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Measuring International Economic Linkages with Stock Market Data

JOHN AMMER and JIANPING MEI*

ABSTRACT

This article develops a new framework for measuring financial and real economic linkages between countries. Using United States and United Kingdom data from 1957 to 1989, we find closer financial linkages after the Bretton Woods currency arrangement was abandoned and Britain suspended exchange controls. In a pairwise application to fifteen countries over a shorter period, we also find that news about future dividend growth is more highly correlated between countries than contemporaneous output measures. This suggests that there are lags in the international transmission of economic shocks and that contemporaneous output correlation may understate the magnitude of integration.

THE DEGREE OF INTEGRATION among different economies is an important issue in international economics. Much of the literature in this area has concentrated on measuring international financial integration. The most direct methods apply the law of one price to financial assets. For example, Mishkin (1984) uses an interest rate parity relation, and Kleidon and Werner (1993) look for arbitrage opportunities associated with cross-listed stocks. However, these strategies are limited by their dependence on the existence of assets in different countries with the same risk. Other studies focus on one-period returns and the conditional means and variances of one-period returns in characterizing international financial integration. (See, for instance, Wheatley (1988), Gultekin, Gultekin, and Penati (1989), Campbell and Hamao (1992), Bekaert and Hodrick (1992), Chan, Karolyi, and Stulz (1992), King, Sentana, and Wadhwani (1994), and Heston and Rouwenhorst (1994)). One weakness of this sort of approach is that one may overlook persistent comovements in long-term expected returns that could be quite important in asset pricing— comovements of short-term (expected) returns may be obfuscated by transitory shocks that

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mask the true degree of integration.[1] In this article, we develop a new framework in which one can measure both financial and real economic integration by analyzing covariation between components of returns on national stock markets. By examining the comovement of future returns aggregated over a long horizon instead of the comovement of one-period expected returns, our methodology could detect small but persistent comovements in expected returns, and more accurately measure the degree of financial integration.

International economists also have had a long-standing interest in real integration. Real economic integration has traditionally been defined conceptually by considering the degree to which tariffs and other trade barriers inhibit international trade in goods. (See, for example, Eatwell et al. (1987)). However, many nontariff barriers to trade are difficult to measure, such as subtle biases in local regulations.[2] Accordingly, some researchers have explored less direct methods of measuring or testing for integration. One strategy, used by Huang (1987) and Abuaf and Jorion (1990), involves purchasing power parity (PPP), the law of one price in goods markets. However, PPP can be difficult to implement on an economy-wide price level because of international differences in the way price indices are measured.

Other papers have used quantities, rather than prices. One indirect measure, often referred to as "openness," is computed as the ratio of imports and/or exports to national output. This metric is employed by Whitman (1969), Grassman (1980), and Mokhtari and Rassekh (1989). One problem with the openness measure is that it is not clear how much trade there ought to be between any particular pair of countries in the absence of trade barriers. Another class of approaches, found in the literature that deals with the international transmission of business cycles, involves testing measures of output growth in different countries for either contemporaneous comovement or short-term Granger causality. Layton (1987), Stockman (1988), and Phillips (1991) work with three variations on this general approach. However, if there are some shocks that are transmitted across borders with longer lags, such measures may understate the true degree of real integration. The measure we develop here is capable of capturing long-term comovement that might be missed by other methods. Our methodology also departs from the literature in its simultaneous treatment of real and financial linkages. The advantage of this is that it enables us to treat aspects of the stock market, the money market, the goods market, and the foreign exchange market in the context of a single unified system, making it possible to study their interactions without many ad hoc assumptions. Moreover, by relying more on financial market data than on macroeconomic data, we likely encounter fewer problems with measurement error.

[1] Also, in a recent article, Karolyi and Stulz (1995) point out that using the comovement of short-term excess returns (such as daily or weekly) may understate the degree of integration due to nonsynchronous trading and nonoverlapping trading hours across different markets.

[2] For example, in 1992, a Canadian province levied an "environmental tax" on beer cans, in order to protect producers of (bottled) Canadian beer against competition from cheaper canned beer made in the United States.

The mechanics of our approach are straightforward. 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 comovements of these different excess return components among various countries, we can assess the relative importance of different types of international linkages among the world's economies. To be more specific, we measure real economic integration by calculating the correlations of dividend innovations between 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 of two national economies by calculating the correlation between innovations in future expected stock returns in the two 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 excess returns must move in tandem, as linear combinations of a set of common risk premiums. In the extreme case of a one-factor model with fixed factor loadings (betas), 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 in different countries.

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

I. Decomposing Domestic and Foreign Stock Returns

We first use an excess return version of the Campbell (1991) approximate present value relation to decompose the innovation in the domestic stock

[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)). Even in a single factor model, if betas are time-varying, the conditional mean returns of two assets need not be perfectly correlated over time. However, Ferson and Harvey (1991) found that time variation in factor risk premiums accounted for more of the variation in conditional mean returns than did time variation in factor loadings.

return as news about future dividends, interest rates, and equity risk premiums:[4]

$$\tilde{e}_{t+1} = (\mathrm{E}_{t+1} - \mathrm{E}_t)\left\{ \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j} - \sum_{j=0}^{\infty} \rho^j r_{t+1+j} - \sum_{j=1}^{\infty} \rho^j e_{t+1+j} \right\} \tag{1}$$

Here, r is the one-period Treasury bill return, e is the equity excess return (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 $(\mathrm{E}_{t+1} - \mathrm{E}_t)$ is the revision in expectations given new information arrived during period $t + 1$. The parameter ρ is a constant of linearization that is slightly less than one.[5] For convenience, we define simpler notation to refer to the three news components above:

$$\tilde{e} = \tilde{e}_{\mathrm{d}} - \tilde{e}_{\mathrm{r}} - \tilde{e}_{\mathrm{e}} \tag{2}$$

Each term in equation (2) corresponds to one of the summations in equation (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 equity return.

A foreign version of the stock equation (1) is

$$\tilde{e}^*_{t+1} = (\mathrm{E}_{t+1} - \mathrm{E}_t)\left\{ \sum_{j=0}^{\infty} (\rho^*)^j \Delta d^*_{t+1+j} - \sum_{j=0}^{\infty} (\rho^*)^j r^*_{t+1+j} - \sum_{j=1}^{\infty} (\rho^*)^j e^*_{t+1+j} \right\} \tag{3}$$

[4] 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).

