EC4050 Economics of Securities Markets

Tutorial 3
International portfolio diversification

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One important function of financial markets is to allow investors to diversify away risk that is specific to individual assets. Suppose that we construct a portfolio p made of N assets. Then, the expected return and the risk of this portfolio are given by, respectively,

$$ER_p = \sum_{i=1}^{N} w_i ER_i$$

$$\sigma_p^2 = \sum_{i=1}^{N} w_i^2 \sigma_i^2 + \sum_{i=1}^{N} \sum_{j=1, i \neq j}^{N} w_i w_j \rho_{ij} \sigma_i \sigma_j$$

If we assume that the variances of all individual asset returns are equal (so $\sigma_i^2 = \sigma^2$) and that all assets are held in equal proportions (so $w_i = 1/N$), we get

$$\sigma_p^2 = \sum_{i=1}^{N} \left(\frac{1}{N}\right)^2 \sigma^2 + \sum_{i=1}^{N} \sum_{j=1}^{N} \frac{1}{N} \frac{1}{N} \sigma_{ij}$$

$$\sigma_p^2 = \frac{1}{N} \sigma^2 + \frac{N-1}{N} \sum_{i=1}^{N} \sum_{j=1}^{N} \frac{\sigma_{ij}}{N(N-1)}$$

$$\sigma_p^2 = \frac{1}{N} \sigma^2 + \frac{N-1}{N} \overline{\sigma_{ij}}$$

$$\sigma_p^2 = \frac{1}{N} \sigma^2 + \overline{\sigma_{ij}} - \frac{1}{N} \overline{\sigma_{ij}}$$

$$\sigma_p^2 = \frac{1}{N} \left(\sigma^2 - \overline{\sigma_{ij}}\right) + \overline{\sigma_{ij}}$$

1   Domestic diversification

Holding a diversified portfolio reduces risk. But how many domestic securities should we include in this portfolio to achieve a substantial reduction in risk, i.e. approaching $\overline{\sigma_{ij}}$? Solnik (1974) constructs several portfolios of the same size (number of securities), calculates the average risk of the portfolio, and then repeats this procedure by increasing the size of the portfolio gradually. Solnik (1974) focuses on seven countries: the United Kingdom, Germany, France, Switzerland, Italy, Belgium and the Netherlands. He also reports evidence for the United States as a comparison. The main result of this analysis is that a relatively smaller number of securities will achieve most of the diversification benefits.

2   International diversification

An investor could achieve an even greater reduction in total risk by exploiting the historically low correlation of stock market returns across countries. Figure 1 shows the reduction in total risk achieved by selecting a equal number of stocks across countries. The benefits of international diversification are substantial. Total risk converges to 11.7% while it is only 27% with domestic diversification in the United States only. And the reduction in total risk is even larger for European countries, for which total risk is typically larger than in the United States (because the latter country has a huge financial market, allowing for better diversification opportunities).

Diversifying across countries is usually more beneficial than diversifying across global industries. There is extensive empirical evidence supporting this initial finding of Solnik (1974), even though the introduction of the euro means that diversification across industries may become more beneficial in Europe nowadays. We return to this issue below.

3   Home bias

Solnik (1974) and a host of other researchers have shown that international portfolio diversification carries significant benefits in terms of lower total risk. As a result, we should observe extensive diversification, which means that domestic investors should hold most of their wealth in foreign stocks rather than domestic stocks.

The evidence contradicts this hypothesis. Equity portfolios of investors are typically very concentrated in domestic stocks. The table below from Cooper and Kaplanis (1994) shows the proportion of domestic stocks in the world market portfolio, and the proportion of portfolios held in domestic stocks. Clearly, investors are not taking the opportunity of diversifying internationally. There are various explanations for this home bias in domestic stocks.

