Measuring capital market integration

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Abstract

The convergence of European economies in the wake of European monetary union, together with increasingly common dynamics in currency and equity returns, suggests that capital markets are at least partially integrated. We impose a dynamic factor analytical model for the returns on currency and stock portfolios on eight European markets, taking into account predictability by forward premia and dividend yields. The resulting asset pricing model is characterised by time-varying risk premia, and constant betas and return variances. We propose a measure of the degree of integration and examine its evolution from 1979 until 1997. We find that the degree of integration for equity markets increased in the 1990s but that this was mainly due to an increase in the premium for extra-European currency risk. We also find that the sources of co-movement lie only in part in the US equity markets.

1. Introduction

This paper studies the extent to which capital markets in Europe are integrated. If markets are completely integrated, assets possessing the same risk characteristics will have the same price even if they are traded on different markets. In completely integrated capital markets, investors face common and country-specific or idiosyncratic risk, but price (identically in all markets) only common risk factors, because country-specific risk is fully diversifiable. When markets are partially integrated, investors face both common and idiosyncratic risks and price them both. If markets are completely segmented, investors face and price only country-specific sources of risk. In this case, the same projects in two countries can have different expected returns, since the sources of risk and their prices may differ across markets.

One way to measure the degree of financial integration is to study the effect of legal barriers and taxes on capital flows[2] or prices,[3] such as restrictions on foreign stock ownership and regulations on mutual funds' investments. This approach suffers from the disadvantage that, on the one hand, not all countries impose the same formal restrictions on capital flows, and on the other hand, investors find ways to circumvent legal barriers to arbitrage, so that cross-country comparisons and the effective intensity of segmentation become difficult to measure.

Another approach is to test whether markets are integrated by assuming an asset pricing model. Under the assumption of fully integrated capital markets, the price of an asset will depend on its covariance or beta with the return on a mean variance efficient benchmark portfolio. This approach has been used extensively to study world capital market integration: for example by Harvey (1989, 1991) and De Santis and Gerard (1997) through a world CAPM; by Ferson and Harvey (1993, 1994) through a multiple risk observable factor model; and by Adler and Dumas (1983), Stulz (1981, 1998), Dumas and Solnik (1995), Dumas (1994) and De Santis et al (1998) through a world CAPM with currency risk and a consumption-based model. Testing integration in this framework entails testing the

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2 See, for example, Portes and Rey (1999) and Lemmen and Eijffinger (1995). More recently, Bekaert and Harvey (1995) have used capital flows together with other macroeconomic variables to date integration in world markets.

3 For example, Hietala (1989) and Bailey and Jagtiani (1994) study the price differential between restricted and unrestricted shares that have identical payoffs, and Bonser-Neal et al (1990) study the differences between official and black market exchange rates, between official and offshore interest rates, or between the market price and the net asset value of closed end mutual funds.

pricing restriction imposed on all the assets by the model. Therefore, if the benchmark portfolio is misspecified, in the sense that it does not capture all systematic sources of risk, the test will reject the integration hypothesis incorrectly. In order to curtail this problem, it is possible to consider that, even though the benchmark portfolio is unobservable, the covariance matrix of the asset returns follows a latent factor structure. Arbitrage pricing theory (APT) tells us that, as long as the latent risk factors are correctly identified, assets can be priced accurately through their covariance with the factors. In this case, identification of the systematic sources of risk is, from a statistical point of view, more complicated, in the sense that one needs to make assumptions on the statistical properties of the data generating process for returns. Such assumptions are made on the conditional mean of returns (Campbell and Hamao (1992), Bekaert and Hodrick (1992)), the conditional variance of returns or the conditional variance of the factors, such as the factor-ARCH model used by Engle et al (1990) and many others more recently, such as Ferson and Harvey (1999). The APT provides us with a pricing restriction that can be tested or used to ascertain the validity of the factor model. In the framework of an international APT, this is the approach followed by King et al (1994) and Sentana et al (1999) to study the sources of time variation in the correlations between market returns and the effects of EMU on the cost of capital.

In this paper, we use a K-latent dynamic factor model with constant betas and constant conditional second moments for currency and stock returns on eight European markets. A dynamic factor approach is needed in order to capture the predictability of monthly returns.[4] In particular, the asset pricing model is dynamic in the sense that conditional expected returns vary through time because common factor risk premia are time-varying.[5] Furthermore, because an investor would price only systematic sources of risk, the model for returns should be able to distinguish between this type of risk and idiosyncratic or diversifiable risk. Therefore, I adopt the dynamic factor model proposed by Forni and Reichlin (1998). This model imposes returns to be predictable, the source of predictability and co-movement being "European" common shocks that propagate across markets and countries and generate the observed co-movement of returns. In fully integrated markets, these common shocks also constitute systematic or undiversifiable "business cycle risks", as opposed to idiosyncratic or country-specific sources of risk which a European investor can completely diversify away by investing in the different markets.

This paper evaluates the extent to which the source of common risk valued by investors in European markets is "macroeconomic" fluctuations, in contrast to "financial" ones, and investigates whether their source lies in Europe or spills over from the US economy and financial markets. Having imposed the dynamic factor model on the set of asset returns in different European countries, we are able to extract their common component. This is, by construction, the part of each market's expected asset return that is spanned by the same systematic risk premia and it is used to investigate the following questions concerning the sources of the common shocks: What are the sources of common fluctuations in stock returns? Have the aggregate currency and market risk premia increased? Does the source of EU-wide market risk lie in US or home output? Furthermore, are European financial common components mainly due to spillovers from the US stock markets?

The organisation of this paper is as follows. Section 1 presents the dynamic factor model, which we impose on returns on currency and stock portfolios across European markets. Section 2 describes the asset pricing model and uses a "no arbitrage opportunities" argument to show that asset returns will follow a one-factor model under the hypothesis that capital markets are perfectly integrated. Section 3 presents the estimation methodology and the measure of the degree of integration. Section 4 presents the empirical application and the results. Section 5 summarises and concludes.

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4 For the United States, see Fama and French (1992), Fama (1990) and Bekaert and Hodrick (1992); see also Campbell and Hamao (1992) for international currency and stock returns and Canova and DeNicolo (1997) for currency and bond returns in Europe.

5 In a general equilibrium model, common factor risk premia would reflect the price of risk associated with the business cycle.

2. The conditional factor model for returns

The starting point for the analysis is a dynamic factor model for returns, based on the dynamic factor analytical model proposed by Forni and Reichlin (1998). Assume a world with a large number of countries, i = 1...N. For each country, consider the returns on two types of portfolios: a currency portfolio with excess return χ_{it}^{c}, and a stock portfolio with return χ_{it}^{r}. Stock returns are expressed in home currency, in excess of the eurocurrency rate for a one-month investment on the London market. Currency returns are considered for a covered investment in USD and, under interest rate parity, we have that currency returns are currency prices in excess of the previous month forward rate. Consider also dividend yields, χ_{it}^{dy}, and forward premia, χ_{it}^{fp}. Let us assume that the vector return process χ_{it}, of size equal to J = 4, containing the stacked $\left\{\chi_{it}^{(j)}\right\}$ $j=\{c,r,dy,fp\}$, has the following dynamic factor structure:

$$\chi_{it}=\mu_i+\sum_{k=1}^{K}C_k^i(L)u_{kt}+\varepsilon_{it}\,,\quad i=1...N \tag{1}$$

K < NJ is the dimension of the factor model. Of course, we can write equation (1) for each variable separately, but for what we will need further on, we will just present the two equations concerning returns:

$$\chi_{it}^{c}=\mu_i^{c}+\sum_{k=1}^{K}C_{ck}^{i}(L)u_{kt}+\varepsilon_{it}^{(c)}=\chi_{it}^{(c)}+\varepsilon_{it}^{(c)} \tag{2}$$

$$\chi_{it}^{r}=\mu_i^{r}+\sum_{k=1}^{K}C_{rk}^{i}(L)u_{kt}+\varepsilon_{it}^{(r)}=\chi_{it}^{(r)}+\varepsilon_{it}^{(r)} \tag{3}$$

where $\left\{\mu_i^j\right\}$ are the unconditional means of the variables, $u_{kt}\,,k=1...K$ are K shocks or systematic risk factors, common to all European capital markets and economies, $\left\{\varepsilon_{it}^{(j)}\right\}$ are country- and variable-specific or idiosyncratic components associated with currency, stock returns, dividend yields and forward premia in each country respectively, $\left\{C_{jk}^{i}(L)\right\}$ are infinite order lag polynomials in the lag operator L and $\left\{\chi_{it}^{(j)}\right\}$ will be called the common components. The common shocks are uncorrelated with each other contemporaneously and at all leads and lags, and uncorrelated with all idiosyncratic variables. In particular, for E_{t-1}, noting the conditional expectation with respect to the information set, the following assumptions are made:

1. The common shocks $u_{kt}\,,k=1...K$ and the idiosyncratic components, $\left\{\varepsilon_{it}^{(j)}\right\}$, are zero mean variables, mutually uncorrelated and orthogonal at all leads and lags, ie $E_{t-1}u_{kt}=0$ for $k=1...K$ and $E_{t-1}\varepsilon_{it}=0$,
   $E_{t-1}u_{kt}u_{lt}=0$ for $k,l=1...K$, $E_{t-1}u_{kt}\varepsilon_{it}=0$ for $k=1...K$

   which, in turn, implies:

   $E_{t-1}u_{lt}u_{kt-s}=0$ for $s=1,2...$, and $E_{t-1}u_{kt}\varepsilon_{it-s}=0$ for $k=1...K, s=1,2...$

2. $E_{t-1}(u_{kt-1})^2=E(u_{kt-1})^2=\sigma^2$ for $k=1...K$: the common shocks have constant conditional variances.

3. $E_{t-1}\left(\varepsilon_{it}^{(j)}\right)^2\prec\infty,\forall j$: the idiosyncratic term also has constant and finite conditional variance.

Furthermore, as in Forni and Reichlin (1998), it is assumed that the idiosyncratic components are mutually orthogonal, although they could be autocorrelated.

The model allows for cross section and time series heterogeneity, since the degree of the lag polynomials may differ across countries. Using a law of large numbers argument, Forni and Reichlin

(1998) show that as the cross section becomes asymptotically large, because of the orthogonality property of the idiosyncratic components, the idiosyncratic component "vanishes" when we form K aggregates of the variables.[6] This means that the K aggregates, formed by taking linear combinations of the variables, will span the space of the common shocks and that we can use them to identify the number of common shocks, recover the common component and also estimate the factor risk premia.

This factor model for the asset returns is observationally equivalent to the general K-factor model with time-varying conditional mean for returns and constant second moments used in the financial literature by, for example, Fama (1990), Campbell and Hamao (1992) and Bekaert and Hodrick (1992). To see this, note that equation (1) can be rewritten in the following way:

$$\begin{aligned} \chi_{it} &= E_{t-1}\chi_{it} + \sum_{k=1}^{K} C_k^i(0)\mu_{kt} + \varepsilon_{it} = E_{t-1}\chi_{it} + \eta_{it} \\ \text{with } E_{t-1}\chi_{it} &= \mu_i + \sum_{k=1}^{K} C_k^i(L)\mu_{kt-1} \end{aligned} \tag{4}$$

where $E_{t-1}\chi_{it}$ is the vector of the conditional mean returns on the currency and stock portfolios or, in other terms, the risk premia for the portfolios in country i and η_{it} is the corresponding unanticipated (at t-1) component for returns. Notice that the information set I_{t-1} also contains the past of dividend yields and forward premia. The usual factor representation for the covariance structure of returns is the following:

$$\chi_{it} = E_{t-1}\chi_{it} + \sum_{k=1}^{K} \beta_{ik} f_{kt} + \varepsilon_{it} \tag{5}$$

The factors, f_{kt}, are mutually orthogonal and uncorrelated with the idiosyncratic term ε_{it}, and the time-invariant beta coefficients β_{ik} measure the sensitivity of each asset to the common sources of risk. In the general case, the statistical model for returns does not explicitly restrict the conditional mean to depend on the factors. An asset pricing restriction obtained through an economic model such as a partial equilibrium consumption model, or through a model-free assumption, such as a no arbitrage opportunities argument, will link the conditional mean of returns to time-varying factor risk premia. Furthermore, all time variation in the risk prices is assumed to be captured by a few state variables in the information set. The dynamic factor model imposes that the state variables in the economy and the asset returns span the same space, which in turn is spanned by the common shocks. The conditional mean of the returns depends for this reason on the factors themselves and the betas measure not only the sensitivity of individual asset returns to the different sources of risk, but also the delay in propagation of the shocks in each market and country.

Equations (2) and (3) decompose returns into two components. The first, χ_{it}, is spanned by the present and past of the common shocks or risk factors and the second, ε_{it}, is country- and variable-specific. Equations (4) and (5) decompose the unanticipated component of returns into two parts: the first depends on the current realisation of the common shocks but differs across countries depending on the sensitivity of each variable in each market with respect to the risk under consideration; the second is the idiosyncratic component and, under the assumptions, it is diversifiable. Note that the two representations are observationally equivalent and further assumptions need to be made to estimate the two models. One possibility is to model the variance of the asset returns as a GARCH process. In this case, the time variation of conditional asset returns stems from the time variation of factor variances, as for example in King et al (1994) and Engle et al (1990). Another possibility is to consider that time variation in conditional mean returns stems from time-varying prices/risk premia of common factor risk, as for example in Bekaert and Hodrick (1992). The dynamic factor model also uses this second approach.

The motivation for this is twofold. First, we would like to focus on whether a few European-wide shocks can generate common cycles in currency and stock returns across countries. There is evidence in

[6] The same result is obtained through milder conditions on the idiosyncratic components in Forni and Lippi (2000) and Forni et al (1999).

Europe that a few variables have the ability to forecast returns on different markets and for different types of assets. Canova and De Nicolo (1995), based on a theoretical model developed in Canova (1993), present some empirical evidence on the relation between stock returns and real activity in Europe in the form of Fama regressions. Calibration of their theoretical model to European data supports the view that international linkages in stock returns emerge because foreign variables contain information about the future path of domestic variables. In another paper, Canova and De Nicolo (1997) examine the relation between stock returns, the term structure of interest rates, inflation and real activity for the United States, Japan, the United Kingdom and Germany from an open economy perspective. They find that nominal stock returns are linked with US inflation and United States, rather than European real variables, and that real and financial variables do not respond to innovations in inflation and exchange rates. Patelis (1997) confirms for the United States that variables that predict the US business cycle, such as the term spread, have the ability to predict US stock returns.

The second motivation for using a dynamic factor model is that, when using weekly or daily data, asset pricing models that impose time variation in second moments perform well empirically, and the GARCH modelling approach seems more suitable; with monthly data however, conditional return variances appear to be constant whereas time variation in the conditional mean is more important, and therefore, the second approach should be more appropriate. Predictability of stock returns, which is associated with time-varying expected returns, is mainly observed over long horizons, as shown for the US by Fama (1990), and Schwert (1990). However, changes in the conditional variance of stock returns are observed mainly in daily and weekly data and not over longer periods. In particular, volatility does not seem to move with business cycles, whereas there is some evidence (in the United States) that expected returns do (Schwert (1990), Harvey (1991)). Forecasts of excess stock returns do not appear to move proportionally with estimates of the conditional variance (Harvey (1989, 1991)). Finally, from a theoretical point of view, one would like ultimately to derive time-varying volatility of returns endogenously from a general equilibrium model. For example, the asset pricing restriction that we will derive in the next section can be obtained through the consumption capital asset pricing model if d_t the stochastic discount factor, is interpreted as the common intertemporal marginal rate of substitution in consumption, with power utility function. Unfortunately, as Campbell (1998) points out, there is no evidence of cyclical variation in consumption or dividend volatility that could be the source of stock market volatility or the source of time-varying mean returns.

3. Asset pricing

In the previous section, we imposed a factor structure for the asset returns. Now we will derive a pricing restriction that must hold for all assets in every market under the assumption of full integration. Then we will show how to estimate the model if we relax this assumption and how to construct a measure of integration for each market in each country.

