The diversification benefits of Australian equities to international investors

We examine whether Australia offers any unique diversification benefits to an international investor. Our motivation arises from the implications such diversification benefits may have upon the trading strategies of offshore fund managers. Our research indicates that the Australian equities market, as a whole, does not provide a global investor with any unique diversification benefits that are not available elsewhere.

DAVID COSTELLO is a graduate student at the UQ Business School, University of Queensland. Email: d.costello@uq.edu.au

STEPHEN GRAY is Professor of Finance, UQ Business School, University of Queensland. Email: s.gray@business.uq.edu.au

ALAN McCRYSTAL is Research Fellow, UQ Business School, University of Queensland. Email: a.mccrystal@uq.edu.au

OUR APPROACH IS TO CONSTRUCT the efficient frontier of optimal portfolios (minimum risk for a given level of return) using returns from 43 national equity indices including an Australian index. As a cross-check, we also construct the efficient frontier for a subset of 17 developed nations, including Australia. We then re-plot the efficient frontiers after removing the Australian index from the samples.

We apply statistical tests to determine whether the efficient frontier *with Australia* is significantly different from that *without Australia*. We also apply the Gibbons, Ross and Shanken (1989) test to determine whether the slope of the capital market line is significantly different in the two cases (with and without Australian equities). We demonstrate that there are negligible diversification benefits to be derived by a non-resident investor from holding Australian stocks within a well-diversified portfolio. The other equity markets that are available to a global investor effectively include the sorts of diversification opportunities provided by Australian equities.

International portfolio diversification

There is a large body of finance literature that demonstrates that investors gain from international portfolio diversification. For example, de Santis and Gerard (1997) compare a US equities index with a world index during the 1970–94 period and report that the expected gain from international diversification is 2.11% on an annual basis. Similarly, Solnik (1995, p. 90) states that the gains from international diversification are 'substantial', noting that 'an internationally diversified portfolio is likely to carry a much smaller risk than a typical domestic portfolio'.

With the conventional wisdom being that the Australian market is rich in resource and agricultural stocks and is geographically separate from the rest of the world, you might think that Australia offers overseas investors some great diversification benefits. This should mean that Australian stock returns are relatively less correlated with returns from other global stock markets. If this is the case, the Australian market might command a 'diversification premium', i.e. international investors and fund managers could benefit from the extent to which gaining exposure to the Australian market helps them to diversify the risk of their existing portfolios.

This would have clear implications for Australian businesses seeking to raise capital offshore, and for Australian and international fund managers.

This presumes that there are diversification benefits that are unique to the Australian market. The key question here is whether Australian equities offer international investors a diversification benefit that is unavailable elsewhere. That is, do Australian equities improve the risk–return opportunities available to international investors?

To the extent that (i) the global economy is becoming more integrated over time; (ii) Australian resource stocks are linked more closely to global economic conditions; (iii) the tyranny of distance has been largely overcome; and (iv) the globally integrated Australian financial and services sectors have gained importance over time, the unique benefits of diversifying into Australia may be lower than expected.

Our study does not seek to assess the quantum of the benefits of international portfolio diversification generally, as the evidence in support of international portfolio diversification is well documented. Rather, we seek to determine whether there are any special diversification benefits to a non-resident investor that are peculiar to the Australian market, i.e. 'Does Australia offer any special diversification benefits to an international investor?'

Research design

Our approach is to construct the efficient frontier using returns from 43 national equity indices. As a cross-check, we also construct an efficient frontier for a subset of 17 developed nations. We then re-plot the efficient frontiers after removing the Australian index from the samples. Two tests are conducted to examine whether the efficient frontier *with Australia* is statistically significantly different from that *without Australia*. The first is an F-test for equality of variances at the point of maximum difference between the two frontiers. The second is the Gibbons, Ross and Shanken (1989) test of the relative efficiency of two portfolios.

Data

The efficient frontier represents the set of all efficient portfolios of risky assets. These portfolios are efficient in the sense that they have the greatest possible expected return for a given level of volatility or, alternatively, have the least possible volatility for a given expected return (Sharpe 1964). We construct the efficient frontier numerically to create 100 equally spaced portfolios that minimise portfolio variance for each level of expected return. In all cases, we impose a no-short-sale constraint. This means that the investment in each country must be zero or positive – reflecting reality for the vast majority of fund managers and individual investors.

