THE MYTH OF INTERNATIONAL DIVERSIFICATION

1. Introduction

A consensus view that seems to have been established in the finance literature is that international diversification leads to more efficient portfolios (in terms of the risk-return criterion) than purely domestic portfolios. Grubel (1968), Levy and Sarnat (1970), Grubel and Fander (1971), Solnik (1974), Lassard (1976) and Biger (1979) have demonstrated that international diversification provides U.S. investors with a lower risk for a given level of expected return. For example, Grubel (1968) found that U.S. investors could have achieved better risk-return opportunities by investing part of their portfolio in foreign stock markets during the period 1959-1966. Levy and Sarnat (1970) demonstrated the diversification benefits from investing in both developed and developing stock markets during the period 1951-1967. Grubel and Fander (1971) show that industry correlations within countries exceed industry correlations across countries. The implication here is that a necessary condition for risk reduction through international diversification is low correlation between stock returns[1].

A similar story is told by the more recent studies conduced by Bailey and Stultz (1990), Odier and Solnik (1993), Doukas and Yung (1993), Chang *et al.* (1995), Solnik (1995; 1997), Akdogan (1996), Michaud *et al.* (1996), De Santis and Gerard (1997), Griffin and Karolyi (1998) and by Ang and Bekaert (2002). Merkellos and Siriopoulous (1997) found that despite increasing international integration, opportunities for diversification in smaller and less studied European stock markets still exist. Gorman (1998) argues that the typical U.S. pension plan remains underexposed to international equity and recommends more to be allocated to international

[1] Goetzmann *et al.* (2005) argue that the benefits of international diversification have been recognised for a long time, putting forward as a supportive argument the 18th century development of Dutch mutual funds that aimed at holding international securities in their portfolios.

securities. Ang and Bekaret (2002) show that, despite the risk of time-varying correlation, the benefits of international diversification are still significant.

Also recently, some advocates of international diversification argued that diversification into emerging markets can be useful. For example, Conover *et al.* (2002) suggest that emerging equity markets are a worthy addition to a U.S. investor's portfolio of developed market equities. Specifically, they found that portfolio returns increased by approximately 1.5 percentage points a year when emerging country equities were included in the portfolio. A similar idea is put forward by Russel (1998) who states that

> "even the relatively risky practice of investing in emerging markets has been viewed, by some, as a sound investment strategy for individuals".

Goetzmann *et al.* (2005) argue that globalisation has resulted in limiting the benefits of diversification to the extent that it can best be achieved by investing in emerging markets.

If this is the case, why is it then that there is very strong home-country bias with investors? For example, French and Poterba (1991) found that the significant home bias cannot be explained in terms of capital controls, tax burden and transaction costs. Baxter and Jermann (1997) argue that

> "while recent years have witnessed an increase in international diversification, holdings of domestic assets are still too high to be consistent with the theory of portfolio choice".

They also wonder why this has been happening despite the increased integration of capital markets[2]. Wright and McCarthy (2002) also demonstrate lack of international diversification by Australian investors, arguing that they perceive foreign shares as risky and casting doubt on the ability of investors to realize the benefits of international portfolio diversification by purchasing shares in multinational corporations. Russel (1998) concludes that exchange-traded international securities like ADRs are not the ideal vehicles for diversification.

The tendency of investors to allocate a relatively large fraction of their wealth to domestic securities, despite the perceived benefits

[2] The use of the word 'despite' here is rather strange. High holdings of domestic assets are 'caused by' increased market integration. They do not happen 'despite' increased market integration.

of international diversification, has become to be known as the 'home bias puzzle'[3]. Some attempts have been made to resolve this puzzle in terms of barriers to international investment (Errunza and Losq, 1985), departures from purchasing power parity (Cooper and Kaplanis, 1994), the hedging of human capital or other nontraded assets (Baxter and Jermann, 1997; Stockman and Dellas, 1989; Obstfeld and Rogoff, 1998; Wheatley, 2001), and in terms of stock market development and familiarity (Chan *et al.*, 2005). Research has also revealed that the home bias is not only international but also regional (Coval and Moskowitz, 1999; Grinblatt and Keloharju, 2001).

Perhaps the reason for home bias, which may explain the puzzle, is that international diversification does not pay off or that it is not effective in reducing risk. For example, Kalra *et al.* (2004) find that the benefits of international diversification are much smaller than previously thought. Their findings suggest that only a small allocation of 10 per cent to international securities may be justified and that even the slight advantage of international diversification may disappear when taxes are incorporated in the evaluation. They also argue that to maintain the intended diversification, periodic rebalancing of the portfolio is necessary to keep the domestic and foreign component weights at target levels as suggested by Rowland (1999) and Laker (2003). However, international investment (particularly in developing markets) involve nontrivial transaction costs that need to be considered when estimating portfolio performance. Thus, in the presence of periodic rebalancing and associated transaction costs, international diversification does not pay off.

In this paper we pursue this line of reasoning, arguing that the observed extent of international diversification is limited because it is not effective in terms of risk reduction. We measure the effectiveness of international diversification by the extent to which it produces significant risk reduction, as indicated by two statistics: variance ratio and variance reduction.

2. International diversification without the exchange rate factor

The proposition that international diversification is beneficial is an extension of the idea that domestic diversification is beneficial.

[3] See Lewis (1999) and Karolyi and Stulz (2003) for surveys of the home bias literature.

Indeed, international diversification is thought to be more effective because domestic and foreign returns are less correlated than returns on various domestic stocks. So, the whole idea centres on low correlation, as demonstrated below. In this section, we consider returns in local currency terms by ignoring the exchange rate factor (changes in the exchange rate between the domestic and the foreign currencies). This, of course, does not mean that the currency factor is irrelevant, but this part of the analysis is based on one of the following assumptions: (i) the exchange rate is fixed, (ii) the foreign currency position is fully hedged, or (iii) the foreign position is funded in the same foreign currency.

