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STRATEGIC RETURNS TO INTERNATIONAL DIVERSIFICATION: AN APPLICATION TO THE EQUITY MARKETS OF EUROPE, JAPAN, AND NORTH AMERICA

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ABSTRACT

We undertake a decomposition of the risk factor loadings of fifteen national stock market returns from 1972 to 1990, using a variant of the Campbell-Shiller (1988) linearization. We find considerable variation among countries in the relative importance of a cash flow component and a discount rate component in determining the beta with the world equity index return and with other risk factors. Also, the international heterogeneity we find in factor loadings suggests that a global portfolio allows substantial hedging opportunities, presumably deriving from differences in underlying economic structure.

Strategic Returns to International Diversification:
An Application to the Equity Markets of Europe, Japan, and North America

John Ammer and Jianping Mei[1]

1. Introduction

Lately, there has been increasing interest in measuring the risks associated with international equity investment. In this paper, we analyze the sensitivity of fifteen national stock market returns to several global risk factors, including the world stock portfolio return. We first restate an expression derived by Campbell (1991) relating the unexpected excess return on any asset to news about its future cash flows and future discount rates. We show how to construct empirical proxies for these sources of news, and we use these proxies to decompose the factor loadings of returns into cash flow betas and expected return betas.

We combine two common modes of analysis in finance: cross-sectional analysis of multiple risk factor models and traditional fundamental analysis that uses the present value relation. The former analysis breaks risk down into sensitivities to various factors, while the latter distinguishes between cash flow risk and discount rate risk. Here we use both contemporaneous cross-sectional information and time-series information to describe the dynamic behavior of asset returns.

In our empirical application, we find that, on average, both the cash flow component and the discount rate component contribute to the world market beta and other risk factor

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loadings, although there is substantial cross-country variation in their relative importance. Second, for most countries, variation in expected returns on the national stock market has the effect of increasing its sensitivity to the world market. Third, cash flow betas and expected return betas often have offsetting effects on the overall betas of assets with economic state variables. Fourth, some assets have positive betas towards some of the state variables while others have negative betas towards these variables. This is interesting because it tells us how particular global economic risks can be reduced through a diversified international portfolio.

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 three different components: innovations (or news) about dividend growth, interest rates, and future expected returns. We then use the three components to compute the cash flow beta, the interest rate beta, and the future return beta in the following section. This framework is derived by Campbell and Mei (1993). In the fourth section, we present our empirical results. The final section summarizes our conclusions.

2. Decomposing 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:[2]

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[2] 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

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

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 constant of linearization that is slightly less than one.[3]

For convenience, we define simpler notation to refer to the three news components above:

$$\tilde{e} = \tilde{e}_d - \tilde{e}_r - \tilde{e}_e \tag{2}$$

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

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details, see Campbell (1991) or Campbell and Ammer (1993).

[3] It is approximately equal to the inverse of the mean of the gross *income* return on stocks, or about .997 for our world stock market measure.

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.

In order to apply equation (2), we need some means by which to compute expectations of the variables in equation (1). 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 interest rates have significant forecasting power for stock returns.[4] Accordingly, our VAR specification includes the dividend-price ratio for the world stock market index and the (ex post) real treasury bill rate, as well as world average measures of inflation and industrial production growth.

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

$$\tilde{e}_d = \tilde{e} + \tilde{e}_r + \tilde{e}_e \tag{3}$$

3. Decomposing Beta

In this paper we define beta using unconditional variances and covariances of innovations in returns and factors. That is, we study the unconditional covariance of the

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

return innovation with a factor innovation, divided by the unconditional variance of the factor innovation. This is neither a full conditional beta (which would use conditional variances and covariances), nor a straightforward unconditional beta (which would use returns themselves rather than innovations in returns). Beta as defined here has the advantage that it can be broken into components in a relatively simple way. If all elements of the conditional variance-covariance matrix of innovations are constant or changing in proportion to one another, then our beta equals the full conditional beta. Under these conditions, asset pricing theory can be used in a deeper analysis of beta, but for the present, we simply take our beta as a useful summary measure of an asset's sensitivity to a factor.