In the first instance, the portfolios consist of national equity indices from 43 countries, including 17 nations classified as developed nations and 26 nations classified as developing countries. We then construct a portfolio from the equity indices of the 17 developed countries only, to reflect the set of investable markets for fund managers that do not have a mandate to invest outside the major developed markets. Countries are classified as developed on the basis of their inclusion in the Morgan Stanley Capital International (MSCI) Developed Markets: World Index. Six of the 23 countries included in this index were removed from our sample on the basis that returns observations were not available for the entire sample period.[1] All other nations are classified as developing countries.

Returns data for each of these indices are taken from the default total return indices reported by Datastream, with the exception of China and South Africa. Alternative indices were used for these markets as the default index reported by Datastream returned incomplete data. The China A-DS Index and FTSE/JSE Industrials were substituted for the default Chinese and South African indices respectively.

Our sample consists of monthly returns observations from the period January 1998 to March 2008.

As a cross-check we also construct an efficient frontier from the equity indices of the 17 developed markets. This takes into account the possibility that the diversification benefits to a non-resident investor from investing in Australian stocks may be increased when the set of investable markets is restricted to only the developed markets. This could arise if the bulk of diversification benefits arise from investing in developing markets whose economies are at different stages of the business cycle to the developed markets.

Results

Figure 1 presents the efficient frontier of optimal portfolios constructed from all 43 national equity indices. The efficient frontier with Australia is presented in the lighter colour and the efficient frontier without Australia is presented in the darker colour. Data points appearing below the efficient frontier represent each individual market in the sample.

Figure 1 shows that the respective efficient frontiers are almost indistinguishable. The additional diversification benefits associated with holding Australian stocks in a well-diversified portfolio consisting of stocks from developed and developing markets is economically negligible. In the subsequent section we show that the difference between the two frontiers is also statistically insignificant.

The straight line in Figure 1 represents the capital market line (CML). This is a straight line drawn between the risk-free rate (assumed to be 5%) and the point of tangency with the efficient frontier. This represents the optimal risk–return possibilities to an investor with access to the set of equity markets and a risk-free asset. In fact, two lines are plotted in the figure – the CML *with* and *without Australia*. The fact that two separate lines cannot even be distinguished confirms that there are no special diversification benefits that are available from expanding the opportunity set to include Australia. In the subsequent section we show that the difference between the two capital market lines is also statistically insignificant.

As a cross-check, Figure 2 presents an efficient frontier comprised of the 17 developed equity markets. This test allows us to examine whether the diversification benefits to a non-resident investor from holding Australian stocks alters when the portfolio is limited to stocks from developed markets. Again, the efficient frontier including Australia is presented in the lighter colour and the efficient frontier excluding Australia is shown in the darker colour.

The additional diversification benefits to be derived by a non-resident investor from holding Australian stocks in a well-diversified portfolio of stocks from developed countries are again negligible. It is difficult to even detect that there are two different frontiers and two different capital market lines plotted in the figure. Again, the subsequent section confirms that there is no statistically significant difference between the cases *with* and *without Australia*.

