CENTER FOR FINANCIAL STUDIES

No. 2006/31

Revisiting the Home Bias Puzzle. Downside Equity Risk

Rachel A. Campbell and Roman Kräussl

Center for Financial Studies
an der Universität Frankfurt ■ Mertonstraße 17-21 ■ D-60325 Frankfurt am Main
Telefon: +49 (0)69 798-30050
Fax: +49 (0)69 798-30077 ■ http://www.ifk-cfs.de ■ E-Mail: info@ifk-cfs.de

Center for Financial Studies

The *Center for Financial Studies* is a nonprofit research organization, supported by an association of more than 120 banks, insurance companies, industrial corporations and public institutions. Established in 1968 and closely affiliated with the University of Frankfurt, it provides a strong link between the financial community and academia.

The CFS Working Paper Series presents the result of scientific research on selected topics in the field of money, banking and finance. The authors were either participants in the Center´s Research Fellow Program or members of one of the Center´s Research Projects.

If you would like to know more about the *Center for Financial Studies*, please let us know of your interest.

Prof. Dr. Jan Pieter Krahnen

Prof. Volker Wieland, Ph.D.

Center for Financial Studies
an der Universität Frankfurt ▪ Mertonstraße 17-21 ▪ D-60325 Frankfurt am Main
Telefon: +49 (0)69 798-30050
Fax: +49 (0)69 798-30077 ▪ http://www.ifk-cfs.de ▪ E-Mail: info@ifk-cfs.de

CFS Working Paper No. 2006/31

Revisiting the Home Bias Puzzle. Downside Equity Risk*

Rachel A. Campbell[1] and Roman Kräussl[2]

March 2006

Abstract:
Deviations from normality in financial return series have led to the development of alternative portfolio selection models. One such model is the downside risk model, whereby the investor maximizes his return given a downside risk constraint. In this paper we empirically observe the international equity allocation for the downside risk investor using 9 international markets' returns over the last 34 years. The results are stable for various robustness checks. Investors may think globally, but instead act locally, due to greater downside risk. The results provide an alternative view of the home bias phenomenon, documented in international financial markets.

JEL Classification: G11, G12, G15

Keywords: Asset Pricing, Home Bias, Downside Risk, Prospect Theory

1 Corresponding author: Dr. Rachel Campbell, Assistant Professor of Finance, Maastricht University, Faculty of Economics & Business Administration, PO Box 616, 6200 MD Maastricht, The Netherlands, Tel: +31 433883648. Fax: +31 433884875
Email: r.campbell@berfin.unimaas.nl

2 Free University of Amsterdam and Center for Financial Studies

1 Introduction

Despite greater integration of international capital markets, investors continue to hold portfolios largely dominated by domestic assets. By the end of 2003, U.S. investors held only 14% of their equity portfolios in foreign stocks, whilst such stocks accounted for 54% of world market capitalisation (see Thomas, Warnock and Wongswan, 2004). Worldwide this lack of international diversification remains a puzzle to financial economists. Lewis (1999) suggests that a U.S. investor, maximising a mean-variance portfolio strategy should hold at least 40% in foreign stocks. Because such a high allocation is not seen in practise, assuming a mean-variance strategy from a theoretical point of view, there are two explanations.

Either, investors' expectations of future returns abroad are consistently lower than finance theory predicts. In which case, investors appear to be pessimistic about foreign markets whilst relatively optimistic about their domestic market. Recent research has addressed this issue of lower expected returns being due to estimation error in the mean vector of returns (Hasan and Simaan, 2000). Information and transaction costs from foreign investment can also reduce the returns earned; although this has become less important as an explanation due to the globablisation of financial markets over the recent decade.

Or alternatively, assuming returns from investing abroad are as high as expected, another way of looking at the puzzle is that investors' perceive the risk from investing abroad as greater than the current theory predicts. In the mean-variance framework, this means that the risk from foreign equity investment is higher than is currently captured using the standard deviation of the historical returns. As French and Poterba (1991) point out this could be due to the relative unfamiliarity with foreign markets and institutions. Meaning that certain risks, such as sovereign risk or transfer risk, are larger than perceived and not fully captured in the standard deviation as the correct estimate for risk. The underlying assumption in a mean-variance world is that all risks facing an investor, in his decision to invest in foreign equity, are fully captured by the standard deviation of returns. It is this limiting assumption which we relax in our investigation of the home equity bias.

In this paper we focus on a more general definition for risk as an explanation in resolving the puzzle. It appears that the risk of foreign investment is greater than previously thought resulting in the benefit from diversifying internationally being reduced. We therefore use a definition for risk which empirically captures this greater risk by specifying a model using downside equity risk.

In our analysis we focus on the empirical distribution of returns. In doing so, we can move away from the limiting assumption of normally distributed returns and the implicit assumption that the standard deviation captures all the risk inherent in financial time series. The advantage of this is that any non-normalities in the data enter the investor's decision in the optimal portfolio strategy.

It is well known that empirical time series are non-normal, however too our knowledge non-normalities have not been modelled as an explanation to the home bias. In risk management higher moments of the returns distribution, namely skewness and kurtosis, are commonly used to capture additional risk in the tails of the empirical return distribution. By focusing on the empirical distribution and a more general definition of downside risk, we are able to capture any non-normalities in the data, stemming from skewed and kurtotic financial time series and incorporate the effects of any additional risk occurring from these higher moments in the data.

One non-parametric model for portfolio optimisation is the mean-downside risk model developed by Campbell, Huisman and Koedijk (2001). This model is able to optimise an investor's portfolio of risky assets by maximising the mean-downside-risk portfolio under the assumption of a parametric distribution for the returns, or alternatively in a non-parametric manner, by using the empirical distribution of returns. The use of the empirical distribution is a particularly interesting case since it has the benefit of including any non-normalities in the data into the optimal portfolio decision. Given certain parametric restrictions the model is consistent with capital market equilibrium.[2]

We, therefore, focus on downside risk as the appropriate measure for risk. We model the investor's optimal portfolio allocation using a mean-downside risk optimisation model. The investor is constrained by the desire to prevent his initial level of wealth falling below a given threshold. The higher the threshold the more safety the investor requires and the less tolerant he is to risk. Downside risk increases as the level of safety which an investor requires on his initial investment becomes greater. If the perceived risk from foreign investment results in a higher probability of exceeding the threshold occurring, the investor will choose to invest more domestically and less in foreign equity.

By employing a downside risk portfolio allocation model and using data on international equity markets we provide empirical results to determine the extent of the risk-return trade-off facing investors in international financial markets. Due to greater downside risk the results provide evidence of a greater risk-return trade off in international equity markets than previously acknowledged for investors with a low level of risk tolerance. We

[2] See Campbell et al. (2001) for a greater explanation to capital market equilibria.

also include emerging market data and short selling constraints. From this we are able to offer a plausible empirical explanation to the home equity bias. The empirical results are robust over various investor perspectives, and using a higher data frequency. Investors may think globally, but instead act locally, due to greater downside risk from investing internationally.

The outline of the paper is as follows. In the following section we discuss the home bias phenomenon and previous explanations. Section 3 introduces the concept of downside risk, its behavioural foundations and specifies the optimal asset allocation under downside risk. By using data on international equity markets, section 4 investigates, in a detailed empirical study, how the downside risk approach assesses the risk-return trade off for various confidence levels associated with increasing levels of investors' risk aversion. Our aim is to offer additional insight into how the downside risk approach is able to provide an alternative risk-return trade-off for assessing investors' desires to invest internationally. Conclusions are drawn in the final section 5.

2 The Home Bias Phenomenon

The work of French and Poterba (1991) is probably the most prominent among the numerous studies which document the home equity bias. They report that investors in the U.S., Japan, and the U.K. allocate 94%, 98%, and 82% of their respective equity investment, to domestic shares. Tesar and Werner (1995) study the long-term investment patterns of five major OECD countries and find supporting evidence for the home bias. They demonstrate that international investment positions are well below the current limitations on foreign holdings of institutional investors. Kang and Stulz (1997) present further evidence that the preference for domestic equity holdings is an international phenomenon.

A simple mean-variance illustration based on the sample moments of returns implies that U.S. investors' optimal weight in foreign equities is about 40%. Hence, the point estimates of the mean and the covariance matrix of returns suggest that U.S. investors would benefit by increasing the extent of their international equity diversification. Warnock (2002) shows that although the U.S. equity home bias has lessened somewhat over the past two decades, it still remains high. Thomas, Warnock and Wongswan (2004) conclude that by the end of 2003, U.S. investors held only 14% of their equity portfolios in foreign stocks at a time when such stocks accounted for 54% of the world market capitalization. This gap between investors' actual and presumably optimal behaviour has motivated several studies in the search to find an explanation to this home bias phenomenon.

One perplexing fact is the large home bias found in small and medium sized countries. Cooper and Kaplanis (1994) conclude that domestic equity investment, as a fraction of total portfolio equity, ranges from 65% in France to 100% in Sweden. Small countries, whose equity comprises a small fraction of the global mean-variance efficient portfolio, would presumably have the most to gain from international diversification.