Assume that an investor takes positions on the domestic market and a foreign market, such that the weights assigned to the two markets are β and $1-\beta$, respectively. The rate of return on the portfolio, R_p, is thus a weighted average of the rate of return on the domestic market, R_d, and the rate of return on the foreign market, R_f[4]. Thus, we have

$$R_p = \beta R_d + (1-\beta) R_f \tag{1}$$

Hence, the variance of the portfolio, σ_p^2, is calculated as

$$\sigma_p^2 = \beta^2 \sigma_d^2 + (1-\beta)^2 \sigma_f^2 + 2\beta(1-\beta)\,\sigma_{d,f} \tag{2}$$

where σ_d^2 and σ_f^2 are the variances of the rates of return on the domestic and foreign positions, respectively, whereas $\sigma_{d,f}$ is the covariance of the two rates of return. Given that $\sigma_{d,f} = \rho_{d,f}\sigma_d\sigma_f$ (where $\rho_{d,f}$ is the correlation coefficient between the domestic and foreign rates of return, σ_d is the standard deviation of the rate of return on the domestic position and σ_f is the standard deviation of the rate of return on the foreign position) it follows that

$$\sigma_p^2 = \beta^2 \sigma_d^2 + (1-\beta)^2 \sigma_f^2 + 2\beta(1-\beta)\,\rho_{d,f}\sigma_d\sigma_f \tag{3}$$

From equation (3) it is obvious that the maximum risk reduction is obtained when $\rho_{d,f} = -1$ and that risk reduction is obtained unless $\rho_{d,f} = 1$ because

$$\sigma_p \leq \beta\sigma_d + (1-\beta)\,\sigma_f \tag{4}$$

[4] Certain procedures are used to determine the portfolio weights in the literature. For example, Timmermann and Blake (2005), who studied the international diversification behaviour of British pensions funds, found that a substantial part of the evolution in portfolio weights can be explained by time-varying conditional expected returns, volatilities and covariances with domestic equity returns. In this paper the weights are determined by minimising the variance of the rate of return on the portfolio.

Statman (1987) argues that most of the variance reduction is achieved when the number of stocks in the international portfolio reaches 30. This is because while individual stock return variances matter for the portfolio with few stocks, portfolio variance is driven primarily by the average covariance (correlation) when the number of stocks becomes large.

Based on this analysis, the quest has been for low (or negative) correlations as the source of risk reduction. Goetzmann *et al.* (2005) argue that

> "the primary motive for international diversification has been to take advantage of the low correlation between stocks in different markets".

The argument for international diversification, therefore, has been relying heavily on the proposition that cross-country correlation of stock returns is low. For this reason a large number of studies have been conducted to explain cross-country correlation of returns. For example, Roll (1992) proposes a Ricardian explanation based on country specialisation. However, Heston and Rouwenhorst (1994) reject the proposition that industry differences and country specialisations can explain comovements in stock prices, arguing that country effects are better explanations than industry differences. Other economists attribute market comovements to covariation in fundamental variables such as interest rates and dividend yields[5]. The lack of market integration has also been proposed as an explanation for low correlation (for example, Chen and Knez, 1995; Korajczyk, 1996).

There are two problems with this approach. The first is that if low correlation is the source of risk reduction, then we should expect increased market integration and financial liberalisation to boost correlation and limit the risk reduction that can be obtained from international diversification. It is therefore strange that Baxter and Jermann (1997) wonder why there is less diversification with increased market integration. But given the logic of this argument, risk reduction can result from international diversification even though correlation is positive, simply by taking opposite positions. Equation (1) implies that a long position is taken on both the domestic and foreign markets. But if short sales are allowed then

[5] For example, Campbell and Hamao (1992) show that these variables drive comovement between Japan and the U.S.; Bracker *et al.* (1999) believe that it is international trade.

opposite positions can be taken to utilize the advantage of the high (positive) correlation. For example, if a long position is taken on the domestic market and a short position is taken on the foreign market, then the rate of return on the portfolio becomes

$$R_p = \beta R_d - (1-\beta) R_f \tag{5}$$

which gives

$$\sigma_p^2 = \beta^2 \sigma_d^2 + (1-\beta)^2 \sigma_f^2 - 2\beta(1-\beta)\rho_{d,f}\sigma_d\sigma_f \tag{6}$$

in which case the maximum risk reduction is obtained when $\rho_{d,f} = 1$.

The second problem with the conventional approach to international diversification is statistical. The practice has always been to measure risk reduction by the difference between the numerical values of the standard deviations of the rates of return on the domestic portfolio and the international portfolio. This seems to be the all-common mistake that is often found in the literature of basing inference on the numerical values of certain statistics[6]. Proper inference about the ability of international diversification to reduce risk should be based on something like the variance ratio test, in which the null is $\sigma_d^2 + \sigma_p^2$. Rejection of the null hypothesis in favour of the alternative hypothesis $\sigma_d^2 > \sigma_p^2$ means that international diversification is effective in reducing risk. The lower (higher) the correlation coefficient, the more (less) likely it is that the null will be rejected when a long (short) position is taken on the foreign market. What we intend to do here is to demonstrate the ability (or otherwise) of international diversification to reduce risk using the variance ratio test.

3. International diversification with the exchange rate factor

In this section, the foreign exchange factor is introduced by considering the rates of return on the domestic market and the foreign market when they are measured in domestic currency terms. In this case

[6] This 'malpractice' is particularly evident in the forecasting literature, but it is also frequent in studies of performance evaluation. We typically come across statements like "Model A is better than Model B because it has a lower mean square error" and that "Portfolio Manager X is better than Portfolio Manager Y because the former's track record produces a better Sharpe ratio". Strange that we test for differences between means and variances but not between mean square errors and Sharpe ratios.

$$R_{f*} = (1+R_f)(1+e)-1 \tag{7}$$

where e is the percentage change in the exchange rate measured as the domestic currency price of one unit of the foreign currency[7]. An approximation of (7) is obtained when $R_f e \approx 0$, which is a valid assumption for small values of R_f and e. Thus, we have

$$R_{f*} = R_f + e \tag{8}$$

Let the variance of the rate of return on the foreign portfolio be σ^2_{f*}. If similar positions are taken, then

$$\sigma^2_{f*} = \sigma^2_f + \sigma^2_e + 2\rho_{f,e}\sigma_f\sigma_e \tag{9}$$

where σ^2_e is the variance of the percentage change in the exchange rate, $\rho_{f,e}$ is the correlation coefficient between the rate of return on the foreign market and the percentage change in the exchange rate, and σ_e is the standard deviation of the percentage change in the exchange rate. Thus, the minimum value of σ^2_{f*} is obtained when $\rho_{f,e}=-1$. The variance of the rate of return on the portfolio when similar positions are taken can thus be written as

$$\sigma^2_p = \beta^2\sigma^2_d + (1-\beta)^2\sigma^2_{f*} + 2\beta(1-\beta)\rho_{d,f*}\sigma_d\sigma_{f*} \tag{10}$$