Figure 1: International diversification. Source: Solnik (1974).
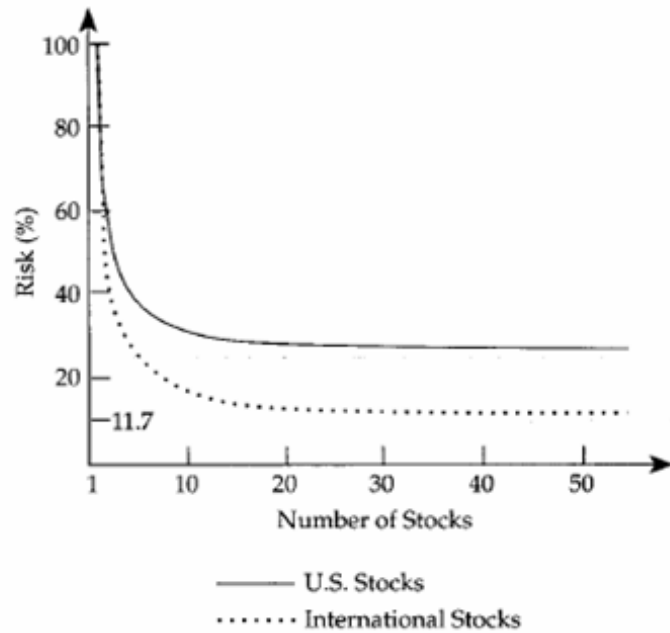
Figure 9.   International Diversification

— U.S. Stocks
······· International Stocks

Table 1
The home bias in equity portfolios, December 1987

Country	Market capitalization as a percentage of total	Percentage of equity portfolio in domestic equities
France	2.6	64.4
Italy	1.9	91.0
Japan	43.7	86.7
Spain	1.1	94.2
Sweden	0.8	100.0
UK	10.3	78.5
USA	36.4	98.0
Germany	3.2	75.4
Total	100.0	

Market capitalizations are Morgan Stanley Capital International Indices (1987). The sources of portfolio holdings are for the United States, Survey of Current Business; for the United Kingdom, CSO Financial Statistics (Feb. 1990); for the remaining countries, Financial Accounts Statistics (OECD) (1988–1989). The domestic proportion for Japan is for bonds and shares combined.

Table 1: Return correlations before the Mexican crisis (05/07/1994 - 30/11/1994)

	Argentina	Brazil	Mexico
Argentina	1		
Brazil	0.17	1	
Mexico	0.36	0.11	1

Table 2: Return correlations during the Mexican crisis (01/12/1994 - 31/03/1995)

	Argentina	Brazil	Mexico
Argentina	1		
Brazil	0.77	1	
Mexico	0.44	0.32	1

4   Return correlations and financial crises

The benefits of international portfolio diversification arise largely from the relatively low correlation between country returns. It would be particularly useful to achieve a lower total risk in times of financial market crises, which are typically characterised by losses. Unfortunately, the empirical evidence shows that correlation coefficients across countries *rise* during periods of financial crises. Consequently, the benefits from international diversification are reduced just when they are most needed!

Tables 1 to 6 present evidence for three financial crises that took place during the nineties. We have two samples of stock market returns for each crisis, one before the crisis occurs, and the other during the crisis. The tables show that correlation coefficients increase during times of financial stress. In particular, researchers have argued that financial crises are transmitted in a contagious manner across borders, thereby raising stock market comovements.

Table 3: Return correlations before the Asian crisis (02/01/1996 - 03/07/1997)

	Philippines	Korea	Malaysia	Thailand	Indonesia
Philippines	1				
Korea	0.01	1			
Malaysia	0.25	0.02	1		
Thailand	0.06	0.002	0.19	1	
Indonesia	0.33	-0.09	0.40	0.16	1

Table 4: Return correlations during the Asian crisis (04/07/1997 - 31/03/1998)

	Philippines	Korea	Malaysia	Thailand	Indonesia
Philippines	1				
Korea	0.17	1			
Malaysia	0.30	0.21	1		
Thailand	0.38	0.26	0.35	1	
Indonesia	0.44	0.10	0.34	0.44	1

Table 5: Return correlations before the Russian crisis (01/04/1998 - 14/08/1998)

	Czech Republic	Poland	Hungary	Russia
Czech Republic	1			
Poland	0.46	1		
Hungary	0.40	0.37	1	
Russia	0.51	0.45	0.53	1

Table 6: Return correlations during the Russian crisis (17/08/1998 - 31/10/1998)

	Czech Republic	Poland	Hungary	Russia
Czech Republic	1			
Poland	0.62	1		
Hungary	0.70	0.61	1	
Russia	0.38	0.24	0.37	1