In the general case, any factor model implies the following restriction for the conditional mean of returns using our previous notation, where λ_{kt} is the price of risk for the k^{th} risk factor[7]

$$E_{t-1}\chi_{it}^{j} = \sum_{k=1}^{K} \beta_{ik}^{j} \lambda_{kt} \quad \text{for } j = c, r \tag{6}$$

This restriction can be obtained in different ways and in each case there will be a different interpretation for the K priced sources of risk. For example, in Campbell (1996) the restriction obtains in an intertemporal asset pricing model, for a closed economy consumption CAPM, while in Adler and Dumas (1983) and Dumas (1994), it obtains for an open economy consumption CAPM with idiosyncratic exchange rate risk. Equivalently, the pricing restriction can be obtained by using arbitrage pricing theory. If no arbitrage opportunities exist, it is possible to show that, under some conditions on the size of the idiosyncratic component, a pricing kernel or stochastic discount factor will always exist and that it will allow assets to be priced correctly through its covariance with the return on each asset.

[7] The risk premia λ_{kt} belong to the information set I_{t-1}.

This approach is particularly useful in our context since, under the model assumptions, if we allowed the cross section to increase asymptotically and then formed K portfolios using the assets at hand, these aggregate portfolios would contain no idiosyncratic risk. Since the predictable component of the return of each aggregate portfolio is a linear combination of the K-factor risk premia, we can use conditional expected aggregate returns as estimates of the factor risk premia.

King et al (1994) show for a static factor model with time-varying conditional factor variances that, under a mild no arbitrage condition and under the assumption that the idiosyncratic component "vanishes" as the cross-sectional dimension increases asymptotically, there exists a stochastic discount factor d_t which prices the available assets by discounting their random payoffs to their present value. Since the condition on the idiosyncratic component is also satisfied by this dynamic factor model, we will follow their line of argument to obtain a pricing relation under the null hypothesis of completely integrated European markets.

Under the hypothesis that financial markets are fully integrated, there exists a stochastic discount factor which prices all types of assets in all markets. The discount factor can be thought of as the return on a portfolio that captures only aggregate sources of risk. For example, in a closed economy APT model, the pricing kernel is reduced to the return on the risk-free asset. In a consumption CAPM model, the pricing kernel is the intertemporal elasticity of substitution in consumption. In other words, the pricing kernel provides us with a measure with which to evaluate the riskiness of the assets. As with observable benchmark asset pricing models, the premium of the asset depends on its covariance with the benchmark portfolio, in this case d_t. Since we are considering currency returns that are in excess of the risk-free rate and stock returns that are hedged for currency risk, the absence of arbitrage opportunities in perfectly integrated markets implies the following pricing restriction on returns χ_{it}:

$$E_{t-1} d_t \chi_{it}^j = 0 \quad \text{for } j = c, r \tag{7}$$

Furthermore, since d_t is a return on an asset, it has a factor representation as in (1):

$$\begin{gathered} d_t = d_t^* + \sum_{k=1}^{K} C_k^*(0) u_{kt} + \varepsilon_t^{(*)} \\ \text{where } d_t^* = E_{t-1} d_t \end{gathered} \tag{8}$$

Now, replacing the definition for d_t from (8) and for returns from (2-3) in (7) and under the model assumptions (1) to (3), obtain:

$$E_{t-1} d_t \chi_{it}^j = 0 \Leftrightarrow d_t^* E_{t-1} \chi_{it}^j + \sum_{k=1}^{K} C_k^*(0) C_{jk}^i(0) \sigma_k^2 + E_{t-1} \varepsilon_t^* \varepsilon_{it}^{(j)} = 0 \quad \text{for } j = c, r$$

Under the null of perfectly integrated markets, d_t is, by definition, the return on a well diversified portfolio, therefore the idiosyncratic term is zero in conditional mean squares (assumption (3) in the model). So asset excess returns χ_{it} and d_t are correlated only through the common risk factors $u_{1t}, \ldots, u_{Kt}$ and as a consequence, the last term of the above sum converges to zero. It follows that the pricing restriction (7) becomes:

$$\begin{gathered} E_{t-1} \chi_{it}^j = -\sum_{k=1}^{K} \frac{C_k^*(0)}{d_t^*} C_{jk}^i(0) \sigma_k^2 \Leftrightarrow E_{t-1} \chi_{it}^j = \sum_{k=1}^{K} C_{jk}^i(0) \pi_{kt} \\ \text{with } \pi_{kt} \equiv \frac{C_k^*(0)}{d_t^*} \sigma_k^2 \quad \text{for } j = c, r \text{ and } k = 1 \ldots K \end{gathered} \tag{9}$$

where π_{kt} are the K-factor risk premia.[8] Equation (9) is the linear factor pricing model for risk and provides a connection between the conditional mean of returns and the factor risk premia. Factor risk premia measure the amount of expected return that the agent is willing to give up to reduce variability

8 Notice that $\pi_{kt} \in I_{t-1}$ since $d_t^* \in I_{t-1}$.

by σ_k^2 units. Notice that the risk premia depend on the common factors (shocks), not the assets, and that under the null of completely integrated markets, idiosyncratic risk is not priced. Factor risk premia are time-varying because the conditional mean of the pricing kernel, d_t^*, is time-varying. Full integration implies that all risk premia will be proportional to $\left(\frac{1}{d_t^*}\right)$. The next section explains how to proceed with estimation and testing.

4. Estimation and testing

The pricing equations in (9) state that the *2N* conditional expected returns on the currency and stock portfolios are proportional to the expected returns on *K* well diversified portfolios or, equivalently, to *J* linear combinations of the *K*-factor risk premia, $C(0)\pi_t$. In the next section, we follow the methodology proposed in Forni and Reichlin (1998) to construct *J* aggregates and estimate the common component of returns.

4.1 Aggregation and estimation of the common components

Under the assumptions (1)-(3) of the factor model, Forni and Reichlin (1998) show that when the cross section is asymptotically large, the idiosyncratic component vanishes through aggregation. This implies that, if *K* is known, *K* aggregates and the common shocks span the same space and, therefore, we can use the aggregates to determine the number of common (priced) risks under the null of completely integrated markets. Aggregation can be achieved using different types of averaging sequences as long as they satisfy the properties presented in Forni et al (1999). One possibility is to use simple averages, but we must check that the aggregates obtained in this way are not collinear. Collinearity would have as a potential consequence the underestimation of the dimension of the factor space *K*. One advantage of taking simple averages compared to other aggregation methods, such as static or dynamic principal components, is that they produce aggregates which are straightforward to interpret. We construct the aggregates by averaging each variable over *N* countries.

$$\chi_t^c = \frac{1}{N}\sum_{k=1}^{N}\chi_{it}^c,\ \chi_t^r = \frac{1}{N}\sum_{k=1}^{N}\chi_{it}^r,\ \chi_t^{dy} = \frac{1}{N}\sum_{k=1}^{N}\chi_{it}^{dy},\ \chi_t^{fp} = \frac{1}{N}\sum_{k=1}^{N}\chi_{it}^{fp}$$

To estimate *K*, we use a procedure based on the dynamic eigenvalues of χ_{it} described in Forni et al (1999). Then, to obtain a consistent estimate of the common component, we regress each variable (demeaned) on the past, present and future of the aggregates as in equation (10):

$$\chi_{it}^j = \sum_{j=c,r,dy,fp}\left(\sum_{l=-p}^{p}\gamma_{j,l}\chi_{t-l}^j\right) + \hat{\varepsilon}_{it}^j \Rightarrow R_{ij}^2 \qquad (10)$$

Finally, we perform diagnostic tests on the estimated idiosyncratic components, $\hat{\varepsilon}_{it}^j$ to confirm that they are only mildly correlated, as is required by the model assumptions.

4.2 Measuring the degree of integration

In this section, we define the degree of integration between two markets in different countries, disentangle two sources of European-wide risk and study their evolution. Sentana et al (1999) and De Santis et al (2000) find that the prospect of European monetary union has mainly had two effects: first, to reduce the premium associated with interest rate fluctuations, as a result of a single monetary policy. In their study, Sentana et al (1999) find that lower idiosyncratic exchange rate risk leads to lower interest rate risk premia, one of the reasons being that, with a single currency, national central banks are not forced to defend their currency against other European currencies. Second, they find evidence that although the single currency eliminates intra-European currency risk, this effect is small relative to the increase in the premium for non-EMU risk.

