The Effectiveness of International Diversification: Whole Markets versus Sectors

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Abstract

A hedging approach is used to examine the effect of sectoral factors on the effectiveness of international diversification. By using data covering seven countries and various sectors we find that international diversification is more effective when assets from developed markets only are used and when multi-asset portfolios are used instead two-asset portfolios. The results also reveal that international diversification across whole markets is more effective than diversification across sectors. These results reflect the pattern of return correlation.

Keywords: International Diversification, Variance Ratio, Variance Reduction

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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. More specifically, it is envisaged that international diversification provides lower risk or/and higher return than what can be obtained from investment in domestic assets. The underlying idea is that effective diversification requires low return correlations of the constituent components of a diversified portfolio. Since stock returns are less highly correlated across countries than within one country, it follows that international diversification is more effective than diversification within one country.

This proposition made a lot of sense in the 1960s and 1970s when markets were segmented and capital controls as well as other impediments were imposed to restrict capital outflows and foreign ownership of domestic stocks—these factors made cross-country stock returns weakly correlated. Hence, although the scope for international diversification was limited, it was intuitive to suggest that diversification across countries was useful. Studies of international diversification that were conducted in the 1960s and 1970s were overwhelmingly supportive of the benefits of international diversification (for example, Grubel, 1968; Levy and Sarnat, 1970; Grubel and Fander, 1971; Solnik, 1974; Lassard, 1976; Biger, 1979).

But things have changed since the advent of globalization and the removal of restrictions on foreign investment in domestic markets and domestic investment in foreign markets. These developments have made stock returns highly correlated, hence reducing the effectiveness of international diversification, particularly amongst

developed countries. It is for this reason that some advocates of international diversification believe that diversification into emerging markets can be useful, at least relative to diversification into developed markets. It is why there are those who cast doubt on the benefits of international diversification and suggest that as an explanation for home bias. For example, Kalra et al. (2004) find that the benefits of international diversification are much smaller than previously thought. On the basis of her results, Lewis (2006) concludes that "the benefits to diversification have declined both for stocks inside and outside the US".

Studies of the benefits of international diversification are typically based on the mean-variance criterion whereby the risk and return on domestic and internationally diversified portfolios are compared, typically without testing the equality of means and variances. Furthermore, the usual assumption is that only long positions are taken, and this is why low correlation is the conduit to effective international diversification. An alternative approach is found in the hedging literature where emphasis is placed on risk reduction. In their study of international diversification, Coeurdacier and Guibaud (2011) refer to the concept of hedging in conjunction with the concept of home bias. Specifically, they address the issue of whether or not investors correctly hedge their over-exposure to domestic risk by investing in foreign stock markets. However, they emphasise low correlation, implying that the investor always takes similar positions (long-long). In the hedging approach, opposite positions are taken on the asset to be hedged and the hedging instrument, which means that high positive correlation produces a more effective hedge. Moosa and Al-Deehani (2009) and Moosa and Ramiah (2013) use the same approach and conclude that diversification into emerging markets is not effective in terms of risk reduction and that it is effective

predominantly for developed markets and only if opposite positions are taken on domestic and foreign assets.

The objective of this study is to find out if international diversification is more or less effective when conducted on a sector-by-sector basis as opposed to the whole market. The underlying idea is that sectoral stock returns across countries are unlikely to be as strongly (or weakly) correlated as whole market returns—this depends on the underlying sector. For example, it is intuitive to suggest that returns on utilities are less highly correlated than returns on airlines on a cross-border basis and that the sectoral correlation patterns are not necessarily similar to those of whole markets.

The Effect of Sectoral Factors

One aspect of international diversification that has attracted significant attention recently is whether international diversification should be considered across countries or across industries/sectors. While the majority of studies have shown that the country effect dominates the industry effect (Griffin and Karolyi, 1998), it is widely believed that the industry effect has grown in importance relative to the country effect in developed markets since the late 1990s (Baca et al., 2000; Cavaglia et al., 2000; Phylaktis and Xia, 2006). Similar findings have been revealed for Asian emerging markets (Wang et al., 2003).

