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ABSTRACT

The Impact of Globalization on the Equity Cost of Capital*

The advent of the single currency within the European Union provides a natural experiment to measure how the cost of equity changes as globalization takes place. This is because the launch of the single currency has led to the elimination of currency-related restrictions on the composition of institutional investors' portfolios and, hence, to increased risk sharing among EU investors. We focus not only on the impact of globalization on the level of the cost of equity, but also on the cross-country and cross-sectoral dispersion in the cost of capital. Over the 1990s it is shown that the cost of equity within EU sectors falls by between 0.5 and 3 percentage points. There is strong evidence of convergence in the cost of equity across different countries in the same sector. Convergence across different sectors is small. An implication for portfolio management is that country effects are becoming smaller and sector effects larger.

JEL Classification: G11, G12 and G15
Keywords: convergence, cost of equity, globalization and integration

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The Impact of Globalization on the Equity Cost of Capital

Non-Technical Summary

Throughout the 1990s the European Union (EU) has undertaken an ambitious program of capital market reforms that have aimed to integrate the capital markets of member states of the EU. A major argument in favour of such reforms is that they remove barriers to cross border trade and consequently capital markets become increasingly integrated. Because increased integration of capital markets leads to more cross-border risk sharing and more diversification opportunities, investors will lower the required rate of return that they demand to hold a unit of risk. That is, the cost of equity capital should fall if reforms lead to capital markets becoming more integrated. The capital market reforms undertaken within the EU provide a near natural experiment to examine if the equity of cost of capital has fallen as reform has taken place.

Examining whether the cost of equity capital has fallen within the EU is important for a number of reasons. First, as the cost of equity falls the net present value of current and future investments rises. This should lead to an increase in GDP of member states. Baldwin (1990) estimates that if the cost of equity falls by 0.5% the long term cumulative increase in GDP could be as much as 10%. Therefore there are important welfare implications of EU capital market reform. A second important reason for examining whether the cost of equity has fallen relates to asset allocation strategies. As capital markets become more integrated country effects gradually disappear and sector effects become dominant. The reforms by member state's of their public pension systems has led to an increase in the amounts of individuals wealth being invested in equity markets through private mutual and pension funds. In order to invest optimally it is imperative that we understand whether country effects or sector effects are important. Finally, if EU reform is leading to more integrated capital markets and a subsequent lower cost of capital, corporate mangers need to know the impact of this on their firm's cost of capital if they are to make optimal real investment decisions.

We approach the issue of whether the cost of capital has fallen in the EU using the traditional measure of a firm's beta relative to a market portfolio along with a measure of the long run equity market risk premium. However, we allow individual member state's equity markets to be partially integrated into the aggregate EU equity market. The partial integration model we use specifies that there are two potential sources of risk. The first is the aggregate EU market portfolio and the second is the local market portfolio.

The level of integration is conditional on the weight placed on these factors. When all the weight is placed on the local market portfolio the local market is completely segmented from the EU aggregate market. When all the weight is on the aggregate EU market portfolio markets are completely integrated. Partial integration arises when the weight is shared between each market portfolio. Because in most cases we would expect a firm's beta relative to the aggregate EU index to be smaller than relative to its domestic equity market beta, and because we know the aggregate EU equity market risk premium is lower than the domestic equity market risk premium, we would expect the cost of equity to fall as the level of integration increases.

As reforms are enacted markets become increasingly integrated and therefore it is necessary to allow integration to change over time. The degree of integration is modelled as a function of a country's forward interest rate differential vis-à-vis Germany. The forward rate differential is a measure of the market perception of whether or not a country will join the single currency. As reforms are enacted the probability of a country joining the single currency should increase. Moreover, the single currency in its own right can be thought of as a major reform that has the very important implication of removing restrictions on domestic investors equity holdings. Many pension funds and life assurance companies are not allowed to hold assets that are denominated in a foreign currency. Other investors face the cost of hedging foreign currency risk. If a country adopts the single currency these regulation and costs no longer exist across single currency members and hence we would expect to see an increase in cross border equity holdings, more risk sharing, increase equity market integration and consequently a fall in the cost of equity.

The empirical analysis uses stock returns from 10 different sectors. We choose to undertake the analysis using sectors because we expect that there will be cross sectional differences in the impact of integration on the cost of equity. For example, non-tradeable and semi-nontradeable sectors like Resources and Utilities are likely to be affected differently than industries that are already international, such as IT and Financials. In addition, using sector level data allows us to examine whether there has been a convergence in the cost of equity within a given sector across EU countries (that is, a reduction in country effects) and, or a convergence in the cost of equity across sectors in a given country (that is, a reduction in sector effects). As well as including the data on the countries that are member of the single currency we also include data on Denmark, Sweden and the UK. These countries are members of the EU but not members of the single currency and should act as a control group.

We find that for many sectors for most countries who are members of the single currency the process of capital market reform as proxied by the forward rate differentials has lowered the cost of equity capital by up to as mush as 3% and on average around 1.5%. Some sector that were already international, such as IT and Financials have not benefited as much from the reforms. Overall, the reduction in the cost of equity will lead to an important rise in net present value and hence national wealth. When we examine the convergence in the cost of equity for a given sector across countries we notice that it has risen. However, we find that there has been little convergence cost of equity capital across different sectors. This evidence supports the notion that country effects are being reduced and sector effects are more pronounced and should have important implications for asset management strategies. When we examine the cost of equity for the three non-single currency members we find that there has been no corresponding decrease in the cost of equity.

1 Introduction

When enacting stock market liberalization policies, the aim of regulators is to integrate the domestic stock market into world markets. A major argument in favour of increased integration is that it leads to international risk sharing and, as a result, lowers the cost of equity capital (Stulz 1999). Examining this issue is important for a number of reasons. First, there is an ongoing debate on the benefits of globalization. Baldwin (1990) estimates that the benefit from a reduction in the cost of capital in the EU of 0.5% could lead in the long term to a cumulative increase in GDP of between 5 and 10%. Second, integration of financial markets has important implications for asset allocation strategies. In particular, as markets become more integrated, country effects gradually disappear and hence sector allocation strategies gain in importance, compared to country allocation[1]. Third, if liberalization polices change the cost of capital, it is important for corporate managers to know the effect this has on their firm's cost of capital.

This paper studies the impact of globalization on the cost of equity capital using a data set on European Union (EU) stock market sectors. We examine the EU, rather than the typical emerging markets (see Bekaert and Harvey (2000) and Henry (2000)), because apart from the rich array of regulatory, economic and political liberalizations aimed at globalizing these economies, they have the unique feature of adopting the single currency which has led to a gradual increase in integration of EU stock markets in the late 1990s. The integration of European stock markets has occurred through both the elimination of barriers to intra-European investments and the launch of the common currency. The adoption of the euro eliminated currency risk and nullified legal barriers on the foreign currency composition of institutional investors (Hardouvelis et al. 2001).

An additional advantage of examining EU sectors is that it allows for a cross-sectional analysis across disparate sectors, in which we might expect globalization to have different effects. Whilst extant studies have examined country level effects, there is no reason to assume that all sectors in a country will benefit from globalization because the country does. For example, non-tradable or semi-tradable sectors like Resources and Utilities are likely to be affected differently than industries, which are already internationalized, such as Information Technology (IT), Consumer Goods and Financials. If globalization is important, we should see it impacting differently on different

[1] Adjaute et al. (2000) examine the performance of sector allocation versus country allocation strategies in the EU. Their results suggest that sector portfolios outperform country portfolios in terms of return per unit risk.

sectors.

Furthermore, by examining sectoral data, we are able to assess whether globalization has led to a convergence in the cost of equity within a given sector across EU countries, or across sectors in a given country. The issue of the convergence in the cost of capital has important investment implications with respect to whether optimal asset allocation takes place across countries or across sectors. By choosing the EU we are also able to examine data from three countries that are not members of the single currency: Denmark, Sweden and the UK. This acts as a control on our results.

We define globalization as both a change in the regulatory environment that removes barriers to free trade and a process of increased stock market integration in which the pricing of local stocks is increasingly dominated by international risk factors. This calls for measuring the impact on the cost of equity (i.e. the benefit) from globalization using a formal asset pricing model that allows for a time-varying degree of stock market integration. We do this be employing a version of a time-varying integration model first suggested by Bekaert and Harvey (1995, 1997) to measure integration of emerging stock markets and used by Hardouvelis et al. (2001) to measure the integration of EU stock markets.

The rest of the paper is organized as follows: Section 2 discusses issues of measurement of the cost of equity and describes the channels through which economic and monetary integration in Europe affects the cost of equity. Section 3 presents the model we use to measure the cost of equity when markets are partially integrated. Section 4 describes the data. Section 5 presents the results and section 6 provides some robustness tests. Section 7 concludes.

2 Stock Market Integration and the Cost of Equity Capital

2.1 Review of the Literature

The cost of equity capital is the real return required by investors in order to hold one company share. Its importance lies in the fact that it determines the fair price of equity as the discounted value of all future dividend payments over the holding period of the share. Hence, if the required real return on equity is high, investors will be willing to pay a low price for one share of equity, making it more costly to raise equity capital in order to finance new investment projects.

Measuring the cost of equity capital is not straightforward. Empirical studies often refer to the present value formula as a useful analytical frame-

work of obtaining a measure of the cost of equity capital. According to the Gordon growth model (Gordon (1962)), in equilibrium, the cost of equity capital is equal to the return on equity. The latter is given as the sum of two components: the dividend yield and the growth rate of dividends, which in equilibrium is equal to the rate of capital gains. This is because with constant payout ratios, dividends, earnings and share prices all grow at a constant rate. Based on the Gordon growth model, there are two obvious methods to measure the cost of equity capital: (i) the historical total return on equity; (ii) the dividend yield, adjusted with the constant growth rate of dividends.