The most familiar type of beta is a market beta. Our definition of the market beta is

$$\beta_{i,m} \equiv \frac{Cov(\tilde{e}_i, \tilde{e}_m)}{Var(\tilde{e}_m)} \tag{4}$$

Here $\tilde{e}_i$ is the unexpected excess return on asset i and $\tilde{e}_m$ is the unexpected excess return on the market. (For notational simplicity we suppress time subscripts on these and similar variables wherever possible.) Equation (2) allows us to decompose $\beta_{i,m}$ as

$$\begin{aligned} \beta_{i,m} &= \frac{Cov(\tilde{e}_{di}, \tilde{e}_m)}{Var(\tilde{e}_m)} - \frac{Cov(\tilde{e}_r, \tilde{e}_m)}{Var(\tilde{e}_m)} - \frac{Cov(\tilde{e}_{ei}, \tilde{e}_m)}{Var(\tilde{e}_m)} \\ &= \beta_{di,m} - \beta_{r,m} - \beta_{ei,m} \end{aligned} \tag{5}$$

where $\beta_{di,m}$ is the market beta of news about asset i's future cash flows, $\beta_{r,m}$ is the market beta of news about future real interest rates, and $\beta_{ei,m}$ is the market beta of news about asset i's future excess returns.

More generally, one may want to work with K common factors in asset returns. Our definition of beta with the k_{th} factor $\tilde{f}_k$ is

$$\beta_{i,k} \equiv \frac{Cov(\tilde{e}_i, \tilde{f}_k)}{Var(\tilde{f}_k)} \tag{6}$$

Equation (2) allows us to decompose this beta as follows:

$$\begin{aligned} \beta_{i,k} &= \frac{Cov(\tilde{e}_{di}, \tilde{f}_k)}{Var(\tilde{f}_k)} - \frac{Cov(\tilde{e}_r, \tilde{f}_k)}{Var(\tilde{f}_k)} - \frac{Cov(\tilde{e}_{ei}, \tilde{f}_k)}{Var(\tilde{f}_k)} \\ &= \beta_{di,k} - \beta_{r,k} - \beta_{ei,k} \end{aligned} \tag{7}$$

Equations (5) and (7) give the basic decomposition we use in our empirical work.

In order to implement our beta decomposition, we need to construct empirical proxies for news about future cash flows, excess returns, and real interest rates. To do this, we assume that we observe N excess returns over a 1-month Treasury bill return. The first excess return is on the value-weighted market portfolio of stocks. We postulate that expectations of these excess returns are linear in a vector of state variables $\underline{x}_t$ with K elements x_{kt}, k = 1, ..., K. The first of these elements is the excess return on the market and the second is the real return on a 1-month Treasury bill, while the other elements are variables known to the market by the end of period t. Thus the excess return on any asset can be written as

$$e_{i,t+1} = a_i' x_t + \tilde{e}_{i,t+1} \tag{8}$$

for some K-element column vector a_i. The expected excess return on the market is given by $a_1' x_t$, and the unexpected excess return on the market is $\tilde{e}_{1,t+1}$.

Next we assume that the state vector follows a first-order VAR:

$$x_{t+1} = \Pi x_t + \tilde{x}_{t+1} \tag{9}$$

where we again use the notational convention that $\tilde{x}_{t+1}$ is the innovation in x_{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 Π is known as the companion matrix of the VAR. The assumptions we have made imply that a_1' is the first row of Π. Given the VAR model, revisions in long-horizon expectations of x_{t+1} are:

$$\left(E_{t+1} - E_t\right) x_{t+j+1} = \Pi^j \tilde{x}_{t+1} \tag{10}$$

Finally, we define ι_2 to be an L-element column vector the second element of which is one with all other elements equal to zero. This vector picks the real interest rate out of the state vector. Then equation (10) and the definitions of $\tilde{e}_{di}$, $\tilde{e}_r$, and $\tilde{e}_{ei}$ in (2) imply that the components of asset returns can be written as

$$\tilde{e}_{ei} = \rho\, a_i' (I - \rho\Pi)^{-1} \tilde{x}_{t+1} , \tag{11}$$

$$\tilde{e}_{di} = \tilde{e}_{i,t+1} + \left(\iota_2' + \rho a_i'\right)(I - \rho\Pi)^{-1} \tilde{x}_{t+1} , \tag{12}$$

