

# The benefits of international diversification

Diversifying internationally becomes attractive when the local market is volatile and its co-movement with the international market is low. **EDWARD (CHIEN-TING) LIN** makes the case that the extent of the diversification benefits is a result of these two factors.



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**T**he benefits of international diversification have been recognised for decades (for example, see Solnik (1974), and Griffin and Karolyi (1998)). Risk reduction through diversification works because the co-movements in returns among different markets are not perfect. These unsynchronised movements among different markets attenuate volatilities in an internationally diversified portfolio.

Recent evidence however suggests that the diversification benefits have diminished due to the trend of increasing correlations among share markets. Longin and Solnik (1995) report that correlations among major share market indices increased from 1970 to 1990. Statman and Scheid (2005) similarly document that correlations between the returns of a US portfolio and an international portfolio reached a high of 0.86 in the last few years from a low of 0.35 in the mid-1980s.

These findings are perhaps expected given that the world has become more economically integrated. Goetzmann, Li and Rouwenhorst (2005) further point out that international diversification potential today is low because capital is relatively free to flow across international borders. The increased capital market integration encourages higher correlations between markets.

While it is true that higher correlations between markets have

reduced gains from international diversification, another influential factor, volatility of the markets, is just as important but has often been ignored. More specifically, an increase in the volatilities of international portfolios relative to those of the local portfolio will have a similar effect in reducing diversification potential. This paper provides some evidence that the reduction in gains from international diversification over the last two decades for an Australian investor is not only caused by the increases in market correlations but also by the decreases in local volatilities relative to the international volatilities. From the recent data, the declining trend in Australian return volatilities seems to have a larger negative impact on the diversification benefits than the increasing trend in return correlations.

## PORTFOLIO RETURNS, VOLATILITIES AND CORRELATIONS

According to modern portfolio theory, total risk can be distilled into diversifiable and undiversifiable (or market) risk. A good diversified portfolio is one where the diversifiable risk is largely reduced. To illustrate the effects of correlations and volatilities on risk reduction, assume that an Australian investor creates a diversified portfolio by investing equally in the local and overseas markets. The risk of the diversified portfolio is then:

$$\sigma_d^2 = (1/2)^2\sigma_a^2 + (1/2)^2\sigma_i^2 + 2(1/2)(1/2)\sigma_a\sigma_i\rho_{ai} \quad (1)$$

Where,  $\sigma_d^2$ ,  $\sigma_a^2$  and  $\sigma_i^2$  are the variance of the returns of the diversified, Australian, and international portfolios respectively; the coefficients of 1/2 are the weights of the Australian and international portfolios; and  $\rho_{ai}$  is the correlation between them.

The diversifiable risk that can be eliminated as measured by the proportion of risk reduction from holding the Australian portfolio to the diversified portfolio is therefore:

$$\frac{\sigma_a^2 - \sigma_d^2}{\sigma_a^2} = (3/4) - (1/4)(\frac{\sigma_i}{\sigma_a})^2 - (1/2)\frac{\sigma_i}{\sigma_a}\rho_{ai} \quad (2)$$

Equation 2 shows that the extent of risk reduction in the diversified portfolio depends on both the correlation  $\rho_{ai}$  and the ratio of the volatility of

international portfolio and the volatility of the Australian portfolio  $\sigma_i/\sigma_a$ . An increase in the correlation  $\rho_{ai}$  will decrease the diversifiable risk in proportion to the total risk, but an increase in the  $\sigma_i/\sigma_a$  ratio will have the same negative effect.

To examine the extent of the influence of each individual factor, a partial derivative of the diversifiable risk  $D$  is first taken with respect to the correlation  $\rho_{ai}$ .

$$\frac{\partial D}{\partial \rho_{ai}} = (1/2)(\frac{\sigma_i}{\sigma_a}), \text{ where } \frac{\sigma_a^2 - \sigma_d^2}{\sigma_a^2} = D \quad (3)$$

Equation 3 shows that the effect of the correlation factor  $\rho_{ai}$  is dependent on the size of the volatility ratio  $\sigma_i/\sigma_a$ . The larger the volatility ratio, the greater is the impact of the correlation factor  $\rho_{ai}$ . Therefore, an increase in the

correlation will lead to a lower reduction in the diversifiable risk if the volatility ratio also increases.