[5] ρ in equation (1) is computed as $1/(1 + \exp(f))$, where f is the sample mean of the log dividend-price ratio. We compute a ρ of 0.9973 for the U.S. and 0.9960 for the U.K. monthly data analyzed in the following section. As Campbell and Shiller (1988) discuss, the approximation (equation (1)) is exact whenever the log dividend-price ratio is equal to its sample mean. They also find that the approximation is nearly exact for the range of variation of aggregate U.S. dividend yields in the twentieth century. Campbell and Mei (1993) also tested the accuracy of equation (1); they find that equation (1) holds quite well for a wide range of possible ρ. Thus, we would expect to get similar results even if we had used a common ρ for the two countries.

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:

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

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

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

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

$$\tilde{f} = \tilde{f}_{\mathrm{d}} - \tilde{f}_{\mathrm{r}} - \tilde{f}_{\mathrm{q}} - \tilde{f}_{\mathrm{f}} \tag{6}$$

The intuition for the signs on $f_{\mathrm{d}}, f_{\mathrm{r}}$, and f_{f} components 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 expected 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 article, we measure real integration between two countries by the correlation between the long-run real components of the two stock returns: future domestic dividend innovations, e_{d}, and future foreign dividend innovations, f_{d}.[6] We also measure financial integration by using the correlation between future domestic expected return innovations, e_{e}, and future foreign expected return innovations, f_{f}. To see why these two correlations are reasonable measures of real and financial integration, let us consider the following two extreme hypothetical cases.

[6] The article essentially uses innovations on long-term corporate dividends to proxy for innovations on long-term real economic activities across different countries. To the extent that news on long-term corporate dividends move in tandem with news about real production measures such as long-term GDP growth, our dividend correlations provide an accurate measure of real economic integration across different countries. However, if the distribution of national income shifts dramatically across labor, capital, and government, such as dramatic changes in the relative importance of corporate taxes and wage compensation, then our dividend correlations may be a poor measure of real economic integration across different countries.

First, imagine a world consisting of two countries that have open capital markets, but no international labor mobility, no trade in goods between the two countries, and no international communication about technological innovations. Given the lack of connection between the real economies of the two countries, we would expect zero correlation in long-term profits and zero correlation in e_d and f_d. Next, we assume that changes in the cost of capital are driven by changes in the world price of risk and have negligible effects on production or long-term profits.[7] This is possible because we assume that changes in the stock market risk premium reflect variation in the price of risk, rather than changes in the riskiness of the future cash flows that will accrue to shareholders. Access to foreign financial markets provides investors with increased opportunities for portfolio diversification and intertemporal trade. We further assume that asset returns are conditionally multivariate normal, so that the conditional Capital Asset Pricing Model (CAPM) holds. Because the two capital markets are perfectly linked, and risk premiums are driven by a common world market factor, 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, and 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 country, and that macroeconomic shocks have negligible effects on the expected 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. Of course, in some cases, the correlation between e_d and f_d could overstate the degree of real integration. For example, under autarky, if fluctuations in two agricultural economies were driven largely by the same weather shocks, they could have very highly correlated output and profits in the absence of any genuine real integration. However, the same criticism applies to output-based measures of integration.

II. 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 that expectations are generated by a vector autoregression (VAR). Previous studies have found that dividend yields

[7] Campbell and Ammer (1993) find that the correlation between e_d and e_e is close to zero for U.S. data, using the NYSE value-weighted index. Thus, changes in long-term profits could be independent of changes in long-term cost of capital. We find similar results for both the U.S. and the U.K., which were reported in an earlier version of the article.

and nominal interest rates have significant forecasting power for stock returns. (See, for example, Ferson and Harvey (1991), Fama and French (1988, 1989), and Keim and Stambaugh (1986)). Accordingly, our VAR specification includes a dividend-price ratio for each stock market, and Δi (the change in the nominal U.S. 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 equations (2) and (6) by rearranging the equations as

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

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 (GMM) of Hansen 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:

$$\begin{aligned}\text{Var}(\tilde{e}) = {} & \text{Var}(\tilde{e}_d) - 2\text{Cov}(\tilde{e}_d, \tilde{e}_r) + \text{Var}(\tilde{e}_r) \\ & - 2\text{Cov}(\tilde{e}_d, \tilde{e}_e) + \text{Var}(\tilde{e}_e) + 2\text{Cov}(\tilde{e}_r, \tilde{e}_e)\end{aligned} \tag{10}$$

The results of such a variance decomposition are reported in Table I for several VAR specifications and sample periods.[9] The six components are scaled by the

[8] We use the value-weighted NYSE index as the U.S. stock portfolio and the Financial Times All Shares Index as the foreign equity asset. Data were acquired from the Center for Research in Securities Prices (CRSP) tapes and the London Share Price Database. The Treasury bill return is from Ibbotson Associates.

[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

Table I

Variance Decomposition for U.S. Excess Stock Returns

This table provides the results of a variance decomposition of U.S. excess stock returns using several vector autoregression (VAR) specifications and sample periods. The VAR is in excess return on U.S. stocks, excess return on United Kingdom (U.K.) stocks, U.S. real rates, change in the U.S. nominal interest rates, the real exchange rates, U.S. dividend yield, and U.K. dividend yield. Dividend yields are computed as the sum of dividends over the last twelve months divided by the current price. Excess returns are measured in dollars relative to the one-month U.S. Treasury bill rate. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, and excess returns. The variance of the excess returns is decomposed as follows:

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

where $\tilde{e}_d$ is news about U.S. future dividends, $\tilde{e}_r$ is news about U.S. future interest rates, $\tilde{e}_e$ is news about U.S. future excess returns, and $\tilde{e}$ is innovation in excess return on U.S. stocks ($\tilde{e} = \tilde{e}_d - \tilde{e}_r - \tilde{e}_e$). The components are divided by $\mathrm{Var}(\tilde{e})$ so that they sum to one. Each column represents one VAR specification and lists the sample period, the number of lags used in the estimation, the value of $\mathrm{Var}(\tilde{e})$, and the proportion of $\mathrm{Var}(\tilde{e})$ associated with each component. The standard error for each statistic appears in parentheses. All variables are measured in logs. Variables are measured in real terms unless otherwise noted.

