate the gains in lifetime utility associated with expanding the portfolio to include the extended set of assets (Cole and Obstfeld (1991), Lewis (1996)). The utility gain is measured as the percentage reduction in permanent consumption that makes an individual indifferent between the optimal portfolio when the investor can hold assets from the benchmark and the extended-set and the optimal portfolio when the investor is restricted to holding assets from the benchmark set only.[5]

Let C_t denote permanent consumption at time t of an individual holding the optimal portfolio of benchmark assets and let C_t^* denote the permanent consumption at time t of an individual holding the optimal portfolio of benchmark and extended-set assets. The utility gain, δ, is given by the relationship

$$\text{(3.1)} \qquad U_0(C_0) = U_0\left(C_0^*(1-\delta)\right).$$

[4] See DeSantis (1993), Bekaert and Urias (1996) and Campbell, Lo and MacKinlay (1997).

[5] The utility-gain metric has two shortcomings. First, the spanning test presented in Section 3 is the test of the hypothesis that the asset-pricing kernel is the same for the two sets of assets. If the asset-pricing kernel is not valid across the two sets of assets, then the utility-gain metric, which is a function of the mean and variance of the portfolios, is also not valid. Second, we do not consider the variance of the utility-gain metric. Despite these shortcomings, this metric provides an economically intuitive measure of the distance between portfolio frontiers.

Following Lewis (1996), we use the Epstein-Zin-Weil utility function specification which allows the risk-aversion parameter, γ, to differ from the inverse of the elasticity of intertemporal substitution parameter, θ.

$$U_t = \left[c_t^{(1-\theta)} + \beta \left[E_t \left(U_{t+1}^{\;1-\gamma} \right) \right]^{(1-\theta)/1-\gamma} \right]^{1/(1-\theta)} \quad \text{for } \gamma, \theta > 0; \gamma, \theta \neq 1 \tag{3.2}$$

The utility maximizing portfolio is obtained by maximizing the utility function given in equation (3.2) subject to the portfolio frontier of available assets. The portfolio returns are assumed to be jointly log-normally distributed such that $\ln(r_{B,t}) \sim N\left(\mu_B - \frac{1}{2}\sigma_B^2, \sigma_B^2 \right)$ and $\ln(r_{BE,t}) \sim N\left(\mu_{BE} - \frac{1}{2}\sigma_{BE}^2, \sigma_{BE}^2 \right)$, where $r_{B,t}$ and $r_{BE,t}$ are the vector of net returns on the benchmark portfolio and the vector of net returns on the portfolio that includes the benchmark and extended-set assets, respectively. The expected utility of consumption for an investor who is holding the optimal benchmark portfolio may be written as

$$E_t U(C_t) = W_t \left\{ 1 - \beta \exp\left[(1-\theta) \left(\mu_B - \frac{1}{2}\gamma\sigma_B^2 \right) \right] \right\}^{-(1/(1-\theta))} \tag{3.3}$$

and the expected utility of consumption for an investor who is holding the optimal portfolio of benchmark and extended-set assets may be written as

$$E_t U(C_t) = W_t \left\{ 1 - \beta \exp\left[(1-\theta) \left(\mu_{BE} - \frac{1}{2}\gamma\sigma_{BE}^2 \right) \right] \right\}^{-(1/(1-\theta))} \tag{3.4}$$

where W_t is equal to the individual's wealth at time t and is assumed to be exogenous.

Figure 1 illustrates the utility gain from adding the extended set of assets to the portfolio of benchmark assets. Without the extended set of assets the investor maximizes utility subject to the portfolio frontier of benchmark assets. The optimal portfolio is obtained at the tangency labeled T_B. If the set of available assets is expanded to include both the benchmark and extended-set assets, the investor increases utility by choosing the optimal portfolio at T_{BE}. The utility gain is measured as the percentage reduction in permanent consumption that makes an individual indifferent between the optimal portfolio at T_{BE} and the optimal portfolio at T_B, as given in equation (3.1).

The mean and variance of the optimal portfolios at T_B and T_{BE} are obtained by equating the marginal rate of substitution and the marginal rate of transformation. The marginal rate of substitution is obtained by taking the total differential of the utility function.

$$W_t\left(\frac{-1}{1-\theta}\right)\left(1-\beta\exp\left[(1-\theta)\left(\mu-\frac{1}{2}\gamma\sigma^2\right)\right]\right)^{\frac{-1}{(1-\theta)}-\frac{(1-\theta)}{(1-\theta)}}$$

(3.5)

$$\text{x }(-\beta)\exp\left[(1-\theta)\left(\mu-\frac{1}{2}\gamma\sigma^2\right)\right](1-\theta)\,d\mu$$

$$+W_t\left(\frac{-1}{1-\theta}\right)\left(1-\beta\exp\left[(1-\theta)\left(\mu-\frac{1}{2}\gamma\sigma^2\right)\right]\right)^{\frac{-1}{(1-\theta)}-\frac{(1-\theta)}{(1-\theta)}}$$

$$\text{x }(-\beta)\exp\left[(1-\theta)\left(\mu-\frac{1}{2}\gamma\sigma^2\right)\right](1-\theta)\left(-\frac{1}{2}\gamma\right)d\sigma^2=0$$

Simplifying equation (3.5) yields

(3.6) $$\frac{d\sigma^2}{d\mu}=\frac{2}{\gamma}.$$

From Ingersoll (1987), the marginal rate of transformation along the portfolio frontier is

(3.7) $$\frac{d\sigma^2}{d\mu}=\frac{2A\mu-2B}{\Delta}$$

where $A=\iota'\Sigma^{-1}\iota$, $B=\iota'\Sigma^{-1}\bar{z}$, $\Delta=AC-B^2$, $C=\bar{z}'\Sigma\bar{z}$, Σ is the covariance matrix of returns and $\bar{z}$ is the vector of mean asset returns. Equating equations (3.6) and (3.7) yields the mean of the optimal portfolio.

(3.8) $$\mu^*=\frac{\Delta}{\gamma A}-\frac{B}{A}$$

From Ingersoll (1987), the variance of the optimal portfolio is

(3.9) $$\sigma^2{}^*=\frac{A(\mu^*)^2-2B\mu^*+C}{\Delta}.$$

The utility gain from diversification is inferred from the means and variances of the two optimal portfolios, as given by equations (3.8) and (3.9). Following Lewis (1996), combining equations (3.1), (3.3) and (3.4) yields a measure of the utility gain from expanding the available set of assets from the benchmark assets to include the extended-set assets.

$$\delta=1-\left\{E_0\left[U\left(C_0^*\right)\right]\Big/E_0\left[U\left(C_0\right)\right]\right\}^{(1/(1-\theta))}$$

(3.10)

$$=1-\left\{\frac{\left(1-\beta\exp\left[(1-\theta)\left(\mu_B^*-\frac{1}{2}\gamma\sigma_B^{2*}\right)\right]\right)}{\left(1-\beta\exp\left[(1-\theta)\left(\mu_{BE}^*-\frac{1}{2}\gamma\sigma_{BE}^{2*}\right)\right]\right)}\right\}^{(1/(1-\theta))}$$

The values of μ_B^* and μ_{BE}^* are obtained from equation (3.8) using the appropriate values of Σ and $\bar{z}$. Similarly, the values of σ_B^{2*} and σ_{BE}^{2*} are obtained from equations (3.9), again using the appropriate values of Σ and $\bar{z}$.

For the utility specifications in equations (3.3) and (3.4), the admissible combinations of γ and θ are restricted such that the discount factor, β, is less than one (see Lewis (1996)).

$$\beta^{-1} > \exp\left[(1-\theta)\left(\mu - \frac{1}{2}\gamma\sigma^2\right)\right] \tag{3.11}$$

We consider the utility gain from diversification for two values of the risk-aversion parameter ($\gamma = 2$ and $\gamma = 5$) and an elasticity of intertemporal substitution parameter of two ($\theta = 2$).[6] There is little consensus in the literature about the "true" magnitudes of risk aversion and intertemporal substitution. Our measures are intended as being suggestive of the possible gains from diversification and the parameter values are chosen so that our measures can be compared to estimates in other studies.

4. Data Description

We consider the benefits of diversification – through the addition of multinationals or the addition of foreign market indices – from the perspective of investors from Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. For each country in the sample, firm-level data is used to construct portfolios by industry classification, firm size and domestic/multinational status. The number of domestic portfolios ranges from 14 for Italy to 21 for the United States. All of the data is extracted from Datastream, a proprietary database. In instances where Datastream is not the primary source of the data, the primary source is cited. With the exception of Japan, the sample of equities includes firms that are currently traded or were previously traded.[7] International equities that are cross-listed on the domestic market are eliminated from the sample of domestic firms. The time series are sampled weekly and the data sample spans the time period from January 4, 1984 to December 30, 1992. The sample is divided into two subsamples of equal size, January 1984 to June 1988 and July 1988 to December 1992.

4.1 Domestic Portfolios

Within each country, equities are classified according to industry, firm size and domestic/ multinational status. The four industry classifications are consumer goods and services, energy and utilities, finance and real estate, and industrials. A firm's size is determined based on its relative market capitalization within its industry. The three classifications are small, medium and large. In addition, each

[6] Lewis (1996) discusses the relationship between the risk-aversion parameter and the elasticity of intertemporal substitution parameter. She reports findings for a broader set of parameter values for an investor who holds a portfolio of market indices.

[7] Our sampling of Japanese companies from the Datastream database yielded no delisted or bankrupt firms and no firms were allocated to the "other" industry classification (see Appendix A). The possibility that there were delistings and bankruptcies in Japan that are not covered by Datastream would cause our results to overstate the benefits of holding Japanese stocks.

equity is classified as a domestic or a multinational equity. Therefore, each country's portfolio includes a maximum of twenty-four categories: half of the categories are domestic equities and half of the categories are multinational equities. A brief overview of the data-set construction is provided in this section. Details of the equity classification methodology and construction methodology of the time series of portfolio returns are explained fully in Appendix A. A listing of the multinational firms in each country is provided in Appendix B

A summary by country of the category characteristics is presented in Tables 1.1 through 1.7. The first column of each of the tables shows the number of firms per category. For example, there are 787 small, domestic, consumer-goods-and-services firms in Canada covered by the Datastream database. Notice that no country has firms in all of the categories. The United States has the most non-empty categories with 21. For each category, a value-weighted portfolio is constructed by drawing a random sample from the set of available firms within each category. The maximum size of the random sample is 30.[8] Column two reports the number of firms in the sample portfolio. For example, the sample portfolio for the small, domestic, consumer-goods-and-services category in Canada contains 30 firms. The weights within the sample portfolio change over time as the market capitalization of the component firms changes. This ensures that the sample portfolio for each category is value weighted over the full time series of returns.

A summary of the sample mean returns, the sample standard deviations of returns, and the mean return per unit risk for each category over the full sample (January 4, 1984 to December 30, 1992) is reported in columns three through five of Tables 1.1 through 1.7. Tables 2.1 through 2.7 report the summary statistics for the two subsamples. The return series for each category incorporates the price appreciation of its component parts and the disbursement of dividends.[9]

4.2 International Indices

In a subset of testing scenarios, the extended-set portfolio contains international market indices from the countries other than the benchmark country. The Datastream total-return index for each sample country is used to construct a time series of weekly returns for each index. The total-return index is a value-weighted index that includes dividend reinvestment. Dividend disbursements are incorporated into the index return through the most recent dividend yield on the component security.

[8] Ideally, one should create portfolios based on the entire set of firms within each country-industry-size class. Unfortunately, Datastream does not provide clear documentation of the status of many international firms. We therefore drew a random sample from each country-industry-size class and used alternative sources to verify the status of each firm in our random sample.

[9] Datastream incorporates the dividend payment by multiplying the return due to price appreciation by the most recent dividend yield.

The sample means and standard deviations of the return series for each country-specific index are reported in Tables 3.1 and 3.2. The summary statistics are presented for the full nine-year sample and the two subsamples. Table 3.1 reports the summary statistics in the local currency and Table 3.2 reports the returns in US dollars. Notice that the mean return decreases from the first subsample to the second sample for all countries. The largest decreases are obtained for the Japanese and Italian indices. The Japanese mean weekly return decreases more than 69 basis points, from 0.525 percent per week to -0.168 percent per week.[10] The large decrease in the mean return on the Japanese index reflects the large decrease in the market capitalization of the Japanese equity market during the second subsample. The mean weekly return on the Italian index decreases nearly 49 basis points, from 0.546 percent per week to 0.057 percent per week.

The volatility of the return on each index, as measured by the standard deviation of the weekly return, decreases from the first subsample to the second subsample for every country-specific index except Japan. The standard deviation of the weekly return on the Japanese index increases from 2.56 percent per week to 2.90 percent, an increase of approximately thirteen percent. The increased volatility of the Japanese index is not surprising given the large decrease in the market capitalization of the Japanese equity market. For the six indices whose standard deviations decrease, the average decrease is twenty-two percent of the standard deviation. The standard deviation of the Canadian index exhibits the largest decrease of 32.8 percent, from 2.16 percent per week to 1.45 percent per week. The Italian index exhibits the smallest decrease of fifteen percent, from 2.68 percent per week to 2.28 percent.