By substituting equation (9) into equation (10), we obtain

$$\sigma^2_p = \beta^2\sigma^2_d + (1-\beta)^2[\sigma^2_f + \sigma^2_e + 2\rho_{f,e}\sigma_f\sigma_e] + 2\beta(1-\beta)\rho_{d,f*}\sigma_d\sigma_{f*} \tag{11}$$

which shows that the variance of the portfolio depends on two correlation coefficients: the correlation coefficient between the rate of return on the foreign market and the percentage change in the exchange rate, $\rho_{f,e}$, and the correlation coefficient between the rate of return on the domestic market and the rate of return on the foreign market in domestic currency terms, $\rho_{d,f*}$. This means that the minimum value of the the variance of the rate of return on the international portfolio is obtained when $\rho_{f,e}=\rho_{d,f*}=-1$. It is possible, however, to express the variance of the rate of return on the international portfolio in terms of $\rho_{f,e}$ only, because

$$\rho_{d,f*} = \frac{\sigma_{d,f*}}{\sigma_d\sigma_{f*}} \tag{12}$$

which gives

$$\rho_{d,f*} = \frac{\sigma_{d,f*}}{\sigma_d\sqrt{\sigma^2_f + \sigma^2_e + 2\rho_{f,e}\sigma_f\sigma_e}} \tag{13}$$

[7] Hence when the percentage change in the exchange rate is positive this implies appreciation of the foreign currency and depreciation of the domestic currency.

Hence

$$\sigma_p^2 = \beta^2\sigma_d^2 + (1-\beta)^2\left[\sigma_f^2 + \sigma_e^2 + 2\rho_{f,e}\sigma_f\sigma_e\right] + 2\beta(\beta-1)\left[\frac{\sigma_{d,f*}\sigma_d\sigma_{f*}}{\sigma_d\sqrt{\sigma_f^2 + \sigma_e^2 + 2\rho_{f,e}\sigma_f\sigma_e}}\right] \tag{14}$$

which shows that the effect of $\rho_{f,e}$ on σ_p^2 is ambiguous[8]. Correlation between the rate of return on the foreign market and the percentage change in the exchange rate can be positive or negative. For example, appreciation of the foreign currency can hurt foreign exporting firms, leading to a decline in stock prices, hence negative correlation. On the other hand, appreciation of the foreign currency makes foreign stocks attractive for foreigners. The increase in demand for foreign stocks pushes up their prices, hence positive correlation results.

4. Methodology

In this study we investigate the effectiveness of international diversification in reducing risk as measured by the variance of the rate of return on the international portfolio. We concentrate on the presumed risk-reduction benefits of international diversification because (according to Solnik and McLeavey, 2004, p. 464):

> "risk diversification is the most established and frequently invoked argument in favour of foreign investment"[9].

The idea is very simple: we compare the variance of the rate of return on a domestic diversified portfolio (represented by the market index) with the variance of the rate of return on an international portfolio consisting of a long position on the domestic market and either a long or a short position on the foreign market. Whether a long or a short position is taken on the foreign market depends on the correlation between the rates of return on the two markets.

The size of the position on the foreign market is determined by minimising the variance of the rate of return on the portfolio.

[8] When opposite positions are taken, the variance of the rate of return on the portfolio will be as in (14), except that the last term will have a negative sign.

[9] It is typically argued that international diversification lowers risk by eliminating non-systematic volatility without sacrificing expected return.

Consider equation (3), which defines the variance of the rate of return on the portfolio when similar positions are taken without considering the exchange rate factor. The value of β that minimises the variance of the rate of return on the portfolio can be obtained by differentiating the equation with respect to β to obtain

$$\frac{\partial(\sigma_p^2)}{\partial\beta} = 2\beta\sigma_d^2 - 2(1-\beta)\sigma_f^2 + 2(1-\beta)\sigma_{d,f} \qquad (15)$$

which is then equated to zero to produce

$$\beta(\sigma_d^2 + \sigma_f^2 - \sigma_{d,f}) = \sigma_f^2 \qquad (16)$$

Hence

$$\beta = \frac{\sigma_f^2}{(\sigma_d^2 + \sigma_f^2 - \sigma_{d,f})} \qquad (17)$$

Likewise, we can calculate the value of β for the other three cases. Table 1 lists the formulas used to calculate R_p, σ_p^2 and β for (1) similar positions without the exchange rate factor, (2) opposite positions without the exchange rate factor, (3) similar positions with the exchange rate factor, and (4) opposite positions with the exchange rate factor.

TABLE 1 - *Calculating the Rate of Return on the Portfolio*

Case	R_p	σ_p^2	β
1	$R_p = \beta R_d + (1-\beta)R_f$	$\sigma_p^2 = \beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 + 2\beta(1-\beta)\rho_{d,f}\sigma_d\sigma_f$	$\beta = \frac{\sigma_f^2}{(\sigma_d^2 + \sigma_f^2 - \sigma_{d,f})}$
2	$R_p = \beta R_d - (1-\beta)R_f$	$\sigma_p^2 = \beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 - 2\beta(1-\beta)\rho_{d,f}\sigma_d\sigma_f$	$\beta = \frac{\sigma_f^2}{(\sigma_d^2 + \sigma_f^2 + \sigma_{d,f})}$
3	$R_p = \beta R_d + (1-\beta)R_{f*}$	$\sigma_p^2 = \beta^2\sigma_d^2 + (1-\beta)^2\sigma_{f*}^2 + 2\beta(1-\beta)\rho_{d,f*}\sigma_d\sigma_{f*}$	$\beta = \frac{\sigma_{f*}^2}{(\sigma_d^2 + \sigma_{f*}^2 - \sigma_{d,f*})}$
4	$R_p = \beta R_d - (1-\beta)R_{f*}$	$\sigma_p^2 = \beta^2\sigma_d^2 + (1-\beta)^2\sigma_{f*}^2 - 2\beta(1-\beta)\rho_{d,f*}\sigma_d\sigma_{f*}$	$\beta = \frac{\sigma_{f*}^2}{(\sigma_d^2 + \sigma_{f*}^2 + \sigma_{d,f*})}$