Sample Period Number of Lags	1957–89 2 lags	1957–72 2 lags	1973–89 2 lags	1957–89 5 lags	1979–89 1 lag
$\mathrm{Var}(\tilde{e})$	17.62	12.47	21.37	16.29	21.55
	(1.778)	(1.313)	(2.975)	(1.648)	(4.664)
Component			Proportion of $\mathrm{Var}(\tilde{e})$		
$\mathrm{Var}(\tilde{e}_d)$	0.121	0.277	0.116	0.119	0.210
	(0.375)	(0.214)	(0.294)	(0.375)	(0.145)
$-2\mathrm{Cov}(\tilde{e}_d, \tilde{e}_r)$	−0.033	−0.077	−0.077	−0.065	−0.026
	(0.034)	(0.074)	(0.092)	(0.068)	(0.129)
$\mathrm{Var}(\tilde{e}_r)$	0.031	0.008	0.054	0.051	0.046
	(0.016)	(0.007)	(0.038)	(0.032)	(0.053)
$-2\mathrm{Cov}(\tilde{e}_d, \tilde{e}_e)$	0.075	0.129	−0.123	0.023	0.169
	(0.343)	(0.449)	(0.590)	(0.745)	(0.247)
$\mathrm{Var}(\tilde{e}_e)$	0.729	0.669	0.895	0.749	0.424
	(0.250)	(0.311)	(0.323)	(0.379)	(0.308)
$2\mathrm{Cov}(\tilde{e}_r, \tilde{e}_e)$	0.077	−0.005	0.135	−0.124	0.177
	(0.122)	(0.075)	(0.172)	(0.124)	(0.145)

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 (NYSE). Table II reports the outcomes of analogous variance decompositions for the London Stock Exchange market portfolio. Again, news about future

second. The 2-lag specification had the highest score for both of the shorter samples. The results reported are based on the 2-lag estimation.

Table II

Variance Decomposition for U.K. Excess Stock Returns

This table provides the results of a variance decomposition of United Kingdom (U.K.) excess stock returns using several vector autoregression (VAR) specifications and sample periods. The VAR is in excess return on U.S. stocks, excess return on U.K. stocks, U.S. real rates, change in the U.S. nominal interest rates, the real exchange rates, U.S. dividend yield, and U.K. dividend yield. Excess returns are measured in dollars relative to the one-month U.S. Treasury bill rate. Dividend yields are computed as the sum of dividends over the last twelve months divided by the current price. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, exchange rates, and excess returns. The variance of the excess returns is decomposed as follows:

$$\mathrm{Var}(\tilde{f}) = \mathrm{Var}(\tilde{f}_d) - 2\mathrm{Cov}(\tilde{f}_d, \tilde{f}_r) - 2\mathrm{Cov}(\tilde{f}_d, \tilde{f}_q) - 2\mathrm{Cov}(\tilde{f}_d, \tilde{f}_f) + \mathrm{Var}(\tilde{f}_r) + 2\mathrm{Cov}(\tilde{f}_r, \tilde{f}_q)$$
$$+ 2\mathrm{Cov}(\tilde{f}_r, \tilde{f}_f) + \mathrm{Var}(\tilde{f}_q) + 2\mathrm{Cov}(\tilde{f}_q, \tilde{f}_f) + \mathrm{Var}(\tilde{f}_f)$$

where $\tilde{f}_d$ is news about U.K. future dividends, $\tilde{f}_r$ is news about future interest rates, $\tilde{f}_q$ is news about future exchange rates, $\tilde{f}_f$ is news about U.K. future excess returns, and $\tilde{f}$ is innovation in excess return on U.K. stocks ($\tilde{f} = \tilde{f}_d - \tilde{f}_r - \tilde{f}_q - \tilde{f}_f$). The components are divided by $\mathrm{Var}(\tilde{f})$ so that they sum to one. Each column represents one VAR specification and lists the sample period, the number of lags used in the estimation, the value of $\mathrm{Var}(\tilde{f})$, and the proportion of $\mathrm{Var}(\tilde{f})$ associated with each component. The standard error for each statistic appears in parentheses. All variables are measured in logs. Variables are measured in real terms unless otherwise noted.

Sample Period Number of Lags	1957–89 2 lags	1957–72 2 lags	1973–89 2 lags	1957–89 5 lags	1979–89 1 lag
$\mathrm{Var}(\tilde{f})$	41.38	20.42	58.69	37.88	37.04
	(4.821)	(2.539)	(8.480)	(3.760)	(5.821)
Components			Proportion of $\mathrm{Var}(\tilde{f})$		
$\mathrm{Var}(\tilde{f}_d)$	0.173	0.160	0.179	0.243	0.106
	(0.055)	(0.401)	(0.108)	(0.165)	(0.075)
$-2\mathrm{Cov}(\tilde{f}_d, \tilde{f}_r)$	−0.041	−0.019	−0.060	−0.088	−0.021
	(0.031)	(0.033)	(0.057)	(0.068)	(0.072)
$-2\mathrm{Cov}(\tilde{f}_d, \tilde{f}_q)$	0.000	0.000	−0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$-2\mathrm{Cov}(\tilde{f}_d, \tilde{f}_f)$	0.131	0.165	−0.001	0.141	−0.006
	(0.230)	(0.873)	(0.328)	(0.292)	(0.251)
$\mathrm{Var}(\tilde{f}_r)$	0.013	0.005	0.020	0.021	0.026
	(0.230)	(0.004)	(0.014)	(0.012)	(0.028)
$2\mathrm{Cov}(\tilde{f}_r, \tilde{f}_q)$	0.000	−0.000	0.000	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$2\mathrm{Cov}(\tilde{f}_r, \tilde{f}_f)$	−0.043	−0.025	−0.021	−0.041	0.166
	(0.071)	(0.053)	(0.096)	(0.075)	(0.109)
$\mathrm{Var}(\tilde{f}_q)$	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$2\mathrm{Cov}(\tilde{f}_q, \tilde{f}_f)$	0.000	0.000	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
$\mathrm{Var}(\tilde{f}_f)$	0.766	0.714	0.882	0.724	0.729
	(0.246)	(0.569)	(0.299)	(0.244)	(0.244)