The correlation structure of the returns on the international indices is presented in Table 4 for the full nine-year sample and the two subsamples. The majority of correlations increase from the first subsample to the second subsample. The largest increases in correlation include an increase in the correlation between France and Germany from 0.43 to 0.73, an increase between France and Italy from 0.34 to 0.51, an increase between France and the UK from 0.39 to 0.55 and an increase between Germany and Italy from 0.29 to 0.51. The average increase in correlation between the first and second subsamples is 0.106. The largest decreases in correlation are between Canada and the UK (0.61 to 0.48) and between the UK and the US (0.46 to 0.33). The average decrease across the subsamples is 0.11. Because the changes in the correlation structure are mixed, the change in diversification opportunities across samples is not readily apparent.

4.3 Exchange Rates

The time series of exchange rates for the seven sample countries are the Datastream weekly exchange rates. The mean and standard deviation of the sample exchange rates are presented in Table 5.

[10] One basis point is one one-hundredth of a percent. Therefore, 100 basis points in equal to one percent.

For ease of comparison, the exchange rates are stated in pounds per foreign-currency unit. From the first sample to the second sample, the Canadian dollar and the U.S. dollar depreciate against the pound. The mean Canadian exchange rate decreases by 4.8 percent, from 0.515 pounds per Canadian dollar in the first subsample to 0.49 pounds per Canadian dollar in the second. The percentage decrease in the mean U.S. exchange rate is much larger than Canadian decrease. The U.S. exchange rate decreases from 0.688 pounds per U.S. dollar to 0.58 pounds per U.S. dollar, a 15.6 percent decrease.

From the first subsample to the second subsample, all other currencies appreciate against the pound. The Deutsche mark exhibits the largest percentage increase in the mean exchange rate of 14.8 percent, from 0.30 pounds per Deutsche mark to 0.344 pounds per Deutsche mark. The percentage increase in the mean exchange rate of the Japanese yen is slightly lower at 14.7 percent, from 0.377 pounds per 100 yen to 0.432 pounds per 100 yen. The percentage increase in the mean exchange rate for the French franc and the Italian lire are 8.4 percent and 2.9 percent, respectively.

With the exception of the French franc, the standard deviation of the exchange rate for each currency decreases by an average of thirty-two percent. The standard deviation of the pound-U.S. dollar exchange rate exhibits the largest decrease of 53.7 percent, from 0.93 to 0.43. The pound-French franc exchange rate shows a small increase in standard deviation of 3.2 percent, from 0.0074 to 0.0077.

To implement the spanning test, the returns on the extended-set assets are converted into the currency of the benchmark portfolio. For example, if the benchmark country is France and the Germany and UK indices are the assets in the extended-set portfolio, the time series of returns for the German and UK indices are converted into French francs using the appropriate exchange rates. The returns on the benchmark portfolio are not converted because the returns on the French assets are stated in the local currency. The strength of the data set is the flexibility to specify any of the sample countries as the benchmark country. As a result, the benefits of diversification are evaluated from the perspective of an investor in each country.

5. Do Multinationals Provide Diversification Benefits?

Given their international exposure, equity in multinational corporations is often suggested as an indirect means of obtaining international diversification benefits free of the impediments and transactions costs that may be associated with buying equity in foreign markets. In this section, we examine the diversification benefits of multinational equities from two perspectives. First, multinational equities are added to a portfolio of domestic equities. Setting up the spanning test in this way reveals the marginal benefit of adding multinationals to a portfolio of purely domestic stocks. The second test adds multinational equities to a portfolio that contains domestic equities as well as international equity market indices. This test reveals the marginal diversification benefits of multinational equities relative to all assets available to the investor. If, for example, the returns of multinational firms tend to "mimic" international markets, the null hypothesis of spanning would be rejected in the first test but not necessarily in the second. If on the other hand, multinationals provide diversification benefits that are different from the benefits provided by international markets, the null hypothesis of spanning could be rejected in the second case.

The significance of the spanning test and the associated utility gain are considered jointly. If the null hypothesis is rejected, we conclude that the portfolio frontiers are statistically significantly different. Conditional on the rejection of the null hypothesis, we evaluate the relative magnitude of the utility gain. If the spanning test fails to reject the null hypothesis that the benchmark portfolio spans the set of broader assets, measurement of the utility gain is meaningless because we cannot conclude with a high level of statistical significance that the portfolio frontiers are, in fact, different.

In the first set of tests, the benchmark portfolio is the set of domestic equities and the set of multinational-corporation equities is specified as the extended-set portfolio. The results of the tests are reported in Table 6.1. Three sets of results are reported for each country, a test over the full sample and a test over each of the subsamples. Of the 21 spanning tests reported in Table 6.1, only four tests suggest a rejection of the null hypothesis at a significance level of less than ten percent. In France, Italy, Japan and the U.K., the tests fail to reject the null hypothesis that the benchmark portfolio spans the portfolio comprised of the benchmark and extended-set equities regardless of the sample period. In Canada and Germany, the null hypothesis of spanning is rejected in the full sample at the 7.8 percent and 1.37 percent levels of significance, respectively. The null hypothesis is not rejected in these two countries, however, in either of the two subsamples. In general, the data from markets other than the United States suggest that multinationals have not provided diversification benefits for domestic investors. In the United States, however, there is weak evidence that multinationals may have provided some diversification benefits. The null hypothesis of spanning is rejected at the 6.84 percent level in the full sample and at the 5.89 percent level in the second subsample.

Table 6.1 also reports the utility gains resulting from the shift in the efficiency frontier as multinationals are added to the set of domestic assets. In Canada and Germany, the magnitude of the utility gain from adding multinationals ranges from 2.5 to 5.7 percent, depending on the investor’s degree of risk aversion. (Recall that the portfolio shift is only significant in the full sample.) The US investor receives the largest utility gain from adding multinational equities. For the full sample, the relatively less risk-averse US investor ($\gamma = 2$) has a utility gain of 15.33 percent and a utility gain of 8.52 percent if the investor is more risk-averse ($\gamma = 5$). The utility gains over the second subsample range from 14.3 to 24.6 percent. The finding that U.S. investors could have obtained sizable benefits from holding multinationals may provide part of the explanation for home bias in the U.S., though it does not resolve the puzzle for other countries.

In the second set of tests (Table 62.), the combined set of domestic equity and international equity market indicies are specified as the benchmark portfolio and the set of multinational-corporation equities is specified as the extended-set portfolio. The international market indices are added jointly as an equally-weighted portfolio. All returns are in unhedged and in local currency units. This test yields the diversification benefits of multinational equities relative to all available assets, both domestic and international. Weak evidence for the diversification benefits of multinational equities -- over and above those attained in international markets -- is found only for Canada and Germany and in both of those cases, the result holds only in the full sample. Taken together with the results in Table 6.1, our findings suggest that multinationals offer little diversification benefits in most countries. To the extent that there is weak evidence of diversification benefits through multinationals in the United States, these benefits result from the "international" dimension of multinational firms.

6. International Diversification Benefits of Market Indices

In this section, we examine the benefits of adding international stock market indices to a benchmark portfolio of domestic stocks. To ensure that the domestic portfolio captures all of the possible diversification benefits available on the domestic market, multinationals are included in the benchmark portfolio. Because the benchmark portfolio contains the domestic and multinational equities, the spanning test is the statistical test of the marginal gain from adding an index or set of indices to the domestic portfolio. We consider the benefits of diversification from the perspective of investors domiciled in each of the seven countries covered by our study. Because empirical evidence suggests that only a small fraction of cross-border investment is hedged against exchange rate risk, we consider unhedged returns on the foreign component of the portfolio.

Each country's index is added separately to the set of domestic assets in order to consider the diversification benefits of each country index in isolation. The test results for the individual indices are reported in columns one through seven of Tables 7.1 through 7.7. Note that the spanning test is not reported for the market index of the country under consideration. The market index is a linear combination of the domestic equities and is, therefore, redundant by definition.[11]

The indices are also added jointly to the set of domestic assets in order to consider the diversification benefits of the market indices as a group. The market indices are added under two alternative specifications. The first specification combines the six indices into an equally-weighted portfolio.[12] The results of the spanning tests with respect to the addition of the equally-weighted index are

[11] Specifically, the covariance matrix for the set of assets comprised of the benchmark set of assets and the domestic market index is singular and, therefore, the test statistic is undefined.

[12] The equally-weighted portfolio includes all of the indices accept the index for the country under consideration. Therefore, the equally-weighted portfolio contains six indices. For example, the equally-weighted portfolio for the

reported in column 8, which is labeled "Equal-Wt Index." The second specification does not restrict the portfolio weights on the market indices. In this case, the extended-set portfolio contains six separate assets. This specification allows the indices to be held in various proportions, including short positions, along the portfolio frontier. Because the portfolio weights are unconstrained, the diversification benefits associated with this specification are found to be substantially larger than the diversification benefits from the addition of the equally-weighted index. The results of the spanning tests with respect to the addition of set of market indices are reported in column 9, labeled "All Indices."

Before turning to the specific results, an important feature of the data is worth noting. The returns in the Canadian market are low relative to the returns of all other markets over the full sample and in each of the subsamples. As reported in Table 3.2, the return per unit risk for Canada is by far the lowest of the sample countries for the full sample and the first subsample and has one of the lowest return per unit risk ratios in the second subsample. As a result, if the composition of the portfolio is not restricted, an investor is likely to short the equities with a low return per unit risk and invest the proceeds in other available assets. Thus, investors from Canada can obtain substantial gains from international diversification through holding short positions in the domestic market and going long in other markets. Conversely, investors from other markets may obtain substantial diversification benefits from adding the Canadian index to their portfolio, taking short positions in Canada and long positions in the other available assets.

US Investor

The US equity market is the largest equity market in the world so reviewing the results for this market is an appropriate place to begin. Table 7.7 reports the results of the spanning tests and associated utility gains for an investor holding an initial portfolio of US domestic and multinational equities. Columns one through six report the results from the addition of each country-specific index to the benchmark separately and columns eight and nine report the results from the addition of the equally-weighted index and the six indices added as a group. In spite of being the largest equity market in the world, the null hypothesis that the US benchmark portfolio spans the portfolio comprised of the benchmark and extended-set equities is rejected across the board for all test specifications over the full sample. Over the two subsamples, the null hypothesis is rejected seven out of twelve times.

At first glance, the results of the spanning tests appear to imply that a US investor obtains significant benefits from international diversification. The magnitude of the utility benefits of

spanning test of German domestic equities contains the market indices for Canada, France, Italy, Japan, the UK and the US.

diversification, however, are somewhat modest. The utility gain over the full sample from adding Germany, Italy and Japan separately is less than one percent of permanent consumption. The gains from adding Canada, France and the U.K. range from one to three percent of permanent consumption. In every case the utility gains from adding the market indices separately or as a group are less than the marginal benefit of adding multinationals. The utility gain from adding the Canadian index is achieved by constructing a portfolio that includes a short position in the Canadian index. This implies that, rather than invest heavily in Canadian equities, US investors would be better off if they held a large short position in the Canadian market. Given the poor performance of the Canadian market over the sample period, the result that large utility gains may be obtained from shorting the Canadian index and leveraging a subset of the US portfolio is not surprising.

The largest utility gains from adding the international-equity indices are obtained from adding the markets jointly with unrestricted weights. In the full sample, the utility gains are 7.92 percent when the coefficient of risk aversion is equal to 2 and drops to 4.12 percent when the degree of risk aversion increases to 5. The gains are achieved by holding a short position in some of the international indices and long positions in others.

The results of the spanning tests and the corresponding utility gains for the two subsamples are similar to the full sample results. One difference is worth noting, however. The utility gains over the full sample are generally smaller than the utility gains over each of the subsamples. This result is obtained because of sample-specific investment opportunities. The Japanese market is a good example of this phenomenon. The Japanese market dramatically increased in value over the first subsample and then dramatically decreased in value over the second subsample. The change is evident in the summary information presented in Table 3.2. The return per unit risk for Japan in the first time period is 0.2585, the highest of all of the countries in our study. In the post-July 1988 period, however, the return per unit risk is -0.0349, the lowest of all of the countries. As a result, the weight on the Japanese index in the utility-maximizing portfolio for a US investor is positive in the first subsample. To take advantage of the decline in the value of Japanese equity during the second subsample, the utility-maximizing portfolio contains a *short* position in the Japanese index. Similar sample-specific investment opportunities are available for the other portfolio specifications. Therefore, the increased utility gains in each of the subsamples are a result of sample-specific opportunities that can not be duplicated over the full sample.

To summarize, if a US investor were to take a stepwise approach to portfolio diversification, the largest utility gain comes from the inclusion of US multinational equities. Multinationals do not, however, exhaust the gains from international diversification. U.S. investors could have obtained sizable additional benefits from the addition of international-equity indices although the magnitude of the benefits varies across countries and across the subsamples. In many cases, the utility benefits were a result of taking large short positions in foreign markets, which may not be a feasible strategy for most investors.

UK Investor

Table 7.6 reports the results of the spanning tests and associated utility gains for an investor holding an initial portfolio of UK equities. The results for the individual country-specific indices are reported in columns one through five, and column seven. Columns eight and nine report the results for the equally-weighted index and the unrestricted set of six indices, respectively. The null hypothesis that the UK benchmark portfolio spans the portfolio comprised of the benchmark and foreign market indices is rejected across the board for all test specifications over the full sample and the second subsample at the five percent level. The first subsample contains only 81 observations and, as a result, the null hypothesis is rejected only for France and the US at the ten percent level of significant.

