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MEASURING INTERNATIONAL ECONOMIC LINKAGES WITH STOCK MARKET DATA

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ABSTRACT

The covariance between domestic and foreign equity return innovations is decomposed into components associated with news about future real and financial variables. In an application to fifteen national stock markets, we find that news about future dividend growth tends to be more highly correlated than contemporaneous output measures, suggesting that there are lags in the international transmission of real economic shocks. In addition, results from a longer sample period suggest that both real and financial linkages between the U.S. and the U.K. appear to have increased after the Bretton Woods currency arrangement was abandoned in the early 1970's.

Measuring International Economic Linkages with Stock Market Data

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1. Introduction

An important issue in international economics is the degree of integration among different economies. Much of the literature in this area has concentrated on measuring international financial integration.[2] Some other recent studies (e.g., Stockman and Svensson (1987) and Phillips (1990)) have explored linkages between real economic variables in different countries. In this paper, we develop a framework in which one can measure both financial and real economic integration by characterizing components of covariation between returns on national stock markets.

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[2] See, for example, Feldstein and Horioka (1980), Wheatley (1988), Gultekin, Gultekin, and Penati (1989), King, Sentana, and Wadhwani (1990), Campbell and Hamao (1992), and Bekaert and Hodrick (1992).

The intuition behind our approach is very simple. By using the Campbell and Shiller (1988) approximate present value model, we can decompose excess stock return innovations for different countries into news about future excess returns, dividend growth rates, interest rates, and exchange rates. By studying the co-movements of these different excess return components among various countries, we can characterize the relative importance of international linkages between different sectors of the world's economies.

To be more specific, we measure real economic integration by calculating the correlations of dividend innovations among different countries. In a fully integrated economic system, labor and capital would be able to move freely across national borders. International differences in technology and production costs should vanish. Accordingly, a common shock would have a similar impact on economic growth, and thus corporate earnings and dividends, in different countries. We measure the degree of financial integration through calculating the correlations between innovations in future expected returns of different countries. As noted by Campbell and Hamao (1992), if asset returns in different countries are generated by an international multivariate linear factor model, the conditional means of these asset returns must move in tandem, as linear combinations of some common risk premiums. In the extreme case of a one-factor model, any variation over time in mean returns would have to be perfectly correlated across assets.[3] Thus, if national financial markets are highly integrated, we should find high correlations between future expected return innovations.

There are several distinctive advantages of our approach. First, by relying more on financial market data than on macroeconomic data, we likely encounter fewer problems with measurement error. Second, by examining the co-movement of future return news aggregated over a long horizon instead of the co-movement of one-period expected returns,[4] our study could detect small but persistent co-movements in expected returns, and more accurately measure the degree of financial integration. Similarly, by using innovations in long-term dividend growth as our proxy for the real economy, we can pick up the common effects of real shocks that impact output in two countries with different lags. In addition, by examining the covariation in innovations in particular variables rather than changes in those variables over time, we make the distinction between co-movements of expected and unexpected changes. Finally, we integrate the stock market, the money market, the goods market, and the foreign exchange market naturally into a single unified system, making it

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[3] Tests for the number of factors in an APT model typically reject a single factor specification in favor of a multiple factor alternative, but usually a single factor can explain most of the common variations. More to the point, a statistically significant risk premium is often estimated for only one factor (for example, see Connor and Korajczyk (1988)).

[4] See, for instance, Campbell and Hamao (1992) or Bekaert and Hodrick (1992).

possible to study their interactions without many ad hoc assumptions.

The paper is divided into five sections. In the next section, we present an approximate present value model in which we decompose excess returns into four different components: innovations (or news) about dividend growth, interest rates, exchange rates, and future expected returns. This framework is a variant of those derived by Campbell (1991), Campbell and Ammer (1993), and Campbell and Mei (1992). The third section discusses an application to American and British data, under both fixed and floating nominal exchange rate regimes. In the following section, we investigate interactions among 15 industrialized countries in the post-Bretton Woods era. The final section summarizes our conclusions.

2. Decomposing Domestic and Foreign Stock Returns

We first use an excess return version of the Campbell (1991) approximate present value relation to characterize the innovation in the domestic stock return as news about future dividends, interest rates, and equity risk premiums:[5]

$$\tilde{e}_{t+1} = (E_{t+1} - E_t) \{ \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j} - \sum_{j=0}^{\infty} \rho^j r_{t+1+j} - \sum_{j=1}^{\infty} \rho^j e_{t+1+j} \} \quad (1)$$

where r is the one-period treasury bill return, e is the excess return on equity (over the treasury bill), and d is the dividend paid. All variables are measured in real terms and in logs, a tilde (˜) superscript represents an innovation in a variable, and a delta (Δ) designates a first difference. Thus $\tilde{e}$ is the equity excess return innovation, and Δd is the log change in real dividends. We use E_t to denote expectations formed at the end of period t, while $(E_{t+1}-E_t)$ is the revision in expectations given new information arrived during period t+1. The parameter ρ is a