We define the degree of integration of market *j* in country *i* to be the adjusted R^2 of regression (10). Then, to disentangle the evolution of the premia for two sources of common risk, aggregate currency risk and aggregate market risk, we use the following definitions: first, we assume that aggregate exchange rate risk is captured by the return on the aggregate currency portfolio. Aggregate currency portfolios do not contain other types of aggregate or idiosyncratic risk. Second, we define what remains once exchange rate risk is accounted for as the risk associated with a country's stock market.

$$\begin{aligned}\chi_t^c &= a_{c0} + a_{c1}\chi_t^r + e_t^c \\ \chi_t^r &= a_{r0} + a_{r1}\chi_t^c + e_t^r\end{aligned} \tag{11}$$

The components e_t^c and e_t^r represent the aggregate return in excess of the risk-free rate that rewards currency risk and market risk, respectively.

Did the elimination of intra-European currency risk also reduce risk with respect to the dollar? To what extent are co-movements in stock returns due to European-wide common market shocks? To answer these questions, we use the following decomposition: with *J* aggregates, the model is associated with a measure of fit defined previously as R_{ij}^2. We run a regression of the common component of currency returns χ_{it}^c (after we have controlled for the influence of χ_t^r) on e_t^c, and the associated $R_{c,ic}^2$ is the percentage of total variance explained by the reward to aggregate currency risk. This reflects the part of the common fluctuations of currency portfolio returns in $R_{r,ic}^2$ that can be explained by the aggregate currency risk premium. In the same way, $R_{r,ic}^2$ reflects the importance of the component of common fluctuations of stock returns that rewards EU-wide currency risk. Finally, $R_{r,ir}^2$ measures the importance of EU-wide market risk in explaining the common component of stock returns in country *i*. To summarise, $R_{c,ic}^2$, $R_{r,ir}^2$ and $R_{r,ic}^2$ give an indication of the part of total variance of the common component of returns explained by risk premia and are, in fact, the partial correlation coefficients of χ_{it}^c and χ_{it}^r with respect to χ_t^c and χ_t^r computed using the following regressions:

$$\chi_{it}^c = \gamma_{0i}^c + \gamma_{1i}^c\chi_t^c + \gamma_{2i}^c\chi_t^r + w_{it}^c \Rightarrow R_{c,ic}^2 \tag{12}$$

$$\chi_{it}^r = \gamma_{0i}^r + \gamma_{1i}^r\chi_t^c + \gamma_{2i}^r\chi_t^r + w_{it}^r \Rightarrow R_{r,ir}^2, R_{r,ic}^2 \tag{13}$$

In the absence of perfect capital market integration, we are interested in finding out whether financial integration has increased nonetheless, and how the relative importance of the different components evolves over time. The sample (1979:1-1997:12) was split into four subsamples, with break dates 1984:4, 1989:4 and 1993:6. Furthermore, we use rolling estimation of the R_{ij}^2 (equation (10)) to identify dates associated with a steady increase (or decrease) of financial integration. We use a 36-month regression window, starting from the period 1979:2-1982:2 and move this window forward by one month at a time.

Finally, we would like to investigate whether the sources of the common fluctuations in stock returns are associated with the economies of some European countries in particular, the US economy or the US stock market. To answer these questions, we regress the common component of stock returns on aggregate industrial production growth $(\Delta\log(\mathrm{IP_t}))$, aggregate industrial production growth in the United States $(\Delta\log(\mathrm{IPUS_t}))$ and stock returns in the United States $(\Delta\log(\mathrm{RUS_t}))$.

$$\hat{\chi}_{it}^r = a_i\Delta\log(IP_t) + b_i\Delta\log(IPUS_t) + c_i\Delta\log(RUS_t) \tag{14}$$

The estimated coefficients and the partial correlation coefficients in this regression will tell us if the source of European-wide stock market risk lies in the European business cycle, the US business cycle or spillover effects from the US financial markets.

5. Empirical application

5.1 Data

We estimate the models described in the previous sections using monthly data for currency and stock returns on eight European markets between January 1979 and December 1997. Currency returns were constructed using exchange rates in excess of the forward rate for the previous month, which under interest rate parity is equivalent to exchange rate changes in excess of the difference between the eurocurrency rate on the London market and the one-month US Treasury bill rate. Excess equity returns were constructed from price and dividend yield data and were expressed in home currency in excess of the eurocurrency rate on the London market. Notice that the sum of equity returns and currency returns yields the dollar return in excess of the US risk-free rate for an equity investment in country *j* market. The eight countries considered were: Belgium, France, Germany, Italy, the Netherlands, Spain, Finland and the United Kingdom. Of these, the United Kingdom does not participate in EMU. Stock portfolios for each country are capitalisation-weighted market portfolios and at country level they represent well diversified portfolios, in the sense that all sector-specific risk has been eliminated and only country-specific risk is present. We also consider dividend yields ($log(div_{it}/P_{it})$), and forward premia ($log(f_{it}/e_{it})$). The factor model allows us to capture the dynamics of the asset returns. In particular, these variables have been shown by Bekaert and Hodrick (1992) and Campbell and Hamao (1992) to have forecasting power for the currency and stock returns.

Table 1, panel A provides summary statistics on the excess returns in the sample over the entire period. Currency returns are characterised by lower means than stock returns. France, Germany, the Netherlands and the United Kingdom present negative excess currency returns, implying that these portfolios constitute a hedge for the period under study. The cross-sectional variation of standard deviations is relatively low, in agreement with other studies, ranging from 11.48% (Finland) to 13.22% (Spain). Average equity excess returns range from 7% (United Kingdom) to 14% (Spain) in annualised terms. The respective standard deviations are 13.01% and 21.17%. In terms of capitalisation, the largest markets in Europe are the United Kingdom, which represents one third of total capitalisation, and the French and German markets, which together account for another third of total EU-11 capitalisation. The French market presents a mean of 7.48% and standard deviation of 21.04%, which makes it the third most volatile European market in our sample after Italy and Spain. The German market presents a mean excess return of 7.94%, and volatility of 16.91%.

Table 1, panel B presents summary statistics on dividend yields and forward premia. Notice that all variables are stationary except for dividend yields, and that there are clearly some important dynamics in returns and in forward premia.

Table 2 presents the contemporaneous correlation coefficient between currency and stock excess returns. For currency returns, a comparison of correlation averages computed by excluding correlation with the country itself leads us to form three groups of countries: the first includes Italy, Finland and Spain with average correlation 72%, the second contains the Netherlands, Belgium, France and Germany with average correlation 83% and finally, as expected, the United Kingdom stands alone with 67%. Average stock return correlations are very much lower, the maximum presented by the Netherlands and Belgium (43% and 45% respectively) and the minimum by Finland (27%). The average correlation for the other markets does not vary (32% to 37%). Correlations for both types of portfolio returns appear to be quite strong, suggesting that markets are integrated at least to some degree, and, in particular, because of the ERM, currency markets co-move more strongly than equity markets.

Table 2, panel B presents the cross-country correlation coefficients between currency and stock portfolios, and means over all countries. First notice that correlations are negative. Furthermore, it appears that foreign exchange and stock markets co-move relatively strongly in the United Kingdom (–19.4%), Belgium (–20.4%) and the Netherlands (–28.9%). Spillovers for all the other markets are between 16% and 12%, except for France, where the two markets appear to move independently from each other. Looking at the average cross-correlations, we see that stock returns are more affected by currency fluctuations than the contrary. The French currency market is the least sensitive to foreign stock market fluctuations.