Focusing on the results for the full sample and the second subsample, the utility gains for the UK investor vary across markets. The smallest utility gain over the full sample is an increase of 0.18 percent of permanent consumption from the addition of the French index. The largest gain from an individual index is 8.25 percent for the Italian index. The utility gains for the equally-weighted index and the unrestricted set of six indices are larger than the gains from any individual index. The gains range from approximately 2 percent to 14 percent, depending on the parameterization of γ and θ. The utility gains over the second subsample are roughly of the same magnitude of those in the full sample. The utility gains range from zero percent ($\gamma = 2, \theta = 2$) for the French index to 12 percent ($\gamma = 2, \theta = 2$) for the Japanese index. The second subsample utility gains are largest for the unrestricted set of indices. Analogous to the findings for the US investor, the large utility gains of the UK investor are achieved by holding very large short positions in the benchmark and extended-set equities.

Japanese Investor

The returns on the Japanese equities that are summarized in Tables 1.5 and 2.4 may be upwardly biased because the data reported by Datastream includes only currently-traded Japanese equities.[13] The bias of the data results in an investment strategy that leverages against the structure of Japanese returns to obtain large utility gains. Over the full sample and first subsample in which the Japanese returns are relatively high, an investor domiciled in Japan constructs a portfolio with a long position in Japanese equities and a short position in the other available assets. Over the second subsample in which Japanese returns are poor, a Japanese investor holds a short position in a subset of Japanese equities and a long position in the remaining Japanese equities and the other available equities. This data feature is responsible for many of the significant diversification gains associated with the Japanese benchmark portfolio.

The null hypothesis that the Japanese benchmark portfolio spans the portfolio comprised of the benchmark and extended-set of international equities is rejected for all test specifications over the full sample and each of the subsamples (see Table 7.5). The single exception is the failure to reject the null when “all indices” are added in the second subsample. The results indicate that international diversification by a Japanese investor significantly shifts the portfolio frontier and that the associated utility gains are relatively large. The results should be considered with caution given the aforementioned bias in the Japanese data.

In the first subsample, the addition of the Canadian index to the Japanese benchmark portfolio yields the largest utility gain of any of the individual indices. This result is due to the fact that the Canadian index was a poor performer over this time period while Japanese equities performed relatively well. A Japanese investor (with excellent foresight!) would take advantage of the structure of returns by holding a short position in a subset of Japanese equities and the Canadian index and by holding a long position in the remaining Japanese equities. Because the Canadian index and the Japanese equities both yielded relatively low returns in the second subsample, the strategy to short the Canadian market yields sub-optimal utility gains. The utility gains from this strategy are still sizable (11 percent of permanent consumption) but are smaller than the gains of holding large long positions in other, better-performing markets.

Over the full sample, the addition of each of the five international indices separately yields smaller utility gains than the addition of the equally-weighted index or the set of six international indices. The greater utility gain associated with the equally-weighted index indicates that the investor is better off by investing in a broad international index than by selectively investing in any of the country-specific indices.

[13] There were few bankruptcies in Japan during the time period studied here so the extent of bias could be small. The Japanese index is not constructed from our firm-level data and therefore does not contain survivorship bias.

The ability to adjust the portfolio weights for the group of international indices more than doubles the utility gain.

Like the results for the U.S., the utility gains over the two subsamples are larger than the utility gains over the full sample. This is again due to the ability of the investor to take advantage of sample-specific investment opportunities. The largest utility gains are associated with a short position in international equities and a sub-set of Japanese equities and a long position in the remaining Japanese equities. subsampleThese portfolios yield substantial utility gains, however, the feasibility of such a portfolio is questionable. It is also unlikely that such extreme strategies would perform well in out-of-sample tests.

Canadian Investor

In the full sample and the first subsample, the null hypothesis that the domestic portfolio spans the extended-set portfolio is rejected for each of the country-specific indices separately, and for the equally-weighted international market index (see Table 7.1). Over the full sample, the largest benefits come from the addition of France and the United Kingdom to the set of domestic stocks. Again the largest gains are due to the addition of the set of six international indices, which allow the investor to take long and short positions in different markets. The fact that Canadian returns were relatively low during this sample period has already been noted. The optimal strategy for Canadian investors is to hold a long position in the international market indices and hold short positions in the domestic market. Viewed from this perspective, the home bias in Canadian portfolios becomes even more puzzling.

In the full sample, the null hypothesis that the domestic portfolio spans the extended-set portfolio is rejected at the one percent significance level for each of the country-specific indices, for the equally-weighted index and the set of all indices. The largest benefits from an individual country index come from the addition of France and the United Kingdom to the set of domestic stocks. Again the largest gains are due to the addition of the set of six international indices, which allows the investor to take long and short positions in different markets. Six of eight tests in the first subsample and three of eight tests in the second subsample are rejected at the five percent significance level. The fact that Canadian returns were relatively low during the sample period has already been noted. The optimal strategy for Canadian investors is to hold a long position in the international market indices and hold short positions in the domestic market. Viewed from this perspective, the home bias in Canadian portfolios becomes even more puzzling.[14]

French, German and Italian Investors

For investors from France, Germany, and Italy (Tables 7.2 through 7.4), the null hypothesis of spanning can be rejected in almost all cases at the five percent level of significance. The exceptions are the addition of France and Italy to the German portfolio during the first subsample and the addition of the set of all indices in the firs subsample for the set of domestic French assets. Due to the truncated sample for Italy during the first subsample, only two of the eight spanning tests are rejected at the five percent significance level. The utility gains for France are relatively small, with one notable exception. In both subsamples, the addition of Japan to the set of French domestic equities yields dramatically high utility gains. Again, this is due to the exploitation of sample-specific properties of Japanese returns and involves large leveraged positions.

Similarly in Germany, the utility gains are relatively small with the exception of the addition of Canada in the full sample and Japan in the second subsample. The utility gains from adding the Canadian index are obtained by shorting the Canadian index, and the gains from adding the Japanese index are obtained by holding a long position in the Japanese index. Surprisingly, the addition of the Italian index in the second subsample increases German utility by a moderately large 5.16 percent for the coefficient of risk aversion is equal to 2. subsampleFor Italy, the largest utility gains are due to the addition of Japan to the benchmark portfolio, 34.07 percent ($\gamma = 2, \theta = 2$) and 28.67 percent ($\gamma = 5, \theta = 2$) for the first subsample and 4.06 percent ($\gamma = 2, \theta = 2$) and 1.60 percent ($\gamma = 5, \theta = 2$) for the second subsample.

7. Conclusion

Three key conclusions may be drawn from our research. First, ex post, there is weak evidence that investment in multinationals could have provided diversification benefits for U.S. investors over the 1988-92 period. Thus, U.S. home bias during this period could be explained by the indirect international diversification opportunities available to investors at home. Second, the addition of international assets provided further benefits to a benchmark portfolio that includes domestic stocks as well as the stocks of multinationals. The utility gains from diversification vary depending on the assets added to the benchmark

[14] Until recently, Canada has maintained some controls on the level of ownership of foreign stock. It is not clear that the restrictions were binding, however, because the amount of Canadian holdings of foreign equity was well-below the legal limitations (see Tesar and Werner, 1994).

portfolio. Often the largest gains are obtained from the addition of the equally-weighted index and the set of six international indices rather than from the addition of a single foreign market. This result is not surprising given the vast literature on the benefits of international diversification. Third, the utility gains from international diversification are in some cases very substantial but are often obtainable only by holding large long or short positions. If investors face substantial costs in taking short positions, the gains from international diversification may be limited. The sources of the gains from diversification vary across samples and, as a result, a strategy for future portfolio allocations is not readily apparent.

In future work, we plan to utilize this data set to explore a number of other issues related to the benefits of global diversification. First, tests of the spanning hypothesis and an analysis of the associated utility gains for international diversification subject to short-selling constraints would be useful. This test specification would determine if an investor subject to reasonable allocational constraints could obtain sizable utility gains from international diversification. Such an analysis may indicate that the large utility gains are overstated if the investor cannot leverage the portfolio. Second, current research indicates that investment in emerging markets yields substantial diversification benefits. Expanding the set of available assets to include the emerging market indices would be interesting in the testing framework presented above. The results would indicate the magnitude of the utility gains and the portfolio allocations needed to obtain the gains in utility. Finally, all of the results here are based on ex post sample returns. In future work, we plan to examine the benefits of global diversification in a framework that takes into account the investor's uncertainty about future returns.

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Figure 1: Utility Improvement from Expanding the Set of Available Assets

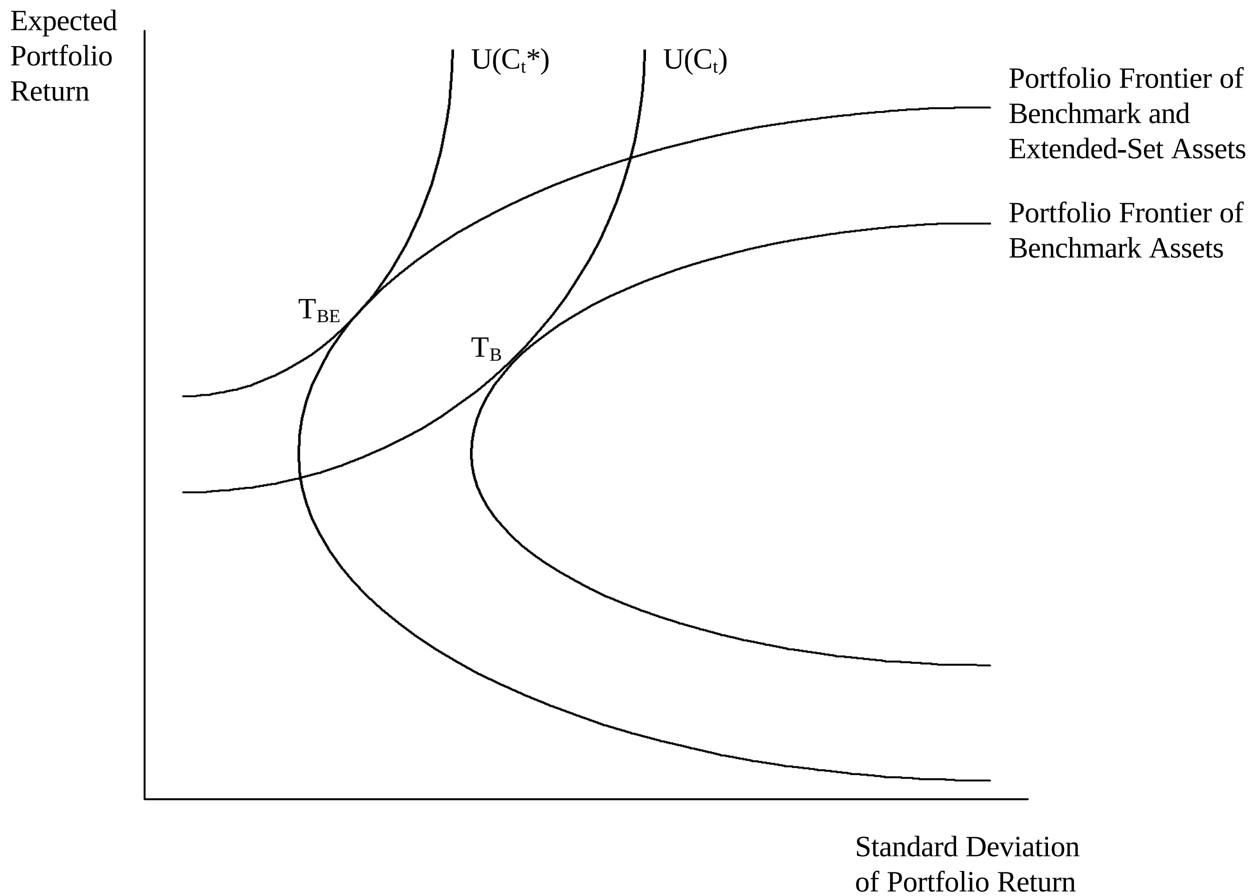

Table 1 Summary Statistics by Country by Firm Classification

Unless otherwise noted, the sample period is from January 4, 1984 to December 30, 1992. The returns are stated in percent return per week in the local currency. The return per unit risk is the sample mean return divided by the sample standard deviation.

Table 1.1 Summary Statistics by Firm Classification, Canada

	Number in Population	Number in Sample	Sample Mean Return	Sample Standard Deviation	Return Per Unit Risk
Canada Domestic					
CGS small	787	30	0.2402	3.1570	0.0761
medium	11	11	0.1585	2.0118	0.0788
large	4	4	0.2816	4.1681	0.0676
EU small	48	30	0.1881	1.6969	0.1108
medium	4	4	0.1973	1.7483	0.1129
large	1	1	0.1782	1.8378	0.0970
FIR small	194	30	0.0179	2.2442	0.0080
medium	7	7	0.1921	2.2896	0.0839
large	3	3	0.2427	2.6660	0.0910
IND small	793	30	0.0141	2.6104	0.0054
medium	19	19	0.0519	2.5153	0.0206
large	7	7	0.0843	2.7178	0.0310
Canada Multinationals					
CGS small	2	2	0.0711	3.9837	0.0178
medium	1	1	0.3095	2.9187	0.1060
large	2	2	0.2685	2.7603	0.0973
IND small	2	2	0.2175	3.8401	0.0566
medium	1	1	0.1574	3.0907	0.0509
large	2	2	0.1984	3.4481	0.0575

Table 1.2 Summary Statistics by Firm Classification, France

The sample period of French firms is truncated to the period from July 17, 1985 to December 20, 1992.