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[5] An approximate intertemporal identity is derived by taking a first-order Taylor expansion of an accounting identity for the log one-period return, computing the forward solution of the resulting difference equation in the log of the dividend-price ratio, and applying expectations operators. The only assumption we make here is to impose a consistency condition on expectations that is somewhat weaker than rational expectations. For details, see Campbell (1991) or Campbell and Ammer (1993).

constant of linearization that is slightly less than one.[6]

For convenience, we define simpler notation to refer to the three news components above (see Table 1 for notational summary):

$$\tilde{e} = \tilde{e}_d - \tilde{e}_r - \tilde{e}_\varepsilon \qquad (2)$$

Each term in (2) corresponds to one of the summations in (1). Equation (2) says that, ceteris paribus, news that dividends will grow more rapidly in the future would have a positive impact on today's stock return. On the other hand, an upward revision to expected future excess returns on stocks, accompanied with no information about future dividends or interest rates, means that the current stock price will have to drop, so that higher future returns can be generated from the same cash flow. In other words, an unexpected increase in the equity risk premium generates an immediate capital loss. Similarly, positive revisions to future interest rate expectations reduce the current return on equity.

A foreign version of the stock equation (1) is

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[6] It is approximately equal to the inverse of the mean of the gross *income* return on stocks, or about .9973 for the U.S. monthly data analyzed in the following section.

$$\tilde{e}^*_{t+1} = (E_{t+1} - E_t) \{ \sum_{j=0}^{\infty} (\rho^*)^j \Delta d^*_{t+1+j} - \sum_{j=0}^{\infty} (\rho^*)^j r^*_{t+1+j} - \sum_{j=1}^{\infty} (\rho^*)^j e^*_{t+1+j} \} \tag{3}$$

where the asterisk (*) superscripts denote foreign variables. However, to facilitate comparison of our results with the international asset pricing literature, we will work with the excess of the foreign stock return (expressed in dollars) over the domestic treasury bill return, given by

$$f_{t+1} = e^*_{t+1} - \Delta q_{t+1} + r^*_{t+1} - r_{t+1} \tag{4}$$

where f is the foreign excess return, and q denotes the real exchange value of the domestic currency. Substituting (4) into (3), the innovation in the foreign stock excess return can be written

$$\tilde{f}_{t+1} = (E_{t+1} - E_t) \{ \sum_{j=0}^{\infty} (\rho^*)^j \Delta d^*_{t+1+j} - \sum_{j=0}^{\infty} (\rho^*)^j r_{t+1+j} - \sum_{j=0}^{\infty} (\rho^*)^j \Delta q_{t+1+j} - \sum_{j=1}^{\infty} (\rho^*)^j f_{t+1+j} \} \tag{5}$$

Defining appropriate notation for the four terms on the right, equation (5) can be rewritten as

$$\tilde{f} = \tilde{f}_d - \tilde{f}_r - \tilde{f}_q - \tilde{f}_f \tag{6}$$

The intuition for the signs on $\tilde{f}_d$, $\tilde{f}_r$, and $\tilde{f}_f$ is the same as that given above for the signs on the corresponding components in equation (2). Also, the sign on the exchange rate component is negative for the same reason as the one for the excess return -- ceteris paribus, news that the dollar will appreciate sometime in the future must reduce dollar returns on foreign assets at some point in time. With no revision in expected future excess returns on foreign stocks, the loss occurs today.

In this paper, we measure real integration between two countries by the correlation between domestic future dividend innovations, e_d, and foreign future dividend innovations, f_d. We also measure financial integration by using the correlation between domestic future expected return innovations, e_e, and foreign future expected return innovations, f_f. To show that these two correlations are reasonable measures of real and financial integration, let us consider the following two extreme hypothetical cases.

First, imagine a world consisting of two countries which have open capital markets, but also a complete lack of international labor mobility, no trade in goods, and complete secrecy about production technology. Further assume that changes in the cost of capital have negligible effects on production or long-term profits, and asset returns are conditionally multivariate normal, so that the conditional Capital Asset Pricing Model (CAPM) holds. Under these assumptions, there is absolutely no connection between the real economies of the two countries, and we would expect zero correlation in long-term profits and, thus, zero correlation in e_d and f_d. However, because the two capital markets are perfectly linked and driven by a one-factor model, any time-variation in expected excess returns in the two countries would be perfectly correlated. Thus, we would have perfect correlation between e_e and f_f.

Now consider the opposite scenario -- frictionless flow of goods, information, labor, but complete capital immobility. Further assume that all shocks have proportional effects on different industries, that profits are perfectly correlated with output in each countries, and that macroeconomic shocks have negligible effects on the expected excess returns required by investors. In this case, we would expect corporate earnings (dividends) to be perfectly correlated internationally, but there would be no possibility for arbitrage between the two equity markets. Thus, we would expect perfect correlation between e_d and f_d but zero correlation between e_e and f_f.