Table 1

Panel A: mean (μ_i), standard deviation (σ_i) and autocorrelation coefficient ($\rho_i(1)$) for currency returns in USD ($\chi_{it}^{(c)}$) and stock returns in national currency ($\chi_{it}^{(r)}$), in percentages, annualised

Period: 1979:02-1997:12

		$\chi_{it}^{(c)}$			$\chi_{it}^{(r)}$	
	μ_i	σ_i	$\rho_i(1)$	μ_i	σ_i	$\rho_i(1)$
Belgium	0.111	3.490	0.142	0.651	4.196	0.338
France	– 0.110	3.332	0.904	0.623	6.080	0.19
Germany	– 0.422	3.504	0.144	0.662	4.886	0.032
Italy	1.053	3.394	0.181	0.615	6.262	0.296
Netherlands	– 0.390	3.544	0.135	0.922	3.791	0.351
Spain	0.879	3.820	0.471	1.268	6.172	0.151
Finland	0.088	3.317	0.144	1.009	5.634	0.363
United Kingdom	– 0.093	3.434	0.132	0.638	3.757	0.195

Panel B: mean (μ_i), standard deviation (σ_i) and autocorrelation coefficient ($\rho_i(1)$) for currency returns in USD ($\chi_{it}^{(dy)}$) and stock returns in national currency ($\chi_{it}^{(fp)}$), in percentages, annualised

Period: 1979:02-1997:12

		$\chi_{it}^{(dy)}$			$\chi_{it}^{(fp)}$	
	μ_i	σ_i	ρ_i (1)	μ_i	σ_i	$\rho_i(1)$
Belgium	0.431	0.212	0.991	– 0.213	0.653	0.874
France	0.350	0.154	0.943	– 0.168	0.733	0.256
Germany	0.320	0.080	0.982	0.417	0.859	0.901
Italy	0.200	0.056	0.949	– 1.379	1.182	0.340
Netherlands	0.393	0.127	0.989	0.258	0.970	0.197
Spain	0.874	0.577	0.995	– 1.209	1.959	0.172
Finland	0.302	0.179	0.987	– 1.032	1.385	0.872
United Kingdom	0.378	0.075	0.975	– 0.117	0.839	0.213

Table 2

Panel A: correlation coefficients between currency and stock portfolios. Above the diagonal are $corr(\chi^r_{it}, \chi^r_{i't})$ and below the diagonal are $corr(\chi^c_{it}, \chi^c_{i't})$ for i, i' = 1...N

	BE	**FR**	**DE**	**IT**	**NL**	**ES**	**FI**	**GB**	**mean χ^r_{it}**
Belgium	1	0.485	0.486	0.352	0.623	0.307	0.348	0.473	0.439
France	0.940	1	0.503	0.252	0.387	0.279	0.131	0.274	0.330
Germany	0.969	0.938	1	0.314	0.530	0.331	0.193	0.317	0.382
Italy	0.809	0.803	0.795	1	0.404	0.393	0.327	0.393	0.344
Netherlands	0.941	0.930	0.959	0.803	1	0.291	0.394	0.541	0.453
Spain	0.750	0.751	0.732	0.703	0.738	1	0.255	0.381	0.320
Finland	0.765	0.779	0.746	0.770	0.762	0.692	1	0.292	0.277
United Kingdom	0.675	0.679	0.662	0.629	0.694	0.634	0.717	1	0.377
mean x^c_{it}	0.836	0.831	0.829	0.759	0.833	0.714	0.747	0.670	

Panel B: cross-correlation coefficients between currency and stock portfolios $corr(\chi^c_{it}, \chi^r_{i't})$. On the diagonal are $corr(\chi^c_{it}, \chi^r_{it})$ for i, i' = 1...N

	BE	**FR**	**DE**	**IT**	**NL**	**ES**	**FI**	**GB**	**mean**
Belgium	– 0.204	– 0.103	– 0.168	– 0.224	– 0.273	– 0.203	– 0.251	– 0.222	– 0.206
France	– 0.201	– 0.090	– 0.163	– 0.232	– 0.270	– 0.190	– 0.249	– 0.215	– 0.217
Germany	– 0.196	– 0.106	– 0.162	– 0.218	– 0.268	– 0.235	– 0.228	– 0.243	– 0.213
Italy	– 0.087	– 0.047	– 0.104	– 0.123	– 0.205	– 0.085	– 0.149	– 0.175	– 0.122
Netherlands	– 0.195	– 0.093	– 0.160	– 0.203	– 0.289	– 0.201	– 0.258	– 0.222	– 0.190
Spain	– 0.169	– 0.053	– 0.192	– 0.188	– 0.324	– 0.120	– 0.289	– 0.166	– 0.197
Finland	– 0.116	– 0.095	– 0.098	– 0.145	– 0.214	– 0.086	– 0.129	– 0.184	– 0.134
United Kingdom	– 0.083	– 0.053	– 0.102	– 0.068	– 0.197	– 0.102	– 0.152	– 0.194	– 0.108
mean	– 0.150	– 0.079	– 0.141	– 0.183	– 0.250	– 0.158	– 0.225	– 0.204	

5.2 Integration

To estimate the degree of integration, the first step is to construct the aggregate variables, currency and stock portfolios, aggregate dividend yields and forward premia, using the methodology described in the previous section, and then estimate the common components. We also have to check that the aggregates constructed in this way are not perfectly collinear; if they were, we would be at risk of underestimating the number of factors. The results in Table 3 show that the aggregates are not perfectly correlated: maximum correlation is between aggregate currency returns and aggregate forward premia (–53.6%), minimum correlation is between aggregate dividend yields and stock returns.

We estimate K and find that it is equal to four (K = 4). Next, we estimate the common component for the currency and stock portfolios and compute the corresponding adjusted coefficients of determination, R^2_{ij}. Following Forni and Reichlin (1998), to estimate the disaggregated model we regress the individual currency and stock returns on the present, past and future of the aggregates. The R^2_{ij} of these OLS regressions can be used to assess the relative importance of the common and idiosyncratic component for each variable. These values are shown in Table 4, for all four variables and for four subperiods. The corresponding R_{ij}^2 is a measure of the fit of the dynamic factor model, and it is also a measure of the degree of integration, in the sense that it represents the contribution of the common component to the total variance for each variable in each country. We therefore concentrate on the R_{ij}^2 from the currency and stock returns. The first column presents the R_{ij}^2 over the whole period, whereas the subsequent columns present the results for the four separate subsamples.

Table 3

Correlation between aggregates $corr\left(\chi_{it}^{(j)}, \chi_{it}^{(j')}\right)$ for *j, j' = c,r,dy,fp*, for aggregate currency, stock portfolios, aggregate dividend yields and forward premia

Panel A: currency returns

	c	***r***	***dy***	***fp***
c	1	– 0.276	– 0.156	– 0.530
r	– 0.276	1	– 0.049	0.030
dy	– 0.156	– 0.049	1	0.337
fp	– 0.530	0.030	0.337	1

Table 4

Percentage of total variation of excess currency, stock returns, dividend yields and forward premia explained by their common component R_{adj}^2 from *JN* regressions for the estimation of the common components $\chi_{it}^{(j)}$

(I. 1979:02-1984:04, II. 1984:05-1989:04, III. 1989:05-1993:06, IV. 1993:07-1997:12)

Panel A: currency returns

	I-IV	**I**	**II**	**III**	**IV**
Belgium	0.884	0.725	0.772	0.707	0.532
France	0.864	0.727	0.746	0.683	0.440
Germany	0.885	0.742	0.771	0.705	0.489
Italy	0.757	0.711	0.670	0.670	0.452
Netherlands	0.868	0.716	0.770	0.687	0.586
Spain	0.770	0.625	0.708	0.666	0.436
Finland	0.743	0.627	0.713	0.614	0.396
United Kingdom	0.637	0.440	0.619	0.672	0.434

Panel B: stock returns

	I-IV	**I**	**II**	**III**	**IV**
Belgium	0.532	0.260	0.577	0.554	0.548
France	0.440	0.434	0.460	0.434	0.560
Germany	0.489	0.361	0.445	0.601	0.529
Italy	0.452	0.409	0.487	0.575	0.471
Netherlands	0.586	0.562	0.568	0.552	0.584
Spain	0.436	0.348	0.406	0.536	0.513
Finland	0.396	0.227	0.411	0.528	0.463
United Kingdom	0.434	0.429	0.366	0.566	0.485

Panel C: forward premia					
	I-IV	I	II	III	IV
Belgium	0.568	0.478	0.475	0.524	0.527
France	0.453	0.568	0.332	0.613	0.359
Germany	0.652	0.542	0.475	0.485	0.424
Italy	0.401	0.588	0.309	0.289	0.511
Netherlands	0.544	0.302	0.470	0.618	0.390
Spain	0.676	0.600	0.633	0.600	0.601
Finland	0.427	0.624	0.271	0.603	0.482
United Kingdom	0.358	0.409	0.273	0.575	0.424