Having calculated σ_p^2, the effectiveness of international diversification in reducing risk can be based on the null hypothesis

$$H_0: \sigma_d^2 = \sigma_p^2 \qquad (18)$$

Assuming that σ_d^2 is numerically larger than σ_p^2, the null is rejected (implying that diversification is effective in reducing risk) if

$$VR = \frac{\sigma_d^2}{\sigma_p^2} > F(n-1, n-1) \tag{19}$$

where *VR* is the variance ratio and *n* is the sample size. This test can be complemented by the variance reduction, which is calculated as

$$VD = 1 - \frac{1}{VR} \tag{20}$$

Whether or not the null is rejected depends crucially on $\rho_{d,f}$, which can be shown as follows for the case of similar positions without the exchange rate factor. When similar positions are taken, the *VR* can be expressed as

$$VR = \frac{\sigma_d^2}{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 + 2\beta(1-\beta)\sigma_d\sigma_f\rho_{d,f}} \tag{21}$$

which shows that a high negative value for the correlation coefficient produces a high *VR*. The same is true for all of the other cases. Therefore

$$VD = 1 - \frac{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 + 2\beta(1-\beta)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2} \tag{22}$$

which means that a large negative value of the correlation coefficient produces high variance reduction. Table 2 exhibits the formulas that are used to calculate *VR* and *VD* in the four cases considered.

TABLE 2 - *Calculating VR and VD*

Case	*VR*	*VD*
1	$VR = \frac{\sigma_d^2}{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 + 2\beta(1-\beta)\sigma_d\sigma_f\rho_{d,f}}$	$VD = 1 - \frac{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 + 2\beta(1-\beta)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2}$
2	$VR = \frac{\sigma_d^2}{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 - 2\beta(1-\beta)\sigma_d\sigma_f\rho_{d,f}}$	$VD = 1 - \frac{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_f^2 - 2\beta(1-\beta)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2}$
3	$VR = \frac{\sigma_d^2}{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_{f*}^2 + 2\beta(1-\beta)\sigma_d\sigma_{f*}\rho_{d,f*}}$	$VD = 1 - \frac{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_{f*}^2 + 2\beta(1-\beta)\sigma_d\sigma_{f*}\rho_{d,f*}}{\sigma_d^2}$
4	$VR = \frac{\sigma_d^2}{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_{f*}^2 - 2\beta(1-\beta)\sigma_d\sigma_{f*}\rho_{d,f*}}$	$VD = 1 - \frac{\beta^2\sigma_d^2 + (1-\beta)^2\sigma_{f*}^2 - 2\beta(1-\beta)\sigma_d\sigma_{f*}\rho_{d,f*}}{\sigma_d^2}$

5. Data and empirical results

The empirical results presented in this paper are based on daily data on 11 developed and emerging markets covering the period 3 January 2000 to 30 May 2004. The emerging markets are the six markets of the Gulf Co-operation Council: (1) Bahrain (BA), (2) United Arab Emirates (UA), (3) Kuwait (KU), (4) Oman (OM), (5) Qatar (QA), and (6) Saudi Arabia (SA). The reason why these markets are chosen is highly relevant to the issue of international diversification. These are the markets of oil producing countries, which should be affected positively by the rise in oil prices, unlike the markets of oil-importing developed countries, which are adversely affected by rising oil prices[10]. The developed markets include those of: (7) the United States (US), (8) the United Kingdom (UK), (9) Germany (GE), (10) Japan (JP), and (11) Hong Kong (HK). The developed market prices are represented respectively by the S&P 500, the FT index, the DAX index, the Nikkei Dow Jones index and the Hang Seng index. Data on the emerging markets were obtained from the Gulf Investment Corporation, whereas those on developed markets were obtained from the Yahoo Finance website.

We first consider the rates of return in own currencies, which means that we do not take into account changes in exchange rates. This is a legitimate procedure if foreign exchange risk can be eliminated completely by funding the foreign portfolio in the same currency or by covering the foreign position in the forward market. The correlation matrix of the rates of return without the exchange rate factor is reported in Table 3. An examination of the correlation matrix reveals low correlations between stock returns in emerging markets and between those returns and the returns in developed

[10] Several studies have been done on the effect of oil prices on stock prices. Hong and Stein (1999) and Hong *et al.* (2003) put forward several hypotheses suggesting that some properties of oil prices make it interesting to focus on the predictive ability of oil prices for stock returns. Driesprong *et al.* (2004) studied the ability of oil prices to predict stock returns, arguing that the price of oil is a perfect example of a macroeconomic variable whose exact impact on the stock market is not yet known whereas the variable itself can be easily and almost continuously observed. They found out that a rise in oil prices lowers stock returns. Basher and Sadorsky (2004) tested the relation in emerging markets and found strong evidence indicating that oil price risk impacts emerging stock markets. Almuraikhi (2005) uses oil prices as an explanatory variable in an equation relating Kuwait's stock price index to a set of fundamental variables.

markets. In this case, long positions in both markets should reduce risk. High correlations can be observed between returns in developed markets, particularly between the U.S. and the U.K., the U.S. and Germany, the U.K. and Germany and between Japan and Hong Kong. In this case opposite positions should be taken in the two markets to reduce risk.