3. Linkages between the United States and the United Kingdom

In this section, we apply equation (2) to a three-part decomposition of U.S. stock returns, and use equation (6) to break U.K. stock returns into four components. In order to proceed, we need some means by which to compute expectations of the variables in equations (1) and (5). Rather than rely on a specific theoretical model, we assume expectations are generated by a vector autoregression (VAR). Previous studies have found that dividend yields and nominal interest rates have significant forecasting power for stock returns.[7] Accordingly, our VAR specification includes a dividend-price for each stock market, and Δi (the change in the nominal treasury bill rate), in addition to q, r, e, and f.

Forecasts for q, r, e, and f from the VAR are used to calculate both the excess return innovations and the components of these innovations that are associated with exchange rates, interest rates, and excess returns, as defined in equations (1) and (5). The dividend growth components can then be inferred from (2) and (6) by rearranging the equations as

$$\tilde{e}_d = \tilde{e} + \tilde{e}_r + \tilde{e}_e \tag{7}$$

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[7] See, for example, Ferson and Harvey (1991), Fama and French (1988a), (1988b), (1989), and Keim and Stambaugh (1986).

and

$$\tilde{f}_d = \tilde{f} + \tilde{f}_r + \tilde{f}_q + \tilde{f}_f \tag{8}$$

By leaving monthly dividend growth out of our time series model, we avoid confronting the apparent seasonal variation in dividends.

The generalized method of moments of Hansen (1982) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. To calculate the standard errors associated with estimation error for any statistic, we first let g and V represent the whole set of parameters and their variance-covariance matrix respectively. Next, we write any statistic, such as the covariance between news about future dividend growth and news about future expected returns, as a nonlinear function f(g) of the parameter vector g. The standard error for the statistic is then estimated as

$$\sqrt[2]{f_g' \, V f_g} \tag{9}$$

where f_g is the gradient of the statistic with respect to the parameters (g).

Our first empirical exercise is a variance decomposition of the domestic stock return.[8] From equation (2) it is clear that the variance of the excess return innovation can be written as the sum of six terms:

$$Var(\tilde{e}) = Var(\tilde{e}_d) - 2Cov(\tilde{e}_d, \tilde{e}_r) + Var(\tilde{e}_r) - 2Cov(\tilde{e}_d, \tilde{e}_e) + Var(\tilde{e}_e) + 2Cov(\tilde{e}_r, \tilde{e}_e) \quad (10)$$

The results of such a variance decomposition are reported in Table 2 for several VAR specifications and sample periods.[9] The six components are scaled by the total variance so that they sum to one. Like Campbell (1991) and Campbell and Ammer (1993), we find in all cases that variation in the equity risk premium accounts for most of the aggregate volatility on the New York Stock Exchange.[10]

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[8] We use the value-weighted New York Stock Exchange as the U.S. stock portfolio and the Financial Times All Shares Index as the foreign equity asset. Data were acquired from the CRSP tapes and the London Share Price Database. The treasury bill return is from Ibbotson (1991).

[9] The Akaike Information Criterion was used as a guide in choosing lag lengths. For the 1957 to 1989 period, a 5-lag specification had the highest score, but a 2-lag specification was a close second. The 2-lag specification had the highest score for both of the shorter samples.

[10] Because the reliability of the empirical results is dependent on how accurately our VAR model measures expectations, robustness to specification changes is an important feature.

Table 3 reports the outcomes of analogous variance decompositions for the London Stock Exchange market portfolio. Again, news about future excess returns is the main source of variation in current returns. In contrast the exchange rate news component contributes nothing to equity market variance, because our VAR model is not capable of forecasting changes in the real exchange rate.

Next we examine interactions between the American and British markets. Some simple data correlations appear in Table 4 for our full sample (1957 to 1989) and two subsamples. Note that for all three periods the correlation between the two country's stock returns is substantially greater than the correlation of measures of their real output growth. In addition, the contemporaneous correlations between equity returns and output growth are negligible. Nevertheless, it is impossible to determine from these statistics alone whether real or financial integration is driving co-movements in the two stock markets. Common shocks that persistently impact the two economies' long-run economic growth and risk premiums but with different lags could be an important signs of real and financial integration. However, one can not see that impact from the contemporaneous correlations between equity returns and output growths due to the time lags. By examine the co-movement of innovations on future dividend growth and excess return, we may be able to discover important evidence of long-term real and financial integration.

The covariance between stock return innovations in the U.S. and the U.K. is the sum of the covariances between each of the terms on the right sides of equations (2) and (6). The contributions of each of these 12 covariance components are listed in Table 5 for our three sample periods. In general, the two largest contributions to the total covariance come from correlated news about future dividend growth in the two countries and correlated news about future excess returns, although interactions between these two components also plays a role. Ironically, the common interest rate news component makes only a negligible contribution. This is because changes in real interest rates are difficult to forecast.