The rising importance of sectoral factors in explaining stock return correlation is attributed in part to globalisation and financial market integration (Campa and Fernandes, 2006) and the dominant role played by information technology (Brooks and Del Negro, 2006). For example, it is plausible to suggest that economic and

financial integration in Europe has impacted macroeconomic fundamentals across the European Union, giving rise to the dominance or otherwise of the industry effect over the country effect (Flavin, 2004; Ferreira and Ferreira, 2006). Griffin and Karolyi (1998) and Griffin and Stulz (2001) argue that sector-specific shocks may have a greater impact on industries that produce internationally traded goods. Growing trade as a result of the single currency has the effect of raising the sensitivity of certain stocks to sector-specific shocks, thus enhancing their effects on stock returns. Furthermore, as industrial specialisation takes place, the industry effect is expected to dominate the country effect.

Empirical evidence on the relative importance of country effect and industry effect is abundant. Rouwenhorst (1999) investigates the relative importance of country and industry effects in the European Union during the period 1993-1998. He finds the country effect to be more significant despite the convergence of interest rates and the harmonisation of fiscal and monetary policies following the implementation of the 1992 Maastricht Treaty. Since then, studies by Flavin (2004) and Ferreira and Ferreira (2006) have documented an increasing importance of the industry effect relative to the country effect in the 1990s to the extent that the industry effect has assumed a similar magnitude to the country effect since the launch of the euro. In particular, Ferreira and Ferreira (2006) show that the rise in the relative importance of the industry effect is caused by convergence of the nominal interest rates across EU countries.

Using a mean-variance approach and utilising a longer data set spanning the period 1995-2004, Moerman (2008) finds that a pure industry investment strategy contains better diversification opportunities than a pure country strategy during the period

1999-2004, thus supporting the view that the industry effect has gained greater importance than country effect in the European Union. A more recent study by Eiling et al. (2011) reveals a surge in the importance of the industry effect in the nine years after the introduction of the euro. Their analysis shows that for the group of countries with the strongest pre-euro linkages (Germany, France, the Netherlands, Belgium, Austria and Finland), the industry effect has been dominant since 1990 and that it has strengthened further following the introduction of the euro.

While Chou et al. (2013) argue that the introduction of the common currency has led to a shift in factor importance from the country effect to the industry effect, the evidence indicates that the recent financial crisis has caused a return to the dominance of the country effect. More specifically, they suggest that since late 2007 the country effect has gained greater importance in explaining stock returns in the EU and that diversification by country is as effective, in terms of risk reduction, as diversification by industry. This reversal in the relative importance of country and industry effects is attributed to deteriorating macroeconomic fundamentals and rising sovereign risk as a result of the European financial crisis.

Methodology

Hedging effectiveness is measured by the reduction in the variance of a portfolio of the unhedged (domestic) asset and assets from one or more foreign markets. The construction of the portfolios requires the calculation of the hedge ratio by minimising the variance of the rate of return on the hedged position (the portfolio). The rate of return on a two-asset portfolio, R^T, is defined as

$$R^T = R - hR^* \qquad (1)$$

where R is the rate of return on the domestic asset, R^* is the rate of return on the foreign asset and h is the hedge ratio. The variance of the rate of return on the portfolio, $\sigma^2(R^T)$, is given by

$$\sigma^2(R^T) = \sigma^2(R) + h^2\sigma^2(R^*) - 2h\sigma(R, R^*) \tag{2}$$

where $\sigma^2(R)$ is the variance of the rate of return on the domestic asset, $\sigma^2(R^*)$ is the variance of the rate of return on the foreign asset and $\sigma(R, R^*)$ is the covariance of domestic and foreign returns. The minimum-risk hedge ratio is calculated from the first order condition

$$\frac{\partial \sigma^2(R^T)}{\partial h} = 2\sigma^2(R)h - 2\sigma(R, R^*) = 0 \tag{3}$$

Hence

$$h = \frac{\sigma(R, R^*)}{\sigma^2(R^*)} \tag{4}$$

Empirically, the minimum-risk hedge ratio can be calculated from historical data by estimating the regression equation

$$R_t = \alpha + hR_t^* + \varepsilon_t \tag{5}$$

If the rate of return is taken to be the first log difference (or the percentage change) of the stock price, equation (5) can be re-written as

$$\Delta p_t = \alpha + h\Delta p_t^* + \varepsilon_t \tag{6}$$

where p_t and p_t^* are the logarithms of domestic and foreign stock prices, respectively.