Table III

Contemporaneous Correlations between United States and United Kingdom

This table presents results on the contemporaneous correlations among various variables for different sample periods. e is excess return on U.S. stocks over the one-month Treasury bill. f is excess dollar return on foreign stocks over the U.S. Treasury bill. Δq is change in real exchange rate index. Δy is change in (real) U.S. industrial production growth. Δy^* is change in (real) U.K. industrial production growth. Panels A and B present monthly and quarterly correlations, respectively.

	e	f	Δq	Δy
Panel A: Monthly Correlations				
1957:1–1989:12				
f	0.464			
Δq	−0.031	−0.452		
Δy	0.022	−0.046	0.120	—
1957:1–1972:12				
f	0.348			
Δq	−0.028	−0.028		
Δy	0.133	0.074	0.039	—
1973:1–1989:12				
f	0.516			
Δq	−0.033	−0.487		
Δy	−0.077	−0.137	0.183	
Δy^*	−0.070	0.035	−0.098	0.243

Panel B: Quarterly Correlations of GDP Growth

Sample Period	1957–1989	1957–1972	1973–1989
U.S. & U.K.	0.074	−0.087	0.177

excess returns is the main source of variation in current returns. The exchange rate news component contributes little to equity market variance, because changes in the real exchange rate are difficult to forecast.

Next we examine interactions between the American and British markets. Some simple data correlations appear in Table III 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 comovements in the two stock markets. Common shocks that persistently impact the two economies' long-run economic growth rates or risk premiums, but with different lags, could be an important manifestation of real and financial integration. However, this sort of comovement may not be reflected in the contemporaneous correlation between equity returns or output growth because of its asynchronicity. By examining the comovement of innovations in future dividend growth and excess returns, we may be able to discover more subtle 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 IV for our four 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 play a role. Ironically, the only common component in the domestic and foreign stock return innovations—interest rate news—makes a relatively small contribution. This is because changes in real interest rates are difficult to forecast. Campbell and Ammer (1993) obtain an analogous result from a decomposition of the covariance of U.S. stock and bond returns.

A comparison of the two subsamples of 1957–1972 and 1973–1989 shows a significant rise in the covariance of American and British stock returns after fixed exchange rates were abandoned in 1973. The covariance increases from about 5.6 to 17.5. The decomposition leads us to attribute most of the increase in return covariance to greater financial integration in the later period. Note that the covariance between f_f and e_e has increased significantly from about 1.7 to 22, while changes in the other covariance terms are much smaller in magnitude. The change is statistically significant with a t-statistic of 1.99.

A similar comparison of the two sub-samples of 1957–1972 and 1979–1989 also shows a significant rise in the covariance of American and British stock returns after relaxation of capital controls in October 1979. The covariance has increased from about 5.6 to 17.1. The decomposition also leads us to attribute most of the increase in return covariance to greater financial integration in the later period. We can see that the covariance between f_f and e_e has increased from about 1.7 to 6.7. However, due to the large standard errors, the increases are not statistically significant. Together, the results in Panels C and D suggest that the increase in financial integration is associated more with floating exchange rates than with the alleviation of capital controls.

Table V reports simple correlations of the return components. A comparison of the correlations between f_f and e_e in Panels B and C confirms the greater degree of financial integration measured in the later period. The correlation between U.S. and U.K. excess return news increased more than four-fold between the 1957–1972 and the 1973–1989 sample periods. However, due to the relatively large standard errors, the change from 0.155 to 0.700 is not statistically significant. (Similar results also hold for the 1957–1972 and 1979–1989 period.) The two dividend growth components are highly correlated in both subsamples, 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,

Table IV

Covariance Decomposition of United States and United Kingdom Excess Stock Returns

This table provides the results of a covariance decomposition of U.S. and U.K. excess stock returns using several sample periods. The VAR is in excess return on U.S. stocks, excess return on U.K. stocks, U.S. real rates, change in the U.S. nominal interest rates, the real exchange rates, U.S. dividend yield, and U.K. dividend yield. Excess returns are measured in dollars relative to the one-month U.S. Treasury bill rate. Dividend yields are computed as the sum of dividends over the last twelve months divided by the current price. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, exchange rates, and excess returns. The covariance of the excess returns is decomposed as follows:

$$\begin{aligned}\mathrm{Cov}(\tilde{e},\tilde{f}) = {} & \mathrm{Cov}(\tilde{e}_d,\tilde{f}_d) - \mathrm{Cov}(\tilde{e}_d,\tilde{f}_r) - \mathrm{Cov}(\tilde{e}_d,\tilde{f}_q) - \mathrm{Cov}(\tilde{e}_d,\tilde{f}_f)\\ & - \mathrm{Cov}(\tilde{e}_r,\tilde{f}_d) + \mathrm{Cov}(\tilde{e}_r,\tilde{f}_r) + \mathrm{Cov}(\tilde{e}_r,\tilde{f}_q) + \mathrm{Cov}(\tilde{e}_r,\tilde{f}_f)\\ & - \mathrm{Cov}(\tilde{e}_e,\tilde{f}_d) + \mathrm{Cov}(\tilde{e}_e,\tilde{f}_r) + \mathrm{Cov}(\tilde{e}_e,\tilde{f}_q) + \mathrm{Cov}(\tilde{e}_e,\tilde{f}_f)\end{aligned}$$

where $\tilde{e}_d$ is news about U.S. future dividends, $\tilde{e}_r$ is news about U.S. future interest rates, $\tilde{e}_e$ is news about U.S. future excess returns, and $\tilde{e}$ is innovation in excess return on U.S. stocks ($\tilde{e} = \tilde{e}_d - \tilde{e}_r - \tilde{e}_e$). $\tilde{f}_d$ is news about U.K. future dividends. $\tilde{f}_r$ is news about future interest rates. $\tilde{f}_q$ is news about future exchange rates. $\tilde{f}_f$ is news about U.K. future excess returns. $\tilde{f}$ is innovation in excess return on U.K. stocks. ($\tilde{f} = \tilde{f}_d - \tilde{f}_r - \tilde{f}_q - \tilde{f}_f$). Each panel represents one sample period. The covariance of the return innovations is provided on the first line of each panel. The standard error for each statistic appears in parentheses. A 2-lag VAR is used for the estimation.