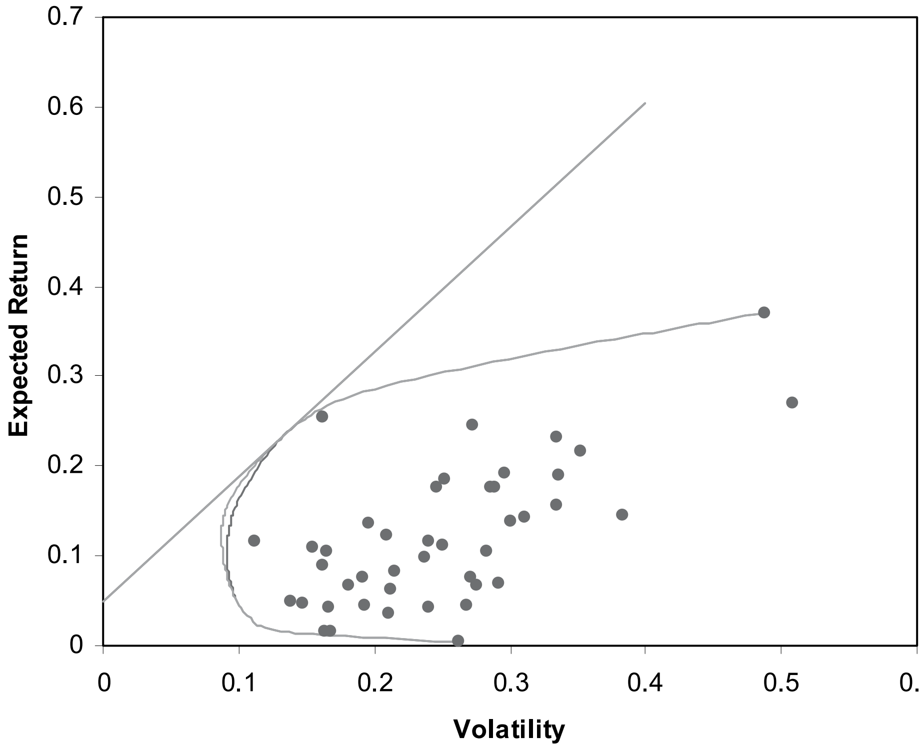
Statistical tests

F-test for equality of variances

Our first statistical test examines whether adding Australia to a portfolio of other markets results in a significant reduction in volatility. Specifically, we test whether the efficient frontier moves significantly to the left when Australia is included in the set of investable markets.

To conduct a test for the equality of two variances, we first locate the level of expected return where the

FIGURE 1: **The efficient frontier of all 43 national equity indices**



Notes: The efficient frontier comprising all 43 national equity indices examined and including Australia is presented in the lighter colour. The efficient frontier excluding the Australian index is presented in the darker colour. Data points appearing below the efficient frontier represent individual index returns. Data consists of monthly total return series from Datastream from January 1998 to March 2008.

difference between the standard deviation of the two efficient frontiers is maximised. In Figure 1, this occurs where the expected return is 14.93% p.a. At this point, the *without Australia* frontier has a standard deviation of 9.02% p.a. while the *with Australia* frontier has a standard deviation of 9.65% p.a. These parameters are converted from annual to monthly statistics by dividing the mean by 12 and the standard deviation by $\sqrt{12}$.

We then randomly draw a set of monthly returns from each of two normal distributions. These distributions will have the same mean (of 14.93% p.a. expressed in monthly terms), but different standard deviations (9.02% p.a. and 9.65% p.a. respectively, both expressed in monthly terms). We consider sample sizes of 60 observations and 120 observations, reflecting investment horizons of five and 10 years respectively.

In the first instance, we randomly sample 60 monthly return observations from each of the two normal distributions. We then compute the variance of the two sets of randomly generated returns and calculate the following statistic:

$$R = \frac{(n_2 - 1)\sum\left(X_{1i} - \overline{X}_1\right)^2}{(n_1 - 1)\sum\left(X_{2i} - \overline{X}_2\right)^2}$$

The *R* statistic has an *F* distribution with 59 and 59 degrees of freedom.