Both methods have been extensively used in empirical event studies which attempt to measure the impact of liberalization on the cost of equity capital. Bekaert and Harvey (2000) and Henry (2000) both employ event windows to examine changes in the cost of equity around dates of liberalization policies. Henry (2000) calculates abnormal returns, while Bekaert and Harvey (2000) focus on dividend yield changes to measure changes in the cost of equity given a liberalization policy. Whilst both studies find some evidence of a fall in the cost of equity capital post-liberalization, the effects are small relative to what is expected (see Stulz (1999)). For example, Bekaert and Harvey (2000) calculate a reduction in the cost of equity of between only 5 and 75 basis points.

Stulz (1999) notes a number of specific and general problems with employing event studies to measure the impact of liberalization on the cost of equity, which may account for the somewhat small effects found so far in the literature. First, the timing of liberalization events is unknown and the researcher does not know whether liberalizations are anticipated or, at the other extreme, whether their effects occur with a time lag. More importantly, liberalizations may be endogenous in the sense that they are themselves determined by the cost of equity capital (see Chari and Henry 2001). This may occur if governments choose to liberalize after a period when the stock market has done well.

Second, one common assumption of event studies is that, due to liberalization, investors take full advantage of international risk sharing and, consequently, the market jumps from a state of complete segmentation to a state of complete integration with world markets. It is probably closer to reality to assume that markets are neither fully segmented nor fully integrated and that liberalization policies affect the degree of integration with world markets gradually over time.

Third, the cost of equity capital is a conditional variable in the sense that it is the required rate of return on equity given information up to the

present time period. In a given national market the required rate of return is determined by two factors: (i) the risk free interest rate which is the opportunity cost of investing in equities and (ii) the equity risk premium required by investors to compensate for uncertainty about the future value of their investment. Consequently, estimating the cost of capital requires the use of an asset pricing model which measures in a compact form required rates of return given risk attitudes of investors, risk factors and investment opportunities of the economy.

Summing up, in order to measure the cost of equity capital, we require a conditional asset pricing model of partially integrated markets, where the degree of integration evolves over time to capture the gradual impact of liberalization on globalization and risk sharing.

Black (1974), Stehle (1977), Stulz (1981), Errunza and Losq (1985), Merton (1987) and Cooper and Kaplanis (2000), among others, propose asset pricing models of partially integrated markets. Stulz (1981) shows that investors exclude from their portfolio those foreign assets which do not provide an expected return large enough to offset the cost of holding them. Cooper and Kaplanis (2000) expand the Stulz model in a multi-country setting and show that the expected return on a local asset is determined by a premium for its covariance with the global market index and a premium for the part of its risk that is unrelated to global assets (local risk). A similar result is also obtained in Errunza and Losq (1985), where some investors are precluded from holding some securities. Merton (1987) illustrates how broadening the investor base for a given stock, and by extension for a local stock market, leads to a decrease in the cost of equity because international investors are better diversified than local investors and, consequently, they require a lower reward for each unit of local market risk they undertake.

2.2 The Effect of EMU on the Cost of Equity Capital

Economic and monetary integration in Europe has affected the cost of equity capital of European firms in three ways. The first and, probably, most important effect of EMU on the cost of equity is due to the gradual abolition of barriers to intra-EU investments and the launch of the common currency. Investment barriers were lifted during the 1990s to harmonize the regulatory framework of financial markets.[2] Additionally, the launch of the common currency lifted all remaining restrictions on the currency composition of institutional investors like pension funds and life insurance companies. As

[2] For a survey on the regulatory and legislative aspects of European stock market integration see Licht (1998).

a result of both decreasing barriers and the launch of the common currency, risk sharing among EU investors increased, reducing the required equity risk premium and, hence, lowering the cost of equity capital.

In order to get a feel for the extent of the change in risk sharing we can examine cross-border equity flows and portfolio holdings of EU investors. Relative to the early 1990s, by mid 1998 cross border equity flows in the EU had nearly tripled to around \$120-\$140 billion. Estimates of the total rebalancing of equity portfolios from domestic to pan-European portfolios are in the region of \$1.5 trillion (more than one third of market capitalization) (Euromoney, August 1998). Two client surveys shortly before the launch of the euro[3] found that over one quarter of fund managers had already implemented some change in their equity portfolios, over 50% had already well ahead in their preparations for EMU, and three-quarter indicated that they would be reconsidering their assets allocation as a direct result of EMU. Dathine et al (2000) report increased holdings of foreign assets by domestic residents within the EU.

More formal evidence of the impact of EMU on portfolio holdings is reported in table 1 which shows actual foreign equity holdings of pension funds and life insurance companies as a percentage of total equity holdings. Data are from Intersec Research. Foreign equity holdings of pension funds in EMU countries increased on average from 29% of total equity holdings in 1992 to more than 50% in 1999. In sharp contrast, foreign equity holdings of pension funds in non-EMU countries remained unchanged at around 20% over the same period. Note that the foreign equity holdings of both pension funds and life insurance companies in UK and Sweden, two EU members who are not in EMU, have not followed the same patterns as that of EMU members. In Sweden the share of foreign equity actually fell.

The portfolio reallocation towards foreign equity in the EMU countries is even stronger for life insurance companies. Life insurance companies in EMU countries increased their foreign equity holdings from 11% of total equity holdings in 1992 to 30% in 1999. In contrast, foreign equity holdings of life insurance companies in non-EMU countries increased only slightly from 24% in 1992 to 27% in 1999. These portfolio shifts towards foreign equity in EMU countries suggest that risk sharing increased among EMU investors. They also illustrate that these patterns did not emerge in non-EU countries and EU countries that did not join the single currency.

The impact of EMU on the pricing of stocks should have been felt even

[3] Dresdner Klienwort Benson (March/April 1998) and Goldman Sachs and Watson Wyatt (March 1998)

before the introduction of the common currency since European stock market integration was a gradual process rather than a one-off event. After all, the launch of the euro did not come as a surprise but was widely anticipated at least since February 1992, when the Maastricht Treaty was signed. The expectation of the future elimination of currency-related barriers on asset allocation ought to have affected required returns and the cost of equity capital prior to 1999. This effect should be stronger the higher the probability of the euro occurring and the closer the time span to the launch of the euro. It follows that a model of partial stock market integration that purports to explain the European experience of the 1990s ought to incorporate features associated with the likelihood and the time of EMU occurring.

The second effect of EMU on the cost of equity is the elimination of intra-European currency risk as a result of the launch of the common currency. As a consequence, to the extent that currency risk was priced, the cost of equity has fallen. Hardouvelis et al. (2001) estimate that, prior to the launch of the euro, intra-European currency risk contributed on average about 14% of the equity risk premium across EU countries. In order to keep our model simple, and to be consistent with models of the cost of equity used in practice we do not incorporate currency risk in our estimates. However, it should be noted that it is a part of global risk that has been eliminated with the inception of the euro. Our focus is on the impact that the single currency has on the weight of global versus local factors on required returns, i.e. the level of integration, and how this has affected the cost of equity.

The final effect of EMU on the cost of equity is related to interest rate convergence. As a precondition to EMU entry, both inflation and interest rates converged among EU countries towards the lower levels of Germany, which used to be considered as the benchmark country. Although this convergence process does not imply lower real rates in general, EU countries with historically high levels of inflation have benefited from the new low inflation environment: inflation has become less volatile and, consequently, more predictable. Hence, to the extent that inflation uncertainty was priced in money and bond markets, the reduction in the inflation premium in these countries has led to lower real interest rates and, as a result, lower cost of capital for national investors. It should be noted, however, that interest rate convergence has benefited mainly local investors who had no access to the lowest real risk-free rates prior to EMU.

3 Empirical Model

The empirical model we use is based on the intuition of partial integration discussed in the previous section. We consider a small European country whose equity market consists of a number of n sectors. In order to abstract from the effect of interest rate convergence on the cost of equity, we assume that investors have unlimited access to a single risk-free asset across the EU in order to finance investment projects. However, due to the existence of barriers to international investment, investors are restricted from holding the EU market portfolio. As a result, the home equity market is partially integrated into the EU market. Hence, the expected excess return on a domestic sector is determined as a weighted average of a premium for its covariance with the EU market excess return (market risk) and a premium for its covariance with the local market excess return (local risk).[4] For a particular country i, the vector of expected excess returns of the n sectors can be written as:

$$\mathbf{r}_{i,t} = \theta_{i,t-1}\left(\boldsymbol{\beta}_i^{EU} r_t^{EU}\right) + (1-\theta_{i,t-1})\left(\boldsymbol{\beta}_i^{L} r_t^{L}\right) + \mathbf{e}_{i,t}, \tag{1}$$

where $\mathbf{r}_{i,t} = (r_{i1,t}, ..., r_{in,t})'$ is the $1 \times n$ vector of sector excess returns in country i (expressed in a common currency) over a common EU risk-free rate, $\boldsymbol{\beta}_i^{EU}$ is a $1 \times n$ vector of sector betas with respect to the EU market excess return over the EU risk-free rate, defined as r_t^{EU}, $\boldsymbol{\beta}_i^{L}$ is a $1 \times n$ vector of sector betas with respect to the country i market excess return over the EU risk-free rate, defined as r_t^{L}, $\theta_{i,t-1}$ is the degree of integration of country i into the EU market, conditional on information up to time $t-1$ and $\mathbf{e}_{i,t}$ is a vector of sector residuals.