	Number in Population	Number in Sample	Sample Mean Return	Sample Standard Deviation	Return Per Unit Risk
France Domestic					
CGS small	331	30	0.3581	3.0879	0.1160
medium	19	19	0.2541	2.9752	0.0854
large	4	4	0.3633	3.9628	0.0917
EU small	10	10	0.3819	4.3724	0.0873
medium	0				
large	1	1	0.5116	4.3379	0.1179
FIR small	175	30	0.0846	1.8781	0.0451
medium	21	21	0.2073	2.8262	0.0734
large	10	10	0.2095	3.6842	0.0569
IND small	278	30	0.2819	3.4988	0.0806
medium	12	12	0.2908	3.5968	0.0808
large	3	3	0.3380	4.7876	0.0706
France Multinationals					
CGS small	1	1	0.1371	5.3929	0.0254
medium	3	3	0.1524	3.5836	0.0425
large	3	3	0.4280	3.4211	0.1251
IND small	2	2	0.3086	3.8238	0.0807
medium	9	9	0.3957	3.5498	0.1115
large	2	2	0.4194	3.3737	0.1243

Table 1.3 Summary Statistics by Firm Classification, Germany

	Number in Population	Number in Sample	Sample Mean Return	Sample Standard Deviation	Return Per Unit Risk
Germany Domestic					
CGS small	394	30	0.1735	2.3841	0.0728
Medium	37	30	0.1313	2.5503	0.0515
Large	20	20	0.1383	3.1787	0.0435
EU small	45	30	0.1944	1.3762	0.1412
Medium	10	10	0.2346	2.2531	0.1041
Large	6	6	0.2920	3.2841	0.0889
FIR small	197	30	0.1873	2.4521	0.0764
Medium	23	23	0.2928	3.3447	0.0875
Large	10	10	0.1201	4.3504	0.0276
IND small	675	30	0.1766	2.5770	0.0685
Medium	3	3	0.0350	2.6462	0.0132
Large	0				
Germany Multinationals					
CGS small	0				
Medium	1	1	0.2379	3.1087	0.0765
Large	1	1	0.2629	3.1224	0.0842
EU small	0				
Medium	0				
Large	1	1	0.2778	3.0336	0.0916
FIR small	0				
Medium	0				
Large	2	2	0.3115	3.4514	0.0903
IND small	8	8	0.1692	3.0739	0.0551
Medium	5	5	0.1675	2.9151	0.0575
Large	3	3	0.1540	3.0799	0.0500

Table 1.4 Summary Statistics by Firm Classification, Italy

The sample period for Italian firms is truncated to the period from January 15, 1986 to December 30, 1992.

	Number in Population	Number in Sample	Sample Mean Return	Sample Standard Deviation	Return Per Unit Risk
Italy Domestic					
CGS small	52	30	0.1267	2.6004	0.0487
Medium	10	10	0.1686	3.4516	0.0488
Large	4	4	0.0131	3.9345	0.0033
EU small	8	8	0.1912	2.8147	0.0679
Medium	2	2	0.2230	3.6862	0.0605
Large	1	1	0.2664	4.5834	0.0581
FIR small	92	30	0.0810	3.1770	0.0255
medium	11	11	0.1738	3.6227	0.0480
large	2	2	0.2455	3.6444	0.0674
IND small	116	30	-0.0575	3.1246	-0.0184
medium	11	11	0.0240	3.0499	0.0079
large	2	2	-0.0557	4.3326	-0.0129
Italy Multinationals					
IND small	0				
medium	1	1	0.0324	4.9322	0.0066
large	3	3	0.0183	4.2780	0.0043

Table 1.5 Summary Statistics by Firm Classification, Japan

		Number in Population	Number in Sample	Sample Mean Return	Sample Standard Deviation	Return Per Unit Risk
Japan Domestic						
CGS	small	503	30	0.2042	3.0438	0.0671
	medium	44	30	0.1917	2.8543	0.0672
	large	14	14	0.2058	2.9709	0.0693
EU	small	22	22	0.3055	3.8713	0.0789
	medium	4	4	0.2563	4.0181	0.0638
	large	3	3	0.2894	4.5289	0.0639
FIR	small	186	30	0.2775	3.3746	0.0822
	medium	9	9	0.4806	4.5079	0.1066
	large	6	6	0.4663	4.6552	0.1002
IND	small	1047	30	0.3427	3.5109	0.0976
	medium	43	30	0.0630	2.8653	0.0220
	large	5	5	0.0387	2.9733	0.0130
Japan Multinationals						
CGS	small	3	3	0.2269	4.0778	0.0556
	medium	4	4	0.1800	3.2821	0.0548
	large	6	6	0.1997	3.3811	0.0591
IND	small	12	12	0.1492	2.9836	0.0500
	medium	25	25	0.1176	2.9561	0.0398
	large	12	12	0.0770	3.4700	0.0222

Table 1.6 Summary Statistics by Firm Classification, United Kingdom

The sample period for UK firms is truncated to the period from December 17, 1986 to December 30, 1992.

	Number in Population	Number in Sample	Sample Mean Return	Sample Standard Deviation	Return Per Unit Risk
UK Domestic					
CGS small	548	30	0.2551	2.8449	0.0897
medium	16	16	0.3038	2.5175	0.1207
large	3	3	0.4219	3.1236	0.1351
EU small	45	30	0.7676	4.5137	0.1701
medium	3	3	0.3818	3.0976	0.1233
large	2	2	0.3628	3.0808	0.1178
FIR small	196	30	0.2338	3.0886	0.0757
medium	10	10	0.2802	3.1639	0.0886
large	5	5	0.3315	3.2493	0.1020
IND small	507	30	0.2508	3.0863	0.0813
medium	3	3	0.0057	3.9855	0.0014
large	2	2	0.3081	2.5320	0.1217
UK Multinationals					
CGS small	9	9	0.2262	3.0532	0.0741
medium	4	4	0.2709	2.9260	0.0926
large	3	3	0.4173	2.8050	0.1488
IND small	24	24	0.2309	3.0376	0.0760
medium	10	10	0.2869	2.9441	0.0975
large	1	1	0.1979	3.5385	0.0559

Table 1.7 Summary Statistics by Firm Classification, United States

	Number in Population	Number in Sample	Sample Mean Return	Sample Standard Deviation	Return Per Unit Risk
US Domestic					
CGS small	3481	30	0.4535	3.3831	0.1340
medium	76	30	0.4518	2.5904	0.1744
large	17	17	0.3811	2.6721	0.1426
EU small	609	30	0.2645	1.8616	0.1421
medium	30	30	0.3273	1.8153	0.1803
large	5	5	0.3773	2.3343	0.1616
FIR small	2215	30	0.3352	2.5374	0.1321
medium	122	30	0.3356	2.4455	0.1372
large	20	20	0.3005	2.8592	0.1051
IND small	3170	30	0.2022	3.4517	0.0586
medium	55	30	0.1875	2.6620	0.0704
large	6	6	0.1029	4.0015	0.0257
US Multinationals					
CGS small	19	19	0.3749	2.6629	0.1408
medium	22	22	0.4014	2.4817	0.1617
large	15	15	0.4256	2.5398	0.1676
EU small	0				
medium	0				
large	1	1	0.3404	2.7793	0.1225
FIR small	3	3	0.4542	5.0945	0.0892
medium	0				
large	4	4	0.2160	3.4676	0.0623
IND small	77	30	0.2476	2.9035	0.0853
medium	50	30	0.3534	2.7932	0.1265
large	12	12	0.2168	2.0589	0.1053

Table 2 **Summary Statistics by Country by Firm Classification by Subsample**

Unless otherwise noted, the first subsample period is from January 4, 1984 to June 29, 1988 and the second subsample is from July 6, 1988 until December 30, 1992. The returns are stated in percent return per week in the local currency. The return per unit risk is the sample mean return divided by the sample standard deviation.

Table 2.1 **Subsample Summary Statistics by Firm Classification, Canada**

	First Subsample January 1984 - June 1988			Second Subsample July 1988 – December 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
Canada Domestic						
CGS small	0.4375	3.5875	0.1220	0.0428	2.6508	0.0162
medium	0.2689	2.1500	0.1251	0.0482	1.8616	0.0259
large	0.4346	4.1110	0.1057	0.1286	4.2276	0.0304
EU small	0.2393	1.8119	0.1321	0.1368	1.5758	0.0868
medium	0.2599	1.7872	0.1454	0.1348	1.7101	0.0788
large	0.1859	1.9848	0.0937	0.1706	1.6824	0.1014
FIR small	-0.1071	2.7117	-0.0395	0.1429	1.6462	0.0868
medium	0.2136	2.3665	0.0903	0.1705	2.2148	0.0770
large	0.2238	2.7804	0.0805	0.2616	2.5522	0.1025
IND small	0.1661	2.9350	0.0566	-0.1378	2.2354	-0.0617
medium	0.0990	3.0478	0.0325	0.0048	1.8403	0.0026
large	0.1628	3.0823	0.0528	0.0059	2.3003	0.0026
Canada Multinationals						
CGS small	0.1039	4.4124	0.0236	0.0382	3.5123	0.0109
medium	0.3879	3.2333	0.1200	0.2311	2.5705	0.0899
large	0.3196	3.1767	0.1006	0.2175	2.2747	0.0956
IND small	0.5511	4.7048	0.1171	-0.1161	2.6827	-0.0433
medium	0.3412	3.2522	0.1049	-0.0265	2.9156	-0.0091
large	0.1148	3.6970	0.0311	0.2819	3.1854	0.0885

Table 2.2 Subsample Summary Statistics by Firm Classification, France

	Truncated First Subsample July 24, 1985 - June 1988			Second Subsample July 1988 – December 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
France Domestic						
CGS small	0.5665	4.2230	0.1341	0.2215	2.0253	0.1094
medium	0.2673	3.8179	0.0700	0.2455	2.2686	0.1082
large	0.4878	5.1781	0.0942	0.2817	2.9138	0.0967
EU small	0.4965	5.6536	0.0878	0.3067	3.2843	0.0934
medium						
large	0.7132	5.5333	0.1289	0.3795	3.3374	0.1137
FIR small	0.1036	2.2290	0.0465	0.0722	1.6124	0.0448
medium	0.2730	3.3047	0.0826	0.1643	2.4696	0.0665
large	0.3787	4.3955	0.0862	0.0987	3.1372	0.0315
IND small	0.4459	4.2301	0.1054	0.1745	2.9273	0.0596
medium	0.4485	4.6374	0.0967	0.1874	2.7135	0.0691
large	-0.0676	5.4690	-0.0124	0.6038	4.2745	0.1413
France Multinationals						
CGS small	0.0503	5.5928	0.0090	0.1939	5.2692	0.0368
medium	0.3762	4.3235	0.0870	0.0058	3.0028	0.0019
large	0.5454	4.2451	0.1285	0.3512	2.7583	0.1273
IND small	0.3254	4.2366	0.0768	0.2975	3.5366	0.0841
medium	0.6896	4.4271	0.1558	0.2032	2.8257	0.0719
large	0.4002	3.9550	0.1012	0.4320	2.9402	0.1469

Table 2.3 Subsample Summary Statistics by Firm Classification, Germany

	First Subsample January 1984 - June 1988			Second Subsample July 1988 – December 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
Germany Domestic						
CGS small	0.1682	2.8540	0.0589	0.1789	1.8019	0.0993
medium	0.1316	2.7623	0.0476	0.1310	2.3250	0.0564
large	0.1978	3.3643	0.0588	0.0788	2.9877	0.0264
EU small	0.2391	1.4027	0.1704	0.1497	1.3506	0.1108
medium	0.2213	2.1740	0.1018	0.2479	2.3341	0.1062
large	0.2170	3.1146	0.0697	0.3670	3.4503	0.1064
FIR small	0.2543	2.8285	0.0899	0.1202	2.0103	0.0598
medium	0.3278	3.7412	0.0876	0.2577	2.9020	0.0888
large	0.2210	4.8883	0.0452	0.0191	3.7440	0.0051
IND small	0.1613	2.9218	0.0552	0.1918	2.1846	0.0878
medium	0.0417	2.7432	0.0152	0.0283	2.5514	0.0111
large						
Germany Multinationals						
CGS small						
medium	0.2389	3.0783	0.0776	0.2369	3.1454	0.0753
large	0.2698	3.5865	0.0752	0.2560	2.5840	0.0991
EU small						
medium						
large	0.3189	2.9364	0.1086	0.2366	3.1335	0.0755
FIR small						
medium						
large	0.3521	3.8097	0.0924	0.2709	3.0592	0.0886
IND small	0.0955	3.0317	0.0315	0.2430	3.1203	0.0779
medium	0.2623	2.9877	0.0878	0.0728	2.8438	0.0256
large	0.2013	3.3238	0.0606	0.1066	2.8212	0.0378