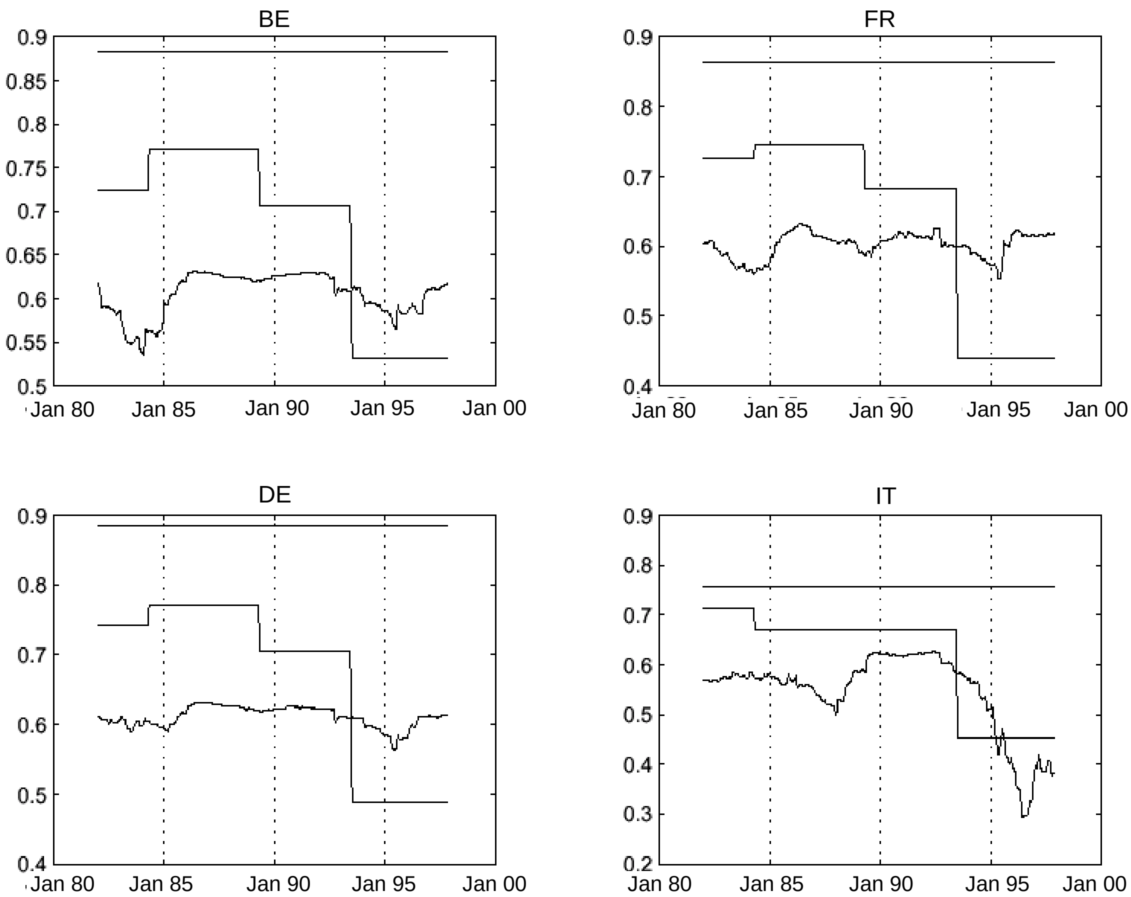
Panel D: forward premia					
	I-IV	I	II	III	IV
Belgium	0.886	0.585	0.718	0.358	0.683
France	0.822	0.601	0.636	0.626	0.672
Germany	0.704	0.673	0.559	0.574	0.495
Italy	0.178	0.494	0.589	0.583	0.205
Netherlands	0.806	0.655	0.314	0.649	0.654
Spain	0.872	0.464	0.709	0.466	0.572
Finland	0.782	0.608	0.664	0.626	0.479
United Kingdom	0.662	0.469	0.450	0.563	0.593

Foreign exchange markets appear to co-move more strongly than equity markets, the high degree presented by the foreign exchanges in Belgium, Germany, the Netherlands and France. The UK market appears to move more independently. Notice that it is the only market for which the R_{ij}^2 increases over the second period, probably because sterling joined the EMS in December 1989 even if it eventually dropped out. Italy, Spain and Finland lie somewhere in between. Stock markets are clearly less integrated than foreign exchange markets, the lowest degree of co-movement attained by Finland (39.6%). Under the null of perfectly integrated markets, the same aggregates should have been able to explain equally well the co-movements in both stock markets and equity markets, but this is not the case. Table 4 shows that the aggregates explain co-movements in the foreign exchange markets better. However, it is also clear from Table 4 that there has been a positive evolution in equity markets towards integration. Comparing the R_{ij}^2 over the four subsamples, we see that the increase has been more prominent in small markets such as Belgium, Spain and Finland, where the same common shocks double their explanatory power between the first and the last period. The increase is smaller for Germany and France. The UK's degree of market integration remains unchanged. We observe a different evolution in the foreign exchange markets, where the R_{ij}^2 remain relatively constant over the first three periods, and then decrease in the fourth, implying that the variation in exchange rates with respect to the US dollar becomes idiosyncratic.

Next, we examine the evidence provided by the rolling estimation using a window of three years and moving it forward by a month. Graphs 1-4 present graphs of the rolling R_{ij}^2 for the currency and stock portfolios. They confirm that the R^2 are indeed constant for Belgium, France, Germany and the Netherlands, which have been in the EMS longer. Countries whose currencies were at the centre of the currency crisis, ie Finland, Italy, Spain and the United Kingdom, show more variation over the sample: notice the large decrease in 1985 and 1992 for Finland and the steady decrease after mid-1993 for Italy and the United Kingdom. As far as the stock markets are concerned, it appears that, as in the previous analysis, small markets become more integrated. However, there are differences in timing. For Belgium and Finland, the process already starts in 1979 and stabilises after 1989. In Spain, the process starts later (1989) and has peaked by 1995. The rolling estimations reveal that Germany and the Netherlands also follow a similar process, starting in 1988 and peaking in 1990 for the Netherlands and 1993 for Germany. In conclusion, there appear to be differences between countries with regard to the starting dates of the integration process and the time it takes for the process to peak.

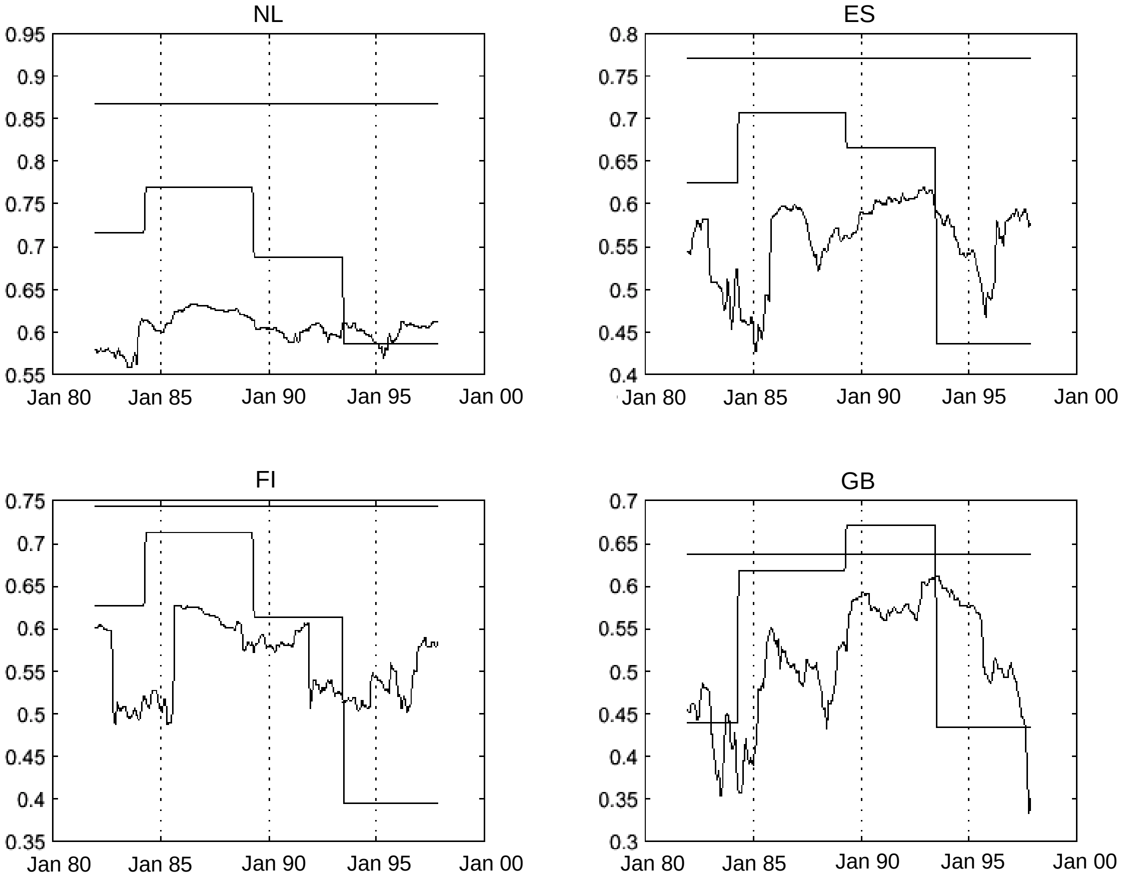
Graph 1

Currency returns: estimation of R_{ij}^2 over the entire period, four subsamples and rolling estimation for Belgium (BE), France (FR), Germany (DE) and Italy (IT)