Common explanations for the pervasive home bias puzzle include barriers to international investment and transaction costs, information asymmetries and higher estimation uncertainty for foreign than domestic stocks, hedging demand for stocks with smaller positive correlation with domestic state variables such as inflation risk or non-traded assets such as human capital, and sovereign risk.[3] However, these common explanations seem less reasonable in today's increasingly integrated financial world.

None of these common explanations have provided a satisfactory quantitative account of the observed home bias in international financial markets. For example Lewis (1999) points out that the first group of explanations is weakened by the obstacles to international investment falling substantially over the last thirty years and the existence of large gross investment flows. Ahearne, Grivier and Warnock (2004) confirm that measurable transaction costs fail to explain the observed home bias. Pastor (2000) concludes that it is also far from clear that estimation uncertainty provides a good explanation. The second explanation is weakened by the magnitude with which foreign stocks should be correlated more strongly with domestic risk factors compared with domestic stocks. Cooper and Kaplanis (1994) argue that this phenomenon cannot be explained by either inflation hedging or the directly observable costs of international investment. They show that correlations with deviations from purchasing power parity can even exacerbate the home bias puzzle. Baxter and Jermann (1997) indicate that the puzzle cannot be explained when the importance of human capital is accounted for, since investors should short sell their national stock market because of its high correlation with its human capital. Finally, sovereign risk, which comprises economic and political risk, seems to apply more to emerging market countries than to other mature financial markets, so cannot be a significant explanation.

Although many of these barriers to foreign investment have substantially diminished, the tendency to invest in the respective domestic country remains very strong. Recent research suggests that the home bias puzzle may be part of a larger phenomenon in which investors' exhibit a preference for familiar companies. A number of empirical studies have established an analogue to the home bias within countries themselves.

[3] See Karolyi and Stulz (2002) for an actual survey of the home bias literature.

A company's language, culture, and distance from the investor are three central attributes that might enlighten investors' preferences for certain stocks. Coval and Moskowitz (1999) point out that a typical equity portfolio of a U.S. money manager consists of firms that are located in the 100 mile vicinity of his workplace than the average firm. Huberman (2001) analyzes the geographic distribution of shareholders of U.S. Regional Bell Operating Companies and shows that investors are much more likely to hold shares in their local providers. Grinblatt and Keloharju (2001) find that investors in Finland are more likely to hold stocks of companies which are located close to them geographically, which use their native tongue in company reports, and whose chief executives have the same cultural background. Finally, a recent study by Karlsson and Norden (2004) shows that age, gender, net wealth, occupation and familiarity with risky investments play a crucial role in the decision to allocate assets in foreign equities.

These studies offer empirical evidence that people favour stocks with which they are familiar, and which they believe are more likely to deliver higher returns at lower stock-specific risk. This biases portfolio weights toward familiar stocks. Familiarity may represent information available to the investor, but not yet available in the market. Or it may represent the investors' illusion that he has superior information now or a belief that he will potentially have superior information in the future.

Although it is possible for investors to have superior information about companies located nearer to their home, they may also choose to invest in firms in close proximity because of (perceived) expertise. Agents may invest in familiar securities because they prefer to take a stake in a context in which they consider themselves to be knowledgeable and competent. This is defined by Heath and Tversky (1991) as the 'competence hypothesis'. Experimental evidence provided by Kilka and Weber (2001) suggest that agents feel more capable and are relatively more optimistic about their home equity market[4]. This optimism, in turn, translates into greater investment in familiar companies.

Following Barberis and Thaler (2002), experimental evidence suggests that people dislike situations in which they are uncertain about the probability distribution of a gamble. Such circumstances are known as 'situations of ambiguity', while the general dislike for these kinds of situations are known as 'aversion to

[4] Support for this relative optimism hypothesis is also given by the empirical results of Strong and Xu (2003) who analyze the Merrill Lynch Fund Manager Survey, with respect to U.S., U.K. European, and Japanese fund managers.

ambiguity'.[5] Ambiguity aversion translates into significant carefulness by investors with regard to unknown stocks.

Familiarity and aversion to ambiguity offer a simple way of understanding sub-optimal international asset allocation. Investors may find their national stock markets more familiar and, thus, less ambiguous than foreign stock indices. Since familiar assets are attractive, people invest heavily in those, and invest little or nothing in ambiguous assets. Therefore, their portfolios appear undiversified relative to the predictions of standard finance models. Goetzmann and Kumar (2001) argue that although agents on some occasions appear to have a vague impression that diversification might be beneficial, they still fail to diversify their financial investments adequately.[6]

All the explanations for the home equity bias result in greater risk from investing internationally. This risk is captured implicitly in the empirical return distribution using the domestic currency. When assuming a parametric distribution as a generalizing assumption for the empirical distribution of returns, as is common in most modelling applications, any additional risk in the form of deviations from the Gaussian normal distribution are lost. To include these factors, we adopt a model which is able to focus on the empirical distribution of returns for optimal portfolio allocation. One such model which focuses on the empirical distribution is the downside risk model of Campbell et al. (2001).

3 The Concept of Downside Risk in Financial Markets

It is commonly accepted that investors care more about downside loss, than upside gains. Roy (1952) first proposed the 'safety first' approach to portfolio optimisation as early as 1952. Kahneman and Tversky (1979) used loss aversion preferences, and Gul (1991) used disappointment aversion so that investors could place a greater weight on the loss than on their gains. Advances in behavioural finance research can help us to determine how investors perceive risk. Many of the advances centre on the inadequacies behind some of the axioms on which expected utility theory is based. Rather than imposing a rigid framework for investor

[5] An early discussion of this aversion to ambiguity can be found in Knight (1921); who defines risk as a gamble with known distribution, and uncertainty as a gamble with unknown distribution, and suggests that people dislike uncertainty more than risk.

[6] Moreover, Benartzi (2001) shows that when agents actually diversify risks, they tend do so by following naïve diversification strategies such as the 1/n heuristic.

preferences, behavioural finance allows for non-standard behaviour. This is driven by quasi-rational behaviour or non-standard preferences, which is often based on empirical and/or experimental findings.

Research in the area of behavioural finance has shown results that contradict the axioms and assumptions of expected utility theory. Under expected utility, an equal diversification of risks is optimal, but under prospect theory, conversely, risk concentration will be most favourable. The intuitive reason behind this strong result is that a prospect theory agent is risk-seeking over losses. Investors' attitudes change over the domain of the utility function and differ between negative and positive domains; thus individual investors treat gains and losses differently. The crucial features of prospect theory which drive this outcome are the investors' degree of loss aversion and in particular their diminishing sensitivity to gains and losses. Loss aversion implies that changes are evaluated as gains and losses compared to a reference point, with losses looming larger than gains. It is for these reasons we choose to focus on downside risk, in a model for optimal portfolio allocation.

To recapitulate, there are two advantages from using this model. Firstly, the risk to the investor from investing abroad is specified relative to a benchmark, which in this case is the domestic risk-free rate. This results in the advantage of an investors' decision being made with reference to his home country. The second advantage is the benefit of using a non-parametric distribution for the optimization. By moving away from the restrictive assumption of normality, we are able to observe irregularities in the data, and the effect of any additional risk occurring from either negative skewness and/or fat tailed distributions.

We apply the downside risk model from Campbell et al (2001) for portfolio allocation under a downside risk constraint. This model builds upon the model of Arzac and Bawa (1977) however focuses on the loss in terms of Value-at-Risk rather than simply specifying an admissible probability of failure. The investor's budget constraint is defined as the following equation for initial wealth $W(0)$ and borrowing B:

$$W(0) + B = \sum_{i=1}^{n} \gamma(i)\, P(i,0) \quad . \tag{1}$$

The investor chooses the fractions of asset i, $\gamma(i)$ to be invested at time 0. The investor is assumed to allocate the assets in the portfolio and to choose the amount to borrow or lend so that the expected level of final wealth is maximized. Investor preferences in the 'safety first' world are such that he or she wishes to be c% confident that the final value of the portfolio at time T will not fall below a given downside risk level. The level of downside risk is captured in the downside risk constraint, with the desired level of absolute Value-at-Risk, denoted VaR :

$$\Pr\{W(T, p) \le W(0) - VaR\} \le (1-c)\,. \tag{2}$$

Because we are focusing solely on the risk of losses, our measure for risk depends on the downside only. Hence, the expected wealth from investing in portfolio *p* at the end of the investment horizon becomes:

$$E_0(W(T, p)) = (W(0) + B)(1 + r(p)) - B(1 + r_f)\,. \tag{3}$$

Campbell et al. (2001) derive that the optimal asset allocation occurs when equation (3) is maximized. This results in maximizing equation (4):

$$p': \arg\max_{p} S(p) = \frac{r(p) - r_f}{\varphi(c, p)}\,, \tag{4}$$

where $r(p)$ and r_f are the returns on the portfolio and the risk free rate respectively. Thus, the numerator is the risk premium and the denominator is the expression for risk, defined as follows:

$$\varphi(c, p) = W(0)r_f - VaR(c, p)\,. \tag{5}$$

The level of risk aversion depends crucially on the confidence level associated with the investors' downside risk constraint: the more safety the investor requires, the higher the confidence level associated with the downside risk constraint and the less tolerant the investor is to risk. In this way the higher the confidence level *c*, the more risk averse is the investor.[7]

One of the features, which the downside model also incorporates, is an investors' notion of regret. The investor assesses the risk from an investment, with reference to the value the initial wealth would have attained if invested over the period at the risk-free rate[8]. The investor, therefore, uses the risk-free rate of return as the benchmark to assess the potential allocation strategy. Risk is assessed relative to a benchmark return. For example, the average level of consumption or the deviation from the risk-free rate of return.