Table 2.4 Subsample Summary Statistics by Firm Classification, Italy

	Truncated First Subsample January 15, 1986 - June 1988			Second Subsample July 1988 – December 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
Italy Domestic						
CGS small	0.2328	3.4655	0.0672	0.0684	1.9776	0.0346
medium	0.3433	4.8156	0.0713	0.0727	2.4020	0.0303
large	-0.0682	4.3447	-0.0157	2.4020	3.6991	0.6493
EU small	-0.1998	3.0659	-0.0652	0.4058	2.6491	0.1532
medium	0.0282	3.6657	0.0077	0.3299	3.7008	0.0891
large	0.1258	4.8433	0.0260	0.3436	4.4430	0.0773
FIR small	0.2946	4.0642	0.0725	-0.0363	2.5659	-0.0141
medium	0.1748	4.2241	0.0414	0.1733	3.2555	0.0532
large	0.5919	4.6340	0.1277	0.0554	2.9588	0.0187
IND small	-0.0737	3.4586	-0.0213	-0.0487	2.9329	-0.0166
medium	0.1459	3.2665	0.0447	-0.0429	2.9293	-0.0147
large	0.3139	5.4468	0.0576	-0.2586	3.5741	-0.0723
Italy Multinationals						
IND small						
medium	-0.2648	6.5370	-0.0405	0.1956	3.7798	0.0517
large	0.3813	5.3554	0.0712	-0.1810	3.5482	-0.0510

Table 2.5 Subsample Summary Statistics by Firm Classification, Japan

	First Subsample January 1984 - June 1988			Second Subsample July 1988 – December 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
Japan Domestic						
CGS small	0.5524	2.8754	0.1921	-0.1440	3.1714	-0.0454
medium	0.4529	2.6686	0.1697	-0.0695	3.0118	-0.0231
large	0.5196	2.8886	0.1799	-0.1079	3.0246	-0.0357
EU small	0.6236	4.0788	0.1529	-0.0127	3.6329	-0.0035
medium	0.6527	4.2328	0.1542	-0.1400	3.7587	-0.0372
large	0.9800	5.2122	0.1880	-0.4012	3.6033	-0.1113
FIR small	0.7199	3.8302	0.1879	-0.1648	2.7859	-0.0592
medium	0.9766	4.7766	0.2045	-0.0154	4.1736	-0.0037
large	0.9461	4.8113	0.1966	-0.0134	4.4524	-0.0030
IND small	0.6025	2.8499	0.2114	0.0829	4.0556	0.0204
medium	0.2927	2.7464	0.1066	-0.1667	2.9675	-0.0562
large	0.2692	2.9630	0.0909	-0.1919	2.9720	-0.0646
Japan Multinationals						
CGS small	0.6092	4.3443	0.1402	-0.1553	3.7632	-0.0413
medium	0.4991	3.0712	0.1625	-0.1391	3.4573	-0.0402
large	0.5966	3.6223	0.1647	-0.1971	3.0781	-0.0640
IND small	0.4153	2.4136	0.1721	-0.1169	3.4459	-0.0339
medium	0.3802	2.8731	0.1323	-0.1451	3.0200	-0.0480
large	0.3069	3.7810	0.0812	-0.1528	3.1194	-0.0490

Table 2.6 Subsample Summary Statistics by Firm Classification, UK

	Truncated First Subsample December 17, 1986 - June 1988			Second Subsample July 1988 – December 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
UK Domestic						
CGS small	0.0992	4.0752	0.0243	0.3081	2.2896	0.1346
medium	0.2382	3.0930	0.0770	0.3261	2.2962	0.1420
large	0.0530	3.9889	0.0133	0.5475	2.7674	0.1978
EU small	1.2111	6.1885	0.1957	0.6166	3.7840	0.1629
medium	0.4043	3.6379	0.1111	0.3741	2.8996	0.1290
large	0.3859	3.6702	0.1051	0.3550	2.8615	0.1240
FIR small	0.5720	3.8415	0.1489	0.1186	2.7868	0.0426
medium	0.3698	3.7598	0.0984	0.2497	2.9422	0.0849
large	0.2892	3.8046	0.0760	0.3459	3.0463	0.1136
IND small	0.4040	3.9340	0.1027	0.1986	2.7471	0.0723
medium	0.3116	4.1348	0.0754	-0.0985	3.9370	-0.0250
large	0.1995	3.3630	0.0593	0.3451	2.1862	0.1578
UK Multinationals						
CGS small	0.3818	4.0748	0.0937	0.1732	2.6253	0.0660
medium	0.5649	3.9594	0.1427	0.1708	2.4812	0.0689
large	0.2972	3.8226	0.0778	0.4582	2.3703	0.1933
IND small	0.3602	3.9925	0.0902	0.1869	2.6443	0.0707
medium	0.2795	4.0159	0.0696	0.2894	2.4873	0.1164
large	0.2771	4.2371	0.0654	0.1709	3.2768	0.0521

Table 2.7 Subsample Summary Statistics by Firm Classification, US

	First Subsample January 1984 - June 1988			Second Subsample July 1988 – December 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
US Domestic						
CGS small	0.5274	3.5856	0.1471	0.3796	3.1737	0.1196
medium	0.4773	2.8905	0.1651	0.4262	2.2568	0.1889
large	0.2793	2.8757	0.0971	0.4829	2.4537	0.1968
EU small	0.3107	2.1219	0.1464	0.2183	1.5619	0.1398
medium	0.3478	2.0349	0.1709	0.3068	1.5694	0.1955
large	0.4412	2.5010	0.1764	0.3134	2.1582	0.1452
FIR small	0.3363	2.4458	0.1375	0.3341	2.6310	0.1270
medium	0.3168	2.6336	0.1203	0.3543	2.2472	0.1577
large	0.2717	3.0856	0.0880	0.3293	2.6198	0.1257
IND small	0.0426	3.7472	0.0114	0.3619	3.1284	0.1157
medium	0.2582	3.0392	0.0850	0.1169	2.2262	0.0525
large	-0.1170	4.4327	-0.0264	0.3228	3.5137	0.0919
US Multinationals						
CGS small	0.3256	2.8775	0.1132	0.4241	2.4347	0.1742
medium	0.4198	2.6995	0.1555	0.3830	2.2486	0.1703
large	0.3825	2.6847	0.1425	0.4687	2.3911	0.1960
EU small						
medium						
large	0.2934	2.8872	0.1016	0.3874	2.6725	0.1450
FIR small	0.8193	7.0241	0.1166	0.0892	1.5532	0.0574
medium						
large	0.2425	3.3554	0.0723	0.1895	3.5833	0.0529
IND small	0.3601	3.3688	0.1069	0.1351	2.3499	0.0575
medium	0.4643	3.1338	0.1481	0.2426	2.4067	0.1008
large	0.2622	2.3555	0.1113	0.1714	1.7159	0.0999

Table 3.1 Summary Statistics for the Returns on the International Indices (Local Currency)

The rates of return are stated in percent return per week in the local currency. The return per unit risk is the sample mean return divided by the sample standard deviation.

	Full Sample Jan. 1984 – Dec. 1992			First Subsample Jan. 1984 - June 1988			Second Subsample July 1988 - Dec. 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
Canada	0.1384	1.8398	0.0752	0.1908	2.1612	0.0883	0.0860	1.4519	0.0592
France	0.3416	2.8456	0.1200	0.4746	3.2826	0.1446	0.2086	2.3276	0.0896
Germany	0.1992	2.4850	0.0802	0.2305	2.6819	0.0859	0.1678	2.2764	0.0737
Italy	0.3012	2.9642	0.1016	0.5455	3.2911	0.1658	0.0569	2.5805	0.0220
Japan	0.1784	2.7538	0.0648	0.5248	2.5621	0.2048	-0.1680	2.8972	-0.0580
United Kingdom	0.3547	2.2281	0.1592	0.4192	2.4240	0.1729	0.2902	2.0165	0.1439
United States	0.3030	2.1543	0.1406	0.3069	2.3979	0.1280	0.2992	1.8846	0.1588

Table 3.2 Summary Statistics for the Returns on the International Indices (US Dollars)

	Full Sample Jan. 1984 - Dec. 1992			First Subsample Jan. 1984 - June 1988			Second Subsample July 1988 - Dec. 1992		
	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk	Sample Mean Return	Sample Standard Dev.	Return Per Unit Risk
Canada	0.1377	2.0136	0.0684	0.2036	2.3170	0.0879	0.0717	1.6583	0.0433
France	0.4406	3.1318	0.1407	0.6156	3.5285	0.1745	0.2656	2.6733	0.0994
Germany	0.3202	2.7690	0.1156	0.4069	2.7708	0.1469	0.2335	2.7704	0.0843
Italy	0.3393	3.2903	0.1031	0.6428	3.5271	0.1823	0.0357	3.0121	0.0119
Japan	0.3273	3.2630	0.1003	0.7751	2.9985	0.2585	-0.1205	3.4564	-0.0349
United Kingdom	0.3786	2.7448	0.1379	0.5084	2.9987	0.1695	0.2489	2.4644	0.1010
United States	0.3030	2.1543	0.1406	0.3069	2.3979	0.1280	0.2992	1.8846	0.1588

Table 4 Sample Correlations of the Returns on the International Indices

Table 4.1 Full Sample: January 4, 1984 to December 30, 1992

	Canada	France	Germany	Italy	Japan	UK	US
Canada	1.00	0.43	0.39	0.24	0.33	0.56	0.77
France		1.00	0.54	0.40	0.32	0.45	0.47
Germany			1.00	0.38	0.30	0.43	0.43
Italy				1.00	0.22	0.34	0.27
Japan					1.00	0.34	0.39
UK						1.00	0.58
US							1.00

Table 4.2 First Subsample: January 4, 1984 to June 29, 1984

	Canada	France	Germany	Italy	Japan	UK	US
Canada	1.00	0.43	0.39	0.23	0.36	0.61	0.79
France		1.00	0.43	0.34	0.35	0.39	0.45
Germany			1.00	0.29	0.32	0.40	0.39
Italy				1.00	0.21	0.29	0.24
Japan					1.00	0.32	0.46
UK						1.00	0.61
US							1.00

Table 4.3 Second Subsample: July 6, 1988 to December 30, 1992

	Canada	France	Germany	Italy	Japan	UK	US
Canada	1.00	0.40	0.40	0.25	0.32	0.48	0.75
France		1.00	0.73	0.51	0.29	0.55	0.50
Germany			1.00	0.51	0.28	0.47	0.48
Italy				1.00	0.23	0.42	0.32
Japan					1.00	0.38	0.33
UK						1.00	0.53
US							1.00

Table 5 Summary Statistics for Exchange Rates

The exchange rates are stated as pounds per unit of local currency. The exchange rate for Italy and Japan are stated per 100 units of lire and yen, respectively.

	Full Sample Jan. 1984 - Dec. 1992		First Subsample Jan. 1984 - June 1988		Second Subsample July 1988 - Dec. 1992	
	Mean Rate	Standard Dev.	Mean Rate	Standard Dev.	Mean Rate	Standard Dev.
Canada	0.50248	0.05304	0.51506	0.06532	0.49038	0.03269
France	0.09723	0.00800	0.09376	0.00742	0.10160	0.00766
Germany	0.32059	0.03643	0.30001	0.03471	0.34438	0.02599
Italy (per 100 lire)	0.04482	0.00268	0.04418	0.00319	0.04546	0.00184
Japan (per 100 yen)	0.40163	0.05091	0.37660	0.05193	0.43193	0.03924
United States	0.63268	0.08997	0.68776	0.09276	0.58040	0.04294

Table 6.1 Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification

The benchmark set is the set of domestic assets in each country. The extended set is the set of multinationals in that country.

	Canada	France	Germany	Italy	Japan	UK	US
Full Sample: January 1984 - December 1992							
test statistic	19.4621	13.8068	28.1248	4.0475	18.3476	10.2991	27.6034
p-value	0.0780	0.3132	0.0137	0.3996	0.1055	0.5897	0.0684
#obs	470	390	470	364	470	316	470
df	12	12	14	4	12	12	18
Utility gain (percent)							
(γ=2,θ=2)	5.71	13.55	5.38	3.08	5.47	5.89	15.33
(γ=5,θ=2)	2.50	7.04	2.58	1.29	3.78	3.55	8.52
First Subsample: January 1984 - Dec 1987							
test statistic	14.1690	9.8459	18.6841	5.1594	10.8895	6.7541	16.0336
p-value	0.2900	0.6295	0.1774	0.2713	0.5384	0.8734	0.5902
#obs	235	155	235	129	235	80	235
df	12	12	14	4	12	12	18
Utility gain (percent)							
(γ=2,θ=2)	11.53	19.00	9.54	4.37	7.02	18.56	20.07
(γ=5,θ=2)	6.08	10.26	4.44	2.37	3.85	14.35	11.44
Second Subsample: July 1988 - December 1992							
test statistic	11.2047	12.3546	15.4451	1.7860	10.4148	9.8053	28.2152
p-value	0.5115	0.4176	0.3484	0.7750	0.5796	0.6330	0.0589
#obs	235	235	235	235	235	235	235
df	12	12	14	4	12	12	18
Utility gain (percent)							
(γ=2,θ=2)	13.49	24.21	13.64	4.66	10.30	10.93	24.58
(γ=5,θ=2)	6.42	14.14	7.14	3.01	8.48	5.99	14.28

Notes: The sample data for France, Italy and the United Kingdom are not available for the entire time series. The data series for France begins on July 24, 1985. The data series for Italy begins on January 15, 1986 and the data series for the United Kingdom begins on December 24, 1986.