Equation (1) may be viewed as an approximation of expected returns in partially integrated markets where both global and local risk factors are priced and the degree of integration is evolving over time. This empirical model of partial integration was first developed in a regime switching context by Bekaert and Harvey (1995) to examine equity risk premia in emerging markets. Hardouvelis et. al (2001) use a version of equation (1) to measures integration of EU stock markets during the 1990s.

By computing excess returns over a common EU risk-free rate, the left-hand side of equation (1) does not measure the effect of interest rate con-

[4] The model assumes that the global market portfolio is a market value weighted average of the single currency members. Of course this rules out influences on returns from the rest of the world. Therefore, our measure of integration may be biased due to an omitted variable problem. However, Hardouvelis et. al (2001) find that the measure of integration is invariant to world market influences.

vergence in the run-up to EMU on the equity risk premium, in contrast to measures of the risk premium in excess of local risk-free rates. We choose this method of measuring equity risk premia because, given that European stock markets have increasingly become integrated during the past decade, we are interested in the cost of capital of a project for a pan-European investor. For this type of investor, interest rate convergence did not affect the cost of capital since she had access to the lowest funding costs even prior to EMU. Hence, if there was a saving in the cost of capital for this type of investor, this must be related to a decline in the equity premium and/or a decline in the common EU risk-free rate. Our empirical estimates quantify only the effect of EMU on the equity risk premium. To the extent that EMU has also led to a decrease in the common real risk-free rate, this effect has led to an additional decrease in the cost of capital.[5]

The time-varying degree of integration, $\theta_{i,t-1}$, is proxied by a function of the forward interest rate differential between country i and Germany because this differential is related to the probability of joining the single currency. Hence, $\theta_{i,t-1}$ is modelled as follows:

$$\theta_{i,t-1} = \gamma_{0,i} + \exp\left(\gamma_{1,i}\left|s_{i,t-1}\right|\right), \tag{2}$$

where $s_{i,t-1}$ is the forward interest rate differential between country i and Germany, the benchmark country, $\gamma_{0,i}$, $\gamma_{1,i}$ are country-specific parameters and exp(.) denotes exponentiation. When the forward interest rate differential, $s_{i,t-1}$, is zero, $\exp(..)$ becomes unity. When $s_{i,t-1}$ deviates from zero and $\gamma_{1,i} < 0$ but finite, then $0 < \exp(..) < 1$. The larger the deviation of $s_{i,t-1}$ from zero, whether it is positive or negative, the closer $\exp(..)$ is to zero and the further away from unity.

The role of the forward interest rate differential between two countries is to reflect the expected change in the exchange rate between two *future* points in time. On January 1, 1999 the exchange rates of the EMU countries were fixed. Consequently, if the expectation was that country i and Germany would join EMU in 1999, the forward interest rate differential should be zero. In contrast, the forward interest rate differential between country i and Germany would be different from zero if market participants were expecting that country i would not join EMU in 1999, or that EMU itself may not materialize.

[5] Although European interest rates and inflation both converged towards the German levels in the run-up to EMU, there is no a-priori reason to assume that German real interest rates were also affected, since EMU has led to nominal, not real, convergence.

The constant term $\gamma_{0,i}$ in equation (2) acts as an intercept correction on the level of integration. For example, spreads may be zero by chance but markets may not be fully integrated due to, say, capital market or ownership restrictions. When equation (2) is estimated, $\gamma_{1,i}$ is negative and $\gamma_{0,i}$ is very close to zero, thus the level of integration $\theta_{i,t-1}$ ends up being bounded between zero and unity. In the robustness section we estimate a version of the model that does bound $\theta_{i,t-1}$ between zero and one. The results are robust to this re-specification of the integration parameter.

In order to obtain the level of integration and the betas, the system of equations (1)-(2) is estimated for each country i by maximum likelihood.[6] It is usual to calculate the equity premium by taking the product of the betas and their respective market equity premiums. We follow this convention with the adjustment of weighting the two betas with the time-varying level of integration. The respective equity market premiums are calculated from long historical arithmetic averages.

In the above framework, the equity premium of sector j in country i, $r_{ij,t}$, varies over time due to the time-variability of the level of integration, $\theta_{i,t-1}$, of country i.[7] Hence, we are able to track how a change in the level of integration affects the cost of capital of sector j in country i by taking the partial derivative of expected returns with respect to the conditional degree of integration:

$$\frac{\vartheta r_{ij,t}}{\vartheta \theta_{i,t-1}} \Delta\theta_{i,t-1} = (\beta_{ij}^{EU} \bar{r}^{EU} - \beta_{ij}^{L} \bar{r}_i^{L})(\theta_{i,t-1} - \theta_{i,t-2}), \tag{3}$$

where $r_{ij,t}$ is the cost of equity capital for sector j in country i, $\Delta\theta_{i,t-1}$ is the change in θ_i between time $t-1$ and t conditional on information at time $t-2$ and $t-1$, respectively, β_{ij}^{EU} is the beta of sector j in country i with respect to the EU index, $\bar{r}^{EU}$ is the long term equity market premium on the EU index, β_{ij}^{L} is the beta of sector j in country i with respect to the local market index and $\bar{r}_i^{L}$ is the long term equity market premium on the local market i index.

[6] By estimating country by country and not as one system we run the risk of loosing some efficiency if the residuals across countries are correlated. However, estimating a full system is not possible due to the large number of paramaters. To get a feel for the extent of the problem we calculated the correlation coefficients of the residuals from different countries. The average is around 0.2 and thus the problem does not appear to be too serious.

[7] We assume that changes in the level of integration over time do not influence the size of the betas or the size the market equity premiums. Later on, we provide supporting evidence.

4 Data

4.1 Returns

Of the eleven countries[8] which joined the single currency on January 1, 1999, we collect data for Belgium, France, Germany, Italy, Netherlands and Spain. Data on the following ten major industrial sectors are collected: Resources, Basic Industries, General Industrial, Utilities, Information Technology, Financials, Cyclical Consumer Goods, Non-Cyclical Consumer Goods, Cyclical Services and Non-Cyclical Services. We use weekly, euro denominated, total, continuously compounded stock returns based on Friday closing prices. A value weighted index of the 11 EU countries is used to proxy the EU market portfolio. We calculate excess returns as national returns in euros minus the one month euro interest rate, which is transformed to reflect the return over a weekly horizon. The data source is Datastream International. The sample period for the analysis is 28:06:91 to 25:12:98. The selection of both the countries and the sample period is dictated by the availability of interest rate swaps which are used to calculate forward interest rate differentials.[9]

Table 2 presents summary statistics on the euro-denominated excess returns of the individual sectors in the EU countries. The excess returns display some interesting properties. For example, there is considerable cross sectional variation in both mean excess returns and volatilities. Average volatility is highest in the IT and Cyclical Consumer Goods sectors and lowest in the Cyclical Services and the Utilities sectors. There is no observable pattern between mean excess returns and volatilities across sectors. For example, the Information Technology sector has the highest excess returns whilst the Cyclical Consumer Goods sector has the smallest excess return, both being sectors with high return volatility.

Table 2 also reports correlation coefficients between the excess returns in each sector and those of the local and EU market portfolios. These reveal that in all but two cases (Germany: Resources, France: Utilities) the correlation coefficient with the local market index is higher than with the EU index. The highest average correlations with the local market index are in the Financial, Basic Industries, General Industrial and Cyclical Services sectors. The highest difference between the local market and the EU market

[8] The eleven members of the single currency are: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. Greece became the 12th member of EMU later, on January 1, 2001.

[9] Data for the following sectors was not available over the sample period for a sufficient period of time: Utilities in Netherlands and France, Information Technology in Spain, and Cyclical Consumer Goods in Belgium.

correlation coefficient is in the Financial sector. The smallest difference is in the IT sector where, if Italy is ignored, the correlation coefficients are essentially the same.

The observation that the correlation coefficients with respect to the EU index are generally lower than with respect to the local market index provides some initial evidence that the cost of equity capital may be lower in an integrated EU market than in a segmented/partially integrated market. This follows from the beta estimate which is a function of the correlation coefficient: a lower correlation coefficient implies a lower beta, all else constant.

4.2 Forward Interest Rate Differentials

For each of the countries, we report summary statistics of forward interest rate differentials. The differentials are calculated from swap rates between fixed and floating rate government bonds, collected from Datastream International. Forward interest rate differentials provide a measure of convergence towards EMU, which is independent of the stock market. They have been widely used by market participants in order to assess the probability of individual countries to participate in EMU.[10]

Table 3 presents summary statistics on the forward interest rate differentials including the mean, standard deviation and maximum and minimum values. The mean values of these differentials are quite revealing: the core EU countries of France, Belgium and the Netherlands have small mean differentials, whereas the countries which have been struggling to fulfil the Maastricht criteria for EMU participation (Italy, and Spain) have larger mean differentials. This is also revealed in the standard deviations and minimum and maximum values. Germany has a negative mean differential with the ECU rate, reinforcing our choice of Germany as the country to measure the remaining EU countries against.

Although over longer periods of time forward interest differentials ought to be stationary since they correspond to future forward premia in the foreign exchange market, nonstationarity may be a serious problem in small samples.[11] Since European interest rates were on a downward trend since

[10] See, for example, Goldman Sachs: 'European Bond Spreads and the Probability of EMU', May 1996, JP Morgan: 'The EMU Calculator', October 1996, Paribas: 'EMU countdown', February 1997.

[11] In fact, standard Dickey Fuller tests for a unit root cannot reject the null hypothesis that forward interest rate differentials are nonstationary in four out of six cases: Germany, France, Italy, Spain.

1992, forward interest differentials may have co-trended with interest rates. In this case it would be more appropriate to measure forward interest differentials relative to the level of interest rates. Therefore, we take the ratio between the forward interest differential and the German long bond yield.