[7] This is different from the individual confidence which an investor may have, as in Graham, Harvey and Huang (2004). They find that individual investor confidence can explain why investors trade more frequently and hold more internationally diversified portfolios.

[8] The reference rate could be an alternative specification in the model, such as the average market return.

4 Empirical Analysis

In this section we employ the downside risk model using empirical data. In a first step, we are able to observe the risk-return trade-offs for the US domestic and international markets. We see how the risk-return differs from the consumption-based approach to asset pricing, and discuss the results of modeling the optimal asset allocation under downside risk.

We use monthly data from the MSCI indices in US dollars for the G7 countries: Canada, France, Germany, Italy, Japan, the UK and the US, as well as the 3 month Treasury Bill for the risk free rate, from Datastream. The data are available from January 1970 until December 2004 for the MSCI indices. Unfortunately the data for Emerging Markets, such as for Argentina, Brazil, Chile, Mexico, Korea and Thailand, only date back to January 1988, so we focus on Hong Kong and Singapore only. Summary statistics for the series are given in Table 1.

INSERT TABLE 1

Over the sample period, Hong Kong had the highest average monthly return, translating into an average annual return of 15.2%. It was also the most volatile, with a variance of 39.2% on an annual basis. Singapore was the second most volatile market with 24.8% annual volatility and an average annual return of 10.8%. These returns were slightly less than in the UK, which averaged an 11.0% annual return, but a less volatile 14.1% annual variance. The US was the least volatile market with a 6.9% annual variance, but with a 10.2% average return. Importantly the correlation statistics in Table 2 indicate benefits from diversification for the US investor, investing in foreign equity markets. Correlations range from 0.328 with Japan to 0.728 with Canada.

INSERT TABLE 2

Returning back to Table 1 we can also see that apart from the Japanese MSCI, all the other series have highly significant excess kurtosis. The Jarques-Bera test rejects the hypothesis that these series are normally distributed. This will result in excess downside risk to the investor, apparent in the data, when observed from a US perspective. It is likely to be caused by the additional risks from investing internationally. Given the apparent non-normality in the data, we look at how the downside risk model optimizes an international portfolio of equities, and compare the results to the mean-variance investor.

4.1 US Perspective without Short-selling Constraints

Using the data on the MSCI indices we optimize equation (4), focusing on the US as the domestic country. We maximize the expected return over and above the US risk free rate. This perspective is important since we focus on the US as the home market. We use all combinations of portfolios containing all G7 equity markets over the downside risk of each portfolio combination. The optimization is performed for each confidence level associated with the downside risk constraint. We chose the 95%, 97.5% and 99% confidence levels which are commonly used in risk management. We are therefore able to determine how much a US investor is likely to invest in foreign equities, given the US T-Bill as the benchmark reference point. In this way we can focus on the home equity bias from the US investors' perspective. The results are shown in Table 3 and are depicted in Figure 1.

The model does not require any assumptions to be made as to the nature of the distribution. We derive optimal portfolios using both the empirical returns and for multi-variate normally distributed returns. Alternative parametric distributions could also be used.

In Table 3 we show the results obtained when optimizing the model using the empirically observed distribution to the assumption of parameterizing the model using the normal distribution. The results, under normality, only differ slightly from the mean-variance optimization. The difference is due to the positive risk free rate in the denominator of equation (4). This, therefore, gives us a good indication of how the investor optimizing a downside risk constraint differs to the mean-variance investor for differing levels of risk aversion.

INSERT TABLE 3

From Figure 1, using the empirical distribution, we can see two very important facts. Firstly the US investor allocates a greater proportion of his portfolio to the domestic market as the confidence level associated with the downside risk constraint increases. This means that as investor' require greater levels of certainty with their investments, investors become more concerned about the value of their portfolio not dropping below a certain level. The greater the confidence level associated with the downside risk constraint, the more averse the investor is to downside risk. Secondly the allocation in the domestic portfolio is greater than would be the case using mean-variance portfolio optimization.

INSERT FIGURE 1

Interestingly, the more averse the investor becomes to downside risk, the greater the proportion of their total portfolio allocated into the domestic asset. This is a significant result. Under the assumption of normality, the proportion held in the domestic market is constant, regardless of the confidence level chosen in association with the downside risk.[9] This is because the quantile of the distribution is assumed to be a function of the standard deviation of the distribution. For example, the 95% level for the Value-at-Risk in the downside risk constraint is a 1.95 multiple of the standard deviation, and for the 99% level, a multiple of 2.33 is used. This means that the optimal allocation is independent from the quantile level; hence the optimization results in the same international allocations. It is the assumption of normality which results in the same portfolio of risky assets.[10]

When a non-parametric distribution is used, the portfolio of risky assets changes with the assumption of the confidence level associated with the risk free rate because of irregularities in the data. It is the non-parametric nature of the model which results in a changing optimal allocation of risky assets. This enables us to include the investors' domicile in the decision to invest internationally. Using the notion of regret, regret is higher when investing abroad, since the deviation from the benchmark is potentially greater. Thus the confidence level associated with the investor's downside risk constraint is higher.

To explain the well-documented lack of international diversification by US investors, the confidence level chosen by the investor must be substantial. From our empirical results using the G7 countries, the risk aversion level of the representative investor is associated with a confidence level on the downside risk constraint of nearly 97.5% on a monthly basis.

By optimizing the portfolio for the downside risk investor, using both the empirical distribution and the assumption of normality, and including the emerging market data, our model provides us with similar results. Again, the allocation into the domestic market becomes greater as the investor desires a greater degree of confidence in his downside risk constraint. The more averse to risk he becomes, the greater the allocation

---

[8] The slight deviation in the results under the assumption of normality are due to the estimation error around the point estimate. This increases for higher confidence levels given the few observations available for higher confidence levels in the downside risk constraint.

[9] It can be proven that two-fund separation is attained: first the risky portfolio is chosen and then the amount invested in the risk-free rate is determined, depending on the risk tolerance of the investor.

into US equities. The allocation is lower in the US however increases in a similar pattern over the confidence range.

INSERT TABLE 4 & FIGURE 2

4.2 US Perspective with Short-Selling Constraints

Taking short sale constraints into consideration, the results are consistent with those without short selling constraints, at lower levels of confidence associated with the downside risk constraint. However, for the 99% level of confidence, we observe a lower level of investment in US equity. This is compensated by a significantly greater proportion of the portfolio devoted to Canadian equity, which is highly correlated with the US market. Furthermore the US investor also prefers to allocated a greater proportion to Japanese equity. This in itself is an interesting result since the allocation is the optimal point using the empirical distribution and is, no doubt, driven by normality in the data. Japan presents the investor with less downside risk, resulting from less kurtotic returns. Japan attracts the highly constrained US investor to invest a greater proportion into its market. It would appear that at such a high level of aversion to downside risk, the US investor prefers to substitute a relatively large proportion of his US equity holdings for the apparent safety of the Japanese market. Remember from Table 1, the return series observed over the 34 year period from the Japanese equity market was not significantly different from normal. Thus the downside risk was less in this period than for all other equity markets considered. It appears that under short selling restrictions, the risk to the US investor from extreme market movements (in the bottom 1% of the quantile of the distribution) is less than the additional risk of investing abroad. Only in such a case is he willing to substitute the additional risk from investing abroad for the safety of less extreme market fluctuations.

FIGURE 3

This result may also be emphasized by the low correlation coefficient between the two markets. The correlation between the US and Japan is the lowest of all the equity markets considered, even including the two emerging markets. The effects from extreme market movements, coupled with size conditional correlation coefficients, are intrinsically captured in the empirical data, but are lost when parameterization of the distribution occurs for modeling asset allocation.

Empirical research has shown that as we move further into the tails of the distribution, where extreme events occur, the correlation between international markets increases, and hence the benefits to diversification are reduced.[11] In the downside risk framework, for optimal asset allocation we need not assume a constant coefficient for the joint distribution of returns. Conditional correlation effects are captured in the empirical estimate for correlation so the effects of increasing correlation coefficients are inherently captured. It is highly likely that the effect of increasing correlation in the left tail of the distribution accounts for the changing empirical optimum. This effect is not captured under normality, where correlation is assumed to be constant over the distribution.