Table 6.2 Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification

The benchmark set is the domestic assets and an equally-weighted portfolio of the six international indices. The extended set is the set of multinationals in that country.

	Canada	France	Germany	Italy	Japan	UK	US
Full Sample: January 1984 - December 1992							
test statistic	22.0751	16.2801	24.6120	4.3481	15.1807	8.7452	23.9776
p-value	0.0367	0.1787	0.0386	0.3609	0.2317	0.7245	0.1558
#obs	470	389	470	364	470	315	470
df	12	12	12	12	12	12	12
Utility gain (percent)							
(γ=2,θ=2)	3.73	12.44	4.95	0.11	2.81	1.39	12.07
(γ=5,θ=2)	2.04	6.51	2.55	0.15	1.60	1.34	7.22
First Subsample							
test statistic	14.9551	9.7592	14.5080	2.8967	8.1803	6.7133	16.2905
p-value	0.2439	0.6371	0.4126	0.5753	0.7709	0.8760	0.5723
#obs	235	154	235	129	235	80	235
df	12	12	12	12	12	2	12
Utility gain (percent)							
(γ=2,θ=2)	9.56	21.54	6.70	1.17	8.67	0.75	15.92
(γ=5,θ=2)	5.70	13.53	3.44	1.14	4.83	0.87	9.53
Second Subsample							
test statistic	13.3531	12.1170	16.9174	1.2413	13.8614	10.2333	26.6747
p-value	0.3439	0.4363	0.2606	0.8713	0.3096	0.5955	0.0853
#obs	235	235	235	235	235	235	235
df	12	12	12	12	12	12	12
Utility gain (percent)							
(γ=2,θ=2)	11.15	22.45	11.59	2.20	2.28	8.96	16.92
(γ=5,θ=2)	6.28	14.66	7.31	1.45	1.47	5.58	11.20

Notes: The sample data for France, Italy and the United Kingdom are not available for the entire time series. The data series for France begins on July 24, 1985. The data series for Italy begins on January 15, 1986 and the data series for the United Kingdom begins on December 24, 1986.

Table 7.1 Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification, Canada

The benchmark set is the domestic assets and the international index(es). The mnc assets comprise the extended set.

	Canada	France	Germany	Italy	Japan	UK	US	Equal-Wt Index	All Indices
Full Sample: January 1984 - December 1992									
test statistic		19.8060	19.8255	21.1321	20.0647	19.6541	23.7088	22.1807	22.0751
p-value		0.0708	0.0705	0.0485	0.0659	0.0739	0.0223	0.0355	0.0367
#obs		470	470	470	470	470	470	470	470
df		2	2	2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)		4.95	5.51	5.13	5.36	4.47	4.34	4.19	3.73
(γ=5,θ=2)		2.29	2.49	2.24	2.38	2.05	2.38	1.99	2.04
First Subsample: January 1984 - June 1988									
test statistic		13.5852	13.0308	15.4854	15.3606	14.6768	14.8490	16.3938	14.9551
p-value		0.3280	0.3668	0.2160	0.2223	0.2596	0.2498	0.1739	0.2439
#obs		235	235	235	235	235	235	235	235
df		2	2	2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)		11.14	11.24	11.19	9.69	10.41	11.23	10.05	9.56
(γ=5,θ=2)		6.14	6.00	6.03	5.75	5.79	6.25	5.93	5.70
Second Subsample: July 1988 - December 1992									
test statistic		11.3586	11.3516	11.5743	11.1655	11.4215	13.1472	11.6699	13.3531
p-value		0.4985	0.4991	0.4804	0.5148	0.4932	0.3584	0.4725	0.3439
#obs		235	235	235	235	235	235	235	235
df		2	2	2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)		13.68	13.72	13.73	12.86	12.93	11.88	13.38	11.15
(γ=5,θ=2)		6.63	6.60	6.54	6.24	6.33	6.20	6.37	6.28

Table 7.2 **Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification, France**

The benchmark set is the domestic assets and the international index(es). The mnc assets comprise the extended set.

	Canada	France	Germany	Italy	Japan	UK	US	Equal-Wt Index	All Indices
Truncated Full Sample: July 24, 1985 - December 1992									
test statistic	15.7800		14.2898	15.1258	12.3724	14.6595	13.5123	15.3984	16.2801
p-value	0.2015		0.2826	0.2346	0.4163	0.2606	0.3329	0.2204	0.1787
#obs	389		389	389	389	389	389	389	389
df	2		2	2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	14.11		13.48	13.56	13.32	12.43	13.23	13.23	12.44
(γ=5,θ=2)	7.20		6.85	7.01	6.86	6.20	6.76	6.59	6.51
Truncated First Subsample: July 24, 1985 - June 1988									
test statistic	9.0877		8.8908	9.8626	9.0460	8.2888	8.8734	8.4315	9.7592
p-value	0.6954		0.7122	0.6280	0.6990	0.7622	0.7137	0.7506	0.6371
#obs	154		154	154	154	154	154	154	154
df	2		2	2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	19.09		18.89	18.52	23.04	17.80	19.10	18.99	21.54
(γ=5,θ=2)	10.29		9.93	9.96	14.13	9.26	10.27	10.23	13.53
Second Subsample: July 1988 - December 1992									
test statistic	13.6893		11.1288	11.9199	11.7348	12.8774	12.6823	12.1934	12.1170
p-value	0.3210		0.5179	0.4521	0.4672	0.3780	0.3926	0.4303	0.4363
#obs	235		235	235	235	235	235	235	235
df	2		2	2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	24.47		24.24	23.33	25.29	23.63	23.75	24.75	22.45
(γ=5,θ=2)	14.28		14.16	13.92	15.14	13.60	13.92	14.43	14.66

Table 7.3 Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification, Germany

The benchmark set is the domestic assets and the international index(es). The mnc assets comprise the extended set.

	Canada	France	Germany	Italy	Japan	UK	US	Equal-Wt Index	All Indices
Full Sample: January 1984 - December 1992									
test statistic	23.1864	28.1496		27.7492	28.1446	24.1440	26.6922	26.9885	24.6120
p-value	0.0573	0.0136		0.0154	0.0136	0.0440	0.0211	0.0193	0.0386
#obs	470	470		470	470	470	470	470	470
df	2	2		2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	6.13	4.22		5.17	5.29	5.19	5.15	4.91	4.95
(γ=5,θ=2)	2.88	2.10		2.45	2.52	2.46	2.43	2.29	2.55
First Subsample: January 1984 - June 1988									
test statistic	15.6694	17.6148		17.1077	17.4108	13.9054	16.4307	14.6920	14.5080
p-value	0.3340	0.2249		0.2505	0.2349	0.4568	0.2878	0.3995	0.4126
#obs	235	235		235	235	235	235	235	235
df	2	2		2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	10.83	7.02		8.35	6.79	8.31	10.44	6.75	6.70
(γ=5,θ=2)	4.94	3.33		3.89	3.42	3.76	4.67	3.03	3.44
Second Subsample: July 1988 - December 1992									
test statistic	13.8242	15.9167		15.2031	15.2859	15.2925	15.2872	16.1016	16.9174
p-value	0.4629	0.3185		0.3644	0.3589	0.3585	0.3588	0.3072	0.2606
#obs	235	235		235	235	235	235	235	235
df	2	2		2	2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	12.99	13.74		13.96	11.45	14.05	15.86	13.23	11.59
(γ=5,θ=2)	6.97	7.25		7.40	6.38	7.41	8.54	7.09	7.31

Table 7.4 **Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification, Italy**

The benchmark set is the domestic assets and the international index(es). The mnc assets comprise the extended set.

	Canada	France	Germany	Italy	Japan	UK	US	Equal-Wt Index	All Indices
Truncated Full Sample: January 15 1986 - December 1992									
test statistic	3.9602	6.1537	6.2935		4.3453	3.9904	4.7492	5.1622	4.3481
p-value	0.4114	0.1880	0.1783		0.3613	0.4073	0.3140	0.2711	0.3609
#obs	364	364	364		364	364	364	364	364
df	2	2	2		2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	3.08	3.27	3.23		3.18	3.76	2.98	3.28	0.11
(γ=5,θ=2)	1.27	1.54	1.49		1.37	1.78	1.23	1.48	0.15
Truncated First Sample: January 15 1986 – June 88									
test statistic	5.2560	5.7119	7.5593		5.7124	4.5509	6.5773	6.4713	2.8967
p-value	0.2620	0.2217	0.1091		0.2217	0.3366	0.1600	0.1666	0.5753
#obs	129	129	129		129	129	129	129	129
df	2	2	2		2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	3.86	5.42	5.50		2.87	3.95	4.53	4.77	1.17
(γ=5,θ=2)	1.86	3.53	3.33		1.52	1.83	2.37	2.62	1.14
Second Subsample: July 1988 - December 1992									
test statistic	1.9519	2.0979	2.2686		1.9636	2.6697	1.6800	2.4149	1.2413
p-value	0.7446	0.7178	0.6865		0.7424	0.6145	0.7943	0.6599	0.8713
#obs	235	235	235		235	235	235	235	235
df	2	2	2		2	2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	4.63	3.68	3.96		5.37	4.25	4.34	4.59	2.20
(γ=5,θ=2)	3.01	2.11	2.26		3.42	2.64	2.71	2.70	1.45

Table 7.5 Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification, Japan

The benchmark set is the domestic assets and the international index(es). The mnc assets comprise the extended set.

	Canada	France	Germany	Italy	Japan	UK	US	Equal-Wt Index	All Indices
Full Sample: January 1984 - December 1992									
test statistic	12.2032	15.5102	13.7891	18.8215		18.5063	12.1229	15.8749	15.1807
p-value	0.4295	0.2147	0.3144	0.0929		0.1012	0.4359	0.1970	0.2317
#obs	470	470	470	470		470	470	470	470
df	2	2	2	2		2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	5.17	3.14	3.96	4.49		3.64	3.40	3.20	2.81
(γ=5,θ=2)	2.78	1.96	2.37	2.86		2.15	1.81	1.67	1.60
First Subsample: January 1984 - June 1988									
test statistic	9.8595	9.7344	7.5088	9.6056		10.4935	10.3018	8.4688	8.1803
p-value	0.6283	0.6392	0.8222	0.6505		0.5728	0.5895	0.7475	0.7709
#obs	235	235	235	235		235	235	235	235
df	2	2	2	2		2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	9.04	7.01	7.50	7.00		7.52	9.80	8.12	8.67
(γ=5,θ=2)	4.98	3.68	4.07	3.76		3.96	5.21	4.20	4.83
Second Subsample: July 1988 - December 1992									
test statistic	12.3757	11.0778	9.1695	10.6564		11.3700	11.1557	14.2879	13.8614
p-value	0.4160	0.5223	0.6884	0.5586		0.4975	0.5156	0.2827	0.3096
#obs	235	235	235	235		235	235	235	235
df	2	2	2	2		2	2	2	12
Utility gain (percent)									
(γ=2,θ=2)	2.77	2.90	2.84	5.77		3.65	1.48	1.82	2.28
(γ=5,θ=2)	1.88	2.25	2.18	4.53		2.76	1.02	1.17	1.47

Table 7.6 Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification, United Kingdom

The benchmark set is the domestic assets and the international index(es). The mnc assets comprise the extended set.

	Canada	France	Germany	Italy	Japan	UK	US	Equal-Wt Index	All Indices
Truncated Full Sample: December 24, 1986 to December 1992									
test statistic	9.5948	7.7668	7.7255	9.5930	7.6287		7.9282	7.4648	8.7452
p-value	0.6515	0.8031	0.8062	0.6516	0.8134		0.7907	0.8254	0.7245
#obs	315	315	315	315	315		315	315	315
df	2	2	2	2	2		2	2	12
Utility gain (percent)									
(γ=2,θ=2)	6.79	6.37	7.06	5.84	7.90		6.55	8.01	1.39
(γ=5,θ=2)	3.95	3.66	3.94	3.61	4.50		3.78	4.41	1.34
Truncated First Subsample: December 24, 1986 - June 88									
test statistic	6.7228	6.3505	7.1358	5.6764	5.3565		5.6909	5.8185	6.7133
p-value	0.8754	0.8974	0.8485	0.9315	0.9450		0.9309	0.9250	0.8760
#obs	80	80	80	80	80		80	80	80
df	2	2	2	2	2		2	2	2
Utility gain (percent)									
(γ=2,θ=2)	18.55	21.80	16.60	19.74	17.87		18.62	20.73	0.75
(γ=5,θ=2)	14.40	16.77	13.88	16.12	13.15		14.32	15.73	0.87
Second Subsample: July 1988 - December 1992									
test statistic	9.1053	9.3901	8.6429	11.0049	9.8559		8.4607	8.6364	10.2333
p-value	0.6939	0.6693	0.7331	0.5285	0.6286		0.7482	0.7336	0.5955
#obs	235	235	235	235	235		235	235	235
df	2	2	2	2	2		2	2	12
Utility gain (percent)									
(γ=2,θ=2)	11.06	10.99	11.21	10.30	13.14		11.38	12.30	8.96
(γ=5,θ=2)	6.37	5.97	6.01	5.84	7.61		6.21	6.84	5.58

Table 7.7 Mean-Variance Spanning Tests and the Utility Gain from MNC Diversification, United States

The benchmark set is the domestic assets and the international index(es). The mnc assets comprise the extended set.