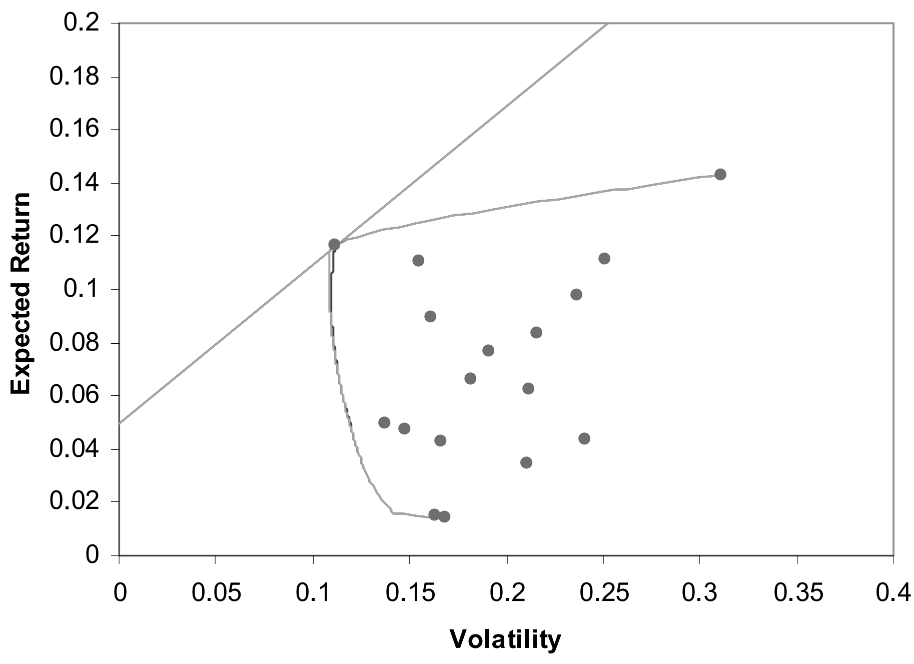
We determine whether it is possible to reject (at the 5% level) the null hypothesis that the *without Australia* sample has the same variance as the *with Australia* sample. We repeat this 100,000 times and report the proportion of trials where the resulting *R* statistic indicates that the two samples are significantly different.[2] If this proportion is greater than 95%, we would conclude that the two frontiers are significantly different at the 5% level of significance. Otherwise, we must conclude that the variance of a sample of returns drawn from one distribution is not statistically significantly different from the variance of a sample of returns drawn from the other: the two variances are so close to one another that they cannot be considered to be statistically significantly different.

We repeat our analysis with an enlarged sample size of 120 observations in order to increase the power of our test. In this instance the *R* statistic has an *F* distribution with 119 and 119 degrees of freedom.

In our five-year sample, only 14.4% of trials returned significantly different variances.[3] In our 10-year sample, 19.6% of trials returned statistically significantly different variances.[4] In both samples, the proportion of trials in which the variances were significantly different is considerably less than 95%. Accordingly, we cannot reject the null hypothesis that the return variance is equal in either case.

Moreover, this is a conservative result, as we have deliberately chosen the point of maximum difference between the two efficient frontiers. That is, testing the *R* statistic against an *F* distribution assumes that the ratio of variances is a random variable. In this case it is not: we have deliberately chosen the point of maximum difference between the two frontiers. Even when we select this maximum difference, we are unable to reject the null hypothesis of equality of variances.

FIGURE 2: **The efficient frontier of the 17 developed national equity indices**



Notes: The efficient frontier comprising the 17 developed national equity indices examined and including Australia is presented in the lighter colour above. The efficient frontier excluding the Australian index is presented in the darker colour. Data points appearing below the efficient frontier represent individual index returns. Data consists of monthly total return series from Datastream from January 1998 to March 2008.

Gibbons, Ross and Shanken test of relative efficiency

Where a riskless asset exists, no rational investor will choose a portfolio of only risky assets. Rather, investors will choose that combination of the risk-free asset and the equity market portfolio that delivers the maximum expected return for a given level of variance. The set of all such available portfolios is described by the CML – a straight line drawn between the risk-free rate and the point of tangency with the efficient frontier (Sharpe 1964). Accordingly, rational investors will be primarily concerned about the slope of the CML.

Gibbons, Ross and Shanken (1989) present a statistical test of the difference between two capital market lines that is based on the following statistic:

$$W = \left[\frac{\sqrt{+\hat{\theta}^{*2}}}{\sqrt{1+\hat{\theta}_p^{\,2}}} \right]^2 - 1 \equiv \psi^2 - 1$$

In this instance, $\hat{\theta}^*$ represents the slope of the line from the risk-free rate to the tangency portfolio on the efficient frontier *with Australia* and $\hat{\theta}_p$ is the slope of the line from the risk-free rate to the tangency portfolio on the efficient frontier *without Australia*.