In the downside risk framework, because we are not required to impose any restrictive modeling assumptions as to the nature of the parametric distribution for the joint return series, the impact of non-normalities in the data can be observed and incorporated into the decision to invest internationally. Since the conditional correlation coefficients between markets are captured in the measure for downside risk, if there are any increases in conditional correlation the benefits from investing internationally decrease, and the model is able to pick up these attributes through the use of the empirical distribution. The results enable us to see how important the conditional correlation coefficient becomes in the decision to hold international assets, and the use of the empirical distribution enables us to correctly assess the true underlying downside risk of investing in foreign equity.

If it is the case that investors focus on a high confidence level, where correlation is higher between international financial markets, then the benefits to international diversification are reduced dramatically, through greater downside equity risk. The results, therefore, indicate a rational explanation of the lack of international diversification and the phenomenon of the home bias, where investors are generally worried about potential downside losses. The model provides an alternative view of the risk-return trade off in international financial markets, without having to resort to very high levels of relative risk aversion.

4.3 US Perspective and Daily Data

For checking the robustness of our empirical results we extend our original dataset and employ daily data from the Datastream total return indices in US dollars for the G7 countries: Canada, France, Germany, Italy, Japan, the UK and the US, as well as the 3 month Treasury Bill for the risk free rate. The data are

---

[10] See Butler and Joaquin (2002), who estimate that the occurrence of greater correlation in bear markets results in the Sharpe ratio being more than 50% too large. See also Campbell, Koedjik and Kofman (2002) who provide empirical evidence of increasing correlation in the left tail of the distribution.

available from January 1973 until December 2004. For consistency with our previous results we only focus on Hong Kong and Singapore as emerging markets only. Summary statistics for the series are given in Table 5.

INSERT TABLE 5

Over the sample period, Singapore had the highest average daily return with 0.107%. It was also the most volatile, with a daily variance of 0.029. Hong Kong was the second most volatile market with 0.019 daily volatility and an average daily return of 0.047%. These returns were slightly less than in France, which averaged a 0.049% daily return, but a less volatile 0.012 daily variance. Canada was the least volatile market with a 0.009 daily variance, but with a 0.038% average daily return. Correlation statistics in Table 6 again indicate diversification benefits for the US investor, investing in foreign equity market, ranging from 0.644 with Canada over 0.376 with the UK to 0.063 with Japan.

INSERT TABLE 6

Returning back to Table 5 we can also see that all daily MSCI return series have highly significant excess kurtosis. As in the monthly data analysis, the Jarques-Bera test rejects in all cases the hypothesis that these series are normally distributed. This will result in excess downside risk to the investor, apparent in the data, when observed from a US perspective.

Using the data on the daily MSCI indices we again optimize equation (4), focusing on the US as the domestic country, following the same procedure as for the monthly data, however the use of daily data results in over 8300 daily observations and a far greater number of portfolio combinations in the optimization process.

Table 7 displays the results obtained when optimizing the model using the empirically observed distribution to the assumption of parameterized the model using the normal distribution.

INSERT TABLE 7

Table 7 shows the empirical results for the daily indices including emerging markets, with and without short-selling constraints from the perspective of a US investor. Comparing this table to Table 4 we see that the empirical results are robust to using daily instead of monthly data. The allocation is greater as the confidence level associated with the downside risk constraint becomes larger. Interestingly the home-bias phenomenon is more greatly pronounced with a significantly greater proportion of the portfolio being allocated to the domestic asset. Again, taking short sale constraints into consideration, as in the case of monthly data, a similar pattern arises and the empirical results of the daily data are highly consistent with those without short selling constraints. Again the home bias is slightly less at the 99% level of confidence when short selling constraints are included.

From Figure 4, using the empirical distribution of daily returns, we can see that as in the case of the monthly MSCI indices, the US investor allocates a greater proportion of his portfolio to the domestic market as the confidence level associated with the downside risk constraint increases. US investor' require greater levels of certainty with their investments, they become more concerned about the value of their portfolio not dropping below a certain level. The greater the confidence level associated with the downside risk constraint, the more averse the investor is to downside risk.

INSERT FIGURE 4

Interestingly, as in the case of the monthly data, the more averse the investor becomes to downside risk, the greater the proportion of their total portfolio allocated into the domestic asset. Figure 5 indicates that as in the case of monthly data, by using daily data and including emerging markets and short selling constraints, we see that at the 99% level of confidence, we observe a lower level of investment in US equity.

FIGURE 5

It appears that under short selling restrictions, the risk to the US investor from extreme market movements is less than the additional risk of investing abroad. Only in such a case is he willing to substitute the additional risk from investing abroad for the safety of less extreme market fluctuations.

4.4 International Perspective

In this section we extend our analysis to analyze whether the observed home bias phenomenon from a US investors' perspective is an international phenomenon. In order to check for the robustness of our empirical results, we analyze the optimal portfolio allocation from the perspective of a Japanese, and UK and a European investor, respectively. This allows us to answer the question of whether this observed phenomenon is an exchange rate effect.

Using the data on the daily Datastream indices we optimize equation (4), focusing on Japan, the UK, and France as the domestic countries, respectively. We maximize the expected return over and above the Japanese, UK, and France risk free rate, respectively. We use all combinations of portfolios containing all G7 equity markets over the downside risk of each portfolio combination. As in the case of the US investor, the optimization is done for each confidence level associated with the downside risk constraint. This allows us to determine how much a Japanese, a UK or a France investor is likely to invest in foreign equities, given the respective risk-free rates as the benchmark reference points.

Table 8 shows the results obtained when optimizing the model using the empirically observed distribution to the assumption of parameterized the model using the normal distribution. It indicates that the empirical results by using monthly data and including emerging markets without short selling constraints are highly robust to the choice of domestic country.[12]

INSERT TABLE 8

The empirical results are robust for the three cases of a Japanese, a UK and a French investor. A higher proportion of the portfolio is allocated to the domestic market than suggested under the mean variance approach. We can therefore assume that this for the US investor observed phenomenon of a home bias is an international phenomenon. For the French investor it also becomes safer to invest in neighboring Germany, which is also highly correlated for the higher confidence levels.

Table 9 displays the empirical results of the portfolio allocation for a Japanese, and a UK, investor, respectively, when using daily data from Datastream, again including emerging markets and no short selling restrictions.

INSERT TABLE 9

Table 9 shows that we can observe again an international home bias from the perspective of the UK, however the results are less robust for the Japanese investor. *Tricky with the introduction of the Euro in 1999, and then* *from 2000 there was a bear market so that the portfolio allocations are no longer reliable and relevant for the analysis.*

Summing up, the international home bias phenomenon holds and can be well-explained with our mean-downside risk approach. It is robust for monthly and daily data as well as from the international perspective of Japanese, UK and European investors, respectively.

5 Concluding Remarks

The home equity bias puzzle can be framed as a result of the empirical risk-return trade-off being larger than otherwise captured in current finance theory. Either returns are lower than expected, or risk perceptions are higher from investing in foreign equity. This results in a foreign market for equity being less attractive to the domestic US investor. Although many explanations have been given as to the various elements involved in determining any additional risk to the investor from investing in foreign corporate equity, the assumption is maintained that the variance of the empirical distribution adequately captures the risk facing the investor. Even when additional types of risks and costs are factored into the standard expected utility and mean-variance framework, the degree of risk aversion still necessary to result in such a high allocation into the domestic market is unrealistically high.

Behavioural approaches to the home bias puzzle draw upon psychological aspects of individual behaviour. So far, in the literature, the familiarity of companies' overly optimistic predictions of domestic companies' performance and (perceived) subjective competence in the home market have been put forward as possible explanations. These features are difficult to factor into a model of optimal portfolio choice in order to successfully address the issue of the home equity bias. The paper applies behavioural insights such as prospect theory and familiarity and ambiguity aversion to one of the classical problems in finance literature: the investor's optimal asset allocation under risk. In particular, we investigate the use of downside risk, focusing on negative movements in stock markets for the assessment of risk, to see if the downside risk approach to asset allocation is able to provide greater insight into the equity home bias puzzle.

Using monthly MSCI data and daily data from Datastream for the G7 countries we are able to express the risk-return trade-off in financial markets in an alternative way, shedding new light on the puzzle

[12] The additonal estimates of monthly and daily data and including emerging markets and short-selling constraints

surrounding the size of the home bias. We find that, contrary to mean-variance portfolio analysis, investors concerned with downside risk tend to hold a larger proportion of their portfolio in domestic equities with increasing aversion to risk. This is captured in the degree of confidence an investor associates with his downside risk constraint in determining the optimal portfolio allocation.