Exposure to a domestic asset can be hedged by taking an opposite position on a number of foreign assets, in which case we have to calculate multiple hedge ratios, one for each foreign asset. The hedge ratio for each one of k foreign assets is

calculated by regressing domestic return on k foreign returns. The regression equation is specified as:

$$\Delta p_t = \alpha + \sum_{i=1}^{k} h_i \Delta p_{it}^* + \varepsilon_t \tag{7}$$

in which case the return on the multi-asset portfolio is calculated as

$$R^T = R - \sum_{i=1}^{k} h_i R_i^* \tag{8}$$

Hedging effectiveness can be measured by the variance of the rate of return on the portfolio compared with the variance of the rate of return on the domestic asset. The underlying null hypothesis is

$$H_0 : \sigma^2(R) = \sigma^2(R^T) \tag{9}$$

whereas the alternative hypothesis of effective hedging is

$$H_1 : \sigma^2(R) > \sigma^2(R^T) \tag{10}$$

The null is rejected if the variance ratio, VR, is statistically significant—that is if

$$VR = \frac{\sigma^2(R)}{\sigma^2(R^T)} > F(n-1, n-1) \tag{11}$$

where n is the sample size. This test can be complemented by calculating variance reduction, VD, as follows:

$$VD = 1 - \frac{1}{VR} = 1 - \frac{\sigma^2(R^T)}{\sigma^2(R)} = \frac{\sigma^2(R - hR^*)}{\sigma^2(R)} \tag{12}$$

The portfolios are constructed as follows. Consider n countries and m sectors (including sector 1, which is the whole market). Let P_{ik} be the price index for sector k

in country i, such that $i = 1, \cdots, n$ and $k = 1, \cdots, m$. The rate of return on a two-asset

portfolio involving countries i and j (where $i \neq j$) and sector k is calculated as

$$R_{ijk}^T = \Delta p_{ik} - h_{ijk} \Delta p_{jk} \tag{13}$$

where R_{ijk}^T is the return on the portfolio, Δp_{ik} is the first log difference of the price

index for sector k in country i, h_{ijk} is the hedge ratio involving countries i and j and

sector k, and Δp_{jk} is the first log difference of the price index for sector k in country j.

For each sector, therefore, we will have $n(n-1)$ portfolios or a total number of

$mn(n-1)$. For multi-asset portfolios we use 3, 4, 5 and 6 foreign assets, such that the

return on the portfolio is calculated as

$$R_{isk}^T = \Delta p_{ik} - \sum_{j \neq i}^{s} h_{ijk} \Delta p_{jk} \tag{14}$$

where R_{isk}^T is the return on a portfolio involving sector k, country i and s assets from s

countries. We will not try all possible combinations and select four portfolios for each

country/sector combination.

Data and Empirical Results

The empirical results are based on monthly data on stock price indices covering seven

countries and nine sectors (as well as the whole market) over the period April 1990-

April 2013. The countries are the US, Japan, UK Australia, Singapore, Thailand and

Hong Kong. The sectors are oil and gas, basic materials, industrial, consumer goods,

health care, consumer services, telecommunications, utilities and financial. Thus the

data set is comprehensive in the sense that it covers a long time period encompassing

episodes of tranquillity and volatility, both developed and emerging markets and

almost the whole universe of sectors. The data were obtained from Datastream.

Consider first the results for two-country portfolios. Figure 1 displays the variance ratios for 42 portfolios in each sector (and the market). The horizontal line represents the 5% critical value of the F distribution with 276, 276 degrees of freedom (1.219). Each dot represents a portfolio such that a dot above the line represents effective diversification (and vice versa). As we can see by looking at Figure 1, diversification across whole markets is most effective as 76% of the portfolios show effective diversification (as represented by a statistically significant VR). Out of the sectors, diversification across industrial portfolios is most effective (71%) while the least effective is diversification across utilities (12%). This pattern is a reflection of differences in correlation as whole market returns seem to be more strongly (positively) correlated than sectoral returns. In Table 1 we report the maximum and minimum risk reduction for the markets and nine sectors. The maximum risk reduction for the whole market is found in a two-asset portfolio comprising the US and UK. In terms of the sectors, five of them show the largest risk reduction in portfolios comprising the US and UK. In the portfolios producing the lowest risk reduction, six out of the ten portfolios include Thailand, which is the least developed of the seven markets.