Using the same approach, the effect of the volatility ratio on the diversifiable risk is related to the volatility ratio itself and the correlation  $\rho_{ai}$ .

$$\frac{\partial D}{\partial (\frac{\sigma_i}{\sigma_a})} = -(1/2)(\frac{\sigma_i}{\sigma_a}) - (1/2)\rho_{ai} \quad (4)$$

Comparing the effect of the correlation and the volatility ratio in equation 3 and 4, volatility ratio carries a larger impact on the diversifiable risk by a magnitude of  $-(1/2)(\rho_{ai})$ . Therefore, while a marginal change in correlation between portfolios is important in changing the effectiveness of diversification, a similar change in volatility ratio will even be more

TABLE 1 VOLATILITIES OF AUSTRALIAN, INTERNATIONAL AND DIVERSIFIED PORTFOLIOS

Period	Annualised standard deviation of returns of Australian shares (%)	Annualised standard deviation of returns of international portfolio (%)	Annualised standard deviation of the diversified portfolio (%)
1975-1979	18.10	11.68	8.44
1976-1980	21.61	10.84	9.50
1977-1981	23.32	10.77	10.14
1978-1982	24.69	11.79	11.09
1979-1983	25.92	11.44	10.76
1980-1984	26.16	12.13	11.60
1981-1985	22.15	11.25	9.57
1982-1986	20.71	11.62	8.57
1983-1987	28.50	15.31	13.41
1984-1988	27.74	15.50	12.96
1985-1989	27.02	14.97	12.47
1986-1990	27.46	17.75	13.68
1987-1991	27.03	17.66	13.95
1988-1992	16.63	14.03	8.70
1989-1993	15.39	14.02	9.53
1990-1994	15.61	13.95	9.74
1991-1995	14.54	10.43	8.73
1992-1996	13.77	9.50	8.11
1993-1997	14.39	10.91	9.11
1994-1998	13.89	13.30	9.65
1995-1999	12.95	13.35	9.23
1996-2000	12.41	14.56	9.35
1997-2001	12.95	16.39	10.25
1998-2002	11.39	17.76	10.16
1999-2003	10.54	13.32	9.42
2000-2004	9.63	15.34	8.85

**TABLE 2 AVERAGE VOLATILITY AND CHANGES IN VOLATILITY OF AUSTRALIAN, INTERNATIONAL AND DIVERSIFIED PORTFOLIOS**

	Australian portfolio	International portfolio	Diversified portfolio
<b>Panel A: Average volatility</b>			
1975–1991	24.65%	13.28%	11.24%
1988–2004	13.39	13.60	9.29
1975–2004	19.01	13.45	10.27
<b>Panel B: Average changes in volatility</b>			
1975–1991	4.14%	4.03%	5.55%
1988–2004	-6.95	0.15	-2.52
1975–2004	-1.83	2.02	1.35

pronounced. The empirical evidence presented in the rest of the paper appears to be consistent with the theoretical analysis above.

**RECENT DIVERSIFICATION BEHAVIOUR**

Monthly share return data from 1975 to 2004 from Datastream was used for the Australian share index return and from MSCI (excluding Australia) for the international share index return. The annualised standard deviation of the returns of the Australian and the international portfolios were then computed over a 5-year rolling window. The annualised standard deviation of the diversified portfolio formed by investing equally in each of the two portfolios is also calculated according to equation 1.

Shown in Figure 1, the volatility of the Australian portfolio appears to differ substantially between the first half and the second half of the sample period. While the 1987 October crash may have driven up the volatilities immediately after the crash, they were also relatively high before 1987. Therefore there seems to be a structural shift in volatilities in more recent years.

To highlight the changes in the volatilities between the pre and post 1987–1991 periods, the entire sample period from 1975 to 2004 was equally divided into two sub-periods. The average volatility in the first sub-period of 1975 to 1991 was 24.65% compared to 13.39% in the second sub-period of 1988 to 2004 (see Panel A of Table 2). The difference represents a decline of over 45%. Panel B of Table 2 further shows that volatility increased at a rate of 4% per year on average in the first

sub-period in contrast to an average decrease of almost 7% per year in the second sub-period. Based on these summary statistics, there is little doubt of a declining trend since early 1990s. Towards the end of the sample period the volatility reached a low of 9.63%.