and

$$\tilde{e}_r = \iota_2' (I - \rho\Pi)^{-1} \tilde{x}_{t+1} . \tag{13}$$

Because the world market excess return is listed first, we can also write

$$\tilde{e}_{em} = \rho a_1' (I - \rho\Pi)^{-1} \tilde{x}_{t+1} \tag{14}$$

and

$$\tilde{e}_{dm} = \left[\iota_1' + \left(\iota_2' + \rho a_1'\right)(I - \rho\Pi)^{-1}\right] \tilde{x}_{t+1} \tag{15}$$

where ι_1 is defined analogously to ι_2. Innovations in expected future excess returns and cash flows are determined by innovations $\tilde{x}$ to the economic state variables, by the matrix Π governing the evolution of the state variables, by the vectors a_i that map state variables to expected returns, and by unexpected asset returns $\tilde{e}_{1,t+1}$. The term $(I - \rho\Pi)^{-1}\ \tilde{x}_{t+1}$ that appears in the above expressions represents the revision at time t+1 in the discounted multi-period forecast of the state vector into the infinite future. Appropriate elements are taken from this state vector forecast revision to form the components of asset returns.

Once we have the asset return components above, it is straightforward to take ratios of covariances to variances to construct betas. In our empirical work we look at betas with the innovations in the economic state variables $\tilde{x}_{t+1}$. That is, we use state variable innovations as factors, as in Chen, Roll, and Ross (1986) or Ferson (1990). The innovation in the market return is just the first element of $\tilde{x}_{t+1}$. In addition to the beta measures defined in (6) and (7), we will also examine a beta that measures the sensitivity of dividend growth news in a particular country to global cash flow news:

$$\beta_{di,dm} \equiv \frac{Cov(\tilde{e}_{di}, \tilde{e}_{dm})}{Var(\tilde{e}_{dm})} \tag{16}$$

Ammer and Mei (1993) associate correlations among countries' dividend growth news with real economic integration.

4. Beta Decomposition for National Stock Markets

For the period from January 1972 to December 1990, we decompose the risk factor loadings of the U.S. dollar excess (over the one-month treasury bill rate) returns on the Morgan Stanley Capital International (MSCI) world stock market index and the dollar excess returns on fifteen national stock markets (also from MSCI) -- those of the United States, Japan, Canada, and the twelve European countries with the largest market capitalization at the end of our sample period.[5] To implement our decomposition, we first estimate a VAR(1) in

[5] These countries are the United Kingdom, Germany, France, Switzerland, Italy, Netherlands, Spain, Sweden, Belgium, Denmark, Austria, and Norway.

five state variables: the world stock index excess return, the (ex post) real U.S. treasury bill return, the MSCI world index dividend-price ratio, and weighted average measures of world inflation and world industrial production growth.[6] The weights for the latter two variables are the 1990 GDP shares of our fifteen countries, compared at purchasing power parity (PPP) exchange rates estimated by the Organization for Economic Cooperation and Development (OECD).[7] The vectors a_i are then estimated by regressing the sixteen excess returns on the five state variables, the excess return components are computed from equations (11)-(15), and the beta components are calculated from (6), (7), and (16).

Table 1 presents the estimated sensitivity of news about cash flow to innovations in world market returns, the real interest rate, the world dividend yield, the global inflation rate, and the global growth rate of industrial production. The table shows that an unexpected increase in the ex post real U.S. interest rate is strongly associated with an increase in expected future cash flows on nearly all of the national portfolios. This finding is broadly consistent with a procyclical real interest rate in the context of internationally integrated financial markets. Positive innovations in dividend yields also tend to increase expected future cash flows in most of the countries, suggesting that shocks to the dividend growth rate are persistent. Increases in the world inflation rate, on the other hand, are associated with downward revisions in expected (real) future cash flows. These inflation and real interest rate results contradict the notion that stocks are a good hedge against inflation. The inflation result is not surprising given the negative relation between future cash flow innovations and

[6] The D/P ratio is computed from dividends paid over the previous 12 months.