5 Return correlations and European Monetary Union

The introduction of the euro should affect stock market return correlations. First, the existence of a single currency means that currency risk disappears completely among the participating countries. Consequently, the barriers to cross-border investment arising from the costs of hedging currency risk are fully eliminated. Second, the common monetary policy inherent in the single currency and the convergence of long-term interest rates arising from the convergence of inflation expectations have brought about almost perfectly correlated real risk-free rates (Cappiello, Engle and Sheppard, 2003). Almost identical risk-free rates will in turn mean a more homogeneous valuation of stocks across the participating countries. Third, the process of monetary integration induces closer real convergence in the form of enhanced trade integration and greater business cycle synchronisation. Consequently, it is likely that expectations of real dividends will become more synchronised across countries.

Taken together, these three reasons explain why asset return correlations should increase after the adoption of the euro, with important implications for financial market participants. Higher cross-country stock market correlations would mean that the traditional approach to international portfolio diversification across countries is not the most appropriate one anymore. It may have become more beneficial to diversify across industries rather than countries.

One way to assess the effect of the euro on correlations between national stock market returns is to compute the correlation of each country's return to an EMU return, both before and after the introduction of the euro. Given our discussion above, we expect correlations with an EMU return to increase with the introduction of the single currency.

Figure 2 shows the evidence for ten participants to European Monetary Union, as well as four European non-EMU countries which should be taken as a control group. Correlations have increased for most countries, with the exception of Belgium, Ireland and Austria. This seems to indicate that the euro has generally increased correlations, especially among the largest European countries. However, we also see that correlations have increased for countries that are not participating into the single currency. A finer examination reveals that the euro has increased correlations between national stock markets, even though financial globalisation has also played a role.

The traditional approach to portfolio diversification has been to allocate wealth firstly across countries and secondly within each country. Rising stock market return correlations across countries would imply lower benefits of portfolio diversification across countries and would mean that an investment strategy based on diversification across industries may become more appealing. Several studies have documented the fall in the dominance of country factors over time and some studies conclude that the introduction of the euro coincides with a greater dominance of industry factors. It has been noted that the shift in the relative importance of country and industry factors has led financial institutions to reorganise their research departments in terms of industries rather than countries.

Figure 3 shows cross-sectional standard deviations of country and industry returns. Cross-sectional standard deviations are another way to get at correlations. A high cross-

sectional deviation means a low correlation, and reciprocally. The figure indicates that correlations have been moving together to a large extent. So it remains unclear which diversification strategy should be preferred!

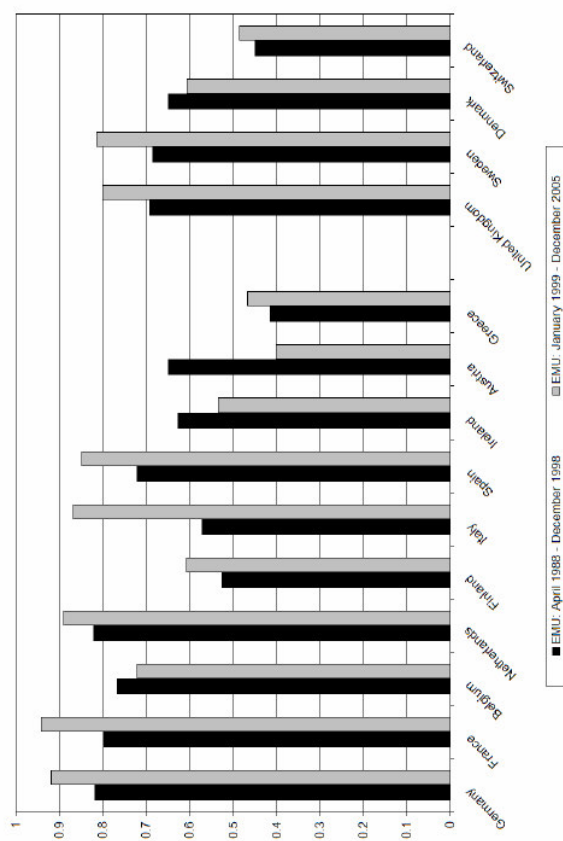Figure 2: Return correlations to an EMU return, two sub-periods

8

Figure 3: Cross-sectional dispersions of country and industry returns