5 Empirical Results

5.1 Model Estimates

Table 4 reports the estimates of the betas and the integration parameters from the system given by equations (1) and (2). One system is estimated for each country. By doing this we are able to impose the restriction that the level of integration in the country is the same across all sectors. Estimates of the slope coefficients $\gamma_{1,i}$ of equation (2) are all negative and statistically significant. This implies that when spreads fall, integration increases. Inspection of the levels of integration (available on request) reveals a strong upward trend over the sample period. In all cases the level of integration approaches unity at the end of the sample.[12]

The betas with respect to the local and global indices are reported for each sector, country by country. In the vast majority of cases the local beta is greater than the global beta. The most interesting exceptions here are the IT and Cyclical Consumer Goods sectors where global betas are bigger in half of the countries. Furthermore, the highest recorded betas are in the IT sector with respect to the global index. It is also interesting to note that betas with respect to the global index for Financials are sometimes bigger than the local betas. The betas in this sector are in sharp contrast to the Resources, Basic Industries and General Industrial sectors, where in most cases the local betas are larger than the global betas. Presumably, the explanation for this lies in the international nature of the IT and Cyclical Consumer Goods sectors.

To check the stability of the estimated betas we performed a Chow test for structural stability. This is undertaken by spliting the sample into an initial period between June 1991 and December 1996 and a second period of January 1997 and December 1998. We choose this period because most of the convergence in the integration parameter took place after 1996. The Chow tests are available on request and show that out of the 116 tests 18

[12] Hardouvelis, Malliaropulos, and Priestley (2001) find that this specification of the integration parameter is robust to the inclusion of other intrumental variables to condition the integration parameter.

reject the null on parameter stability. Therefore, assuming constant betas does not appear to be too restrictive.

5.2 Estimates of the Cost of Equity

It is conventional to estimate the equity risk premium using a long historical time period. For example, for the U.S., the equity premium is often calculated from annual data going back to the early twentieth century, or at least to the end of world war II. Data over such a long time period are more difficult to obtain for our sample of countries. We employ total return data from 1973 provided by Datastream to estimate the equity market premium.

Table 5 reports the arithmetic mean equity premia. The excess returns are calculated in euro. The EU index is a market value weighted average of the EU-11 countries. The risk free rate is the short term German rate since no euro rates are available back to 1973. The equity premium is highest in Italy. It is approximately double that of Germany and Belgium. Germany has the lowest equity premium. The average premium across the EU-11 is 9.76%.

Table 6 reports the estimated equity premium for each sector in each country. The table is organized by industry, allowing for a comparison of the industry cost of capital across countries. For each industry, the first row reports estimates of the average equity premium and the second row reports end of sample estimates. In addition, we also report the contribution of the global (EU-specific) equity premium component to the total equity premium in parentheses. The final column in the table reports averages in the respective sectors. Some striking features are apparent from the cross-section of estimated equity premia. First, on average all sectors experience a decrease in the cost of equity with the exception of the Information Technology sector. In many cases the difference is greater than one percentage point, especially in the so called 'old economy' sectors. At the end of the sample the Utilities sector has the lowest cost of capital and the IT sector has the highest. This result is in line with our earlier observation that volatility is highest in the IT and among the lowest in the Utilities sector.

The contribution of global risk to total expected returns is given in parentheses in table 6. Whilst, in most sectors, global risk contributes on average over the whole sample between 30% and 37% to the equity premium, at the end of the sample, as the level of integration approaches one, its contribution exceeds 90%. Over the whole sample period the contribution of global risk is highest in the IT sector. It is lowest in the General Industrial sector and the Utilities sector. This result is probably related to the fact that the latter

industries are more exposed to country-specific factors such as the make up of natural resources, regulatory influences (especially in the utilities sector) and local market conditions.

5.3 Estimating the Benefit for Globalization

Table 7 reports the total cumulative saving in the cost of equity over the whole sample. In Panel A, for each sector, the cumulated saving in the cost of capital is averaged across countries using equal weights. Over the 1990s, the reduction in the cost of equity has been substantial in the old economy industries of Resources, General Industries, Basic industries and Utilities, approximately 2 percentage points each. The Financial sector records a more modest fall in the cost of equity. The IT sector, on the other hand, reports an increase in the cost of equity of just over 0.6 percentage points over the sample period, although this is not statistically different from zero. The various Goods and Services sectors display more modest, but still significant falls, except Cyclical Goods, where the change in the cost of capital is positive but statistically insignificant.

Figure 1 displays estimates of the cumulative average saving in the cost of equity due to the integration of European stock markets. The effect of integration on the cost of equity is relatively low during the first half of the sample, when markets were less integrated, and relatively high towards the end of the sample, particularly in 1997, the year when most of the convergence in European bond yields took place. It should be noted that, according to the Maastricht Treaty, 1997 was the year during which the convergence criteria had to be satisfied for joining EMU in 1999.

Panel B of table 7 reports the average reduction in the cost of equity within a country. We take an equal weight of the ten sectors in each country and then cumulate the saving in the cost of equity. We report two numbers for each country. The first is the average across all ten sectors, the second is across nine omitting the IT sector. All countries except Germany report a statistically significant fall in the cost of equity capital, ranging from around 0.5 percentage points in Belgium to 3.6 percentage points in Italy. Germany reports a significant increase of 2 percentage points. When the IT sector is excluded, the drop in the cost of capital becomes larger in Belgium and France and the increase in the cost of capital becomes smaller in Germany.

5.4 Is there a Reduction in the Dispersion of the Equity Premium Across Sectors and Across Countries?

In addition to analyzing changes in the cost of equity capital, we also examine if the cost of equity has converged over time across sectors and countries. This issue is of particular importance for both corporate managers and investors. If, for example, the cost of equity converges across countries, then cross-listed firms face no comparative advantage in raising equity capital. Similarly, the importance of country allocation strategies for international investors decreases.

The finding that the cost of equity in Europe has decreased over the 1990s as a result of higher stock market integration does not necessarily imply that the cost of equity has converged across sectors in a particular country or across countries in a particular sector. By convergence, we mean a tendency towards the reduction over time of the dispersion in the cost of equity across sectors or across countries.

In perfectly integrated markets the dispersion of the cost of equity is reduced only if the exposure of firms to different risk factors converges over time. For example, in the framework of the standard CAPM, the cost of equity across sectors converges if there is a tendency for the exposure of sectors to market risk (betas) to approach each other over time. However, there is no a-priori economic reason why this should happen.

In imperfectly integrated markets, however, convergence in the cost of equity can be related to the evolution over time of the degree of market integration plus the degree of convergence in local betas. We would expect that, as stock markets become more integrated, the cost of equity in a particular sector should converge across countries due to the elimination of local risk. Convergence in the cost of equity should be positively related to the degree of market integration the higher is the cross-country dispersion of local betas and local market premia and the lower is the cross-country dispersion of global betas.

To illustrate this claim, consider the cost of equity for sector j in country i from equation (1). In the case of perfect segmentation ($\theta = 0$), $r_{ji,t} = \beta_{ij}^{L}\bar{r}_i^{L}$, whereas in the case of perfect integration ($\theta = 1$), $r_{ji,t} = \beta_{ij}^{EU}\bar{r}^{EU}$. Assume for simplicity that the sectors' exposures to market risk are equal across countries, $\beta_{ij}^{L} = \beta_j^{L}$, $\beta_{ij}^{EU} = \beta_j^{EU}$. The variance of the cost of equity in sector j across countries in the case of perfect segmentation is given as: $(\beta_j^{L})^2 var(\bar{r}_i^{L})$. In words, the within-sector cross-country variance of the cost of equity is positively related to the cross-country variance of market premia.

When markets are perfectly integrated, however, the cross-country vari-

ance of the cost of equity in sector j is: $(\beta_j^{EU})^2 var(\bar{r}_i^{EU}) = 0$, since $var(\bar{r}_i^{EU}) = 0$. That is, given that stocks are exposed to a single, identical risk factor (the EU market portfolio), the cost of equity shows no cross-country variation. Of course, this result is subject to our simplifying assumption that betas are equal across countries. Allowing betas to differ across countries generally introduces a lower bound on the cross-country variance of local betas for the cost of equity to converge when the degree of integration increases. This lower bound is given as a weighted difference between the cross-country variance of global betas and the cross-country variance of local market premia.[13] Given the empirical evidence that cross-country variation in market risk premia is more important than cross-country variation in betas[14], this lower bound should be easy to meet under a fairly wide range of parameter values.

To test the hypothesis that increased market integration in Europe has led to a convergence in the cost of equity, we compute the dispersion of the cost of equity across countries or sectors and test whether this dispersion decreases over time. Table 8, panel A reports the results of convergence in the cost of equity across countries within a given sector. In all sectors, to varying degrees, we observe that the dispersion of the cost of equity across countries decreases over time. The estimates of the trend coefficient suggest that dispersion decreases by 0.2 to 0.6% per week, corresponding to roughly 10 to 30% per annum.

Panel B of table 8 reports the results of convergence in the cost of equity across sectors within a given country. The results are mixed with the two main stock markets of France and Germany experiencing a divergence in the cost of equity across sectors. The remaining four countries experience a convergence in the cost of equity across sectors, although this is modest in Italy.