We controlled for robustness in various ways. We analyzed the risk-return trade-off from the perspective of an US investor by using monthly data and by including emerging markets and with and without short selling constraints. In a second step, we were able to increase the number of observations dramatically using daily return series, which is important given the high percentiles used in the examples. The results are extremely robust to the use of daily data and for the US the extent of the home-bias actually becomes more pronounced. Daily data is known to deviate more from the assumption of normality and greater downside risk is captured by the model. US investors therefore shy away from international diversification with a much greater proportion of equity held in the domestic country than mean-variance optimisation would predict.

We also analyzed the observed US investors' home bias from an international point of view to see if the effect is a worldwide phenomenon. We investigated the monthly and the daily portfolio allocation from the perspective of a Japanese, a UK and an European investor, respectively. In all cases we checked the results for robustness by including emerging markets and analyzing the results with and without short selling constraints. The empirical results indicate that the home bias is indeed an international phenomenon: Investors may think globally, but instead act locally, due to greater downside risk from investing abroad.

The main advantage of this paper is that by focusing on a downside risk model for asset allocation, which centres on the empirical distribution of returns, we can observe historically whether any additional risk, in the form of negatively skewed distributions and excess kurtosis, may play a role in the decision making process in the optimal allocation between domestic and foreign equity. A further advantage of the model is the definition of downside risk. It has been acknowledged in the behavioural finance literature that investors tend to frame their investment decisions, relative to a benchmark. In the downside risk model this benchmark is determined independently, as the domestic equity index or the domestic risk free rate. The ability of the model to incorporate behavioural aspects of investors', means that the allocation of equity is more in line with the behaviour of investors in general.

The empirical results have shown the tendency to concentrate risks on a single asset (country) rather than to hold a well diversified portfolio. Clearly, the home bias puzzle is a complex and multi-faceted

from the perspective of a Japanese, UK and French investor, respectively, are available by request.

phenomenon, and explanations for the empirical results have been developed in the literature. The dissatisfaction with institutional explanations has led to the consideration of additional behavioural explanations such as familiarity, ambiguity aversion, and optimism toward the domestic equity market. The combination of prospect theory agents, who show familiarity and optimism toward their domestic stock market, can help to explain the home bias puzzle in international finance. The model for downside risk is able to incorporate the additional risk involved with investing in foreign equity, and help understand the bias for home equity. It is not surprising then that behavioral aspects from investors more willing to invest locally, or at least domestically are likely to play a crucial role in the decision making process on optimal portfolio allocation. These behavioral aspects are likely to lead to the empirical result that investors hold a greater proportion of their assets domestically than would be the case in a mean-variance world.

The empirical results are of significant interest for further research in asset pricing and portfolio management. It would be of interest to specify a utility function for the downside risk investors' decision to changes in his specification of the confidence level associated with the downside risk constraint for alternative time horizons. This would enable a direct test of the downside risk approach against the consumption-based approach in finance theory.

Acknowledgments

We thank seminar participants at the Federal Reserve Bank of Atlanta, Lally School of Business at Rensselaer Polytechnic Institute, Free University of Amsterdam, FMA 2004 meetings in Zurich, and participants at the Tor Vergata 2003 meetings in Rome. The authors would also like to thank two anonymous reviewers. All errors pertain to the authors.

References

Ahearne, A., W. Grivier, and F. Warnock, 2004. Information Costs and Home Bias: An Analysis of US Holdings of Foreign Equities. Journal of International Economics, 62, 313-336.

Arzac, E. R. and V. S. Bawa, 1977. Portfolio Choice and Equilibrium in Capital markets with Safety-First Investors. Journal of Financial Economics, 4, 277-288.

Barberis, N. and R. Thaler, 2002. A Survey of Behavioral Finance. NBER Working Paper #9222.

Baxter, M. and U.J. Jermann, 1997. The International Diversification Puzzle Is Worse than You Think. American Economic Review, 87, 170-180.

Benartzi, S., 2001. Naïve Diversification Strategies in Defined Contribution Saving Plans. American Economic Review, 91, 79-98.

Butler, K. C and D. Joaquin, 2002. Are the Gains from International Portfolio Diversification Exaggerated? The Influence of Downside Risk in Bear Markets. Journal of International Money and Finance, 21, 981-1011.

Campbell, R. A., R. Huisman and C. G. Koedijk, 2001, Optimal Asset Allocation in a Value-at-Risk Framework. Journal of Banking and Finance, 25, 1789-1804.

Campbell, R. A., C. G. Koedijk and P. Kofman, 2002. Covariance and Correlation in International Equity Returns: A Value-at-Risk Approach. Financial Analysts Journal, 58, 87-94.

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

Coval, J. D. and T. J. Moskowitz, 1999. Home Bias at Home: Locally Equity Preference in Domestic Portfolios. Journal of Finance, 54, 1-39.

French, K. R. and J. M. Poterba, 1991. Investor Diversification and International Equity Markets. American Economic Review, 81, 222-226.

Goetzmann, W.N. and A. Kumar, 2001. Equity Portfolio Diversification. NBER Working Paper #8686.

Graham, J.R., C. R. Harvey and H. Huang, 2004. Investor Competence, Trading Frequency and Home Bias. Working Paper, Duke University, Durham.

Grinblatt, M. and M. Keloharju, 2001. How Distance, Language, and Culture Influence Stockholdings and Trades. Journal of Finance, 56, 1053-1073.

Gul, F, 1991. A Theory of Disappointment Aversion, Econometrica, vol. 59(3), pages 667-86.

Hasan, I. and Y. Simaan, 2000. A Rational Explanation for Home Country Bias. Journal of International Money and Finance, 19, 331-361.

Heath, C. and A. Tversky, 1991. Preferences and Beliefs: Ambiguity and Competence in Choice under Uncertainty. Journal of Risk and Uncertainty, 4, 5-28.

Huberman, G., 2001. Familiarity Breeds Investment. Review of Financial Studies, 14, 659-680.

Kahneman, D. and A. Tversky, 1979. Prospect Theory: An Analysis of Decision under Risk. Econometrica, 47, 263-291.

Kang, J. and R. Stulz, 1997. Why Is There a Home Bias? An Analysis of Foreign Portfolio Equity Ownership in Japan. Journal of Financial Economics, 46, 3-28.

Karlsson, A. and L.L. Norden, 2004. Home Sweet Home: Home Bias and International Diversification among Individual Investors. Stockholm University Working Paper.

Karolyi, G.A. and R. Stulz, 2002. Are Financial Assets Priced Locally or Globally? NBER Working Paper #8994.

Kilka, M. and M. Weber, 2001. Home Bias in International Stock Return Expectations. Journal of Psychology and Financial Markets, 1, 176-192.

Knight, F., 1921. Risk, Uncertainty and Profit. Houghton Mifflin, Boston.

Lewis, K.K., 1999. Trying to Explain Home Bias in Equities and Consumption. Journal of Economic Literature, 37, 571-608.

Pastor, L., 2000. Portfolio Selection and Asset Pricing Models. Journal of Finance, 55, 179-223.

Roy, A. D., 1952. Safety-First and the Holding of Assets, Econometrica, 20, 431-449.

Strong, N. and X. Xu, 2003. Understanding the Equity Home Bias: Evidence from Survey Data. Review of Economics and Statistics, 85, 307-312.

Tesar, L.L. and I.M. Werner, 1995. Home Bias and High Turnover. Journal of International Money and Finance, 14, 467-492.

Thomas, C. P., F. E. Warnock and J. Wongswan, 2004. The Performance of International Portfolios. International Finance Discussion Papers #817, Board of Governors of the Federal Reserve.

Warnock, F.E., 2002. Home Bias and High Turnover Reconsidered. Journal of International Money and Finance, 21, 798-805.

Figure 1

International Diversification for US Investors

The figure gives the optimal portfolio selection for a US investor for an international equity portfolio in the G7 MSCI equity indices. Optimal allocations are found using the empirical distribution, for monthly data from January 1970 until December 2004, and under the assumption of multivariate normality, for a variety of confidence levels.