Looking at the volatility of the international portfolio over the same sample period, it appears that while it varies, it does not exhibit the same trend as those observed in the Australian portfolio (see Figure 1). The small difference in the average volatilities between the two sub-periods reported in Panel A of Table 2 and the positive average changes in volatilities each year in Panel B of Table 2 suggest that the international portfolio does behave quite differently. Overall, the characteristics of the international portfolio are in line with a return generating process of lower volatilities and of smaller changes.

On the diversified portfolio created from the combination of the Australian and the international portfolios, it is not surprising that the annualised standard deviation of the diversified portfolio is the lowest among the portfolios. However, the time-series risk behaviour in the diversified portfolio tends to follow closely that of the Australian portfolio since variation of the international portfolio volatilities is relatively small. Consistent with such observation, the average diversified volatility of 9.29% in the second half of the sample period is lower than 11.24% in the earlier sub-period. The annual average volatility changes of 5.55% and -2.52% in the two sub-periods also follow similar changes found in the Australian portfolio.

Has the proportion of total risk that can be eliminated from the diversified portfolio changed over the last 30 years? In other words, to what extent can an Australian investor reduce the total risk in a large diversified portfolio? Using equation 2, this can be addressed by calculating the percentage of risk that the diversified portfolio could reduce by taking the difference in the risk (measured in standard deviation) between the Australian and the diversified portfolios, and dividing it by the Australian portfolio risk (initial total risk).

Table 3 and Figure 2 present the proportion of risk reduction in the diversified portfolio from 1975 to 2004. The figures show that over time, the diversification benefits have reduced substantially. In the 1970s and 1980s, the average total risk that could be eliminated by investing overseas fluctuated between 70% and 80%. In contrast, the risk reduction in the past decade quickly dropped below 50% and then to a mere 15% in the period of 2000 to 2004. Therefore, if the recent trend persists, we will continue to find that diversification adds smaller benefits in reducing risk.

As discussed earlier, there are two factors in determining the extent of diversification benefits. First, the correlations between the Australian portfolio and the international portfolio and returns have increased over time especially in the last decade, in line with the negative outcome of the risk reduction (see Figure 2). The increased correlations have been attributed by some commentators to economic globalisation and the increased integration of financial markets.