In Figure 2 we plot the average sectors cross-country dispersion of the

[13] This can be obtained from a first order Taylor series approximation of returns as follows: for $\theta = 0$ returns can be approximated as $r_{ji} = \beta_{ij,0}^L(\bar{r}_i^L - \bar{r}_{i,0}^L) + \bar{r}_{i,0}^L(\beta_{ij}^L - \beta_{ij,0}^L)$, where $\beta_{ij,0}^L$ is the cross-country mean of the local beta and $\bar{r}_{i,0}^L$ is the cross-country mean of the local market premium. Similarly, for $\theta = 1$ returns can be approximated as $r_{ji} = \bar{r}_0^{EU}(\beta_{ij}^{EU} - \beta_{ij,0}^{EU})$. Computing the variance of returns for $\theta = 0$ and $\theta = 1$ gives $(\bar{r}_{i,0}^L)^2 var(\beta_{ij}^L) + (\beta_{ij,0}^L)^2 var(\bar{r}_i^L)$ and $(\bar{r}_0^{EU})^2 var(\beta_{ij}^{EU})$, respectively. Hence, the cross-country variance of the cost of equity decreases when the markets go from a state of perfect segmentation to a state of perfect integration if $var(\beta_{ij}^L) > (\frac{\bar{r}^{EU}}{\bar{r}_i^L})^2 var(\beta_{ij}^{EU}) - (\frac{\overline{\beta_{ij}^L}}{\overline{\beta_{ij}^{EU}}})^2 var(\bar{r}_i^L)$.

[14] See, e.g. Braun et.al (1995).

cost of equity across sectors over time. The figure reinforces the results in panel A of table 8 and illustrates the downward trend in the cross-country variation of the sectoral equity premia. In Figure 3 we plot the average cross-sectoral dispersion of the cost of equity for the six countries. There appears at best only a slight fall over the sample period in the variance of the cost of equity within a country .

Our results have important implications for both corporate managers and investors. First, convergence is the cost of equity across countries within a given sector implies that cross-listing of companies in different national bourses as a strategy to take advantage of differences in cost of equity capital is increasingly loosing in importance. Second, evidence of cross-country convergence in the sector cost of equity indicates that country allocation effects are becoming less important as markets become more integrated. Hence, sector allocation strategies gain in importance.

6 Robustness

This section of the paper reports a number of robustness tests of the estimated model. We consider a group of EU countries that have not become members of the single currency. This should act as a control group check on our results. Second, we consider an alternative specification for the integration parameter. Third, we consider models that assume complete segmentation and complete integration.

6.1 Countries Outside the Euro Area

In order to test the robustness of our results, we consider whether the observed patterns in the cost of equity capital are also present in EU countries which are not members of EMU. This group of countries consists of Denmark, Sweden and the UK. Data for the UK is available over the full sample for all ten sector classifications. For Denmark the data on interest rate swap yields starts in February 1993 and there is no data available for the Resources and IT sectors. In Sweden interest rate swap yields start in January 1992 and all sectors are available with the exception of non-cyclical services. Equity market risk premia, betas and the level of integration are calculated as in the case for members of the single currency. We adjust the global market index to also include these members of the EU. From these results (available on request) we generate the cumulative saving in the cost

of equity.[15]

For the EU countries outside the euro area we would not expect the impact on the cost of equity to be as large as that of members of the single currency. Table 9 reports the cumulative saving in the cost of equity for each sector across the three countries. In panel A we report the results for the sectors. With the exception of non-cyclical services, there is a fall in the cost of equity. However, unlike the case of the euro members, the cumulative effect is economically very small over the sample period and is never statistically significant. The average fall in the cost of equity for these three countries is around 30% of the corresponding fall of the EMU members.

In panel B we report the impact across countries which is found to be small and negative in Sweden and the UK but not statistically different from zero. In Denmark the impact is positive, suggesting that the cost of capital has increased over the sample period. However, this increase is economically small and statistically insignificant. In sum, there are clear economic differences between the impact on the cost of equity for the EMU members and the non-EMU members. Unlike the EMU members, countries outside EMU have not experienced a significant fall in the cost of equity capital.

6.2 An Alternative Specification of Integration

Although the integration parameter ends up being bounded between zero and one when we estimate the model for each country, we do not impose this as a restriction. Therefore, as an alternative to the earlier specification of $\theta_{i,t-1}$ we also specify a function that does bound $\theta_{i,t-1}$, between zero and one. Specifically we re-estimate the model using[16]:

$$\theta_{i,t-1} = \frac{1}{(1 + |g_{0,i} + g_{1,i} s_{i,t-1}|)} \tag{4}$$

In table 10 we report the average savings for each sector and country. As can be seen, the effects are very similar, irrespective of the specification of $\theta_{i,t-1}$. The major difference is that the reduction in the cost of capital is slightly larger with this specification of the integration parameter. However, the differences in the total reduction in the cost of capital between the two

[15] We do not test for convergence in the cost of equity in these countries as we have only three observations on the cost of equity at one point in time in order to calculate the dispersion.

[16] See Bekaert and Harvey (1997) for an alternative specification of $\theta_{i,t-1}$ that is bounded between one and zero.

specifications is very small. Thus, our results appear to be robust to the specification of the integration parameter.

6.3 The Cases of Complete Segmentation and Complete Integration

The estimated model of partial integration imposes a set of restrictions on the models of complete segmentation and complete integration. The two alternative specifications are nested within the model of partial integration.[17] Consequently, a likelihood ratio test can be performed by estimating the two alternatives and testing the restrictions they place on the partial integration model. The likelihood ratio test is distributed χ^2 with two degrees of freedom. Table 11, panel A, reports these tests and shows that in all but one case we can reject the restrictions that either complete integration or complete segmentation places on the partial integration model. The exception is Italy where we cannot reject complete segmentation. This result is probably due to the low level of integration in this market in the first part of the sample. Interestingly, the rejections of full integration are much stronger than the corresponding rejections of full segmentation. This is important to note given the predominance of the assumption of perfect integration in many empirical studies of international asset pricing.

An informal way to test the appropriateness of the models is to compare the cost of capital estimates they produce. The complete integration and complete segmentation models produce a scalar estimate over the entire sample. The partial integration model produces a time series of cost of capital estimates. Therefore, it is possible to compare the mean of the cost of capital from the partial integration model with the scalar of the two alternatives using a t-test. The average absolute differences in the cost of capital estimates are reported in panel B of table 11. With respect to complete segmentation, the differences range from just over 2% per annum in Belgium to just over 0.2% per annum in Italy. The average across all countries is just under 1%. Out of the 55 individual differences, 23 are statistically significant. With respect to complete integration, the differences range from just over 2% per annum in Belgium to just over 1% per annum in Italy. The average across all countries is 1.5%. Out of the 55 individual differences, 33 are statistically significant. In line with the results of the likelihood ratio tests, the estimates of the cost of equity from the different

[17] Note that complete integration (segmentation) is equivalent with the restrictions $\gamma_{0,i} = 1$, $\gamma_{1,i} = 0$ ($\gamma_{0,i} = 0$, $\gamma_{1,i} = 0$) in equation (2).

models suggest greater differences with respect to complete integration than complete segmentation.

7 Conclusion

This paper examines whether the process of economic and monetary integration in Europe during the 1990s and the adoption of the euro has led to a reduction in the level of the cost of equity capital and whether the cost of equity within the EU has converged. The integration of European stock markets increased due to the gradual abolition of barriers to intra-EU investments and the launch of the common currency, which eliminated currency-related restrictions on the portfolio composition of institutional investors. As a result, the increase in portfolio diversification across EU countries has led to increased risk sharing among EU investors and, hence, to a decrease in non-diversifiable risk.

We used a conditional asset pricing model in order to assess the impact of globalization on the cost of equity capital, which has the attractive feature of tying the impact of globalization on the cost of equity to the change in the level of stock market integration. Using data from various EU sectors we have shown that globalization has led to a significant reduction in the cost of equity in the vast majority of sectors. The exception is the IT sector which records an increase in the cost of equity. At the country level the sector results translate into a significant fall in the cost of equity in all countries but Germany. Overall, on average, European stock market integration has led to a significant reduction in the cost of equity. This in turn should lead to more profitable investment opportunities as net present values rise and thus can boost economic growth and improve welfare. Various tests reveal that the results are robust.

We also assessed the convergence over time in the cost of equity both across sectors and countries. As integration increases, returns are increasingly determined by global rather than local risk factors. This results in a convergence of the sectoral cost of equity across countries. This issue is important given the growth in cross border business. On the other hand, convergence in the equity cost of capital across different sectors is much less pronounced and reflects the differences in global sector betas. This result has potentially far-reaching implications for portfolio management. Differences between sectors seem to remain whilst differences between countries seem to be disappearing. Therefore, a fruitful avenue for future research is the role of country and sector effects in portfolio management.

References

Adjaoute, K., L., Bottazzi, J.-P. Danthine, A. Fischer, R. Hamaui, R. Portes and M. Wickens, 2000, EMU and portfolio adjustment, CEPR Policy Paper No. 5.

Baldwin, R, 1990, On the microeconomics of the European Monetary Union, *European Economy,* Special Edition.

Bekaert, G., and C.R. Harvey, 1995, Time-varying world market integration, *Journal of Finance* 50, 403-444.

Bekaert, G., and C.R. Harvey, 1997, Emerging equity market volatility , *Journal of Financial Economics* 43, 29-77.

Bekaert, Geert and Campbell R. Harvey, 2000, Foreign speculators and emerging equity markets, *Journal of Finance* 55, 565-613.

Black, F., 1974, International capital market equilibrium with investment barriers, *Journal of Financial Economics* 1, 337-352.

Braun, P.A., D.B. Nelson, and A.M. Sunier, 1995, Good news, bad news, volatility and betas, *Journal of Finance 50, 1575-1603.*

Chari, A. and P.B. Henry, 2001, Stock market liberalizations and the repricing of systematic risk, Working Paper.