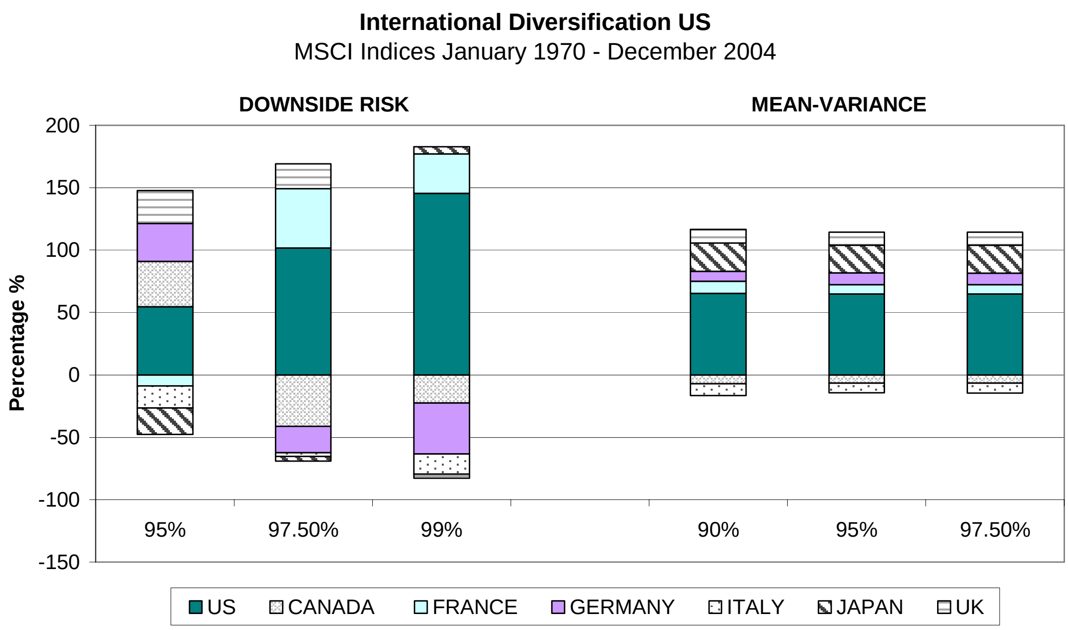

Figure 2

International Diversification for US Investors

Including Hong Kong and Singapore

The figure gives the optimal portfolio selection for a US investor for an international equity portfolio in the G7 MSCI equity indices and Emerging Market Indices. Optimal allocations are determined using the empirical distribution, for monthly data from January 1970 until December 2004, and under the assumption of multivariate normality, for a variety of confidence levels.

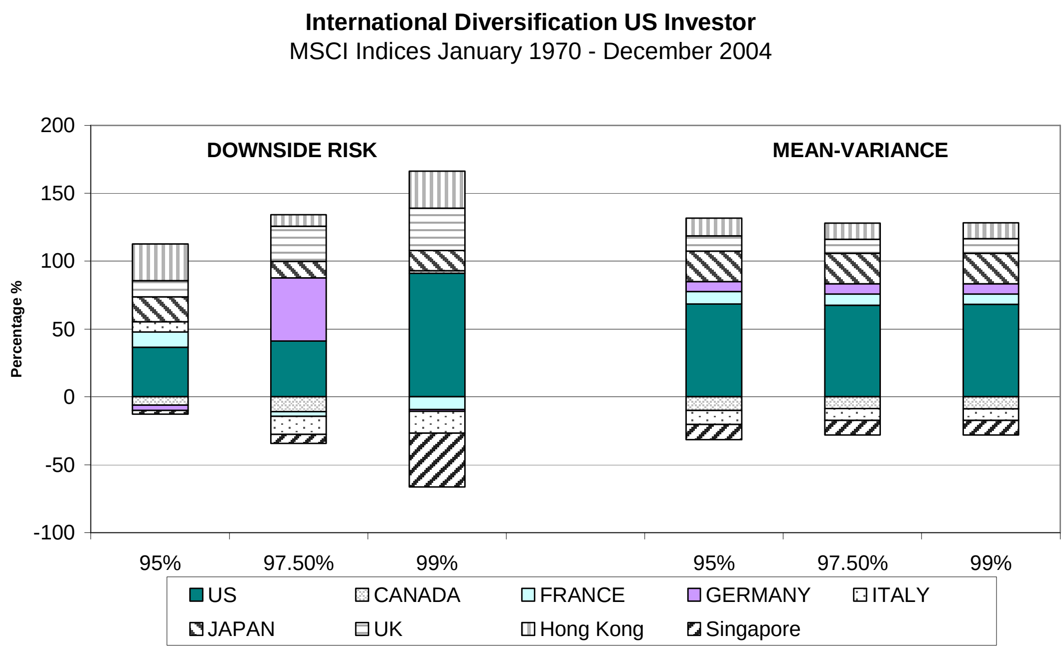

Figure 3

International Diversification for US Investors

Including Short Selling Constraints

The figure gives the optimal portfolio selection for an international equity portfolio in the G7 MSCI equity indices and Emerging Market Indices for a US investor including the effects from short selling constraints. Optimal allocations are found using the empirical distribution, using monthly data from January 1970 until December 2004, and under the assumption of multivariate normality, for a variety of confidence levels.

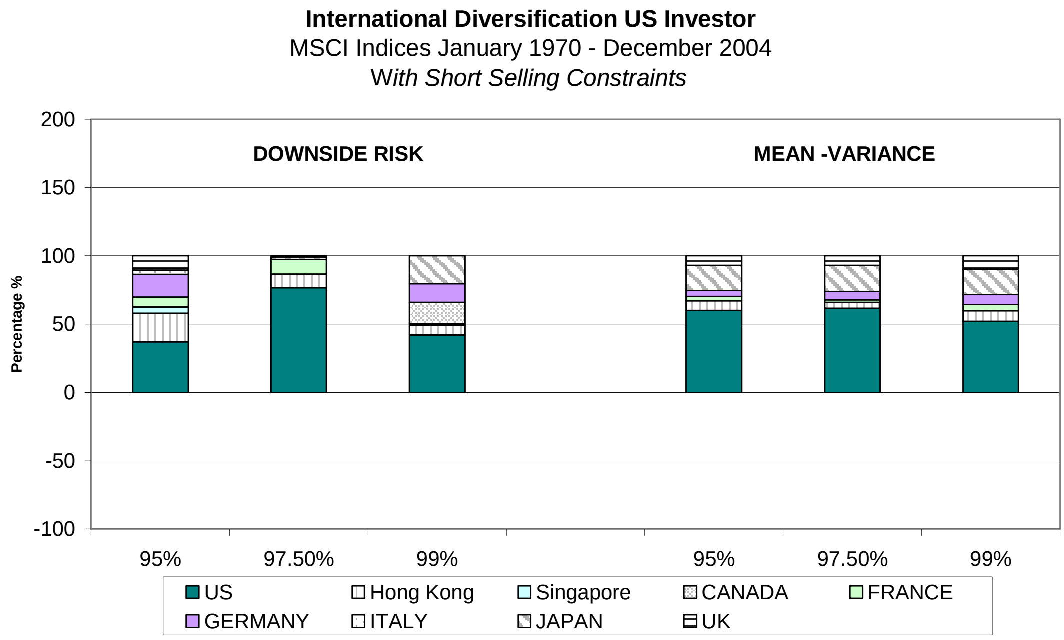

Figure 4

International Diversification for US Investors – Daily data

Including Hong Kong and Singapore

The figure gives the optimal portfolio selection for a US investor for an international equity portfolio in the G7 Datastream total return equity indices and Emerging Market Indices. Optimal allocations are determined using the empirical distribution, for daily data from January 1973 until December 2004, and under the assumption of multivariate normality, for a variety of confidence levels.

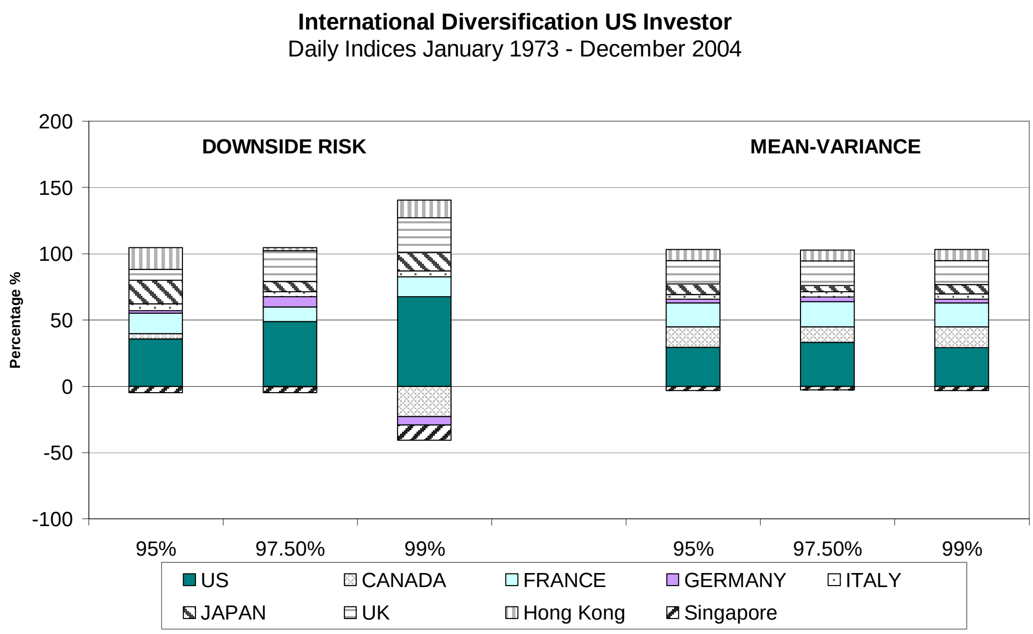

Figure 5

International Diversification for US Investors – Daily data

Including Short Selling Constraints

The figure gives the optimal portfolio selection for an international equity portfolio in the G7 Datstream total return equity indices and Emerging Market Indices for a US investor including the effects from short selling constraints. Optimal allocations are found using the empirical distribution, using daily data from January 1973 until December 2004, and under the assumption of multivariate normality, for a variety of confidence levels