However, the increase in correlations

FIGURE 1 VOLATILITIES OF AUSTRALIAN, INTERNATIONAL AND DIVERSIFIED PORTFOLIOS

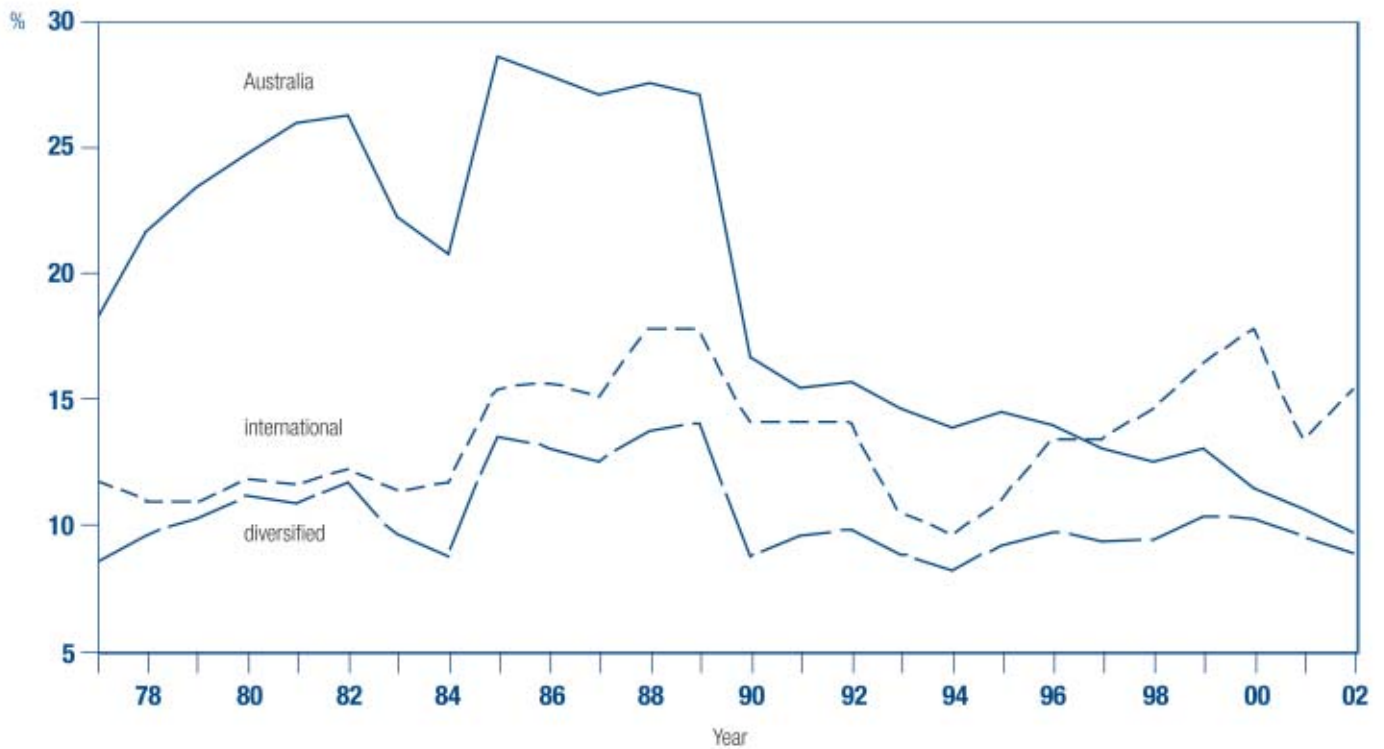
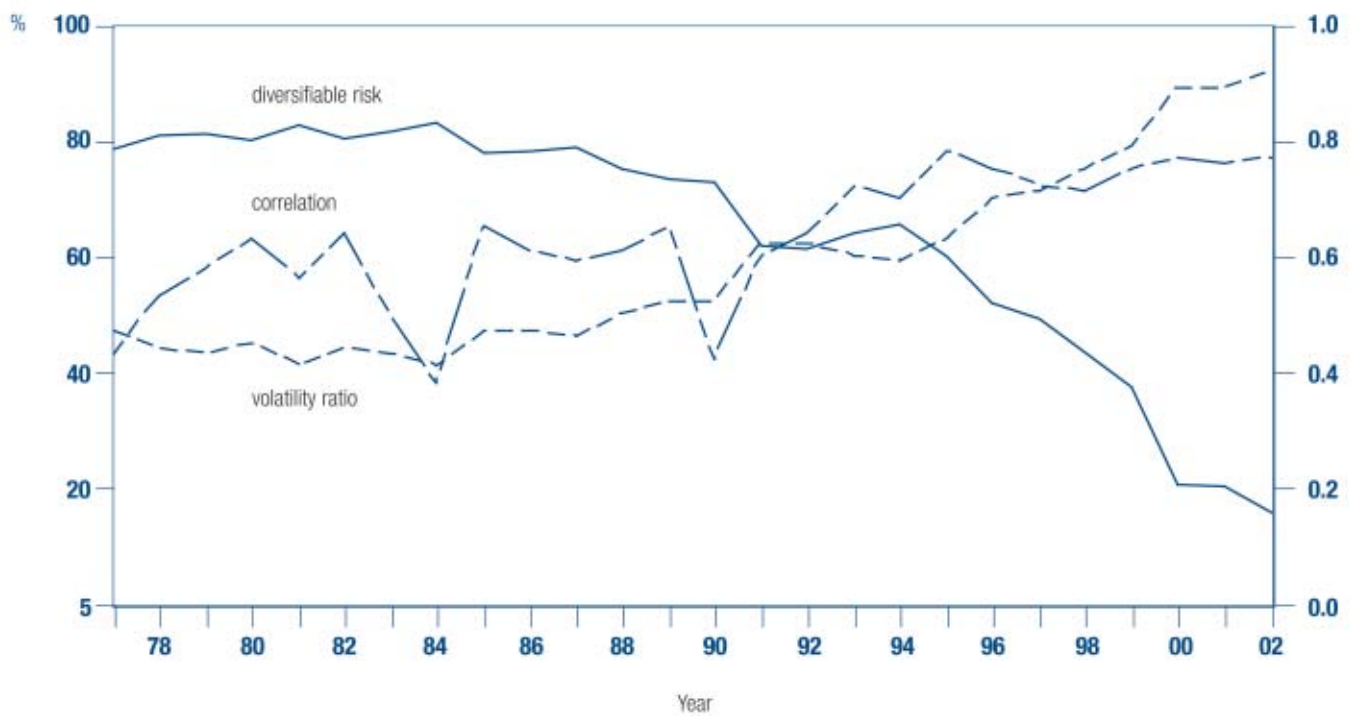