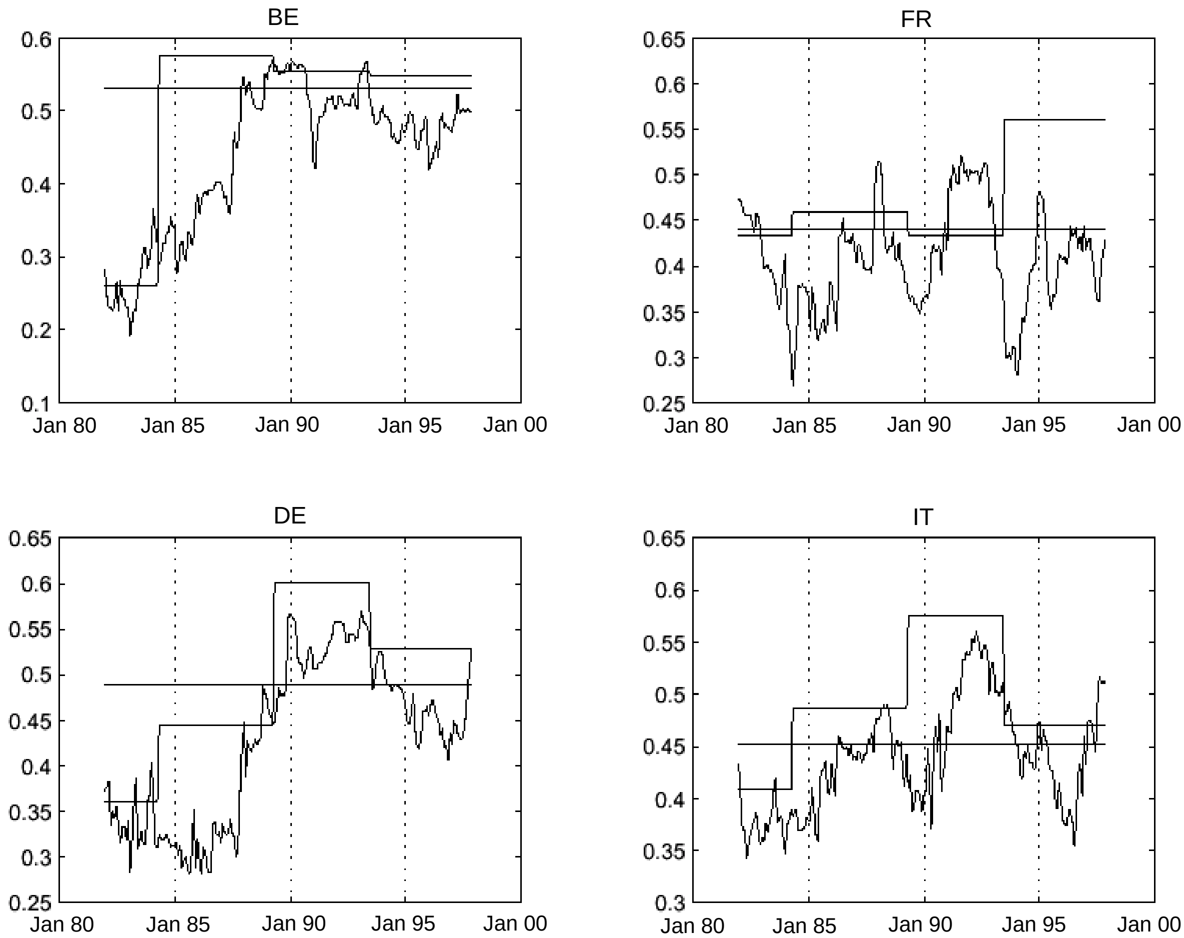
Graph 2

Currency returns: estimation of R^2_{ij} over the entire period, four subsamples and rolling estimation for the Netherlands (NL), Spain (ES), Finland (FI) and the United Kingdom (GB)



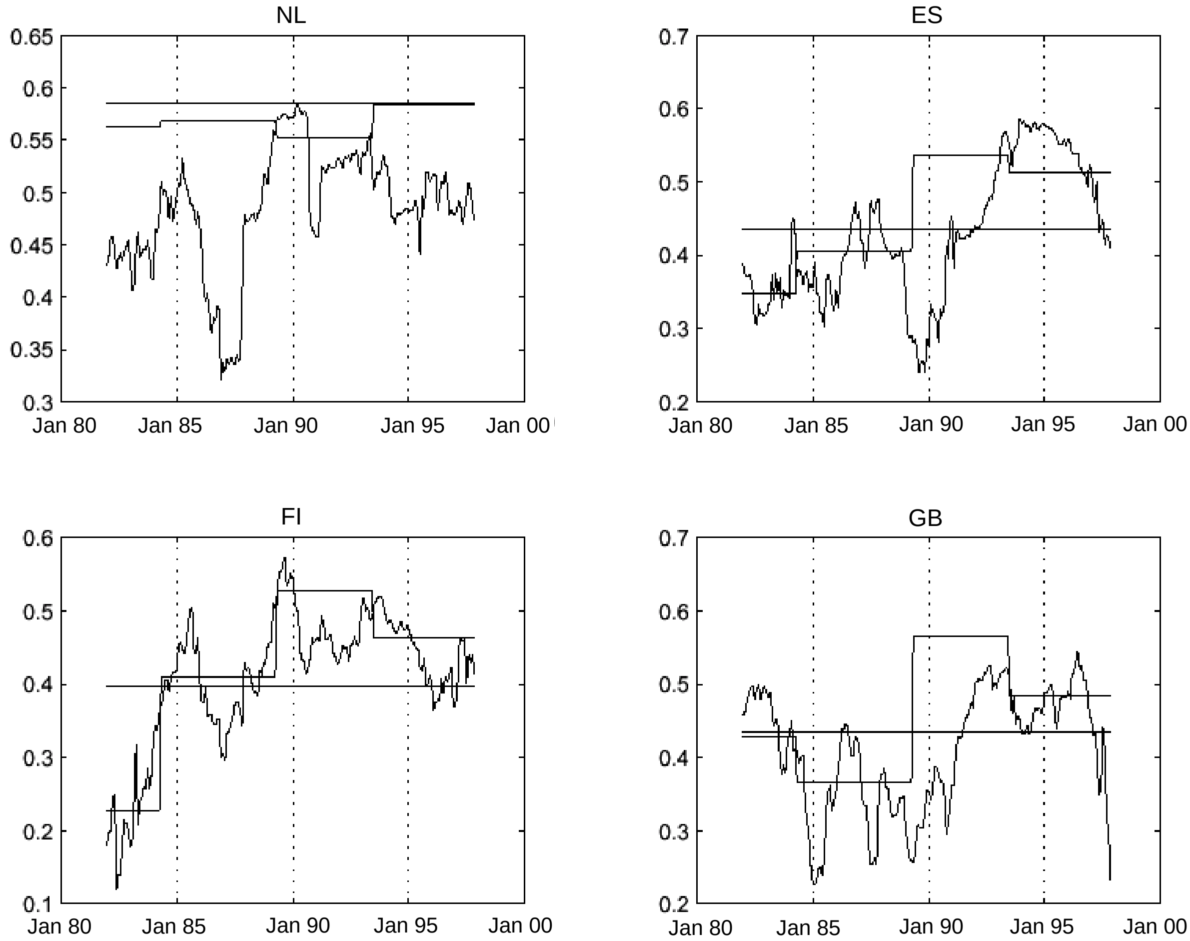
Graph 3

Stock returns: estimation of R_{ij}^2 over the entire period, four subsamples and rolling estimation for Belgium (BE), France (FR), Germany (DE) and Italy (IT)



Graph 4

Stock returns: estimation of R^2_{ij} over the entire period, four subsamples and rolling estimation for the Netherlands (NL), Spain (ES), Finland (FI) and the United Kingdom (GB)



For our next point, we investigate whether the positive evolution in equity markets is due to an increase in the EU market risk premium. First, Panel A of Table 5 illustrates the evolution of foreign exchange markets. The aggregate exchange rate risk premium explains most of the variance of the common component of currency returns (>95%), with the exception of Spain (86%). This confirms our assumption that the aggregate currency portfolio reflects the currency risk premium, ie the premium required by investors for holding a portfolio of European currencies.