A comparison of the two sub-samples shows a significant increase in the covariance of American and British stock returns after fixed exchange rates were abandoned in 1973. The decomposition enables us to attribute most of the change to greater financial integration in the later period. This result may have as much to do with the suspension of capital controls in Great Britain in the late 1970's than it does with the move to floating exchange rates.

Tables 6, 7, and 8 report simple correlations of the return components. A comparison of the correlations between f_f and e_e in Tables 7 and 8 confirms the greater degree of financial integration measured in the later period. The two dividend growth components are highly correlated in both sub-samples, but the correlation is slightly higher under the floating rate regime. This suggests that monetary shocks may not be an important source of variation in the real economy. A move to floating exchange rates reduces the obligation of the two central banks to coordinate monetary policy, whereas monetary shocks tend to be common to all countries under fixed rates.[11]

We can also see from comparing Tables 6, 7, and 8 to Table 4 that the innovations in long-term dividend growth are much more highly correlated between the two countries than are our measures of contemporaneous output growth. This suggests that, although output in the two countries may be affected in the short run by transitory country-specific factors or by common factors but with different lags, long-term dividend growth in the two countries is driven by common influences.

[11] Although sufficiently restrictive capital controls can permit independent monetary policy under fixed exchange rates.

4. Real and Financial Linkages among 15 Industrialized Countries

The United States and the United Kingdom do not seem to be unusual in having more contemporary correlation between their equity returns than between their output growth rates. Tables 9 and 10 report correlation matrices for industrial production growth in 15 industrialized economies and excess dollar returns on their national stock markets, respectively.[12] The mean pair-wise production correlation is about 9 percent, while the equity return correlations average 44 percent.

Once again, we can decompose excess return covariation among the various countries, using equation (6), to measure the relative importance of real and financial integration. For each foreign country, expectations are generated by forecasts from a 2-lag VAR in f, q, r, Δi, the dollar excess return on a world market portfolio, and both the national and world dividend-price ratios.[13] Correlations among the dividend growth components and excess return components of the various countries are provided in Tables 11 and 12. The means of these correlations are 30 percent and 27 percent respectively, suggesting that both real and financial linkages are important. In general, economies that are

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[12] National stock market returns are drawn from the Morgan Stanley Capital International database.

[13] Separate vector autoregressions are used for each country in lieu of estimating a single system to avoid having a problem with degrees of freedom. Results with 1-lag VAR systems were nearly identical.

geographically proximate tend to be connected more closely. For example, we find substantial real and financial integration between France and Germany, but little of either between the Netherlands and Japan. For most pairs of countries, the dividend component correlation exceeds the contemporaneous output correlation reported in Table 9. Thus, again, we see that real and financial linkages are much stronger from a long-run perspective than from a short-run perspective.

5. Conclusions

In addition to making a methodological contribution, this paper has several interesting empirical findings. First, the stylized fact that variations in equity risk premiums are the principal source of stock return variance in the United States appears to apply to the United Kingdom as well. Second, we find substantial degrees of both real and financial integration between the U.S. and U.K. economies. Although common news about future risk premiums accounts for the bulk of the covariance between the two country's stock markets, the dividend growth components of the two returns are also highly correlated. In addition, both real and financial linkages are found to be greater after the Bretton Woods arrangement was abandoned in the early 1970's. A common interest rate news component accounts for only a small part of the return covariance because of the lack of predictability of short-term real interest rates.

In a further application of our methodology to data from 15 countries from 1974 to 1990, we find that both real and financial integration typically contribute to the (consistently positive) correlations between the returns on national stock markets. In most cases, news about future dividend growth in two countries is more highly correlated than contemporaneous output measures. This suggests that there are lags in the international transmission of real economic shocks.

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Appendix

In order to implement our decomposition, we need to construct empirical proxies for news about future cash flows, real interest rates, real exchange rate and excess returns. To do this, we assume that z_t is a vector of state variables which includes (e_t, f_t, r_t, q_t) as its first four elements. Next we assume that the state vector follows a first-order VAR:

$$z_{t+1} = Az_t + w_{t+1}, \tag{A1}$$

where w_{t+1} is the innovation in z_{t+1}. The assumption that the VAR is first-order is not restrictive since a higher-order VAR can always be rewritten in first-order form as discussed by Campbell and Shiller (1988) among others. The matrix A is known as the companion matrix of the VAR. Given the VAR model, revisions in long-horizon expectations of z_{t+1} are:

$$(E_{t+1}-E_t)z_{t+j+1} = A^j w_{t+1}. \tag{A2}$$

Finally, we define e1 to be an L-element column vector whose first element is one and whose other elements are all zero. This vector picks e_t out of the state vector. We also define e2, e3, and e4 to pick f_t, r_t, and q_t out of the state vector, respectively. Equation (1), (2) (5) and (6) imply that the components of domestic and foreign stock excess returns can be written as follows:

$$\tilde{e}_{e,t+1} = e_1'\rho A(I - \rho A)^{-1} w_{t+1},\ \tilde{f}_{f,t+1} = e_2'\rho^* A(I - \rho^* A)^{-1} w_{t+1},$$

$$\tilde{e}_{r,t+1} = e_3'(I - \rho A)^{-1} w_{t+1},\ \tilde{f}_{q,t+1} = e_4'(1 - \rho^*)(I - \rho^* A)^{-1} w_{t+1},$$

$$\tilde{f}_{r,t+1} = e_3'(I - \rho^* A)^{-1} w_{t+1},\ \tilde{f}_{t+1} = e_2' w_{t+1},\ \tilde{e}_{t+1} = e_1' w_{t+1},$$

$$\tilde{e}_{d,t+1} = \tilde{e}_{t+1} + \tilde{e}_{r,t+1} + \tilde{e}_{e,t+1},\ \tilde{f}_{d,t+1} = \tilde{f}_{t+1} + \tilde{f}_{r,t+1} + \tilde{f}_{q,t+1} + \tilde{f}_{f,t+1}. \tag{A3}$$

Once we have the asset return components above, it is straightforward to decompose the domestic and foreign stock returns and study their co-movements.

Table 1

Variable Definitions

e	excess return on U. S. stocks over one-month treasury bill
$\tilde{e}$	innovation in excess return on U.S. stocks (e)
f	excess dollar return on foreign stocks over U.S. treasury bill
$\tilde{f}$	innovation in excess dollar return on foreign stock (f)
r	real return on one-month U.S. treasury bill
Δi	change in (nominal) yield on one-month U.S. treasury bill
q	real exchange rate index (foreign goods per unit U.S. goods)
Δq	change in real exchange rate index
(d/p)	U.S. dividend-price ratio (using dividends for previous 12 months)
$(d/p)^*$	foreign dividend-price ratio
Δy	change in (real) U.S. industrial production
Δy^*	change in (real) foreign industrial production
Δd	real U.S. dividend growth
Δd^*	real foreign dividend growth

News Components of Excess Stock Returns

	Real Dividend Growth	Real Interest Rates	Real Exchange Rates	Excess Stock Return
For $\tilde{e}$	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_q$	$\tilde{e}_e$
For $\tilde{e}$	$\tilde{f}_d$	$\tilde{f}_r$	$\tilde{f}_q$	$\tilde{f}_f$

Note: All variables are measured in logs. Variables are measured in real terms unless otherwise noted. The timing convention is that variables dated t are known at the end of time t.

Table 2

Variance Decomposition for Domestic Excess Stock Returns

Sample Period	57-89	57-72	73-89	57-89	57-89
$Var(\tilde{e})$	17.62	12.47	21.37	16.29	17.65
(S.D)	(1.778)	(1.313)	(2.975)	(1.648)	(1.808)
Shares of	(2 lags)	(2 lags)	(2 lags)	(5 lags)	(2 lags)[1]
$Var(\tilde{e}_d)$	0.121	0.277	0.116	0.119	0.116
	(0.375)	(0.214)	(0.294)	(0.375)	(0.102)
$-2Cov(\tilde{e}_d,\tilde{e}_r)$	-0.033	-0.077	-0.077	-0.065	-0.043
	(0.034)	(0.074)	(0.092)	(0.068)	(0.039)
$-2Cov(\tilde{e}_d,\tilde{e}_e)$	0.075	0.129	-0.123	0.023	0.044
	(0.343)	(0.449)	(0.590)	(0.745)	(0.292)
$Var(\tilde{e}_r)$	0.031	0.008	0.054	0.051	0.033
	(0.016)	(0.007)	(0.038)	(0.032)	(0.018)
$2Cov(\tilde{e}_r,\tilde{e}_e)$	0.077	-0.005	0.135	-0.124	0.091
	(0.122)	(0.075)	(0.172)	(0.124)	(0.143)
$Var(\tilde{e}_e)$	0.729	0.669	0.895	0.749	0.758
	(0.250)	(0.311)	(0.323)	(0.379)	(0.225)

Note: The VAR includes e, f, r, q, Δi, (d/p), and $(d/p)^*$. The equations defining the components are given by (1) and (2) for the domestic excess returns. And we rescale the components by dividing them by $Var(\tilde{e})$ so that the components sum to one.

[1]In this specification, we replace the q variable in the VAR process with the Δq variable.