TABLE 3 - *Correlation Matrix of the Rates of Return (without the Exchange Rate Factor)*

	BA	UA	KU	OM	QA	SA	US	UK	GE	JP	HK
BA	1.00										
UA	0.08	1.00									
KU	0.05	-0.02	1.00								
OM	0.03	0.03	-0.02	1.00							
QA	0.05	0.07	0.00	0.05	1.00						
SA	0.05	0.02	0.14	0.00	0.07	1.00					
US	0.01	0.00	-0.05	-0.04	0.01	0.00	1.00				
UK	0.00	-0.02	0.00	-0.03	-0.03	0.03	0.47	1.00			
GE	-0.02	0.00	0.00	-0.02	-0.03	0.01	0.62	0.74	1.00		
JP	0.05	0.03	0.04	0.01	-0.01	0.02	0.12	0.24	0.20	1.00	
HK	0.02	0.01	0.02	-0.01	-0.04	0.02	0.14	0.34	0.30	0.49	1.00

BA=Bahrain, UA=UAE, KU=Kuwait, OM=Oman, QA=Qatar, SA=Saudi Arabia, US=United States, UK=United Kingdom, GE=Germany, JP=Japan, HK=Hong Kong.

Figure 1 shows a plot of the variance ratio (σ_d^2/σ_f^2) corresponding to the portfolios representing all possible combinations. The horizontal line defines the five per cent critical value of the *VR* (=1.085), such that a significant variance ratio that indicates effective diversification is represented by a dot above the line. As we can see, a small number of dots above the line appear when opposite positions are taken, but none when similar positions are taken. This is because the high correlations that we have are all positive, which means that effective risk reduction can be obtained only when opposite positions are taken. Table 2 reports the details of the portfolios represented by the points above the line in Figure 1(a). These results clearly show that effective diversification involves developed markets only and only when opposite positions are taken. Variance reduction ranges between 9 and 56 per cent, the latter being the case of taking a long position on the U.K. market and a short position on the German market. Two conclusions can be derived from these results. The first is that effective diversification only involves developed markets in which stock returns are highly correlated. The second is that only opposite positions produce risk reduction because strong correlations tend to be positive.

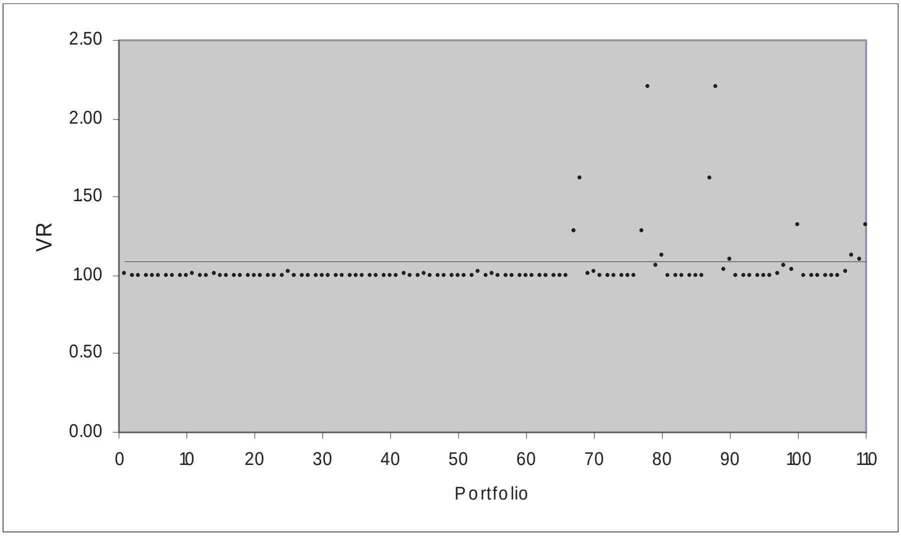
TABLE 4 - *Effective Diversification with a Short Position on the Foreign Market (without the Exchange Rate Factor)*

Domestic Market	Foreign Market	σ_d^2	σ_p^2	*VR*	*VD*
U.S.	U.K.	0.000123	0.000096	1.277	0.21
U.S.	Germany	0.000123	0.000076	1.169	0.38
U.K.	U.S.	0.000124	0.000097	1.277	0.22
U.K.	Germany	0.000124	0.000056	2.203	0.56
U.K.	Hong Kong	0.000124	0.000110	1.126	0.11
Germany	U.S.	0.000258	0.000159	1.619	0.32
Germany	U.K.	0.000258	0.000117	2.203	0.54
Germany	Hong Kong	0.000258	0.000231	1.100	0.09
Japan	Hong Kong	0.000161	0.000122	1.316	0.24
Hong Kong	U.K.	0.000156	0.000138	1.126	0.11
Hong Kong	Germany	0.000156	0.000142	1.100	0.09
Hong Kong	Japan	0.000156	0.000118	1.316	0.24

Now, we turn to the analysis of portfolio returns measured in domestic currency terms, by taking into account the exchange rate factor. This means that the rates of return are measured in domestic currency terms. We consider all cases by allowing any of the eleven markets to be the domestic market. Table 5 is the correlation matrix of stock returns measured in domestic currency terms, $\rho_{d,f*}$. Unlike Table 3, this correlation matrix is not symmetrical because the columns represent the domestic market, whereas the rows represent the foreign markets. For example, when the domestic market is the U.S. and the foreign market is the U.K., the correlation coefficient is 0.43. This is the correlation coefficient between the rate of return in the U.S. (the percentage change in the stock price index) and the rate of return in the U.K. (the percentage change in the stock price index) converted into U.S. dollar terms by adding the percentage change in the exchange rate measured as dollar/pound.