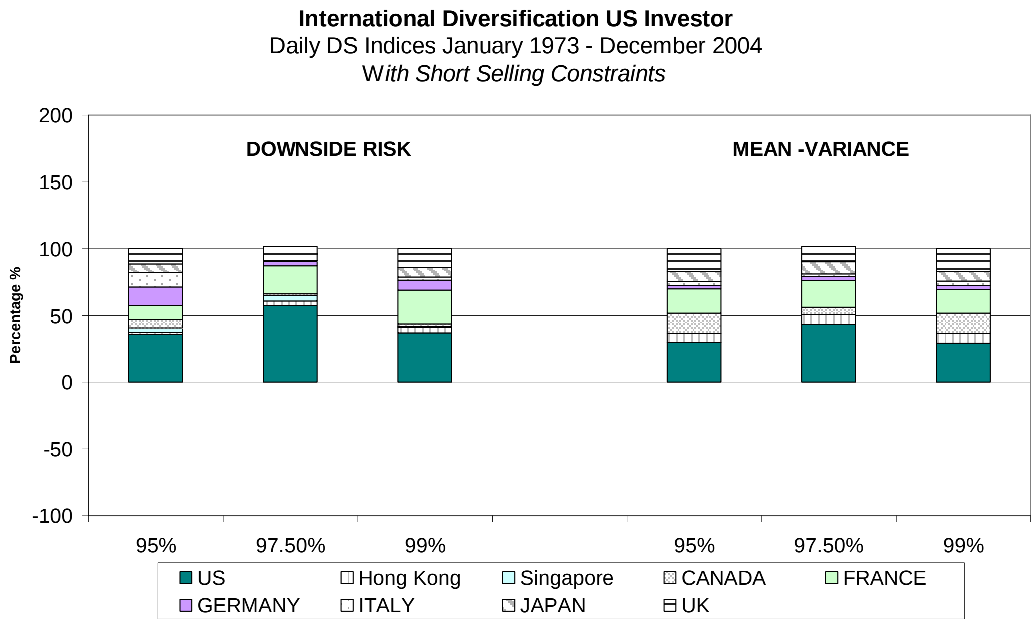

Table 1

Summary Statistics for G7 MSCI Indices, Hong Kong and Singapore

The table gives the summary statistics using monthly data for the G7 MSCI equity indices, and the Emerging Market equity indices available as from January 1970 until December 2004.

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
Mean	0.0082	0.0091	0.0084	0.0128	0.0059	0.0087	0.0091	0.0093	0.0086
Median	0.0121	0.0122	0.0087	0.0099	0.0067	0.0089	0.0106	0.0105	0.0114
Maximum	0.1653	0.2377	0.2133	0.6305	0.2700	0.2172	0.4270	0.4473	0.1637
Minimum	-0.2489	-0.2638	-0.2276	-0.5698	-0.2410	-0.2155	-0.5334	-0.2425	-0.2385
Std. Dev.	0.0560	0.0655	0.0619	0.1070	0.0734	0.0645	0.0852	0.0642	0.0447
Skewness	-0.7975	-0.3455	-0.4561	-0.5158	-0.0155	0.0264	-0.4245	0.4707	-0.5601
Kurtosis	5.7999	4.4723	4.4380	9.3462	3.5961	3.4061	8.8375	8.7990	5.4237
Jarque-Bera	181.2718	46.1840	50.6261	721.7067	6.2194	2.9281	607.5099	602.5668	124.4658
Probability	0.0000	0.0000	0.0000	0.0000	0.0446	0.2313	0.0000	0.0000	0.0000
Sum	3.4182	3.8334	3.5312	5.3519	2.4911	3.6647	3.7949	3.8938	3.5902
Sum Sq. Dev.	1.3087	1.7916	1.6018	4.7865	2.2506	1.7374	3.0362	1.7209	0.8357
Observations	420	420	420	420	420	420	420	420	420

Table 2

Correlation Statistics

The table gives the unconditional correlation between the G7 MSCI equity indices and the Emerging Markets Hong Kong and Singapore using the monthly MSCI data as described in table 1 from the period January 1970 – December 2004.

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
CANADA	1.000								
FRANCE	0.487	1.000							
GERMANY	0.416	0.667	1.000						
HONG KONG	0.407	0.302	0.330	1.000					
ITALY	0.349	0.494	0.454	0.233	1.000				
JAPAN	0.328	0.401	0.370	0.319	0.350	1.000			
SINGAPORE	0.462	0.326	0.333	0.580	0.221	0.362	1.000		
UK	0.529	0.575	0.476	0.401	0.380	0.377	0.483	1.000	
US	0.728	0.496	0.464	0.386	0.294	0.316	0.502	0.543	1.000

Table 3

International Diversification for Domestic US Investors

The table gives the optimal portfolio selection for an international equity portfolio in the G7 MSCI equity indices for a US investor. Optimal allocations are found for a variety of confidence levels using both the empirical distribution and under the assumption of bivariate normality, using the monthly MSCI data as described in table 1.

	CANADA	FRANCE	GERMANY	ITALY	JAPAN	UK	US
EMPIRICAL							
95%	36.30	-8.70	30.30	-17.89	-21.10	26.44	54.65
97.50%	-41.15	47.51	-21.05	-2.94	-3.97	20.03	101.57
99%	-22.47	31.67	-40.87	-16.15	5.63	-3.20	145.39
NORMAL							
95%	-7.09	9.60	8.04	-9.56	22.48	11.19	65.34
97.50%	-6.58	7.49	9.23	-7.75	22.41	10.34	64.86
99%	-6.57	7.61	9.13	-7.84	22.46	10.48	64.72

Table 4: International Diversification for Domestic US Investors

The table gives the optimal portfolio selection for an international equity portfolio in the G7 MSCI equity indices and the Emerging Markets Hong Kong and Singapore for a US investor. Optimal allocations are found for a variety of confidence levels using both the empirical distribution and under the assumption of bivariate normality, using the monthly MSCI data as described in table 1.

Including Emerging Markets

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	-5.99	11.10	-3.94	26.94	7.76	18.20	-2.62	11.90	36.65
97.5%	-10.89	-3.38	46.49	8.39	-13.18	12.28	-6.75	25.99	41.06
99.0%	1.85	-9.26	-1.34	27.28	-15.92	14.66	-39.64	31.21	91.18
NORMAL									
95.0%	-9.99	9.10	7.30	13.15	-10.30	22.46	-11.32	11.09	68.51
97.5%	-8.51	8.11	7.58	11.75	-8.70	22.42	-10.73	10.46	67.63
99.0%	-8.79	7.57	7.56	11.67	-8.46	22.42	-10.81	10.66	68.18

Including Emerging Markets and Short Selling Constraints

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	0.21%	7.03%	16.52	20.98	3.07	1.15	4.61	9.38	37.06
97.5%	0.00%	10.72%	0.00	9.91	0.00	1.86	0.00	0.87	76.64
99.0%	15.70%	0.00%	13.76	7.12	0.00	20.39	0.91	0.00	42.12
NORMAL									
95.0%	0.00%	3.14%	4.47	6.98	0.00	18.43	0.00	6.88	60.10
97.5%	0.00%	1.96%	6.07	4.33	0.00	19.14	0.00	6.91	61.59
99.0%	0.00%	4.54%	7.18	7.76	0.00	18.67	0.00	9.71	52.14

Table 5

Summary Statistics for the Daily G7 Datastream Indices, Hong Kong and Singapore

The table gives the summary statistics using daily data for the G7 Datastream Total Return Equity Indices, and the Emerging Market equity indices available as from January 1973 until December 2004.

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
Mean	0.038%	0.049%	0.040%	0.047%	0.037%	0.033%	0.107%	0.029%	0.046%
Median	0.044%	0.060%	0.044%	0.028%	0.033%	0.000%	0.023%	0.013%	0.040%
Maximum	0.090	0.089	0.076	0.156	0.103	0.114	0.302	0.140	0.093
Minimum	-0.115	-0.095	-0.125	-0.426	-0.101	-0.172	-0.306	-0.263	-0.145
Std. Dev.	0.009	0.012	0.011	0.019	0.014	0.014	0.029	0.015	0.012
Skewness	-0.776	-0.290	-0.374	-1.903	-0.273	-0.089	0.404	-0.630	-0.256
Kurtosis	14.483	6.701	8.558	45.122	6.969	9.776	23.348	24.321	9.211
Jarque-Bera	46695	4881	10938	622196	5582	15980	47484	158677	13509
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sum	3.174	4.123	3.337	3.944	3.084	2.740	2.939	2.454	3.868
Sum Sq. Dev.	0.687	1.272	1.051	2.951	1.724	1.531	2.287	1.797	1.148
Observations	8347	8348	8348	8348	8348	8348	2748	8348	8348

Table 6

Correlation Statistics

The table gives the unconditional correlation between the G7 Datastream total return equity indices and for the Emerging Markets Hong Kong and Singapore using daily data as described in table 5 from the period January 1973 – December 2004.