Table 3

Variance Decomposition for Foreign Excess Stock Returns: UK

Sample Period	57-89	57-72	73-89	57-89	57-89
$Var(\tilde{f})$ (S.D)	41.38 (4.821)	20.42 (2.539)	58.69 (8.480)	37.88 (3.760)	41.46 (4.804)
Shares of	(2 lags)	(2 lags)	(2 lags)	(5 lags)	(2 lags)[1]
$Var(\tilde{f}_d)$	0.173 (0.055)	0.160 (0.401)	0.179 (0.108)	0.243 (0.165)	0.174 (0.083)
$-2Cov(\tilde{f}_d,\tilde{f}_r)$	-0.041 (0.031)	-0.019 (0.033)	-0.060 (0.057)	-0.088 (0.068)	-0.047 (0.035)
$-2Cov(\tilde{f}_d,\tilde{f}_q)$	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.077 (0.088)
$-2Cov(\tilde{f}_d,\tilde{f}_f)$	0.131 (0.230)	0.165 (0.873)	-0.001 (0.328)	0.141 (0.292)	0.169 (0.235)
$Var(\tilde{f}_r)$	0.013 (0.230)	0.005 (0.004)	0.020 (0.014)	0.021 (0.012)	0.014 (0.007)
$2Cov(\tilde{f}_r,\tilde{f}_q)$	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.00 (0.000)	0.037 (0.007)
$2Cov(\tilde{f}_r,\tilde{f}_f)$	-0.043 (0.071)	-0.025 (0.053)	-0.021 (0.096)	-0.041 (0.075)	-0.061 (0.069)
$Var(\tilde{f}_q)$	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.215 (0.057)
$2Cov(\tilde{f}_q,\tilde{f}_f)$	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.006 (0.191)
$Var(\tilde{f}_f)$	0.766 (0.246)	0.714 (0.569)	0.882 (0.299)	0.724 (0.244)	0.570 (0.252)

Note: The VAR includes e, f, r, q, Δi, (d/p), and (d/p)*. The equations defining the components are given by (5) and (6) for the foreign excess returns. And we rescale the components by dividing them by $Var(\tilde{f})$ so that the components sum to one.

[1]In this specification, we replace the q variable in the VAR process with the Δq variable.

Table 4

Data Correlations: U.S. and U.K.

A. Monthly Correlations 1957:1-1972:12

	e	f	Δq	Δy
e	1.000			
f	0.348	1.000		
Δq	-0.028	-0.028	1.000	
Δy	0.133	0.074	0.039	1.000

B. Monthly Correlations 1973:1-1989:12

	e	f	Δq	Δy	Δy^*
e	1.000				
f	0.516	1.000			
Δq	-0.033	-0.487	1.000		
Δy	-0.077	-0.137	0.183	1.000	
Δy^*	-0.070	0.035	-0.098	0.243	1.000

C. Monthly Correlations 1957:1-1989:12

	e	f	Δq	Δy
e	1.000			
f	0.464	1.000		
Δq	-0.031	-0.452	1.000	
Δy	0.022	-0.046	0.120	1.000

D. Quarterly Correlations for Three Sample Periods

Sample Period	1957-1989	1957-1972	1973-1989
US&UK	0.074	-0.087	0.177

Table 5

Covariance Decomposition for U.S. and U.K. Excess Stock Returns

News	$\tilde{f}_d$	$\tilde{f}_r$	$\tilde{f}_q$	$\tilde{f}_f$
$cov(\tilde{e},\tilde{f})$ = 12.15 (2.183)		1957:1-1989:12		
$\tilde{e}_d$	1.150 (1.288)	0.291 (0.287)	-0.001 (0.004)	-2,168 (2.610)
$\tilde{e}_e$	0.865 (0.667)	0.547 (0.279)	0.000 (0.002)	-0.902 (1.478)
$\tilde{e}_e$	2.803 (3.688)	0.626 (1.018)	-0.005 (0.007)	12.530 (5.299)
$cov(\tilde{e},\tilde{f})$ = 5.610 (1.337)		1957:1-1972:12		
$\tilde{e}_d$	1.492 (2.404)	0.472 (0.443)	-0.002 (0.002)	-1.753 (3.507)
$\tilde{e}_r$	0.196 (0.340)	0.101 (0.080)	0.000 (0.000)	-0.265 (0.566)
$\tilde{e}_e$	-1.519 (2.960)	-0.031 (0.451)	-0.001 (0.002)	1.710 (4.602)
$cov(\tilde{e},\tilde{f})$ = 17.51 (3.802)		1973:1-1989:12		
$\tilde{e}_d$	2.631 (2.949)	0.817 (0.936)	0.001 (0.003)	-0.254 (5.159)
$\tilde{e}_r$	1.779 (1.664)	1.156 (0.765)	0.002 (0.002)	-0.599 (2.846)
$\tilde{e}_e$	6.767 (5.710)	1.394 (1.75[illegible])	0.001 (0.006)	22.035 (9.103)

Note: The covariance of the return innovations is provided on the first line of each panel. The standard deviations for each statistics appear in the parentheses. The variables are defined in Table 1 and by equation (1),(2), (5), and (6) in the text. The statistics are estimated based on a 2-lag VAR in e, f, r, q, Δi, (d/p), and (d/p)*.