FIGURE 1 - *Variance Ratios against the 5% Critical Value (without the Exchange Rate Factor)*

(a) Opposite Positions



(b) Similar Positions

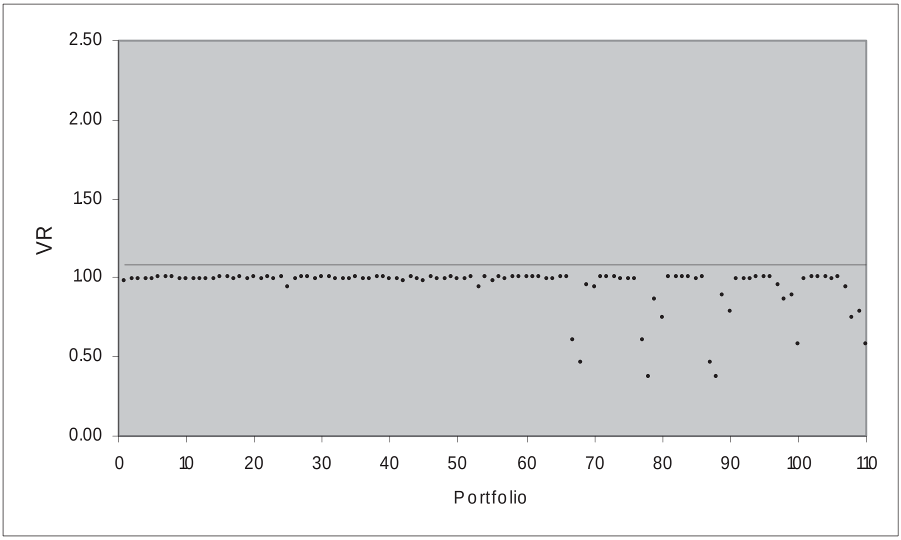


TABLE 5 - *Correlation Matrix of the Rates of Return (with the Foreign Exchange Factor)*

	Domestic Market										
	BA	UA	KU	QM	QA	SA	US	UK	GE	JP	HK
BA	1.00	0.08	0.07	0.02	0.04	0.05	0.02	0.02	0.01	0.06	0.02
UA	0.08	1.00	0.00	0.02	0.06	0.02	0.00	0.00	0.02	0.04	0.01
KU	0.05	-0.01	1.00	-0.03	0.01	0.13	-0.05	0.02	0.01	0.05	0.01
QM	0.03	0.03	-0.01	1.00	0.05	-0.01	-0.04	-0.01	0.00	0.02	-0.03
QA	0.05	0.04	0.01	0.05	1.00	0.07	0.00	0.00	-0.01	0.02	-0.02
SA	0.05	0.02	0.14	-0.01	0.07	1.00	0.00	0.04	0.02	0.04	0.01
US	0.01	0.00	-0.05	-0.04	0.01	0.00	1.00	0.44	0.56	0.13	0.14
UK	-0.01	-0.02	0.02	-0.03	-0.01	0.03	0.43	1.00	0.69	0.20	0.29
GE	0.00	0.00	0.02	-0.02	-0.01	0.01	0.58	0.71	1.00	0.17	0.26
JP	0.04	0.03	0.03	0.01	-0.02	0.01	0.11	0.21	0.17	1.00	0.45
HK	0.03	0.01	0.02	-0.02	-0.03	0.01	0.14	0.32	0.27	0.47	1.00

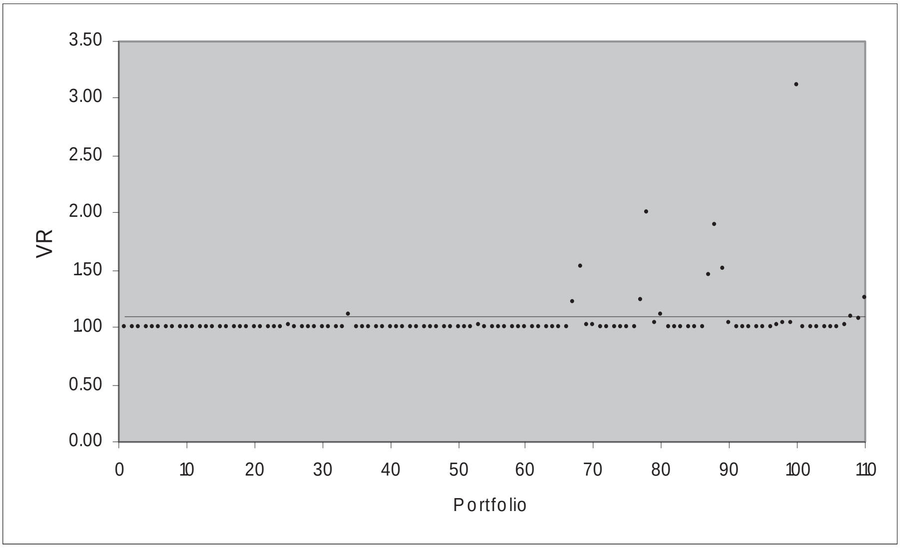
The picture that appears from Table 5 is similar to that appearing from Table 3, as only few combinations, involving developed markets only, produce significantly positive correlation. Only these combinations produce effective diversification, as shown in Table 6. Figure 2 shows that effective diversification is produced only when opposite positions are taken.

TABLE 6 - *Effective Diversification with a Short Position on the Foreign Market (with the Exchange Rate Factor)*

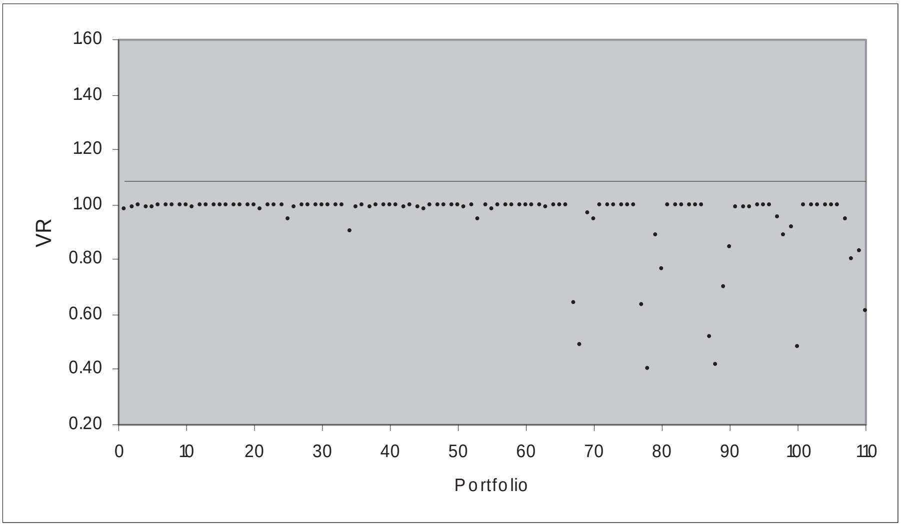
Domestic Market	Foreign Market	σ_d^2	σ_p^2	*VR*	*VD*
U.S.	U.K.	0.000123	0.000099	1.227	0.19
U.S.	Germany	0.000123	0.000080	1.525	0.34
U.K.	U.S.	0.000124	0.000099	1.283	0.19
U.K.	Germany	0.000124	0.000062	2.004	0.50
U.K.	Hong Kong	0.000124	0.000110	1.112	0.10
Germany	U.S.	0.000258	0.000178	1.452	0.31
Germany	U.K.	0.000258	0.000137	1.887	0.47
Germany	Japan	0.000258	0.00017	1.517	0.43
Japan	Hong Kong	0.000161	0.000052	3.118	0.68
Hong Kong	U.K.	0.000156	0.000143	1.091	0.08
Hong Kong	Japan	0.000156	0.000124	1.261	0.21