	Panel A: 1957:1–1989:12			Panel B: 1957:1–1972:12		
Components	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$
	$\mathrm{cov}(\tilde{e}, \tilde{f})$ = 12.15 (2.183)			$\mathrm{cov}(\tilde{e}, \tilde{f})$ = 5.610 (1.337)		
$\tilde{f}_d$	**1.150**	0.865	2.803	1.492	0.196	−1.519
	(1.288)	(0.667)	(3.688)	2.404)	(0.340)	(2.960)
$\tilde{f}_r$	0.291	0.547	0.626	0.472	0.101	−0.031
	(0.287)	(0.279)	(1.018)	(0.443)	(0.080)	(0.451)
$\tilde{f}_q$	−0.001	0.000	−0.005	−0.002	0.000	−0.001
	(0.004)	(0.002)	(0.007)	(0.002)	(0.000)	(0.002)
$\tilde{f}_f$	−2.168	−0.902	**12.530**	−1.753	−0.265	**1.710**
	(3.688)	(1.478)	(0.007)	(3.507)	(0.566)	(4.602)

	Panel C: 1973:1–1989:12			Panel D: 1979:11–1989:12		
News	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$
	$\mathrm{cov}(\tilde{e}, \tilde{f})$ = 17.51 (3.802)			$\mathrm{cov}(\tilde{e}, \tilde{f})$ = 17.12 (4.852)		
$\tilde{f}_d$	**2.631**	1.779	6.767	2.553	0.398	−1.112
	(2.949)	(1.664)	(5.710)	(2.234)	(1.388)	(2.831)
$\tilde{f}_r$	0.817	1.156	1.394	0.283	0.968	1.855
	(0.936)	(0.765)	(1.758)	(1.353)	(1.049)	(0.513)
$\tilde{f}_q$	0.001	0.002	0.001	0.002	0.004	0.007
	(0.003)	(0.002)	(0.006)	(0.007)	(0.005)	(0.008)
$\tilde{f}_f$	−0.254	−0.599	**22.035**	−1.451	3.155	**6.700**
	(5.159)	(2.846)	(9.103)	(4.700)	(2.086)	(8.532)

Table V

Correlations of United States and United Kingdom Excess Stock Returns Components

This table provides the results of correlations of U.S. and U.K. excess stock return components using several sample periods. The VAR is in excess return on U.S. stocks, excess return on U.K. stocks, U.S. real rates, change in the U.S. nominal interest rates, the real exchange rates, U.S. dividend yield, and U.K. dividend yield. Excess returns are measured in dollars relative to the one-month U.S. Treasury bill rate. Dividend yields are computed as the sum of dividends over the last twelve months divided by the current price. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, exchange rates, and excess returns. $\tilde{e}_d$ is news about U.S. future dividends. $\tilde{e}_r$ is news about U.S. future interest rates. $\tilde{e}_e$ is news about U.S. future excess returns. $\tilde{f}_d$ is news about U.K. future dividends. $\tilde{f}_r$ is news about future interest rates. $\tilde{f}_q$ is news about future exchange rates. $\tilde{f}_f$ is news about U.K. future excess returns. Each panel represents one sample period. The standard error for each statistic appears in parentheses. A 2-lag VAR is used for the estimation.

	Panel A: 1957:1–1989:12			Panel B: 1957:1–1972:12		
News	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$
$\tilde{f}_d$	**0.295**	0.435	0.292	**0.445**	0.339	−0.291
	(0.278)	(0.224)	(0.349)	(0.278)	(0.368)	(0.346)
$\tilde{f}_r$	0.271	1.000	0.237	0.805	1.000	−0.034
	(0.241)	(0.000)	(0.396)	(0.241)	(0.000)	(0.501)
$\tilde{f}_q$	−0.108	0.138	−0.312	−0.762	−0.666	−0.345
	(0.597)	(0.514)	(0.390)	(0.597)	(0.346)	(0.343)
$\tilde{f}_f$	−0.264	−0.216	**0.621**	−0.247	−0.216	**0.155**
	(0.397)	(0.331)	(0.163)	(0.397)	(0.488)	(0.365)

	Panel C: 1973:1–1989:12			Panel D: 1979:11–1989:12		
News	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$
$\tilde{f}_d$	**0.516**	0.508	0.477	**0.606**	0.202	−0.185
	(0.589)	(0.287)	(0.308)	(0.262)	(0.607)	(0.489)
$\tilde{f}_r$	0.485	1.000	0.298	0.137	1.000	0.630
	(0.384)	(0.000)	(0.359)	(0.617)	(0.000)	(0.414)
$\tilde{f}_q$	0.168	0.405	0.048	0.260	0.865	0.487
	(0.751)	(0.425)	(0.376)	(0.589)	(0.168)	(0.500)
$\tilde{f}_f$	−0.022	−0.077	**0.700**	−0.131	0.611	**0.426**
	(0.463)	(0.367)	(0.143)	(0.433)	(0.237)	(0.321)

whereas monetary shocks tend to be common to all countries under fixed rates.[10] By comparing Table V to Table III, we can also see 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. The correlation of monthly contemporaneous output growth for the two countries is 0.243

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

Table VI

Integration Study Using Own Country Currency

This table provides the results of covariances and correlations of United States and United Kingdom excess stock returns components using data from the 1973:1–1989:12 sample periods. The VAR is in excess return on U.S. stocks, excess return on U.K. stocks over the one-month U.K. interest rate, U.S. real rates, U.K. real rates, change in the U.S. nominal interest rates, the real exchange rates, U.S. dividend yield, and U.K. dividend yield. Dividend yields are computed as the sum of dividends over the last twelve months divided by the current price. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, exchange rates, and excess returns. $\tilde{e}_d$ is news about U.S. future dividends. $\tilde{e}_r$ is news about U.S. future interest rates. $\tilde{e}_e$ is news about U.S. future excess returns. $\tilde{e}^*_d$ is news about U.K. future dividends using the British pound ($\tilde{e} = \tilde{e}_d - \tilde{e}_r - \tilde{e}_e$). $\tilde{e}^*_r$ is news about U.K. future interest rates. $\tilde{e}^*_e$ is news about U.K. future excess returns over the one-month U.K. interest rate ($\tilde{e}^* = \tilde{e}^*_d - \tilde{e}^*_r - \tilde{e}^*_e$). The covariances of the various return components are provided in Panel A. The correlations of the various return components are provided in Panel B. Standard errors appear below each statistic in parentheses. A 2-lag VAR is used for the estimation.