[7] See OECD (1992).

current news about inflation found by Ammer (1994) for many of the same countries. Industrial production shocks, however, generally have negligible implications for future dividends, perhaps because monthly industrial production data tends to be a very noisy signal of economic activity.[8]

Table 2 presents the estimated sensitivity of news about future expected real returns to innovations in economic state variables. We can see that unexpected increases in the world dividend yield are generally positively related to news about future expected returns, which, at least for the United States and the United Kingdom, is not surprising given the well-documented stylized fact for those countries that high dividend yields have presaged high returns.[9] Inflation innovations, on the other hand, tend to lower expected future returns on many country portfolios. This contradicts the conventional wisdom that periods of high inflation are risky periods during which investors require stock returns that are high on average, and it is also consistent with the relation between expected future stock returns and own-country inflation innovations found by Ammer (1994) for a subset of these countries.

Table 3 reports factor betas for the future real interest rate news component that is common to all sixteen asset returns. The positive real interest rate beta reflects persistence in real interest rate shocks. Most of the other betas in this table are close to zero, because our state variable have little forecasting power for future real interest rates.

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[8] Chen, Roll, and Ross (1986), among others, have found a striking lack of correlation between high frequency U.S. industrial production data and stock prices. Using lower frequency data, Fama (1990) found that equity returns led output.

[9] In addition, Campbell and Hamao (1992) note that the U.S. D/P ratio predicts Japanese stock returns.

Much of the variability in stock returns is associated with changing expected future returns. Since the overall return sensitivity to the innovation in a state variable, $\beta_{i,k}$, is just the cash flow sensitivity less the expected future return sensitivity, and less the interest rate sensitivity, we can combine Tables 1, 2, and 3 to get the implied values for $\beta_{i,k}$. These numbers are reported in Table 4. For example, an unexpected 1% increase in the monthly ex post real interest rate is associated with a 0.96% (4.59% - 1.19% - 2.44%) excess return on the world market. For both the aggregate market and for several national stock market portfolios, the positive impact of the real interest rate on cash flows outweighs the negative impact of an increase in expected future returns and future real rates. In other words, the world's stock markets would be even more sensitive to inflation if expected returns were constant.[10]

A proxy for the degree of integration of a country into the real world economy can be derived from the beta of a country's cash flow news with the world's cash flow news (as opposed to the beta with the overall market return, which is also driven by news about future market returns).[11] Table 5 presents estimates of this alternative beta. We use the notation $\beta_{di,dm}$ to indicate that this is the sensitivity of news about future cash flows on asset i, e_{di}, towards news about future cash flows of the market, e_{dm}. These cash flow-cash flow betas

[10] Overall, the story is consistent with Feldstein (1980), who noted that corporate tax distortions can allow inflation to drive a "wedge" between the return to investors and the cost of capital. This could simultaneously reduce investors expected returns, profit growth, and the level of the investment. The relative magnitude of the first two effects determines the correlation between contemporaneous stock return and inflation innovations. See Ammer (1994) for details.

[11] See Ammer and Mei (1993) for an argument in support of this sort of measure.

vary substantially cross-sectionally, ranging from below zero to above two, and they appear to be negatively correlated with the size of the economy. Perhaps a smaller country has less scope for business cycle fluctuations that are asynchronous with those of its neighbors.

5. Conclusions

In this paper, we have used a dynamic accounting framework to associate unexpected asset returns with changing expectations of future cash flows, on the one hand, and discount rates, on the other hand. We have then calculated the betas of the individual components with the aggregate world market and with various economic state variables. This approach has produced several intriguing results.

First, both expected return betas and cash flow betas typically account for a significant part of overall betas. This result contrasts with that of Campbell and Mei (1993), who found, using only U.S. data, that the expected return component tended to account for most of the factor betas of size and industry portfolios. The lower degree of covariation in discount rates in our sample is consistent with the view that our fifteen national stock markets were not perfectly integrated over the 1970s and 1980s. Second, variation in expected returns on national stock markets generally has the effect of increasing their betas with the world market. Third, cash flow betas and expected return betas often have opposing effects on the overall betas of assets with economic state variables. For example, when inflation increases, a negative effect on cash flows typically outweighs a positive effect on the current return that derives from a downward revision in future expected returns. Fourth, we find some assets have positive betas with respect to some of the state variables, while others have negative betas with respect to these variables. This is quite interesting because it tells us how certain world economic risk can be reduced by having a diversified international portfolio. The stock markets of several of the smaller countries, such as Austria and Denmark, appear to have substantial hedge potential. The cash flow and expected return betas are also helpful for certain strategies for risk hedging.