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
CANADA	1.000								
FRANCE	0.462	1.000							
GERMANY	0.458	0.791	1.000						
HONG KONG	0.240	0.283	0.325	1.000					
ITALY	0.382	0.705	0.634	0.226	1.000				
JAPAN	0.158	0.195	0.214	0.357	0.136	1.000			
SINGAPORE	0.214	0.256	0.269	0.572	0.197	0.369	1.000		
UK	0.435	0.733	0.661	0.317	0.585	0.189	0.271	1.000	
US	0.644	0.391	0.399	0.133	0.317	0.063	0.133	0.376	1.000

Table 7 International Diversification for Domestic US Investors – Daily data

The table gives the optimal portfolio selection for an international equity portfolio in the G7 equity indices and the Emerging Markets Hong Kong and Singapore for a US investor. Optimal allocations are found for a variety of confidence levels using both the empirical distribution and under the assumption of bivariate normality, using the daily data from Datastream as described in table 5.

Including Emerging Markets

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	4.17	15.33	1.89	16.36	5.24	17.62	-4.57	8.28	**35.69**
97.5%	-0.57	10.90	8.01	2.14	3.41	8.01	-3.99	23.33	**48.75**
99.0%	-22.81	15.01	-6.47	13.69	4.37	13.59	-11.39	26.29	**67.72**
NORMAL									
95.0%	15.38	17.90	2.99	8.23	3.46	7.81	-3.01	17.62	**29.62**
97.5%	12.08	18.79	3.34	8.45	4.26	4.75	-2.84	18.22	**32.95**
99.0%	15.72	18.22	2.85	8.50	3.77	7.35	-3.23	17.78	**29.05**

Including Emerging Markets and Short Selling Constraints

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	6.91	10.13	13.85	1.59	10.57	6.86	3.06	11.40	**35.64**
97.5%	1.77	20.50	3.60	3.46	0.00	0.53	3.78	10.39	**57.28**
99.0%	0.93	25.50	6.93	2.78	5.12	8.06	0.00	12.31	**38.37**
NORMAL									
95.0%	15.09	17.84	2.48	7.41	3.29	7.30	0.00	17.31	**29.28**
97.5%	5.57	19.80	3.24	7.36	1.94	8.73	0.00	11.39	**43.29**
99.0%	6.66	19.57	3.62	7.39	1.73	8.78	0.00	10.97	**41.29**

Table 8: International Diversification for Japanese, UK, and French Investors – Monthly Data

The table gives the optimal portfolio selection for an international equity portfolio in the G7 MSCI equity indices and the Emerging Markets Hong Kong and Singapore for a Japanese, UK, and French investor, respectively. Optimal allocations are found for a variety of confidence levels using both the empirical distribution and under the assumption of bivariate normality, using the monthly MSCI data as described in table 1.

Japan Investor's Perspective

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	-29.16	18.74	-1.12	26.76	3.50	**-12.41**	-3.30	-4.08	101.08
97.5%	-8.70	30.75	-20.05	25.70	-24.76	**17.45**	-15.73	-0.16	95.50
99.0%	-4.57	-15.78	-18.56	26.21	-6.46	**13.97**	-55.76	21.34	139.61
NORMAL									
95.0%	-10.12	5.02	6.99	15.80	-10.53	**-5.20**	-7.41	9.89	95.54
97.5%	-12.02	3.52	8.64	12.93	-9.00	**-2.25**	-9.65	8.67	99.15
99.0%	-12.29	3.19	8.28	13.02	-8.83	**-1.93**	-9.78	8.66	99.70

UK Investor's Perspective

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	27.89	8.27	-18.39	26.88	1.67	3.14	-4.59	**-8.41**	63.54
97.5%	-15.35	28.91	-11.20	33.40	-10.43	-1.55	-14.05	**8.90**	81.36
99.0%	-10.43	-3.46	-31.53	26.11	-2.59	36.45	-51.37	**11.57**	125.25
NORMAL									
95.0%	-10.33	12.38	4.02	27.84	-25.89	21.93	-12.71	**-0.06**	82.83
97.5%	-21.61	15.56	-1.35	23.93	-20.85	20.77	-13.33	**-8.36**	105.24
99.0%	-21.27	15.45	-1.24	23.88	-20.71	20.75	-13.24	**-8.23**	104.61

French Investor's Perspective

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	-18.32	**39.39**	-27.80	33.69	-7.35	-19.24	-7.81	3.40	104.06
97.5%	-6.13	**-6.32**	30.44	19.27	-53.36	14.93	-29.64	29.28	101.55
99.0%	-24.33	**11.58**	24.39	-0.39	-32.34	28.12	-18.36	-1.86	113.20
NORMAL									
95.0%	-13.86	**1.76**	-7.66	22.27	-15.20	18.87	-13.79	9.56	98.05
97.5%	-13.54	**-0.01**	-4.67	21.54	-17.11	19.62	-15.55	7.37	102.36
99.0%	-15.23	**-1.11**	-3.49	21.30	-16.77	19.65	-15.77	7.31	104.10

Table 9: International Diversification for Japanese, UK, and French Investors – Daily Data

The table gives the optimal portfolio selection for an international equity portfolio in the G7 equity indices and the Emerging Markets Hong Kong and Singapore for a Japanese, and UK investor, respectively. Optimal allocations are found for a variety of confidence levels using both the empirical distribution and under the assumption of bivariate normality, using the daily data from Datastream as described in table 5.

Japan Investor's Perspective

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	-4.99	46.63	-14.81	19.91	7.39	**27.67**	-27.82	18.01	27.99
97.5%	-36.13	27.44	5.78	22.80	8.67	**20.78**	-19.13	16.32	53.47
99.0%	4.69	33.98	2.77	11.80	-0.30	**20.78**	-20.27	21.04	25.51
NORMAL									
95.0%	-6.33	37.62	-1.08	13.69	-3.53	**25.67**	-19.07	27.19	25.85
97.5%	-6.30	37.52	-0.96	13.56	-3.25	**25.55**	-18.61	26.53	25.96
99.0%	-6.41	37.84	-1.32	13.71	-3.54	**25.66**	-19.09	27.29	25.88

UK Investor's Perspective

	CANADA	FRANCE	GERMANY	HONG KONG	ITALY	JAPAN	SINGAPORE	UK	US
EMPIRICAL									
95.0%	-10.71	17.05	7.86	12.46	9.21	-0.77	-6.36	**25.84**	45.42
97.5%	11.54	18.24	6.18	12.82	-14.51	11.99	-25.99	**31.94**	47.79
99.0%	-33.27	21.08	-2.61	17.29	2.19	6.53	1.46	**39.92**	47.42
NORMAL									
95.0%	8.70	17.91	9.54	6.04	3.05	6.65	-4.92	**38.11**	14.91
97.5%	8.65	17.77	9.46	6.07	3.13	6.67	-4.85	**38.07**	15.03
99.0%	8.87	17.64	9.39	6.08	3.16	6.62	-4.83	**38.29**	14.77

CFS Working Paper Series:

No.	Author(s)	Title
2006/30	**Joao Miguel Sousa** **Andrea Zaghini**	Global Monetary Policy Shocks in the G5: A SVAR Approach
2006/29	**Julia Hirsch**	Public Policy and Venture Capital Financed Innovation: A Contract Design Approach
2006/28	**Christian Gollier** **Alexander Muermann**	Optimal Choice and Beliefs with Ex Ante Savoring and Ex Post Disappointment
2006/27	**Christian Laux** **Uwe Walz**	Tying Lending and Underwriting: Scope Economies, Incentives, and Reputation
2006/26	**Christian Laux** **Alexander Muermann**	Mutual versus Stock Insurers: Fair Premium, Capital, and Solvency
2006/25	**Bea Canto** **Roman Kräussl**	Stock Market Interactions and the Impact of Macroeconomic News – Evidence from High Frequency Data of European Futures Markets
2006/24	**Toker Doganoglu** **Christoph Hartz** **Stefan Mittnik**	Portfolio Optimization when Risk Factors are Conditionally Varying and Heavy Tailed
2006/23	**Christoph Hartz** **Stefan Mittnik** **Marc S. Paolella**	Accurate Value-at-Risk Forecasting Based on the (good old) Normal-GARCH Model
2006/22	**Dirk Krueger** **Hanno Lustig** **Fabrizio Perri**	Evaluating Asset Pricing Models with Limited Commitment using Household Consumption Data
2006/21	**Juan Carlos Conesa** **Sagiri Kitao** **Dirk Krueger**	Taxing Capital? Not a Bad Idea After All!
2006/20	**Annamaria Lusardi** **Olivia S. Mitchell**	Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth

Copies of working papers can be downloaded at http://www.ifk-cfs.de