FIGURE 2 - *Variance Ratios against the 5% Critical Value (with the Exchange Rate Factor)*

(a) Opposite Positions



(b) Similar Positions



6. Further results

Some extra useful results can be reported here. We have already considered correlation between stock returns, R_d, and the percentage change in the exchange rate, *e*, which is labelled $\rho_{d,e}$. This correlation can be either positive or negative, and plausible explanations can be provided for either. Table 7 reports these correlation coefficients, showing not even a single case of significant correlation, be it positive or negative. One explanation for this finding is that contrasting forces act upon these correlations, some towards positive values and others towards negative values. The resultant outcome would be that these correlations would cluster around zero, as shown in Table 7[11].

Table 7 - *Correlation Coefficients between Stock Returns and the Percentage Change in the Exchange Rate*

	BA	UA	KU	OM	QA	SA	US	UK	GE	JP	HK
1	-0.02	-0.01	-0.05	0.04	0.00	0.01	-0.05	-0.03	-0.03	-0.04	0.02
2	-0.01	-0.03	-0.03	0.02	-0.01	-0.03	0.00	-0.02	-0.02	-0.04	0.00
3	-0.02	0.02	-0.03	0.04	-0.01	0.01	-0.03	-0.02	-0.02	-0.03	0.02
4	-0.01	0.08	-0.03	0.00	0.00	0.03	-0.03	-0.03	-0.02	-0.03	0.03
5	-0.02	0.02	-0.03	0.02	-0.01	0.00	0.01	-0.04	-0.03	-0.05	-0.06
6	-0.02	0.02	-0.03	0.02	-0.01	-0.02	0.02	-0.02	-0.02	-0.04	-0.01
7	0.01	0.01	-0.05	0.01	-0.04	0.01	0.02	-0.02	-0.02	-0.04	0.00
8	-0.03	0.00	-0.06	0.02	-0.06	0.00	-0.01	0.02	-0.02	0.01	0.07
9	0.00	-0.01	0.01	-0.02	0.00	0.02	0.02	0.02	0.01	0.03	0.07
10	-0.06	0.00	-0.03	0.02	-0.01	0.05	0.01	-0.03	-0.02	-0.04	0.02

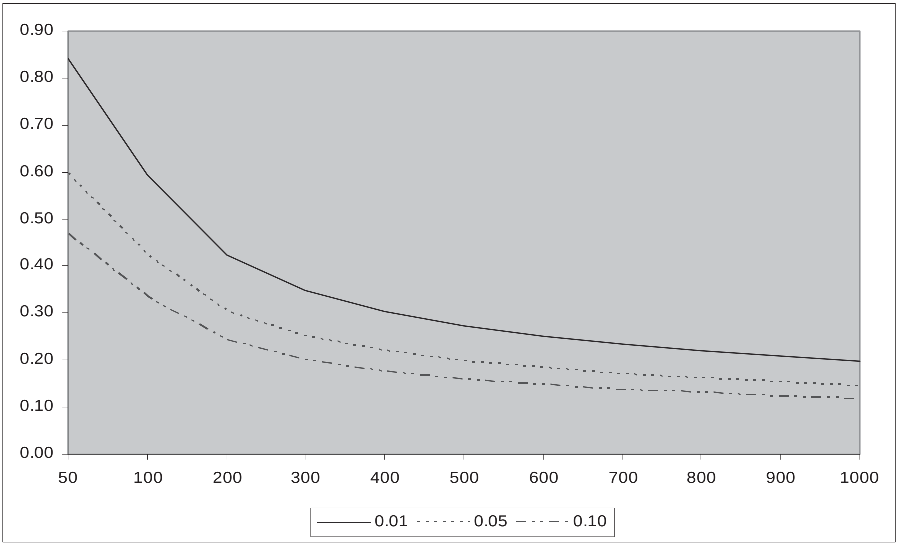
The results presented so far cast doubt on the traditional argument for international diversification, which is risk reduction based on low or negative correlation (necessarily implying taking similar positions on the domestic and foreign markets). We have seen that correlations

[11] Perhaps a word on how to read Table 7 would be useful. Each cell represents the correlation coefficient between the rate of return in the stock market indicated by the two letter symbol and the exchange rate (expressed as domestic/foreign) represented by the numbers. These numbers mean different exchange rates in each case. In the case of Bahrain, for example, 1 represents the exchange rate of the Bahraini dinar against the UAE dirham, 2 against the Kuwaiti dinar, and so on. For the UAE, 1 is the exchange rate against Bahrain, 2 against Kuwait, and so on.

are either significantly positive (as in the case of some developed markets) or low but not adequately low to produce significant risk reduction (what we called effective diversification). When correlation is significantly positive (and adequately high) risk reduction can be achieved but only when opposite positions are taken. Therefore, risk reduction cannot be achieved through international diversification, except in a few cases when opposite positions are taken.