Table 6

Correlations in Components of US and UK Excess Stock Return Innovations (1957-1989)

	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{f}_d$	$\tilde{f}_r$	$\tilde{f}_q$	$\tilde{f}_f$
$\tilde{e}_d$	1.000						
	(0.000)						
$\tilde{e}_r$	-0.270	1.000					
	(0.240)	(0.000)					
$\tilde{e}_e$	0.127	0.254	1.000				
	(0.652)	(0.411)	(0.000)				
$\tilde{f}_d$	0.295	0.435	0.292	1.000			
	(0.278)	(0.224)	(0.349)	(0.000)			
$\tilde{f}_r$	0.271	1.000	0.237	-0.429	1.000		
	(0.241)	(0.000)	(0.396)	(0.225)	(0.000)		
$\tilde{f}_q$	-0.108	0.138	-0.312	0.090	0.160	1.000	
	(0.597)	(0.514)	(0.390)	(0.463)	(0.486)	(0.000)	
$\tilde{f}_f$	-0.264	-0.216	0.621	0.181	-0.216	0.227	1.000
	(0.397)	(0.331)	(0.163)	(0.343)	(0.324)	(0.335)	(0.000)

Note: Asymptotic standard errors appear below each statistic in the parentheses. The variables are defined in Table 1 and by equation (1),(2), (5), and (6) in the text. The statistics are estimated based on a 2-lag VAR in e, f, r, q, Δi, (d/p), and (d/p)*.

Table 7

Correlations in Components of US and UK Excess Stock Return Innovations (1957-1972)

	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{f}_d$	$\tilde{f}_r$	$\tilde{f}_q$	$\tilde{f}_f$
$\tilde{e}_d$	1.000 (0.000)						
$\tilde{e}_r$	-0.811 (0.446)	1.000 (0.00)					
$\tilde{e}_e$	0.150 (0.591)	-0.032 (0.513)	1.000 (0.00)				
$\tilde{f}_d$	0.445 (0.490)	0.339 (0.368)	-0.291 (0.822)	1.000 (0.000)			
$\tilde{f}_r$	0.805 (0.444)	1.000 (0.000)	-0.034 (0.501)	-0.338 (0.363)	1.000 (0.000)		
$\tilde{f}_q$	-0.762 (0.332)	-0.666 (0.346)	-0.345 (0.343)	0.170 (0.516)	-0.656 (0.332)	1.000 (0.000)	
$\tilde{f}_f$	-0.247 (0.540)	-0.216 (0.488)	0.155 (0.365)	0.244 (1.650)	-0.214 (0.474)	0.184 (0.550)	1.000 (0.000)

Note: Asymptotic standard errors appear below each statistic in the parentheses. The variables are defined in Table 1 and by equation (1),(2), (5), and (6) in the text. The statistics are estimated based on a 2-lag VAR in e, f, r, q, Δi, (d/p), and $(d/p)^*$.

Table 8

Correlations in Components of US and UK Excess Stock Return Innovations (1973-1989)

	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{f}_d$	$\tilde{f}_r$	$\tilde{f}_q$	$\tilde{f}_f$
$\tilde{e}_d$	1.000 (0.000)						
$\tilde{e}_r$	-0.486 (0.377)	1.000 (0.000)					
$\tilde{e}_e$	-0.191 (0.664)	0.306 (0.364)	1.000 (0.000)				
$\tilde{f}_d$	0.516 (0.589)	0.508 (0.287)	0.477 (0.308)	1.000 (0.000)			
$\tilde{f}_r$	0.485 (0.384)	1.000 (0.000)	0.298 (0.359)	-0.503 (0.286)	1.000 (0.000)		
$\tilde{f}_q$	0.168 (0.751)	0.405 (0.425)	0.048 (0.376)	-0.100 (0.452)	0.412 (0.414)	1.000 (0.000)	
$\tilde{f}_f$	-0.022 (0.463)	-0.077 (0.367)	0.700 (0.143)	-0.001 (0.412)	-0.078 (0.362)	0.371 (0.301)	1.000 (0.000)

Note: Asymptotic standard errors appear below each statistic in the parentheses. The variables are defined in Table 1 and by equation (1),(2), (5), and (6) in the text. The statistics are estimated based on a 2-lag VAR in e, f, r, q, Δi, (d/p), and (d/p)*.