	Panel A: Covariance of U.S. and U.K. Excess Returns			Panel B: Correlations of U.S. and U.K. Excess Return Components		
News	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$
$\tilde{e}^*_d$	**3.377**	2.588	7.611	**0.595**	0.625	0.500
	(5.849)	(2.493)	(7.465)	(0.330)	(0.265)	(0.323)
$\tilde{e}^*_r$	1.633	2.035	1.137	0.513	0.876	0.133
	(2.593)	(1.768)	(3.754)	(0.397)	(0.088)	(0.426)
$\tilde{e}^*_e$	0.183	0.091	**22.083**	0.017	0.012	**0.771**
	(5.206)	(0.331)	(8.439)	(0.470)	(0.436)	(0.127)

(0.177 for quarterly data) for the 1973–1989 sample period, while the correlation of news on long-term dividend growth is 0.516 during the same period. There are two explanations for this result. First, output growth may be much more highly correlated than what macroeconomic data suggest because of measurement errors. Second, 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. Our result suggests that using contemporaneous output correlation alone may understate the magnitude of international real integration.

Note that a decomposition based on equations (1) and (5) is asymmetric in the sense that the foreign excess return is measured relative to the domestic interest rate. We would like to be certain that the results reported in Tables IV and V are not mere artifacts of this asymmetry. Accordingly, we also undertake a symmetric covariance decomposition based on equations (1) and (3). Our U.K. 1-month interest rate series begins in the late 1960s, so we can only carry out this alternative exercise for the later (1973–1989) sample period. The results are presented in Table VI. We find that our decomposition results are quite robust to this change in specification. Although real interest rate news is highly correlated between the two countries, suggesting that the U.S. and U.K.

Table VII

Robustness Test If Term Spread Is Included in the VAR

This table provides the results of covariances and correlations of United States and United Kingdom excess stock return components using the 1957:1–1989:12 sample periods. The VAR is in excess return on U.S. stocks, excess return on U.K. stocks, U.S. real rates, change in the U.S. nominal interest rates, the real exchange rates, TERM spread, U.S. dividend yield, and U.K. dividend yield. Excess returns are measured in dollars relative to the one-month U.S. Treasury bill rate. Dividend yields are computed as the sum of dividends over the last twelve months divided by the current price. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, exchange rates and excess returns. $\tilde{e}_d$ is news about U.S. future dividends. $\tilde{e}_r$ is news about U.S. future interest rates. $\tilde{e}_e$ is news about U.S. future excess returns. $\tilde{e}$ is innovation in excess return on U.S. stocks. ($\tilde{e} = \tilde{e}_d - \tilde{e}_r - \tilde{e}_e$). $\tilde{f}_d$ is news about U.K. future dividends. $\tilde{f}_r$ is news about future interest rates. $\tilde{f}_q$ is news about future exchange rates. $\tilde{f}_f$ is news about U.K. future excess returns. $\tilde{f}$ is innovation in excess return on U.K. stocks. ($\tilde{f} = \tilde{f}_d - \tilde{f}_r - \tilde{f}_q - \tilde{f}_f$). The covariances of the various return components are provided in Panel A. The correlations of the various return components are provided in Panel B. The standard error for each statistic appears in parentheses. A 2-lag VAR is used for the estimation.

	Panel A: Covariance of U.S. and U.K. Excess Returns Components			Panel B: Correlations of U.S. and U.K. Excess Return Components		
	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$	$\tilde{e}_d$	$\tilde{e}_r$	$\tilde{e}_e$
$\tilde{f}_d$	**1.148**	0.923	3.512	**0.301**	0.447	0.353
	(3.352)	(0.808)	(4.236)	(0.842)	(0.246)	(0.346)
$\tilde{f}_r$	0.309	0.580	1.014	0.288	1.000	0.363
	(0.312)	(0.302)	(0.890)	(0.254)	(0.001)	(0.306)
$\tilde{f}_q$	−0.001	0.001	−0.003	−0.100	0.182	−0.159
	(0.005)	(0.002)	(0.007)	(0.767)	(0.556)	(0.387)
$\tilde{f}_f$	−0.854	−0.368	**13.217**	−0.106	−0.085	**0.632**
	(4.126)	(1.397)	(4.815)	(0.505)	(0.322)	(0.192)

money markets are well integrated, this correlation does not account for much of the excess return covariance. As before, the high correlation between foreign and domestic excess return news accounts for the lion's share of the covariance of current returns for this sample period.

As an additional robustness check, we have tried adding a TERM spread (the difference in yields between 10 year government bond and the 1-month bill) to the VAR process that generated Tables IV and V. Results for 1957–1989 are given in Table VII. We find the additional variable did not change the character of our decomposition results. We have also tried including a default spread (difference between BAA and AAA bond yield) and market volatility (the standard deviation of daily returns) in the VAR process. In addition, we have estimated our model using other VAR lag lengths. We find the results are quite robust to these different specifications of our forecasting model. In a recent article, Goetzman and Jorion (1993) point out that the predictive power of the dividend yield for returns may be spurious due to the fact that the changes in the dividend yield are highly (negatively) correlated with returns. To guard against the possibility that such a phenomenon is driving our results, we have reestimated our model using dividend yield at $t - 1$ instead of t for the forecast of excess returns at $t + 1$. We find that our basic results remain unchanged. Estimations results from these alternative exercises are available upon request.

III. 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. Panel A of Tables VIII and IX report correlation matrices for industrial production growth in 15 industrialized economies and excess dollar returns on their national stock markets (using data from Morgan Stanley Capital International (MSCI)), respectively. The mean pair-wise correlation of industrial production growth 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 (5), to measure the relative importance of real and financial integration. For each pair of countries (i, j), expectations are generated by forecasts from a pooled 2-lag VAR in f_i, f_j, q_i, q_j, r, Δi, and the dividend-price ratios for each country.[11] Correlations among the dividend growth components and excess return components of the various countries are provided in Panel B of Tables VIII and IX. The means of these correlations are 49 percent and 43 percent respectively, and some of the pair-wise correlations are much higher, suggesting that real and financial linkages are each important for some pairs of countries. For most pairs, the dividend component correlations in Panel B of Table VIII exceeds the contemporaneous output correlations reported in Panel A. We interpret this as evidence that real linkages are much stronger from a long-run perspective than from a short-run perspective, a stylized fact that would be consistent with lags in the transmission of real economic shocks.