FIGURE 2 CORRELATION, VOLATILITY RATIO AND DIVERSIFIABLE RISK FORMED BY AUSTRALIAN AND INTERNATIONAL PORTFOLIOS



**TABLE 3 CORRELATION, VOLATILITY RATIO AND DIVERSIFIABLE RISK FORMED BY AUSTRALIAN AND INTERNATIONAL PORTFOLIOS**

Period	Diversifiable risk (%)	Correlation between Australian and international portfolios	$\sigma_i / \sigma_a$
1975-1979	78.26	0.43	0.47
1976-1980	80.67	0.53	0.44
1977-1981	81.09	0.58	0.43
1978-1982	79.82	0.63	0.45
1979-1983	82.77	0.56	0.41
1980-1984	80.34	0.64	0.44
1981-1985	81.33	0.50	0.43
1982-1986	82.88	0.38	0.41
1983-1987	77.86	0.65	0.47
1984-1988	78.17	0.61	0.47
1985-1989	78.70	0.59	0.46
1986-1990	75.18	0.61	0.50
1987-1991	73.36	0.65	0.52
1988-1992	72.63	0.42	0.52
1989-1993	61.66	0.60	0.62
1990-1994	61.07	0.64	0.62
1991-1995	63.95	0.72	0.60
1992-1996	65.31	0.70	0.59
1993-1997	59.92	0.78	0.63
1994-1998	51.73	0.75	0.70
1995-1999	49.20	0.72	0.71
1996-2000	43.24	0.71	0.75
1997-2001	37.35	0.75	0.79
1998-2002	20.43	0.77	0.89
1999-2003	20.12	0.76	0.89
2000-2004	15.54	0.77	0.92

is not the entire story. While a correlation of 0.77 in 2000-2004 is high, it may still achieve a significant risk reduction if the relative volatility of the international portfolio to the Australian portfolio remains low. From Figure 2, we find that the volatility ratios have also increased dramatically since the early 1990s. Based on the findings in Table 1, this increase in the volatility ratios is mainly driven by the continuing decline in the volatilities of the Australian portfolio since the volatilities of the international portfolio remain relatively flat.

According to equation 3, with a higher volatility ratio, the adverse impact of the increased correlation on risk reduction will be larger.

Furthermore, as suggested by equation 4, the effect of the increased volatility ratio is even greater than the increase in correlation. The data seems to confirm the theoretical analysis. For instance, over the sub-periods of 1993 to 2000, when the correlations have declined, the risk reduction continues to diminish because the increase in the volatility ratio is more than enough to offset the decrease in the correlation.

**CONCLUSIONS**

This paper provides some evidence on the gains from international diversification in recent years. While Australian investors continue to reap diversification benefits by investing in foreign shares, such benefits have

diminished significantly in recent years. The decline in risk reduction can be traced to two sources in the portfolio theory framework.

First, correlations between portfolio returns have increased over time and remained high in recent years. The increases in the synchronous co-movement between the returns reduce the part of the total risk that can be diversified away.

Second, and perhaps more importantly, Australian return volatilities have declined substantially in the last decade while the international return volatilities remain relatively flat. These concurrent changes in the risk behaviour in turn have similar effect in lowering the diversification potential by reducing the total diversifiable risk. The combined effects of the increases in the volatility ratios and the correlations accelerate the diminished gains from diversification in recent years. In the analysis, it appears that the volatility ratio is more influential than the correlation.

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