Table 9

Correlation of Industrial Production Growth for Fifteen Nations

	AU	BE	CA	DN	FR	CE	IT	JA	NE	NO	SP	SD	SZ	UK
BE	.27													
CA	.01	.07												
DN	-.02	-.09	.22											
FR	-.03	.13	.34	.20										
GE	-.04	.06	.10	.33	.28									
IT	-.03	-.13	.07	.13	.14	.03								
JA	-.06	.20	.31	.14	.24	.09	-.07							
NE	.05	-.01	-.02	-.05	-.09	.13	.12	-.18						
NO	.04	.10	.15	.06	.16	.04	.05	.04	-.00					
SP	.02	.10	.19	.06	.27	.20	.02	.04	.05	.31				
SD	.08	.06	-.02	.06	.01	.04	.24	-.13	.03	-.10	.03			
SZ	.11	.02	.08	.07	.08	.10	.04	.10	.08	.02	.13	-.01		
UK	.21	.02	.06	.22	.09	.14	.16	-.14	.18	.03	.07	.14	-.00	
US	.10	.04	.43	.18	.18	.13	.18	.22	.10	.08	.10	.07	.23	.25

Note: The fifteen nations are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, United States. The sample covers the time period of 1974:1-1990:12.

Table 10

Correlation of (Dollar) Excess Stock Returns for Fifteen Nations

	AU	BE	CA	DN	FR	CE	IT	JA	NE	NO	SP	SD	SZ	UK
BE	.43													
CA	.20	.41												
DN	.30	.47	.33											
FR	.43	.66	.46	.41										
GE	.63	.66	.31	.47	.59									
IT	.30	.46	.32	.33	.49	.40								
JA	.22	.45	.24	.38	.41	.38	.42							
NE	.41	.68	.58	.49	.59	.68	.41	.41						
NO	.32	.57	.53	.37	.49	.44	.29	.20	.59					
SP	.30	.39	.28	.28	.36	.34	.38	.42	.36	.26				
SD	.35	.46	.37	.36	.34	.43	.36	.40	.48	.42	.36			
SZ	.51	.68	.51	.52	.62	.76	.45	.43	.74	.56	.36	.51		
UK	.27	.52	.56	.42	.53	.42	.40	.56	.64	.48	.34	.42	.56	
US	.17	.46	.72	.35	.46	.36	.28	.26	.60	.53	.27	.41	.53	.53

Note: The fifteen nations are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, United States. The sample covers the time period of 1974:1-1990:12.

Table 11

Correlation of Future Dividend Growth News for Fifteen Nations

	AU	BE	CA	DN	FR	CE	IT	JA	NE	NO	SP	SD	SZ	UK
BE	.58													
CA	.20	.28												
DN	.50	.28	.07											
FR	.45	.49	.26	.28										
GE	.47	.44	.20	.25	.48									
IT	.28	.34	.09	.19	.46	.50								
JA	.38	.23	-.10	.27	.16	-.06	.10							
NE	.45	.46	.27	.32	.56	.71	.46	.05						
NO	.40	.42	.19	.29	.40	.27	.26	.20	.49					
SP	.45	.18	.02	.27	.11	-.21	-.10	.50	-.06	.27				
SD	.33	.36	.05	.23	.33	.47	.38	.16	.56	.40	.02			
SZ	.64	.47	.15	.41	.44	.60	.34	.25	.59	.34	.14	.42		
UK	.46	.39	.28	.32	.41	.35	.34	.36	.57	.47	.27	.45	.54	
US	.33	.13	-.10	.28	.10	-.24	.06	.80	-.00	.31	.60	.12	.17	.41

Note: The fifteen nations are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, United States. The sample covers the time period of 1974:1-1990:12. The statistics are estimated based on a 2-lag VAR in f, r, q, Δi, the dollar excess return on a world market portfolio, the national (d/p), and the world (d/p).

Table 12

Correlation of Excess Stock Return News for Fifteen Nations

	AU	BE	CA	DN	FR	CE	IT	JA	NE	NO	SP	SD	SZ	UK
BE	.46													
CA	-.21	.17												
DN	.52	.42	-.02											
FR	.41	.63	.44	.46										
GE	.51	.61	.30	.46	.66									
IT	.28	.56	.33	.34	.76	.56								
JA	.24	.12	-.26	.18	.24	.05	.22							
NE	.21	.61	.58	.31	.72	.69	.61	.04						
NO	.06	.39	.37	.09	.47	.34	.42	.07	.54					
SP	.11	-.14	-.15	.05	-.13	-.10	-.07	.13	-.14	-.15				
SD	.11	.42	.40	.22	.55	.42	.47	.16	.55	.44	-.14			
SZ	.33	.56	.37	.35	.68	.70	.63	.05	.70	.36	-.18	.45		
UK	-.06	.36	.57	.16	.55	.39	.44	-.00	.68	.39	-.18	.47	.50	
US	-.48	-.07	.54	-.27	.10	-.01	.11	-.33	.27	.23	-.17	.26	.09	.25

Note: The fifteen nations are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, United States. The sample covers the time period of 1974:1-1990:12. The statistics are estimated based on a 2-lag VAR in f, r, q, Δi, the dollar excess return on a world market portfolio, the national (d/p), and the world (d/p).

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