	Canada	France	Germany	Italy	Japan	UK	US	Equal-Wt Index	All Indices
Truncated Full Sample: December 24, 1986 to December 1992									
test statistic	25.2602	27.8704	27.4132	27.1586	26.9986	26.8083		26.4764	23.9776
p-value	0.1179	0.0641	0.0716	0.0761	0.0790	0.0827		0.0894	0.1558
#obs	470	470	470	470	470	470		470	470
df	2	2	2	2	2	2		2	12
Utility gain (percent)									
(γ=2,θ=2)	13.86	14.53	15.39	15.32	15.42	15.32		15.38	12.07
(γ=5,θ=2)	8.17	8.01	8.53	8.48	8.55	8.43		8.47	7.22
Truncated First Subsample: December 24, 1986 - June 88									
test statistic	15.0145	16.4453	16.6118	16.0890	16.8067	15.5776		16.3227	16.2905
p-value	0.6610	0.5615	0.5499	0.5863	0.5364	0.6220		0.5700	0.5723
#obs	235	235	235	235	235	235		235	235
df	2	2	2	2	2	2		2	12
Utility gain (percent)									
(γ=2,θ=2)	20.21	18.36	21.29	18.85	18.30	19.59		19.80	15.92
(γ=5,θ=2)	11.70	10.46	12.36	10.66	10.47	11.11		11.41	9.53
Second Subsample: July 1988 - December 1992									
test statistic	27.6172	26.6097	27.7044	25.2395	24.4299	23.4240		26.1306	26.6747
p-value	0.0681	0.0866	0.0667	0.1185	0.1414	0.1748		0.0968	0.0853
#obs	235	235	235	235	235	235		235	235
df	2	2	2	2	2	2		2	12
Utility gain (percent)									
(γ=2,θ=2)	19.99	24.52	24.38	21.03	23.46	24.38		22.30	16.92
(γ=5,θ=2)	12.67	14.28	14.24	12.57	14.18	14.25		13.42	11.20

Appendix A

Equity Classification Methodology

Datastream classifies firms according to country of origin and industry. The primary classification is by country of origin. American depository receipts, global depository receipts and cross-listed securities are omitted from Datastream's country-specific classification of firms.[15] We follow Datastream's classification hierarchy and use four broad industry categories as defined by Datastream: consumer goods and services (CGS), energy and utilities (EU), finance and real estate (FIR) and industrials (IND). Firms that do not have a valid Datastream industry classification are assigned the industry classification other (OTHER).[16] Firms that are classified as OTHER may have unobservable characteristics that distinguish them from the firms in the four categories. If the OTHER category remains distinct, the portfolio selection process may be biased. To reduce this potential bias, the OTHER category is incorporated into the four industry categories. The methodology is explained below.[17]

We construct the firm size classification within each industry by using a size-sorting algorithm based on the annual observations of each firm's market capitalization denominated in the local currency. If a firm has no market capitalization during the sample period, it is dropped from the sample. A firm may have a reported market capitalization of zero. Datastream measures market capitalization in millions of local currency units. We assume that a firm that has a reported market capitalization of zero either has a true capitalization equal to zero or has a true capitalization that is positive and a reported capitalization of zero due to rounding. Including firms with reported market capitalizations equal to zero and true market capitalizations greater than zero biases the size sorting algorithm such that the marginal firm in a size category is classified as smaller than it actually is.

[15] Datastream documentation states that the lists of firms by country do not include cross-listed securities. (Find specific reference.) We performed a secondary check to ensure that cross-listed securities are not omitted from the sample.

[16] For example, a firm whose trading has been suspended is classified by Datastream as a suspended firm. This designation overlays the industry classification. As a result, the industry classification cannot be determined from the information available from Datastream.

[17] Firms whose trading has been suspended comprise the majority of the firms that are included in the OTHER category. We infer from this status that the firms are poor performers. If the OTHER category contains a disproportionately high number of poor performers, the four other categories contain a disproportionately low number of poor performers. We assume that the investor cannot identify poor performers a priori, therefore, the investor could not construct the OTHER category a priori.

The firms are classified into small, medium and large categories such that approximately one third of the total industry market capitalization falls into each size category. If each size category contains exactly one third of the industry's market capitalization, the value-weighted portfolio weights for each size category in each industry are equal to one third. This methodology provides a reference point for a comparison of the weights derived from mean-variance optimization and the value-weighted portfolio weights.

To allocate firms in this way, the total market capitalization for each industry category is calculated for each set of annual observations. The firms within each industry are sorted by market capitalization in descending order. Beginning with the largest firm in each industry and proceeding with progressively smaller firms, the market capitalizations are summed until the accumulated total is greater than or equal to one third of the industry market capitalization. The market capitalization of the last firm that is added to the accumulated total is the reference point that partitions the medium-sized firms from the large-sized firms. Denote the market capitalization of this firm at time t as $M_t^{M/L}$. The process of summing the market capitalizations continues until the accumulated total is greater than or equal to two thirds of the industry market capitalization. The market capitalization of the last firm that is added to the accumulated total is the reference point that partitions the small-sized firms from the medium-sized firms. Denote the market capitalization of this firm as $M_t^{S/M}$.

The methodology described above is used to calculate the values of $M_t^{S/M}$ and $M_t^{M/L}$ conditional on the market capitalizations of firms that begin trading prior to the first year of the sample or begin trading in the first year of the sample. As new firms begin trading and old firms cease trading over time, the market capitalization of each industry changes. Rather than recalculate $M_t^{S/M}$ and $M_t^{M/L}$ at each point in time conditional on the market capitalizations of all firms at time t, the values of $M_t^{S/M}$ and $M_t^{M/L}$ for time periods after the first year of the sample are scaled to reflect the growth rate in the market capitalization of the industry. For example, if the consumer goods and services industry's market capitalization grows by five percent from the first year to the second year, $M_2^{S/M}$ is equal to $M_1^{S/M}$ times 1.05. As a result, a firm's size is determined only once during the sample and a firm's size classification cannot change during the sample period.

If $M_t^{S/M}$ and $M_t^{M/L}$ were recalculated each year using the market capitalizations of all firms at time t, a small successful firm with an increasing market capitalization could be reclassified as a larger firm and an unsuccessful firm with a diminishing market capitalization could be reclassified as a smaller firm. If the size classification of a firm is permitted to vary with the firm's success or failure, the portfolio weights would be a function of the size classification. The investor would hold relatively more of the large, i.e.

successful, firms and relatively less of the small, i.e. unsuccessful, firms. The portfolio weights would be a function of survivorship bias. By classifying the size of the firm only once, the effects of survivorship bias are reduced.

A firm is designated as a domestic or multinational firm conditional on the listing of multinational corporations in Worldwide Branch Locations of Multinational Companies (1994). The primary criteria for inclusion in the listing is the existence of one or more branches, subsidiaries, manufacturing plants or other holdings located in countries other than the country in which the corporation is headquartered. This selection criteria for multinational corporations is relatively narrow. A broader definition would include all firms with a large percentage of corporate sales outside the country in which the corporation is headquartered. We assume the list of firms with one or more branches, subsidiaries, manufacturing plants or other holdings located in countries other than the country in which the corporation is headquartered is highly correlated with the list of firms that fulfill the broader definition of a multinational firm.

The list includes five hundred multinational corporations. Approximately two hundred are headquartered in the United States and the majority of the remaining three hundred are headquartered in Canada, France, Germany, Japan, the United Kingdom and Sweden. This classification methodology captures the largest and most prominent multinational corporations. Because these firms have a physical presence in other countries, the firms are directly affected by international economic conditions. Firms that have international sales and no international physical presence are less directly affected by international economic conditions.

Sample Selection and Sample Construction Methodology

Conditional on the classification of the firms, a random sample is drawn for each category. Define the initial set of the firms for each category as the population and the random sample from each category as the sample.[18] The maximum number of firms in the sample for each category is arbitrary set at thirty firms. If the number of firms in a category population is less than thirty, all of the firms are included in the sample portfolio.[19] The size of the category sample is reported in the second column of Table 1. For example, the sample size for medium, domestic, finance-and-real-estate firms in Canada is 7.

Datastream provides returns data on firms that are currently traded and firms that are not currently traded but were traded in the past. For firms that are no longer traded, Datastream does not, however,

[18] The database of firms that are available from Datastream is not the true population of firms. For ease of discussion, consider it the population of Datastream firms.
[19] The names of the firms included in each category subsample are available from the authors upon request.

provide information regarding the disposition of the firm on the last day that it was traded. This shortcoming implies that a bankrupt firm can be easily be distinguished from a firm that has been acquired by another firm. As a result, the return series must be edited to reflect the final status of the firm. If the firm went bankrupt, the investor is assumed to have lost the entire amount of the investment and the last return observation is set equal to minus one. If the firm merged with another firm or was acquired by another firm, the investor is assumed to receive the amount of the investment on the day of the last observed return. The investor is assumed to reinvest the proceeds in the portfolio. The last observed return as stated by Datastream, which reflects the capital appreciation and any dividend disbursement over the last period, is not altered.

The primary source used to determine the final status of individual firms is Standard & Poor's Standard Corporate Descriptions (1996). Standard & Poor reports the final disposition of individual securities. In addition to Standard & Poor, Canada Stockwatch, an on-line securities database, is used to verify the final status of some Canadian firms. If these sources do not provide the needed information, the final status of the firm is inferred from the return series and the price series for each individual firm. As a rule of thumb, the firm is assumed to be bankrupt if the time series of prices for the firm's equity approaches zero as the date approaches the final day of trading. The firm is assumed to be acquired by another firm or merged with another firm if the time series of prices for the firm's equity is significantly different from zero as the date approaches the final day of trading. In cases such that the final status of the firm is ambiguous, the firm is assumed to be bankrupt.[20]

Conditional on the random sample of firms by category, a value-weighted portfolio is constructed for each category sample. The firms are chosen randomly from the list of firms for each category. A firm is included in the list if its equity traded during any part of the time series of returns. This selection methodology biases the sample portfolio because firms that trade for a short period of time are over-represented in the list of firms and firms that trade for a long period of time are under-represented in the list of firms. To demonstrate this bias, consider an example. Suppose the sample for small, domestic, industrial firms in Canada is comprised of fifty firms. Forty-five of the firms are traded for six months of the sample time period and five firms are traded for five years of the sample time period. The sample of thirty firms is chosen from the list of fifty firms. This selection methodology implies that each firm is equally likely to be included in the subsample portfolio. If the sample portfolio is constructed on a period-by-period basis however, each firm does not have an equal probability of being included in the sample portfolio. The firms

[20] A summary of the status for all firms, both currently traded and not traded, is available from the authors upon request.

that trade for a long period of time have a higher probability of being traded at any point in time and therefore have a higher probability of inclusion in the period-specific subsample portfolio. To reduce the bias of the sample selection methodology, the weights of the sample portfolio are a function of the value of the firm relative to the total value of all the firms in the category and the relative length of the time series of returns for each firm. The weight for each equity in the sample portfolio is equal to

(A.1) $$\omega_{it} = \left[\frac{mv_{it}}{\sum_{i=1}^{N_S} mv_{it}}\right]\left[\frac{n_i}{\sum_{i=1}^{N_S} n_i}\right]\lambda_t \quad \forall\, i = 1,...N_S$$

where ω_{it} is equal to the portfolio weight on asset i at time t, mv_{it} is equal to the market value of firm i at time t, n_i is equal to the number of observations in the time series of returns for firm i, N_S is the number of firms in the sample and λ_t is an adjustment factor that ensures that the weights of the portfolio sum to one for each time period. Combining the time series of returns for the firms in each sample yields one time series of returns for each category.

The portfolio for each category is augmented to incorporate the return series of the OTHER category because the characteristics of the firms in the OTHER category may not be readily identifiable a-priori. The three size classifications of the OTHER category are individually incorporated into the size categories of the other four industry classifications. For example, the small OTHER category is incorporated into the small categories of the other four industry categories. The return series are combined conditional on the relative market value of each category. The augmented return series is a linear combination of the industry return series and the return series of the OTHER category,

(A.2) $$r_{it}^{A} = r_{it}\omega_{it}^{A} + r_{Ot}\left(1 - \omega_{it}^{A}\right)$$

where r_{it}^{A} is the augmented return of industry category i at time t, r_{it} is the return of industry i at time t, ω_{it}^{A} is the augmented weight on industry i at time t, and (1 - ω_{it}^{A}) is the augmented weight on the other category at time t.[21]

Constructing the augmented weight on industry i is a two step process. The first step is the calculation of the percent of total market value of each size category for each industry:

(A.3) $$z_{it} = \frac{\sum_{j=1}^{N_i} mv_{jt}}{\sum_{j=1}^{N_{CGS}} mv_{jt} + \sum_{j=1}^{N_{EU}} mv_{jt} + \sum_{j=1}^{N_{FIR}} mv_{jt} + \sum_{j=1}^{N_{IND}} mv_{jt} + \sum_{j=1}^{N_{OTHER}} mv_{jt}}$$
$$\forall\, i = CGS, EU, FIR, IND$$

[21] The size category subscript is omitted in this derivation for notational clarity.

where z_{it} is the percent of total market value of industry i, mv_{jt} is the market value of firm j at time t, and N_j is the number of firms in the sample of industry j. For categories where the number of firms in the population is greater than thirty, the total market value of the category is approximated as the average market value of a firm in the category sample times the number of firms in the category's population.