Panel B of Table 5 shows the decomposition of the degree of stock market integration into two components: one linked to a currency risk premium and the other linked to a market risk premium. Aggregate market risk explains more than 88% of the variance of the common component of stock returns, except in the case of Finland (74%). As before, this component stays invariant during the first three subperiods and then increases sharply in the fourth, in all countries except for the Netherlands (from 79% to 64%) and France (from 64% to 51%).

What is the importance of systematic currency risk in the pricing of European stocks? To answer this question, we examine the $R^2_{r,ic}$ in panel C of Table 5. Over the whole period, aggregate currency risk does not seem to play a role for stock valuation, except in the case of the French market. However, the evolution across subperiods is quite different across markets. The currency premium increases in the Netherlands, Belgium and the United Kingdom, and decreases in France and Spain. The growing degree of integration that we have observed in Table 4 appears to be due to an increasing EU-wide market premium and a decreasing currency premium, except for the Netherlands and the United

Kingdom (which also show an increasing currency premium). This result supports the idea of EU-wide market risk reflecting EU business cycle risk: As economies become more integrated, the synchronisation of business cycles increases systematic risk and its premium. On the other hand, elimination of intra-European currency risk reduces the currency premium, at least for the countries participating in the euro. Only in the Netherlands and the United Kingdom does the component of currency risk in the investment portfolio increase. This result agrees with De Santis et al (2000), who find that the European component of currency risk in an international investment portfolio increases in the 1990s (even if the relative increase in the extra-European component is more important).

Table 5

Relative importance of the market and currency risk premium in currency returns (Panel A) and stock returns (Panels B and C). We report the partial R^2 for regressions (12) and (13).

I. 1979:02-1984:04, II. 1984:05-1989:04, III. 1989:05-1993:06, IV. 1993:07-1997:12

Panel A: $R^2_{c,ic}$

	I-IV	**I**	**II**	**III**	**IV**
Belgium	0.969	0.952	0.970	0.926	0.925
France	0.984	0.951	0.967	0.951	0.907
Germany	0.954	0.942	0.972	0.902	0.951
Italy	0.967	0.895	0.954	0.926	0.867
Netherlands	0.982	0.930	0.971	0.945	0.943
Spain	0.853	0.687	0.800	0.838	0.667
Finland	0.951	0.900	0.966	0.510	0.915
United Kingdom	0.932	0.722	0.879	0.930	0.690

Panel B: $R^2_{r,ir}$

	I-IV	**I**	**II**	**III**	**IV**
Belgium	0.960	0.839	0.903	0.881	0.826
France	0.896	0.649	0.846	0.729	0.512
Germany	0.892	0.587	0.713	0.827	0.744
Italy	0.930	0.648	0.680	0.859	0.701
Netherlands	0.882	0.796	0.796	0.829	0.640
Spain	0.882	0.372	0.706	0.907	0.784
Finland	0.747	0.580	0.307	0.582	0.695
United Kingdom	0.890	0.648	0.709	0.904	0.717

Panel C: $R^2_{r,ic}$

	I-IV	**I**	**II**	**III**	**IV**
Belgium	0.072	0.173	0.100	0.057	0.383
France	0.169	0.386	0.004	0.131	0.037
Germany	0.025	0.141	0.093	0.393	0.115
Italy	0.000	0.033	0.018	0.091	0.026
Netherlands	0.090	0.003	0.210	0.045	0.134
Spain	0.002	0.243	0.081	0.220	0.021
Finland	0.092	0.195	0.012	0.215	0.190
United Kingdom	0.039	0.028	0.030	0.169	0.167

Having estimated the common component of currency and stock returns, we use them to examine the sources of stock return co-movement. Do market and currency premia reflect rewards to a common business cycle risk or do they reflect systematic responses of EU markets to US equity markets? Table 6 presents the results from regression (14). It appears that industrial production, European or US, does not help explain the common component of stock returns in European markets. On the other hand, there are some spillovers from the US stock markets: 17.8% of co-movements in Belgium, 16.2% in the United Kingdom and 14% in France and Germany can be explained by US market-related factors. We conclude that even if there are spillovers from US markets to European equity markets, the systematic effect is not very large.

Table 6

Sources of stock market co-movement from regression (14). R^2_{ip}, $R^2_{ip,us}$, $R^2_{r,us}$ **are the partial correlation coefficients for aggregate IP growth in Europe, aggregate IP growth in the United States and stock returns in the United States.**

	R^2_{ip}	$R^2_{r,us}$	$R^2_{ip,us}$
Belgium	0.000	0.005	0.178
France	0.000	0.001	0.144
Germany	0.001	0.000	0.140
Italy	0.001	0.005	0.172
Netherlands	0.001	0.006	0.154
Spain	0.001	0.001	0.155
Finland	0.001	0.023	0.140
United Kingdom	0.001	0.004	0.162

6. Summary and conclusion

This paper examines whether the convergence of European economies towards economic and monetary union has lead to integration of European stock markets. There are several reasons why economic integration should imply financial integration. Apart from the convergence of inflation and short-term interest rates, convergence of monetary and fiscal policies leads to convergence of real expected cash flows and to increased synchronisation of business cycles across European economies, which in turn leads to higher correlations of stock returns. Furthermore, since 1993, intra-European exchange rates have been fixed through the EMS, so intra-European exchange rate risk associated with exchange rate fluctuations should have been gradually eliminated. Assessing whether capital markets are integrated is important in order to measure the effective restrictions on capital flows in Europe and the effectiveness of the policies aimed at the liberalisation of capital markets. It is also important for investors: if markets have indeed become fully integrated, optimal portfolio composition should shift from country diversification to sector diversification. And for firms: if integration reduces the cost of issuing new stock, it may encourage investment.

The paper examines whether the stock markets of eight European countries are fully integrated using a double approach. First, we define a generating process for returns that allows us to exploit the common dynamics of currency returns, stock returns, forward premia and dividend yields. The model assumes that each variable follows a dynamic factor analytical model, and decomposes the variables into a common and an idiosyncratic (variable- and country-specific) component. Financial integration is then defined as a process whereby stock markets become increasingly affected by the common, EU-wide risk factors, while the influence of country-specific risks is gradually reduced. In completely integrated markets, country-specific risks are fully diversifiable and thus investors require no reward to hold assets that contain such risk. In other words, in a completely integrated market investors face both common and idiosyncratic sources of risk, but they price only the first. Imposing a mild no arbitrage condition on the generating process for returns yields exactly this pricing restriction for returns. Exploiting the properties of the factor model to construct well diversified portfolios, the paper examines whether the data satisfy the pricing restriction. Then it measures the degree of integration and examines its evolution during two periods. Finally, the paper investigates whether the sources of common risk lie within Europe or have spilled over from real and financial variables in the United States, and seeks to determine the financial component of a country's inflation.

The empirical application has shown that European equity markets are not perfectly integrated and it has found that the markets examined in this study show similar degrees of integration for the end of the period under study. However, the strongest evolution occurred for the smallest markets, ie Belgium, Spain and Finland. The importance of the common component varies across countries and variables but is generally higher for foreign exchange markets. Furthermore, we have found that the degree of integration is constant for currency markets until 1994, whereas it increases strongly for equity markets during the 1980s and 1990s. There appear to be differences in timing between countries as far as the start of the process is concerned. This increase is primarily due to an increase in the premium associated with European-wide market risk and a decrease in the premium associated with fluctuations of European currencies with respect to the US dollar. Finally, we have found that the sources of the common shocks cannot be explained by changes in European or US industrial production and that they lie only in part in the US equity markets.

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