However, the results of the variance ratio test are different when we use multi-asset portfolios, in the sense that hedging becomes more effective. These results are displayed in Figure 2, where we can see that the most effective diversification is across basic materials (96% of the portfolios show effective diversification). The worst performing sector in terms of the effectiveness of international diversification is telecommunications where only half of the portfolios show effective diversification.

In Table 2, we report the highest and lowest risk reduction. The highest risk reduction are always found in cases where domestic assets are hedged by taking opposite positions on foreign assets from the remaining six countries. In six out of the ten cases, the lowest risk reduction is found in portfolios comprising Thailand and three other countries. Again, the pattern reflects the strength or otherwise of return correlation.

Conclusion

If international diversification is conducted by taking opposite positions on domestic and foreign assets to reduce risk (as in a hedging operation), the results presented in this study show the following. First, risk reduction requires high rather than low return correlation. Given the first finding, it follows that the second finding is that international diversification is more effective when assets from developed markets only are used. The third finding is that international diversification is more effective if multi-asset portfolios are used instead two-asset portfolios. The fourth finding is that in general terms international diversification across whole markets is more effective than diversification across sectors.

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Table 1: Variance Reduction in Two-Asset Portfolios (Maximum and Minimum)

by Sector

Sector	VD (Max)	Domestic	Foreign	VD (Min)	Domestic	Foreign
Market	0.65	US	UK	0.07	JP	TH
Oil and Gas	0.56	UK	US	-0.18	SN	HK
Basic Materials	0.62	UK	US	0.08	JP	TH
Industrial	0.46	HK	SN	-0.63	HK	TH
Consumer Goods	0.42	US	UK	0.02	JP	TH
Health Care	0.38	UK	US	-0.27	HK	SN
Consumer Services	0.52	SN	AU	0.01	JP	TH
Telecom	0.31	UK	US	-0.13	US	AU
Utilities	0.61	TH	SN	-0.24	US	SN
Financial	0.56	SN	HK	0.03	AU	TH

US: United States, UK: United Kingdom, HK: Hong Kong, AU: Australia, SN: Singapore, JP: Japan, TH: Thailand. A negative VD implies that hedging boosts risk.

Table 2: Variance Reduction in Multi-Asset Portfolios (Maximum and

Minimum) by Sector

Sector	VD (Max)	Domestic	Foreign	VD (Min)	Domestic	Foreign
Market	0.73	UK	AU, US, JP, SN, TH, HK	0.14	TH	AU, US, JP
Oil and Gas	0.63	JP	AU, US, UK, SN, TH, HK	0.02	HK	AU, US, JP, UK, SN, TH
Basic Materials	0.73	UK	AU, US, JP, SN, TH, HK	0.18	TH	AU, US, JP
Industrial	0.61	SN	AU, US, JP, UK, TH, HK	0.10	TH	AU, US, JP
Consumer Goods	0.43	JP	AU, US, UK, SN, TH, HK	0.08	TH	AU, US, JP
Health Care	0.53	JP	AU, US, UK, SN, TH, HK	0.05	TH	AU, US, JP
Consumer Services	0.62	UK	AU, US, JP, SN, TH, HK	0.05	TH	AU, US, JP, UK
Telecom	0.36	UK	AU, US, JP, SN, TH, HK	0.004	SN	AU, US, JP
Utilities	0.63	TH	AU, US, JP, SN, TH, HK	0.01	US	AU, US, JP, UK, SN, HK
Financial	0.65	SN	AU, US, JP, UK, TH, HK	0.10	TH	AU, US, JP

US: United States, UK: United Kingdom, HK: Hong Kong, AU: Australia, SN: Singapore, JP: Japan, TH: Thailand.