In some cases, our results suggest that economies that are geographically proximate are connected quite closely. For example, we find substantial real and financial integration between Switzerland and Germany. In contrast, we find a high degree of financial integration between Canada and the United States, but hardly any real integration. This may be a result of an unusually large proportion of traded firms in Canada are producers of raw materials. These firms tend to be more profitable when commodity prices are high. To the extent that U.S. firms do not benefit from, or perhaps even suffer from, high commodity prices, one might expect a lack of correspondence between corporate profits in the two countries.

[11] Separate vector autoregressions are used for each pair of countries in lieu of estimating a single system to avoid having a problem with degrees of freedom. Results with 1-lag VAR systems were very similar, in most cases. We used the same ρ (0.9970) for each pair of countries in Tables VIII and IX. It is based on the sample mean of the log dividend-price ratio of the MSCI World Index.

Table VIII

Correlations of Industrial Production Growth and Future Dividend News for Fifteen Nations

This table provides the correlations of industrial production growth and future dividend news for fifteen nations. The statistics are estimated based on a pooled 2-lag VAR in excess returns to country index i, excess returns to country index j, dollar exchange rate for currency i, dollar exchange rate for currency j, U.S. real interest rates, changes in U.S. nominal rates, and dividend yields for each pair of countries. Excess returns are measured in dollars relative to the one-month U.S. Treasury bill rate. Dividend yields are computed as the sum over the dividends of the last twelve months divided by the current price. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, and excess returns. The fifteen nations are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, and United States (AU-US). The sample covers the time period of 1974:1–1990:12. Panel A reports the correlations of monthly industrial production growth across fifteen countries. Panel B reports the correlations of innovations in future dividend growth across fifteen countries.

	AU	BE	CA	DN	FR	GE	IT	JA	NE	NO	SP	SD	SZ	UK
Panel A: Correlations of Industrial Production Growth														
AU														
BE	0.27													
CA	0.01	0.07												
DN	−0.02	−0.09	0.22											
FR	−0.03	0.13	0.34	0.20										
GE	−0.04	0.06	0.10	0.33	0.28									
IT	−0.03	−0.13	0.07	0.13	0.14	0.03								
JA	−0.06	0.20	0.31	0.14	0.24	0.09	−0.07							
NE	0.05	−0.01	−0.02	−0.05	−0.09	0.13	0.12	−0.18						
NO	0.04	0.10	0.15	0.06	0.16	0.04	0.05	0.04	−0.00					
SP	0.02	0.10	0.19	0.06	0.27	0.20	0.02	0.04	0.05	0.31				
SD	0.08	0.06	−0.02	0.06	0.01	0.04	0.24	−0.13	0.03	−0.10	0.03			
SZ	0.11	0.02	0.08	0.07	0.08	0.10	0.04	0.10	0.08	0.02	0.13	−0.01		
UK	0.21	0.02	0.06	0.22	0.09	0.14	0.16	−0.14	0.18	0.03	0.07	0.14	−0.00	
US	0.10	0.04	0.43	0.18	0.18	0.13	0.18	0.22	0.10	0.08	0.10	0.07	0.23	0.25
Panel B: Correlations of Future Dividend News														
AU														
BE	0.58													
CA	0.44	0.79												
DN	0.64	0.65	−0.01											
FR	0.49	0.81	0.71	0.34										
GE	0.65	0.37	0.57	0.02	0.66									
IT	0.06	0.58	−0.69	0.14	0.57	0.71								
JA	0.66	0.79	0.56	0.37	0.76	0.66	0.75							
NE	0.76	0.47	0.20	−0.28	0.67	0.86	0.86	0.88						
NO	0.44	0.30	0.40	0.34	0.61	0.72	0.37	0.50	0.65					
SP	0.77	0.39	0.40	0.92	0.42	0.23	0.32	0.42	0.51	0.29				
SD	0.20	0.42	0.08	0.40	0.33	0.28	0.43	0.58	0.21	0.23	0.65			
SZ	0.45	0.23	0.54	0.71	0.55	0.83	0.65	0.84	0.85	0.56	0.15	0.47		
UK	0.52	0.56	0.59	0.30	0.75	0.67	0.43	0.78	0.85	0.39	0.18	0.33	0.56	
US	0.54	0.53	0.13	0.78	0.52	0.55	−0.24	0.85	0.70	0.27	0.42	0.51	0.65	0.42

Table IX

Correlations of Excess Returns and Future Excess Return News for Fifteen Nations

This table provides correlations of excess returns and excess future return news for fifteen nations. The statistics are estimated based on a pooled 2-lag VAR in excess returns to country index i, excess returns to country index j, dollar exchange rate for currency i, dollar exchange rate for currency j, U.S. real interest rates, changes in U.S. nominal rates, and dividend yields for each pair of countries. Excess returns are measured in dollars relative to the one-month U.S. Treasury bill rate. Dividend yields are computed as the sum of dividends over the last twelve months divided by the current price. Hansen's generalized method of moments (GMM) is used to jointly estimate the VAR coefficients and the elements of the variance-covariance matrix of VAR innovations. Forecasts of these variables are then used to calculate excess return innovations and the components of the innovations associated with dividend growths, interest rates, and excess returns. The fifteen nations are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, and United States (AU-US). The sample covers the time period of 1974:1–1990:12. Panel A reports the correlations of monthly (US$) excess returns across fifteen countries. Panel B reports the correlations of future excess return news across fifteen countries.