Cooper, Ian and Evi Kaplanis, 2000, Partially segmented international capital markets and international capital budgeting, *Journal of International Money and Finance 43, 287-307.*

Danthine, J.-P., F. Giavazzi and E.-L. von Thadden, 2000, European financial markets after EMU: A first assessment, CEPR Discussion Paper No. 2413.

Errunza, V. and E. Losq, 1985, International asset pricing under mild segmentation: Theory and test, *Journal of Finance* 40, 105-124.

Gordon, M.J., 1962, The investment, financing and valuation of the corporation, Irwin, Homewood, Ill.

Hardouvelis, G., D. Malliaropulos, and R. Priestley, 2001, EMU and European stock market integration, mimeo (an earlier version has been circulated as *CEPR Discussion Paper* No. 2124, Centre for Economic Policy Research, London).

Henry, P.B., 2000, Stock market liberalization, economic reform, and emerging market equity prices, *Journal of Finance* 55, 529-564.

Licht, A. N., 1998, Stock market integration in Europe, CAER II Discussion Paper No. 15, Harvard Institute for International Development, Cambridge, MA.

Merton, R.C., 1987, A simple model of capital market equilibrium with incomplete information, *Journal of Finance* 42, 483-510.

Stehle, R., 1977, An empirical test of the alternative hypotheses of national and international pricing of risky assets, *Journal of Finance* 32, 493-502.

Stulz, R.M., 1981, On the effects of barriers to international investment, *Journal of Finance* 36, 923-934.

Stulz, R.M., 1999, Globalization of equity markets and the cost of capital, NBER Working Paper No. 7021.

Table 1
Equity Holdings of Pension Funds and Life Assurance Companies

	Pension Funds		Life Insurance Companies	
	1992	1999	1992	1999
EMU countries				
Austria	—	38.9	6.5	25.0
Belgium	50.0	80.8	7.1	58.8
France	14.3	37.3	7.9	19.4
Germany	18.3	31.7	5.2	34.7
Ireland	56.5	69.2	0.0	48.5
Italy	0.0	10.9	33.0	12.8
Netherlands	56.3	76.0	23.3	31.3
Spain	6.3	59.4	3.3	9.0
Average EMU	28.8	50.5	10.8	29.9
Non-EMU countries				
Australia	26.2	25.5	30.1	21.6
Canada	29.1	24.1	38.4	39.3
Japan	22.9	35.4	10.0	26.7
Sweden	12.5	11.1	37.0	36.0
UK	28.1	32.4	17.5	29.0
US	7.8	15.9	2.9	3.2
Average non-EMU	19.4	20.9	24.0	26.9

The Table reports the actual foreign equity holdings of pension funds and life insurance companies as a percentage of total equity holdings in 1992 and 1999. Both private and public pension funds are considered. Data are from Intersec Research Corp.

Table 2
Summary Statistics: Excess Returns

	BE	FR	GE	IT	NL	SP	Avg.
			Resources				
r	0.009	0.129	-0.156	0.265	0.171	0.194	0.102
σ	2.734	3.581	2.685	2.289	2.572	2.786	3.312
ρ_l	0.448	0.427	0.149	0.377	0.404	0.474	0.380
ρ_{EU}	0.281	0.424	0.154	0.229	0.353	0.396	0.306
$\rho_l - \rho_{EU}$	0.167	0.003	-0.005	0.148	0.051	0.078	0.074
			Basic				
r	0.075	0.081	0.080	-0.099	0.093	0.063	0.049
σ	2.252	2.392	2.291	3.651	2.742	2.982	2.718
ρ_l	0.539	0.532	0.418	0.523	0.418	0.498	0.488
ρ_{EU}	0.369	0.499	0.378	0.384	0.391	0.418	0.406
$\rho_l - \rho_{EU}$	0.170	0.033	0.040	0.139	0.027	0.080	0.082
			General Industrials				
r	0.228	0.132	0.036	-0.167	0.201	0.137	0.095
σ	2.201	2.642	2.196	3.884	3.991	2.687	2.934
ρ_l	0.534	0.538	0.499	0.503	0.317	0.487	0.480
ρ_{EU}	0.407	0.516	0.435	0.340	0.298	0.403	0.400
$\rho_l - \rho_{EU}$	0.127	0.022	0.064	0.163	0.019	0.084	0.080
			Utilities				
r	0.296	0.272	0.133	0.315	——	0.352	0.274
σ	1.944	3.437	1.327	3.540		2.655	2.581
ρ_l	0.438	0.228	0.177	0.519		0.603	0.393
ρ_{EU}	0.261	0.229	0.156	0.370		0.488	0.301
$\rho_l - \rho_{EU}$	0.177	-0.001	0.021	0.149		0.115	0.092
			Information Technology				
r	0.687	0.095	0.743	–0.066	0.395	———	0.371
σ	5.606	3.945	5.295	3.744	4.192		4.556
ρ_l	0.139	0.509	0.273	0.388	0.261		0.314
ρ_{EU}	0.135	0.509	0.271	0.249	0.252		0.283
$\rho_l - \rho_{EU}$	0.004	0.000	0.002	0.139	0.009		0.031

	BE	FR	GE	IT	NL	SP	Avg.
				Financials			
r	0.252	0.135	0.117	0.115	0.322	0.222	0.194
σ	2.084	3.001	2.531	3.138	2.406	3.106	2.711
ρ_l	0.577	0.476	0.418	0.577	0.506	0.589	0.524
ρ_{EU}	0.428	0.460	0.341	0.378	0.461	0.495	0.427
$\rho_l - \rho_{EU}$	0.149	0.016	0.077	0.199	0.045	0.094	0.097
				Cyclical Consumer Goods			
r	——	0.098	0.113	0.079	0.076	-0.147	0.044
σ		2.088	2.382	3.756	3.545	5.699	4.245
ρ_l		0.491	0.436	0.558	0.187	0.175	0.369
ρ_{EU}		0.465	0.422	0.397	0.173	0.156	0.321
$\rho_l - \rho_{EU}$		0.026	0.014	0.161	0.014	0.019	0.048
				Non-Cyclical Consumer Goods			
r	0.393	0.226	0.089	0.107	0.282	0.123	0.203
σ	2.623	2.376	1.880	3.610	2.242	2.823	2.592
ρ_l	0.424	0.556	0.419	0.459	0.444	0.485	0.465
ρ_{EU}	0.349	0.513	0.393	0.338	0.406	0.376	0.396
$\rho_l - \rho_{EU}$	0.075	0.043	0.026	0.121	0.038	0.109	0.069
				Cyclical Services			
r	0.199	0.098	0.114	0.014	0.260	0.288	0.162
σ	2.124	2.087	2.341	2.630	2.037	2.523	2.290
ρ_l	0.449	0.521	0.414	0.481	0.465	0.549	0.480
ρ_{EU}	0.347	0.491	0.382	0.368	0.449	0.429	0.411
$\rho_l - \rho_{EU}$	0.102	0.030	0.032	0.113	0.016	0.120	0.069
				Non-Cyclical services			
r	0.112	0.444	0.233	0.415	0.258	0.393	0.309
σ	3.333	2.692	3.082	4.274	2.686	3.450	3.253
ρ_l	0.477	0.388	0.455	0.515	0.306	0.523	0.444
ρ_{EU}	0.364	0.362	0.413	0.389	0.296	0.391	0.369
$\rho_l - \rho_{EU}$	0.113	0.026	0.042	0.126	0.010	0.132	0.075

The weekly excess returns are measured as national returns in euros minus the 1 month euro interest rate, which is transformed to reflect the return over a weekly horizon. Columns refer to countries as follows: BE: Belgium, FR: France, GE: Germany, IT: Italy, NL: Netherlands, SP: Spain. All statistics are reported separately for each sector. The first row reports the mean excess return, r. The second row reports the standard deviation of the excess return, σ. The third row reports correlation coefficient, ρ_l, of excess returns between the sector and its local market index. The fourth row reports the

correlation coefficient, ρ_{EU}, of excess returns between the sector and the EU-11 market index. The fifth row reports the difference between the two correlation coefficients, $\rho_l - \rho_{EU}$. The final column of the table reports the average for the sector across all countries. The local market excess returns are total market excess returns. The EU-11 index is a value weighted average of the 11 EMU countries. All data are collected from Datastream and are sampled from 28:06:91 to 25:12:98.. When sector data is not available a blank is recorded in the table.

Table 3
Forward Interest Differentials: Summary Statistics

Country	Mean	Standard Deviation	Minimum	Maximum
Belgium	0.388	0.327	-0.090	1.042
France	0.282	0.458	-0.328	1.339
Germany	-0.518	0.399	-1.779	0.036
Italy	2.776	1.625	-0.016	5.734
Netherlands	0.053	0.150	-0.186	0.438
Spain	2.482	1.584	-0.028	5.704

For each of the countries we report summary statistics of forward interest differentials vis-á-vis Germany. The forward interest differentials are calculated from swap rates between fixed and floating rate government bonds as follows: define $w_{i,\tau}$ as the swap rate for an interest rate contract on government bonds of country i in which the interest payments of a variable rate government bond with τ years to maturity are exchanged against the interest payments of a fixed rate government bond with the same years to maturity. Let $f^n_{i,T}$ denote the n-year forward rate T years from now. From the swap rates we can calculate the forward rates as:

$$f^n_{i,T} = \left[\frac{(1 + w_{i,T+n})^{T+n}}{(1 + w_{i,T})^T} \right]^{\frac{1}{n}} - 1$$

We set $n = 8$ and $T = 2$ and hence for each market the eight year forward rate in two years time is calculated. From this we calculate interest differentials for each market vis-á-vis Germany: $s_{i,t} = f^8_{i,2} - f^8_{GE,2}$. For Germany, the forward interest differential is calculated against the ECU: $s_{GE,t} = f^8_{GE,2} - f^8_{ECU,2}$. Interest rate swap yields for Belgium are converted to a 360 day year by multiplying by (360/365). In all other countries the day count basis is 360. The interest rate swap data are Friday quotes of the all-in cost of the fixed-side of the swap outright from Datastream International. The data are sampled weekly from 28:6:91 to 25:12:98.