This W statistic is then scaled by $(T(T–N–1)/N(T–2))$, where T is the number of time series return observations and N is the sample size. In the first instance, we consider a sample of 120 monthly return observations drawn from 42 foreign equity indices. The resulting statistic has a non-central F distribution with 42 and 77 degrees of freedom. We then repeat our analysis considering only the 17 developed nations in our sample. In this instance, the test statistic has a non-central F distribution with 16 and 103 degrees of freedom.

We determine whether it is possible to reject the null hypothesis that the slope of the *without Australia* CML is equal to the slope of the *with Australia* CML. Under the null hypothesis, ψ^2 will be close to 1 and the value of the W statistic will be small. Alternatively, if $\hat{\theta}^*$ is sufficiently greater than $\hat{\theta}_p$, the slope of the CML *with Australia* will be statistically significantly different from that of the CML *without Australia*.

When applied to our total sample of 43 equity market indices, the Gibbons, Ross and Shanken test confirms that the slopes of the two capital market lines are not statistically significantly different. We calculate a W statistic of 7.46×10^{-6} . This W statistic is then scaled by $(T(T–N–1)/N(T–2))$, which is 1.86 in this instance. This gives a test statistic of 1.39×10^{-6}, a result so small that it is clearly insignificant at any usual level of significance. Accordingly, we cannot reject the null hypothesis that the slopes of the two CMLs are equal.

The same result holds when we consider the sample of developed markets only. Once again, the fact that two separate capital market lines cannot even be distinguished suggests that there are no special diversification benefits that are available from expanding the opportunity set to include Australia. The Gibbons, Ross and Shanken test confirms that the slopes of the two capital market lines are not statistically significantly different. The scaled W statistic is 0.04. The p-value associated with this test statistic is 1.0000 when rounded to 4 decimal places, indicating that there is no evidence whatsoever of a statistically significant difference in the slopes of the two CMLs.

Conclusions

The negligible shift in the efficient frontier arising from including Australian stocks in a well-diversified portfolio suggests that there are no special diversification benefits to be derived by non-resident investors from holding Australian stocks. This result is supported by our F-test for equality of variances, which failed to reject the null hypothesis that the variance of returns from a portfolio on the efficient frontier *with Australia* was equal to the variance of returns from a portfolio on the efficient frontier *without Australia*. Similarly, the Gibbons, Ross and Shanken test failed to reject the null hypothesis that the slope of the CML *with Australia* is equal to the slope of the CML *without Australia*. It follows therefore, that a rational non-resident investor would not willingly accept a lower rate of return from their Australian investments than from their other investments due to diversification benefits that arise from adding Australian investments to an international portfolio.

Of course, we have only examined aggregate markets here. It is possible that an individual stock, or even a market sector might provide some more tangible diversification benefits to international investors, and this would have to be considered on a case-by-case basis. Our point here is simply that the Australian equity market, considered as a whole, provides no such unique diversification benefit.

Notes

1. The six national equity indices excluded from our developed countries sample because of missing data are Denmark, Greece, Italy, New Zealand, Portugal and Singapore.
2. Under the F-distribution, the variances are statistically significantly different (at the 95% level) where the R statistic is less than 0.5973 or greater than 1.6741.
3. In 1.9% of trials, the variance of the efficient frontier 'with Australia' was significantly lower. In 12.5% of trials, the variance of the efficient frontier 'with Australia' was significantly higher.
4. In 0.8% of trials, the variance of the efficient frontier 'with Australia' was significantly lower, while in 18.8% of trials, the variance was significantly higher.

References

de Santis, G. and Gerard B. 1997, 'International asset pricing and portfolio diversification with time varying risk', *The Journal of Finance*, vol. 52, p. 18–81.

Gibbons, M., Ross, S. and Shanken, J. 1989, 'A test of the efficiency of a given portfolio', *Econometrica*, vol. 57, p. 11–21.

Sharpe, W. 1964, 'Capital asset prices: a theory of market equilibrium under conditions of risk', *Journal of Finance*, vol. 19, no. 3, p. 425.

Solnik, B. 1995, 'Why not diversify internationally rather than domestically?', *Financial Analysts Journal*, January–February, p. 89.