(A.4) $$\sum_{j=1}^{N_i} mv_{jt} \cong N_i \left[\frac{1}{\overline{N}_i} \sum_{j=1}^{\overline{N}_i} mv_{jt} \right]$$

$\overline{N}_i$ is the number of firms in the category sample. For example, suppose that the z_{it}s for the medium sized CGS, EU, FIR, IND and OTHER categories are 0.30, 0.10, 0.20, 0.35 and 0.05, respectively. For this example, the IND category is the largest category as measured by market capitalization and the OTHER category is the smallest.

The second step in the construction of the augmented weight is to apportion the return series of the OTHER category to each of the four industry categories in proportion to their percent market value. Therefore, the augmented weight for industry i at time t, $w_{it}{}^{A}$, is equal to

(A.5) $$\omega_{it}^{A} = \frac{z_{it}}{z_{it} + z_{it} z_{Ot}}$$

where z_{Ot} is the percent of total market value of the OTHER category. Using this apportionment methodology and the example percentages from step 1, twenty percent of the return series of the OTHER category, which comprises five percent of the total, is apportioned to the CGS category. The weights for combining the CGS category and the OTHER category would be 0.9524 and 0.0476, respectively. Therefore the augmented return for the CGS category would be

(A.6) $$r_{CGSt}^{A} = r_{CGSt}(0.9524) + r_{Ot}(0.0476).$$

Appendix B

Geographical Listing of Multinational Corporation Headquarters
Source: Worldwide Branch Locations of Multinational Companies

* Data not available from Datastream database.

<u>Canada (11 Firms)</u>

Abitibi-Price, Inc.
Alcan Aluminium Ltd.
Dominion textile, Inc.
Inco Ltd.*
Ivanco, Inc.
John Labatt Ltd.
Moore Corp. Ltd.
Northern Telecom Ltd.
Quebecor, Inc.
The Seagram Company Ltd.
Thomson Corporation

<u>France (22 firms)</u>

L'air Liquide SA
Alcatel Alsthom
BSN Groupe
Bull SA
Cap Gemini Sogeti Holding Company
Club Mediterranee SA
Dumez SA
Groupe Pernod Ricard
Hachette SA
Lafarge Coupee SA
LVMH Moet Hennessy Louis Vuitton
L'Oral SA*
Pechiney SA
Peugeot SA
Regie Nationale Des Usines Renault SA*
Rhone-Poulenc SA
Saint-Gobain
Salamon SA
Societe Bic SA
Societe Nationale Elf
Aquitaine
Source Perrier SA*
Total Compagnie Francaise des Petroles

<u>Germany (32 firms)</u>

Allianz Aktiengesellschaft
BASF Aktiengesellschaft
Bayer AG
Bayerische Motoren Werke AG
Beiersdorf AG
Bertelsmann AG*
Continental AG
Daimler-Benz AG
Degussa AG
Deutch Babcock AG*
Deutch Bank
Dywidag-Systems International GmbH*
FAG Kugelfischer Georg Schaefer KGAA
Feldmuhle Nobel AG*
Franz Haniel & Cie GmbH*
Freudenberg & Co.*
Fried. Krupp GmbH*
Fuchs Petrolub AG OEL & Chemie
Grundig AG*
Hoechst
Kloecknet-Werke AG
Mannesmann AG
Philipp Holzmann AG
Preussag AG
Robert Bosch GmbH*
Schering AG
Siemens AG
Siemens Nixdorf Informationssysteme AG
SMS AG*
Veba AG
Volkswagen AG
Wella AG*

<u>Italy (6 Firms)</u>

Alfa Romeo SpA*
Benetton Group SpA
Fiat SpA
Ing. C. Olivetti & C. SpA
Montedison SpA
Pirelli SpA*

<u>Japan (68 firms)</u>

Advantest Corp.
Ajinomoto Co., Inc.
Alps Electric Co., Ltd.
Anritsu Corp.
Asahi Chemical Industry Co., Ltd.
Bridgestone Corp.
Brothers Industries Ltd.
C. Itoh & Co., Ltd.*
Canon Inc.
Citizen Watch Company
Dai Nippon Printing Co., Ltd.
The Daiei, Inc.
Daihatsu Motor Co.
Dainippon Ink and Chemicals, Inc.
Dentsu Inc.*
Fuji Heavy Industries Ltd.
Fuji Photo Film Co., Ltd.
Fujitsu Ltd.
Furukawa Electric Co.
Hakuhodo, Inc.*
Haseko Corp.
Hitachi Ltd.
Honda Motor Co., Ltd.
Ishikawajima-Harima Heavy Industries Co., Ltd.
Kajima Corp.
Kanematsu Corp.
Kao Corp.
Kawasaki Heavy Industries, Ltd.
Kikkoman Corp.
Kirin Brewery Co., Ltd.
Kobe Steel Ltd.
Komatsu Ltd.

Konica Corp.
Kubota Ltd.
Kyocera Corp.
Marubeni Corp.*
Matsushita Electric Industrial Co., Ltd.
Minolta Camera Co.
Mitsubishi Electric Corp.
Mitsubishi Heavy Industries
Mitsui & Co., Ltd.
NEC Corp.
NGK Insulators
Nippon Mining Co., Ltd.*
Nippon Steel Corp.
Nissan Motor Co., Ltd.
Nissho Iwai Corp.
NTN Corp.
Oki Electric Industry Co., Ltd.
Omron Tatesi Elecronics Co.
Pioneer Electronic Corp.
Ricoh Co., Ltd.
Sanyo Electric Co., Ltd.
Seiko Epson Corp.
Sharp Corp.
Shimuzu Corp.
Sony Corp.
Sumitomo Chemical Co.
Sumitomo Corp.
Sumitomo Heavy Industries Ltd.
Suntory Ltd.*
Suzuki Motor Corp.
Takeda Chemical Industries
TDK Corp.
Toshiba Corp.
Toyota Corp.
Yamaha Corp.
Yoshida Kogyo KK*

United Kingdom (58 firms)

ADT Group Plc*
Allied Lyons Plc*
Amec Plc
APV Plc
Associated British Foods Plc*
BBA Group Plc
BET Plc
BICC Plc
Blue Circle Industries Plc
The BOC Group Plc
Booker Plc
Bowater Plc
Bowthorpe Holdings Plc
British Aerospace Plc
British Petroleum Co. Plc
Bunzl Plc
The Burmah Oil Plc
Cadbury Schweppes Plc
Coats Viyella Plc
Delta Plc
Dowty Group Plc
Eagle Star Insurance Co. Ltd.*
ECC Group Plc
Ferranti International Plc*
FKI-Electricals Plc
GKN Plc
Grand Metropolitan Plc
Halma Plc
Hanson Plc
Hawker Siddeley Group Plc
Ibstock Johnson Plc
ICL Plc*
IMI Plc
Imperial Chemical Industries Plc
Johnson Matthey Plc
Laporte Plc
Lonrho Plc
Lucas Aerospace Ltd.
Pearson Plc
Racal Electronics Plc
The Rank Organisation Plc
Reckitt & Colman Plc
Redland Plc
Reed International Plc
RMC Group Plc
Rolls-Royce Plc
The RTZ Corp. Plc
Saatchi & Saatchi Plc
Scapa group Plc
Shandwick Plc
Smithkline Beecham
Tarmac Plc
Tate and Lyle Plc
Thorn EMI PLV
Towers, Perrin, Forster & Crosby Inc.*
Unilever Plc
United Biscuits (Holdings) Plc
Vickers Plc

United States (214 firms)

Abbott Laboratories
Air Products and Chemicals, Inc.
ALCO Standard Corp.
Allied-Signal Inc.
Amax Inc.
Amdahl Corp.
American Cyanamid Co.
American Express Co.
American Greetings Corp.
American Home Products Corp.
Amoco Corp.
AMP Inc.
Amway Corp.
Anixter Bros., Inc.
Apple Computer, Inc.
Armstrong World Industries, Inc.
Arvin Industries, Inc.
Ashland Oil, Inc.
Atari Corp.
Atlantic Richfield Co.
Avery International Corp.
Avis Rent A Car System, Inc.
Avnet, Inc.
Avon Products, Inc.
Baker Hughes, Inc.
Bausch and Lomb, Inc.
Bechtel Group, Inc.
Berlitz International, Inc.
BF Goodrich
Black & Decker Corp.
The Boeing Co.
Boise Cascade Corp.
Borden, Inc.
Bozell, Inc.
Briggs & Stratton Corp.
Bristol –Meyers Squibb Co.
Burson-Marsteller
Campbell Soup Co.

Caterpillar, Inc.
CBI Industries, Inc.
CBS, Inc.
Champion International Corp.
Chevron Corp.
Chrysler Corp.
Cigna Worldwide, Inc.
The Coca Cola Co.
Colgate-Palmolive Co.
Coltec Industries, Inc.
Communications Satellite Corp.
Compaq Computer Corp.
Control Data Corp.
Cooper Industries, Inc.
Corning, Inc.
CPC International
Crown Cork & Seal Co., Inc.
Cummins Engine Co. Ltd.
Dana Corp.
D'Arcy Masuis Benton & Bowles, Inc.
Data General Corp.
Deere and Co.
Digital Equipment Corp.
Dover Corp.
Dow Chemical Co.
Dow Jones & Co., Inc.
Dresser Industries, Inc.
Du Pont
Dun & Bradstreet Corp.
The Dynatech Corp
Eastman Kodac Co.
Eaton Corp.
EG & G, Inc.
Eli Lilly and Co.
Encore Computer Corp.
Ethyl Corp.
Exxon Corp.
Ferro Corp.
Fluor Corp.
FMC Corp.
Foote, Cone, & Belding Communications, Inc.
Ford Motor Co.
Foster Wheel Corp.
Frank B. Hall international, Inc.
The Franklin Mint
General Dynamic Corp.
General Electric Co.
General Mills, Inc.
General Motors Corp.
General Signal Corp.
Georgia-Pacific Corp.
The Gillette Co.
The Goodyear Tire & Rubber Co.
Grey Advertising Inc.
GTE Corp.
Hasbro, Inc.
H.B. Fuller Co.
Hercules, Inc.
Hershey Foods Corp.
Hewlett-Packard Co.
H.J. Heinz Co.
Honeywell, Inc.
Hosokawa Micron International Inc.
Ingersoll-Rand Co.
International Business Machines Inc.
International Paper Co.
ITT Corp.
James River Corp.
Johnson Controls, Inc.
Johnson & Johnson
Kaiser Aluminum & Chemical Corp.
Kellogg Co.
Kimberly-Clark Corp.
Levi Strauss & Co.
Litton Inc.
The Lubrizol Corp.
Manville Corp.
Martin Marietta Corp.
Mary Kay Cosmetics, Inc.
Mattel, Inc.
McCann-Erickson Worldwide
McDonald's Corp.
McDonnell Douglas Corp.
The Mead Corp.
Measurex Corp.
Medtronic, Inc.
Merck and Co., Inc.
Merrill Lynch, Pierce, Fenner, & Smith
Minnesota Mining and Manufacturing
Mobil Corp.
Molex Inc.
Monsanto
Morton International, Inc.
Motorola, Inc.
Murphy Oil Corp.
National Semiconductor
National Starch and Chemical Co.
NCR Corp.
Neutrogena Corp.
Newmont Mining Corp.
Occidental Petroleum Corp.
Olin Corp.
Omnicom Group, Inc.
Owens-Corning Fiberglass Corp.
Paccar, Inc.
Parker Hannifin Corp.
The Penn Central Corp.
Pepsico, Inc
The Perkin-Elmer Corp.
Pfizer, Inc.
Phelps Dodge Corp.
Phillip Morris Cos., Inc.
Phillips Petroleum Co.
Phillips-Van Heusen Corp.
Pioneer Hi-Bred International, Inc.
Pitney Bowes, Inc.
Polaroid Corp.
PPG Industries, Inc.
Precision Valve Corp.
Premark International
The Prudential Insurance Co. of America
Quaker Oats Co.
Quaker State Corp.
Ralston Purina Co.
Raychem Corp.
Rayovac Corp.
Raytheon Co.
The Reader's Digest Assn., Inc.
Reynolds Metals Co.

RJR Nabisco, Inc.
Rockwell International Corp.
Rohm and Haas
Rosemount Inc.
R.R. Donnelley & Sons
Sara Lee Corp.
Scott Paper Co.
Searle
Sears, Roebuck, and Co.
The Sherwin-Williams Co.
Sonoco Products Co.
Standex International
The Stanley Works
Storage Technology Corp.
Sunstrand Corp.
Sunkist Growers, Inc.
Tektronix, Inc.
Teledyne, Inc.
Tenneco, Inc.
Texaco Inc.
Texas Instruments
Tidewater Marine Service, Inc.
Time Warner, Inc.
Timken Co.
Trinova Corp.
TRW, Inc.
Union Carbide Corp.
Unisys Corp.
United Technologies Corp.
Unocal Corp.
UOP
The Upjohn Co.
USG Corp. International Ltd.
USX Corp.
Varian Associates, Inc.
The Wackenhut Corp.
Wang Laboratories, Inc.
Warner-Lambert Co.
Weatherford International, Inc.
Westinghouse Electric Corp.
Westvaco Corp.
Weyerhaeuser Co.
Witco Corp.
WM. Wrigley Jr. Co.
Xerox Corp.
Zenith Electronics Corp.