Table 4
Partial Integration Estimates of Equity Betas

Belgium

	RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
β^{EU}	0.42* (0.06)	0.42* (0.03)	0.50* (0.04)	0.25* (0.03)	0.56* (0.17)	0.54* (0.02)	—	0.54* (0.05)	0.39* (0.04)	0.78* (0.06)
β^{L}	0.94* (0.09)	0.87* (0.07)	0.74* (0.07)	0.61* (0.09)	0.12 (0.24)	0.59* (0.08)	—	0.62* (0.11)	0.66* (0.07)	0.85* (0.12)
γ_1	−47.30* (2.87)									

France

	RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
β^{EU}	0.63* (0.05)	0.52* (0.03)	0.59* (0.03)	—	1.12* (0.04)	0.65* (0.03)	0.64* (0.03)	0.57* (0.03)	0.43*	0.46* (0.04)
β^{L}	0.79* (0.15)	0.60* (0.06)	0.69* (0.05)	—	0.58* (0.15)	0.66* (0.09)	0.57* (0.08)	0.59* (0.05)	0.53* (0.05)	0.48* (0.08)
γ_1	−23.77* (1.122)									

Germany

	RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
β^{EU}	0.31* (0.07)	0.36* (0.03)	0.43* (0.02)	0.15* (0.03)	0.99* (0.10)	0.44* (0.03)	0.62* (0.03)	0.34* (0.02)	0.45* (0.05)	0.67* (0.04)
β^{L}	−0.06 (0.11)	0.57* (0.07)	0.56* (0.06)	0.04 (0.05)	0.24 (0.16)	0.51* (0.08)	0.56* (0.08)	0.44* (0.06)	0.44* (0.08)	0.59* (0.07)
γ_1	−34.02* (2.23)									

Italy

	RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
β^{EU}	0.45* (0.15)	0.61* (0.08)	0.57* (0.07)	0.52* (0.06)	0.17** (0.08)	0.54* (0.03)	0.60* (0.04)	0.66* (0.08)	0.47* (0.06)	0.67* (0.07)
β^{L}	0.55* (0.07)	0.601*	0.62* (0.03)	0.62* (0.04)	0.59* (0.05)	0.56* (0.03)	0.70* (0.03)	0.48* (0.05)	0.37* (0.03)	0.70* (0.04)
γ_1	−6.95* (0.53)									

Netherlands

	RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
β^{EU}	0.31* (0.04)	0.52* (0.04)	0.45* (0.06)	—	0.42* (0.09)	0.63* (0.03)	0.28* (0.08)	0.51* (0.03)	0.49* (0.03)	0.39* (0.04)
β^{L}	1.14* (0.15)	0.70* (0.18)	1.21* (0.23)	—	1.02* (0.25)	0.52* (0.13)	0.44 (0.31)	0.46* (0.11)	0.50* (0.10)	0.54* (0.18)
γ_1	−35.895* (1.97)									

Spain

	RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
β^{EU}	0.43* (0.07)	0.52* (0.07)	0.61* (0.09)	0.56* (0.05)	—	0.93* (0.04)	0.78* (0.31)	0.52* (0.07)	0.48* (0.05)	0.82* (0.07)
β^{L}	0.56* (0.04)	0.58* (0.04)	0.45* (0.05)	0.65 (0.04)	—	0.57* (0.05)	0.18 (0.13)	0.53* (0.04)	0.56* (0.04)	0.62* (0.06)
γ_1	−32.82* (1.85)									

Estimates of local and global betas and the integration parameter from the following regression are reported:

$$\begin{aligned} \mathbf{r}_{i,t} &= \theta_{i,t-1}\left(\boldsymbol{\beta}_i^{EU} r_t^{EU}\right) + (1-\theta_{i,t-1})\left(\boldsymbol{\beta}_i^{L} r_t^{L}\right) + \mathbf{e}_{i,t} \\ \theta_{i,t-1} &= \gamma_{0,i} + \exp\left(\gamma_{1,i}\left|s_{i,t-1}\right|\right) \end{aligned}$$

where $r_{i,t}$ is the $1 \times n$ vector of sector excess returns in country i, β_i^{EU} is a $1 \times n$ vector of sector betas with respect to the EU-wide index, defined as r_t^{EU}, β_i^{L} is a $1 \times n$ vector of sector betas with respect to the local index of country i, defined as r_t^{L}, $\theta_{i,t-1}$ is the degree of integration of country i into the EU market, conditional on information up to time $t-1$, $s_{i,t-1}$ and $e_{i,t}$ is a vector of sector residuals. Robust standard errors are in parentheses. * denotes statistically significant at the 5% level. The abbreviations are as follows: RS: Resources, BS: Basic Industries, GI: General Industrials, UT: Utilities, IT: Information Technology, FI: Financials, CG: Cyclical Consumer Goods, NG: Non-Cyclical Consumer Goods, CS: Cyclical Services, NS: Non-Cyclical Services.

Table 5
Equity Market Premia: 1973-1998

	BE	FR	GE	IT	NL	SP	EU-11
Mean	8.09	12.85	6.18	15.10	10.57	13.52	9.76
Standard Deviation	21.89	31.77	23.70	41.94	21.83	29.08	22.65

The arithmetic equity premia for the countries is calculated using annual data over the period 1973-1998. The excess returns are calculated in euros. The EU index is a market value weighted average of the EU-11 countries. The risk free rate is the short term German rate.

Table 6
Estimates of the Cost of Equity

	BE	FR	GE	IT	NL	SP	Avg.
Resources							
Full Sample	6.469 (20%)	8.302 (28%)	1.006 (100%)	7.439 (14%)	6.344 (30%)	7.025 (10%)	6.098 (37%)
Final Observation	4.291 (91%)	6.270 (96%)	2.996 (100%)	4.426 (98%)	3.731 (74%)	4.168 (99%)	4.314 (93%)
Basic Industries							
Full Sample	6.113 (21%)	6.489 (36%)	3.538 (40%)	8.421 (16%)	5.961 (57%)	7.447 (11%)	6.328 (30%)
Final Observation	4.237 (92%)	5.174 (96%)	3.542 (100%)	6.008 (98%)	5.288 (90%)	5.139 (99%)	4.898 (96%)
General Industrial							
Full Sample	5.650 (27%)	7.439 (36%)	3.763 (45%)	8.494 (15%)	7.479 (37%)	6.054 (15%)	6.479 (29%)
Final Observation	4.954 (94%)	5.812 (97%)	4.226 (100%)	8.679 (98%)	5.039 (80%)	5.964 (99%)	5.779 (95%)
Utilities							
Full Sample	4.153 (18%)	—	0.721 (82%)	8.405 (14%)	—	8.245 (10%)	5.381 (31%)
Final Observation	2.529 (90%)	—	1.454 (100%)	5.094 (98%)	—	5.495 (99%)	3.643 (97%)
Information Technology							
Full Sample	2.383 (73%)	9.111 (56%)	4.787 (81%)	7.297 (5.3%)	6.530 (40%)	—	6.022 (51%)
Final Observation	5.203 (99%)	10.861 (98%)	9.662 (100%)	1.768 (94%)	4.659 (82%)	—	6.431 (95%)
Financials							
Full Sample	4.924 (36%)	7.457 (39%)	3.583 (48%)	7.776 (16%)	5.928 (66%)	7.946 (17%)	6.269 (37%)
Final Observation	5.254 (97%)	6.383 (97%)	4.255 (100%)	5.277 (98%)	6.139 (93%)	9.035 (99%)	6.057 (97%)
Cyclical Consumer Goods							
Full Sample	—	6.839 (43%)	4.515 (54%)	9.531 (14%)	3.464 (50%)	3.202 (36%)	5.510 (39%)
Final Observation	—	6.253 (97%)	6.021 (100%)	5.899 (98%)	2.905 (87%)	7.555 (99%)	5.727 (96%)
Non-Cyclical Consumer Goods							
Full Sample	5.079 (33%)	6.659 (39%)	2.935 (45%)	7.112 (21%)	4.930 (63%)	8.835 (15%)	5.925 (36%)
Final Observation	5.283 (95%)	5.610 (97%)	3.289 (100%)	6.412 (99%)	4.952 (92%)	8.976 (98%)	5.754 (97%)

Cyclical Services							
Full Sample	4.880 (25%)	5.641 (35%)	3.426 (52%)	5.420 (20%)	4.926 (61%)	7.171 (10%)	5.244 (34%)
Final Observation	3.894 (93%)	4.297 (96%)	4.431 (100%)	4.618 (99%)	4.782 (92%)	4.760 (99%)	4.463 (97%)
Non-Cyclical Services							
Full Sample	7.108 (34%)	6.768 (31%)	4.832 (55%)	9.711 (16%)	4.493 (53%)	8.358 (15%)	6.878 (34%)
Final Observation	7.612 (96%)	4.607 (96%)	6.558 (100%)	6.623 (98%)	3.946 (89%)	8.010 (100%)	6.226 (97%)

Each column represents a different country. The last column provides an arithmetic mean of the six countries. In each industry, the first row reports estimates of the average cost of equity and the second row reports end of sample estimates, denoted in percent. Inside the parentheses is the contribution of the global (EU-specific) cost of equity component to the total cost of equity. The sample period is from 1/5/1991 to 12/25/1998.