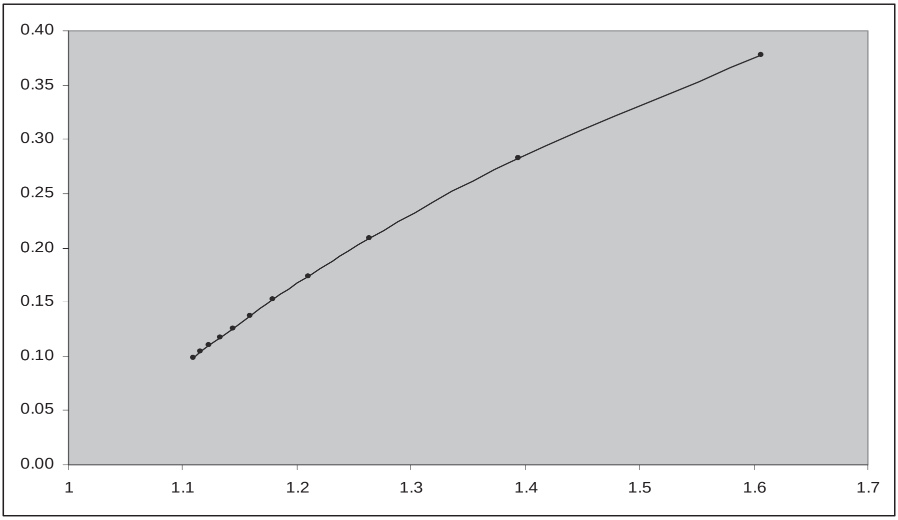
Figure 3 shows the minimum (absolute) value of the correlation coefficient required to produce effective diversification in terms of risk reduction as measured by the variance ratio. Two parameters

FIGURE 3 - *Correlation Required to Produce Effective Risk Diversification for a Given Sample Size and Significance Level*



are important here: the significance level (0.10, 0.05 or 0.01) and the sample size. For example, if the sample size is 50 then a minimum correlation of 0.84 is required to produce a significant *VR* (significant risk reduction) at the 1 per cent significance level. At the 5 per cent and 10 per cent levels, the correlations required to produce significant risk reduction are 0.60 and 0.47, respectively. As the sample size increases, the required value of the correlation coefficient drops. For example, if the sample size is 500, the correlation required at the 5 per cent level is 0.20. This requirement defeats the traditional argument for risk reduction through similar positions, because for that to happen, we need negative correlation of -0.20 (if the sample size is 500). These correlations are simply not available, because stock returns are either positively correlated (in which case similar positions will not produce risk reduction) or weakly correlated (in which case diversification into emerging markets does not work)[12]. Figure 4 shows the risk reduction corresponding to the critical values of the variance ratio at the 5 per cent significance level. For example, the risk reduction corresponding to the critical value of 1.61 (when the sample size is 50) is 0.378 or about 38 per cent. Likewise, the risk reduction corresponding to the critical value of 1.11 (when the sample size is 1000) is 0.099, or about 10 per cent. Overall, these figures cannot be obtained when similar positions are taken, but they can be obtained in a few cases when opposite positions are taken. There is little evidence here to support the traditional argument for international diversification.

FIGURE 4 - *Variance Reduction Corresponding to the 5% Critical Values of the Variance Ratio*



[12] Increased correlation among stock returns in developed markets is the result of several factors including (i) deregulation and openness of capital markets, (ii) increased capital mobility, (iii) increased openness of national economies, and (iv) the globalisation of corporate operations.

7. Conclusion

Financial economists have been writing about the benefits of international diversification so much and for so long that it has become a classic example of the intellectual tyranny of the *status quo* (with respect to current thinking on this issue). Typically in situations like this, any empirical evidence against the underlying hypothesis is not taken to refute the hypothesis but rather it is regarded as a puzzle. A shower of explanations for the alleged puzzle follows in an attempt to preserve the intellectual tyranny of the underlying hypothesis. None of these explanations, of course, refutes the hypothesis.

If we do not shy away from the possibility of refuting a well-established hypothesis, then the results of this study suggest that home bias arises because diversification is not effective in reducing risk. Increased correlations of stock returns in developed markets, as a result of more integration, means that risk cannot be reduced through diversification unless opposite positions are taken. And while correlation between two emerging markets and an emerging market and a developed market is low, it is not adequately low (or negative) to produce effective diversification by taking similar positions on the two markets.

Therefore, the benefits of international diversification are limited, but what about the costs and problems associated with it? These are non-trivial as there are still some barriers to international investment, such as familiarity with foreign markets, political risk, efficiency of foreign markets, regulation, transaction costs, taxes, and currency risk. For example, it is typically the case that transaction costs in foreign markets are higher, including brokerage fees, management fees and the bid-offer spreads. Although the proponents of international diversification argue that these barriers are disappearing, they remain significant (particularly with respect to emerging markets). With limited benefits and significant problems associated with international diversification, it is no wonder that there is home bias. This, however, does not mean that international investment should be dropped from an investor's menu. There are always attractive special situations arising in markets all around the world.

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ABSTRACT

We test the proposition that international diversification is effective in reducing risk. The traditional underlying argument is that low correlations of international stock returns make the variance of an international portfolio lower than the variance of a purely domestic portfolio when long positions are taken on the domestic and foreign markets. Our analysis of more than 100 portfolios involving developed and emerging markets shows that correlations are not adequately low to produce effective diversification when long positions are taken. In a few cases involving developed markets only, correlations are high to the extent that taking opposite positions (long and short) produces effective diversification. The results cast serious doubt on the effectiveness of international diversification in reducing risk.

Keywords: International Diversification, Variance Ratio, Variance Reduction

JEL Classification: F21, G11, G15

RIASSUNTO

Il mito della diversificazione internazionale

Scopo di questo studio è quello di verificare l'ipotesi per la quale una diversificazione internazionale sarebbe efficace nella riduzione del rischio. L'argomentazione comune si basa sul fatto che basse correlazioni dei rendimenti azionari internazionali rendono la varianza di un portafoglio internazionale più bassa di quella di un portafoglio esclusivamente nazionale se si considerano posizioni di lungo periodo. La nostra analisi, svolta su più di 100 portafogli relativi a mercati sia sviluppati che emergenti, mostra che le correlazioni non sono adeguatamente basse per produrre diversificazioni effettive se si considerano posizioni di lungo periodo. Solo in alcuni casi, relativi a mercati sviluppati, le correlazioni sono sufficientemente elevate se si assumono posizioni opposte, sia di lungo sia di breve periodo. I risultati creano quindi ragionevoli dubbi sull'efficacia della diversificazione internazionale nella riduzione del rischio.