	AU	BE	CA	DN	FR	GE	IT	JA	NE	NO	SP	SD	SZ	UK
Panel A: Correlations of Excess Returns														
AU														
BE	0.43													
CA	0.20	0.41												
DN	0.30	0.47	0.33											
FR	0.43	0.66	0.46	0.41										
GE	0.63	0.66	0.31	0.47	0.59									
IT	0.30	0.46	0.32	0.33	0.49	0.40								
JA	0.22	0.45	0.24	0.38	0.41	0.38	0.42							
NE	0.41	0.68	0.58	0.49	0.59	0.68	0.41	0.41						
NO	0.32	0.57	0.53	0.37	0.49	0.44	0.29	0.20	0.59					
SP	0.30	0.39	0.28	0.28	0.36	0.34	0.38	0.42	0.36	0.26				
SD	0.35	0.46	0.37	0.36	0.34	0.43	0.36	0.40	0.48	0.42	0.36			
SZ	0.51	0.68	0.51	0.52	0.62	0.76	0.45	0.43	0.74	0.56	0.36	0.51		
UK	0.27	0.52	0.56	0.42	0.53	0.42	0.40	0.56	0.64	0.48	0.34	0.42	0.56	
US	0.17	0.46	0.72	0.35	0.46	0.36	0.28	0.26	0.60	0.53	0.27	0.41	0.53	0.53
Panel B: Correlations of Future Excess Return News														
AU														
BE	0.73													
CA	−0.12	0.25												
DN	0.71	0.64	0.00											
FR	0.67	0.67	0.19	0.82										
GE	0.74	0.58	−0.22	0.33	0.68									
IT	0.47	0.94	−0.39	0.29	0.52	0.79								
JA	0.46	0.67	0.44	0.50	0.80	0.79	0.67							
NE	0.07	0.76	0.02	0.16	0.77	0.57	0.80	0.68						
NO	0.20	0.74	0.42	0.68	0.66	0.25	0.23	0.54	0.57					
SP	0.33	−0.11	0.47	0.10	−0.10	0.05	0.39	0.33	−0.02	0.31				
SD	0.52	0.70	0.37	0.71	0.65	0.56	0.74	0.85	0.89	0.58	0.22			
SZ	0.55	0.50	0.00	0.69	0.73	0.82	0.76	0.62	0.72	0.38	0.09	0.63		
UK	−0.04	0.50	0.71	−0.02	0.53	0.34	−0.09	0.55	0.59	0.39	−0.08	0.51	0.52	
US	−0.06	0.28	0.92	0.09	0.54	0.09	0.18	−0.55	0.50	0.71	−0.05	0.47	0.28	0.69

Interestingly, Japan and the United States are among the few pairs for which we measure negative long-run financial integration.[12] On a mechanical level, this derives from the fact that in our estimated VAR system for these two countries, most of the long-run predictability of stock returns is due to information in dividend-price ratios. Consistent with Campbell and Hamao (1992), we find that for both countries, long-run returns tend to be higher when the own-market dividend-price ratio is higher and when the other country's d/p is lower. This combination of estimated parameters drives our estimated result for financial integration. Our result is not inconsistent with Campbell and Hamao's (1992) finding of *short-term* integration between these countries—our VAR estimates imply a positive correlation of about 15 percent between one-period-ahead expected returns $E_t f_{t+1}$ and a positive correlation of about 20 percent between news about expected returns one period ahead $(E_{t+1} - E_t) f_{t+2}$. However, these positive correlations are dominated by opposite movement in excess returns further in the future. Thus, we find that while the *short-term* expected returns of the two countries are positively correlated, the *long-term* expected returns are negatively correlated. We believe this negative correlation may be partly attributable to the pattern of depreciation of the dollar (against the yen) during the sample period. We obtain a positive correlation when we measure the Japanese excess return in yen rather than dollars, using a specification analogous to that of Table VI.

IV. Conclusions

In this article, we develop a new framework in which one can measure both financial and real economic integration by characterizing covariation between components of returns on national stock markets. 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 errors. Second, by examining the comovement of future return news aggregated over a long horizon instead of the comovement of one-period expected returns, our study could detect small but persistent comovements 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 to making a methodological contribution, this article 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

[12] It is worth noting that the −0.55 coefficient is not statistically significant due to large standard errors in the VAR estimation. We found that Japanese stock returns are difficult to forecast, and, thus, expected Japanese returns are not measured with much precision.

addition, both real and financial linkages are found to be greater after the Bretton Woods arrangement was abandoned in the early 1970s. We also discover that news about future dividend growth in the two countries is more highly correlated than contemporaneous output measures, which is also confirmed by our 15-country application of the methodology. This suggests that there are lags in the international transmission of real economic shocks. Our results imply that contemporaneous output correlations may in general understate the magnitude of real international integration.

Appendix

In order to implement our decomposition, we need to construct empirical proxies for news about future dividend growth, real interest rates, real exchange rates, and excess returns. Assume that e, f, r, and q are the first four elements of a vector z of state variables that follows a first-order VAR process:

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

As noted by Campbell and Shiller (1988), among others, a higher order VAR can be written in "companion form" as a first-order VAR, so our specification is not very restrictive. We define "news" in terms of revisions in expectations. Given the VAR, the revision at time $t + 1$ in expectations of z_{t+j} is:

$$(\mathrm{E}_{t+1} - \mathrm{E}_t)z_{t+j} = A^{j-1}w_{t+1} \tag{A2}$$

Finally, define ι_1 as a vector whose first element is one and whose other elements are zero. This vector picks e out of the state vector, that is, $\iota_1'z = e$. We also define ι_2, ι_3, and ι_4 in an analogous way, to pick f, r, and q out of z. Now we can write the components of domestic and foreign stock returns defined in equations (1), (2), (5), and (6) as:

$$\tilde{e}_{\mathrm{e},t+1} = \iota_1'\rho A(I - \rho A)^{-1}w_{t+1}, \qquad \tilde{f}_{\mathrm{f},t+1} = \iota_2'\rho^* A(I - \rho^* A)^{-1}w_{t+1},$$

$$\tilde{e}_{\mathrm{r},t+1} = \iota_3'(I - \rho A)^{-1}w_{t+1}, \qquad \tilde{f}_{\mathrm{r},t+1} = \iota_3'(I - \rho^* A)^{-1}w_{t+1},$$

$$\tilde{f}_{\mathrm{q},t+1} = \iota_4'(1 - \rho^*)(I - \rho^* A)^{-1}w_{t+1},$$

$$\tilde{e}_{t+1} = \iota_1'w_{t+1}, \qquad \tilde{f}_{t+1} = \iota_2'w_{t+1},$$

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

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