Table 7
Cumulative Effect of Integration on the Cost of Equity

Panel A: Sector Effect

RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
−2.88*	−2.07*	−2.18*	−2.15*	0.63	−0.48*	0.11	−0.65*	−1.07*	−0.61*

Panel B: Country Effect

	BE	FR	GE	IT	NL	SP
All Industries	−0.57*	−1.55*	2.08*	−3.61*	−2.40*	−1.07*
Ex-IT	−1.16*	−2.13*	1.46*	−3.24*	−2.12*	−1.07*

Panel A reports for each sector the cross-country average of the cumulative change in the cost of equity using equal weights. Panel B reports for each country the cross-sectoral average of the cumulative change in the cost of equity using equal weights. We report two numbers for each country. The first is the average across all ten sectors, the second is across nine omitting the IT sector. * denotes statistically significant at the 5% level.

Table 8
Convergence in the Cost of Equity

Panel A: Cross-Country Dispersion within a Sector

	RS	BS	GI	UT	IT
a_1	-0.006*	-0.002*	-0.005*	-0.005*	-0.003*
	FI	CG	NG	CS	NS
a_1	-0.002*	-0.005*	-0.002*	-0.003*	-0.002*

Panel B: Cross-Sectoral Dispersion within a Country

	BE	FR	GE	IT	NL	SP
a_1	-0.006*	0.005*	0.004*	-0.001*	-0.011*	-0.004*

Panel A reports estimates of the trend coefficient in the cost of equity across countries. For a given sector j, we compute the cross-country standard deviation of the cost of equity in each week t and test for the existence of a negative trend over time from the following regression:

$$\sigma_{jt} = a_0 + a_1 trend + u_{jt}$$

where σ_{jt} is the cross-country standard deviation of sector j in week t, a_0 and a_1 are estimated coefficients and u_{jt} is an error term.
Panel B reports estimates of the trend coefficient in the cost of equity across sectors. For a given country i, we compute the cross-sectoral standard deviation of the cost of equity in each week t and test for the existence of a negative trend over time from the following regression:

$$\sigma_{it} = a_0 + a_1 trend + u_{it}$$

where σ_{jt} is the cross-sector standard deviation of country i in week t, a_0 and a_1 are estimated coefficients and u_{it} is an error term. * denotes statistically significant at the 5% level.

Table 9
Cumulative Effect of Integration on the Cost of Equity Across Sectors: Non-Euro EU Members

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Panel A: Sector Effect

RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
−0.65	−0.42	−0.10	−0.30	−0.45	−0.57	−0.54	−0.59	−0.03	0.15

Panel B: Country Effect

	DK	SD	UK
All Industries	0.30	−1.28	−0.06

Panel A reports for each sector the cross-country average of the total change in the cost of equity using equal weights. Panel B reports for each country the cross-sectoral average of the total change in the cost of equity using equal weights. We report two numbers for each country. The first is the average across all ten sectors, the second is across nine omitting the IT sector. * denotes statistically significant at the 5% level

Table 10
Cumulative Effect of Integration on the Cost of Equity Using an Alternative Measure of θ_i

Panel A: Sector Effect

RS	BS	GI	UT	IT	FI	CG	NG	CS	NS
−3.10*	−2.27*	−2.45*	−2.32*	0.37	−0.66*	−0.12	−1.03*	−1.40*	−1.23*

Panel B: Country Effect

	BE	FR	GE	IT	NL	SP
All Industries	−1.43*	−1.35*	1.10*	−3.77*	−2.23*	−1.08*

Panel A reports for each sector the cross-country average of the cumulative change in the cost of equity using equal weights. Panel B reports for each country the cross-sectoral average of the cumulative change in the cost of equity using equal weights. We report two numbers for each country. The first is the average across all ten sectors, the second is across nine omitting the IT sector. * denotes statistically significant at the 5% level.

Table 11
Tests of Restricted Models

Panel A: Likelihood Ratio Tests

	BE	FR	GE	IT	NL	SP
Complete Segmentation	20.13	18.37	24.39	4.860	20.02	18.06
	[0.045]	[0.073]	[0.018]	[0.960]	[0.045]	[0.081]
Complete Integration	100.58	28.93	40.42	72.68	40.11	78.15
	[0.000]	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]

Panel B: Average Differences in Estimated Equity Premia

	BE	FR	GE	IT	NL	SP
Complete Segmentation	2.17	1.33	0.62	0.27	0.51	0.57
Complete Integration	1.46	0.98	1.94	2.01	0.97	1.47

Panel A of this table reports likelihood ratio tests of the restricted models (complete segmentation and complete integration) against the unrestricted model (partial integration). In Panel B we report the average absolute differences in the estimated cost of equity between the partially integrated model and the two restricted models are reported below in percentage terms. The tests are distributed $\chi^2(2)$. Probability values are reported in brackets.

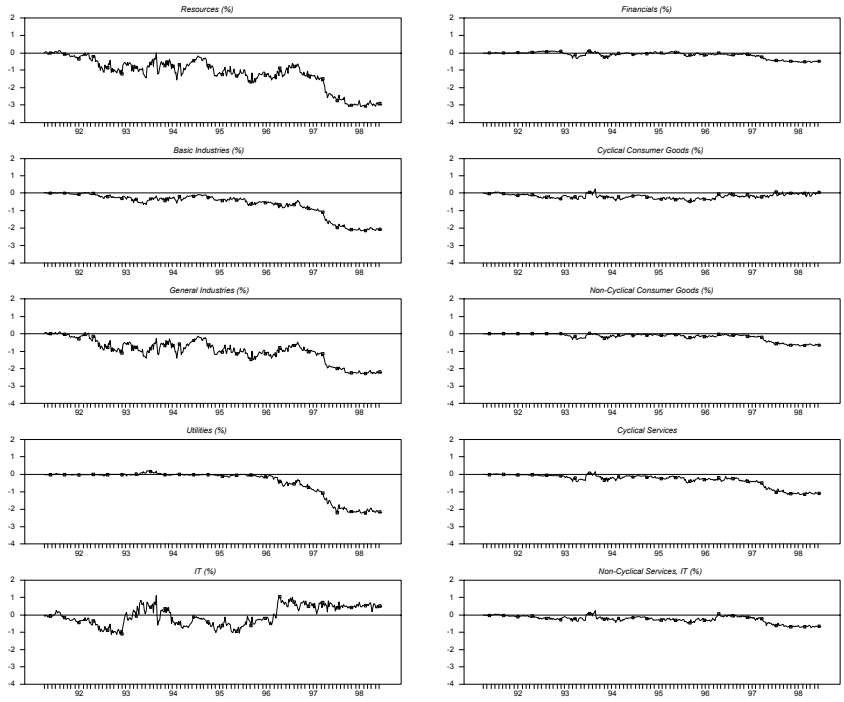

Figure 1: Cummulative Saving in the Cost of Equity

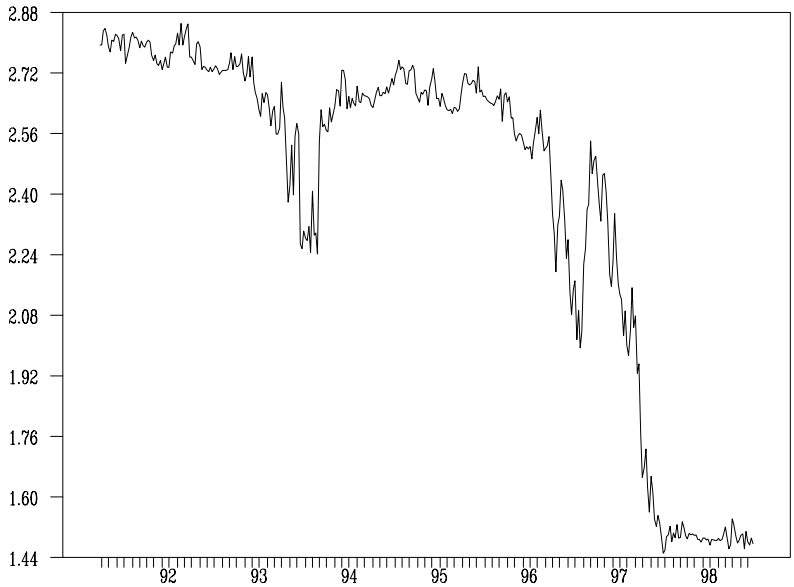

Figure 2: Average Cross-Country Dispersion of the Cost of Equity within a Sector

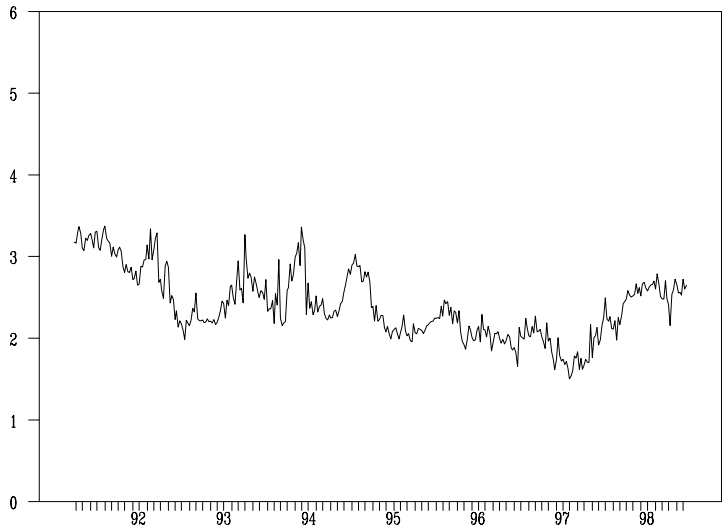

Figure 3: Average Cross-Sectoral Dispersion in the Cost of Equity Capital with a Country