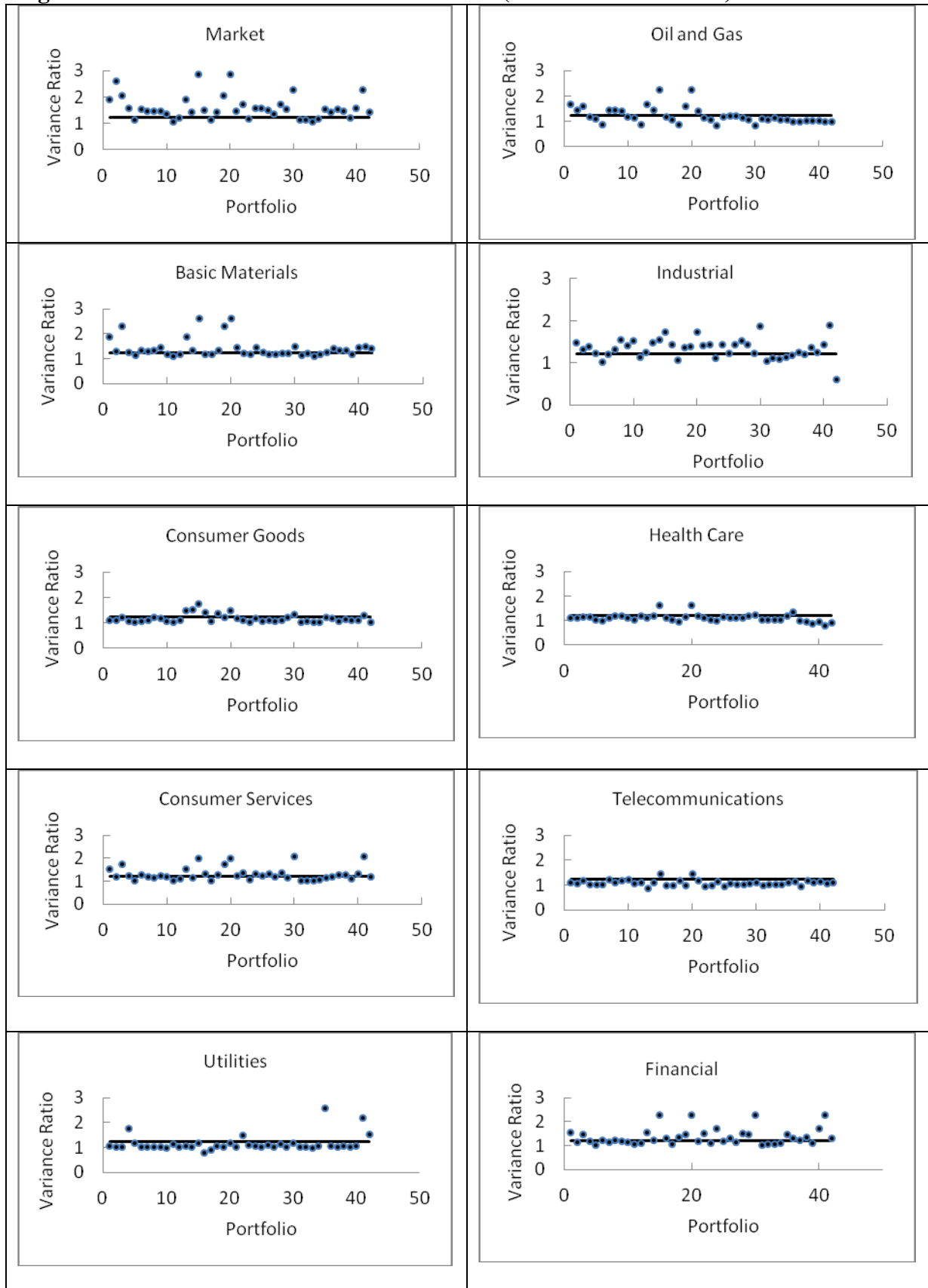**Figure 1: Variance Ratios with Critical Values (Two-Asset Portfolios)**

Figure 2: Variance Ratios with Critical Values (Multi-Asset Portfolios)