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Table 1

Observable Factor Betas of National Stock Market Cash Flow News ($\beta_{di,k}$)

January 1972 - December 1990

	risk factor				
national stock market	world stock market	real U.S. interest rate	world dividend yield	world inflation rate	world industrial production
world portfolio	0.64	4.59	5.85	-0.28	-0.02
Austria	1.66	15.28	-9.88	-0.80	-0.04
Belgium	0.60	8.49	2.18	-0.47	-0.03
Canada	0.23	-1.90	10.68	-0.04	0.00
Denmark	0.30	6.98	-1.40	-0.32	0.01
France	0.09	1.64	12.11	-0.08	0.00
Germany	-0.13	1.35	11.13	-0.05	-0.01
Italy	0.03	4.10	8.66	-0.12	0.03
Japan	0.71	6.95	3.45	-0.36	0.01
Netherlands	-0.27	0.17	14.06	0.02	-0.00
Norway	1.65	9.62	-1.40	-0.55	-0.02
Spain	1.41	14.47	-7.08	-0.66	-0.05
Sweden	-0.36	2.62	18.19	0.10	0.01
Switzerland	0.21	3.79	7.99	-0.22	-0.02
United Kingdom	-0.42	-2.21	19.55	0.18	-0.03
United States	0.32	2.84	8.17	-0.14	-0.01

Notes: All stock returns are measured in dollars as the excess over the treasury bill rate. The dividend yield is based on dividends paid on the world index over the previous 12 months. Inflation and industrial production growth are averages for the 15 countries using GDP (at purchasing power parity) weights from OECD (1992). All data units are percent per month.

Table 2

Observable Factor Betas of National Stock Market Future Return News ($\beta_{ei,k}$)

January 1972 - December 1990

	risk factor				
national stock market	world stock market	real U.S. interest rate	world dividend yield	world inflation rate	world industrial production
world portfolio	-0.38	1.19	4.66	-0.12	0.00
Austria	1.38	11.85	-11.86	-0.68	-0.04
Belgium	-0.04	4.87	1.00	-0.34	-0.01
Canada	-0.69	-3.76	9.27	0.13	0.02
Denmark	-0.14	4.22	0.17	-0.20	0.02
France	-0.78	-1.90	9.52	0.04	0.03
Germany	-0.74	-2.33	9.89	0.10	0.01
Italy	-0.64	0.20	8.30	0.04	0.01
Japan	-0.07	3.65	3.02	-0.23	0.02
Netherlands	-0.99	-3.13	12.13	0.15	0.03
Norway	0.81	8.83	-7.56	-0.59	-0.02
Spain	0.81	10.39	-6.95	-0.52	-0.03
Sweden	-0.98	-2.55	12.48	0.20	0.01
Switzerland	-0.54	-0.16	6.56	-0.06	0.00
United Kingdom	-1.46	-6.68	16.31	0.33	-0.02
United States	-0.61	-0.85	6.50	0.03	0.01

Notes: All stock returns are measured in dollars as the excess over the treasury bill rate. The dividend yield is based on dividends paid on the world index over the previous 12 months. Inflation and industrial production growth are averages for the 15 countries using GDP (at purchasing power parity) weights from OECD (1992). All data units are percent per month.

Table 3

Observable Factor Betas of U.S. Real Interest Rate News ($\beta_{r,k}$)

January 1972 - December 1990

	risk factor				
	world stock market	real U.S. interest rate	world dividend yield	world inflation rate	world industrial production
$\beta_{r,k}$	0.02	2.44	-0.60	-0.09	-0.00

Table 4

Observable Factor Betas of National Stock Market Returns ($\beta_{i,k}$)

January 1972 - December 1990

	risk factor				
national stock market	world stock market	real U.S. interest rate	world dividend yield	world inflation rate	world industrial production
world portfolio	1.00	0.96	1.79	-0.06	-0.02
Austria	0.25	0.99	2.58	-0.03	0.00
Belgium	0.62	1.19	1.78	-0.04	-0.01
Canada	0.90	-0.58	2.01	-0.09	-0.01
Denmark	0.41	0.32	-0.96	-0.02	-0.01
France	0.85	1.10	3.19	-0.03	-0.02
Germany	0.58	1.24	1.84	-0.05	-0.03
Italy	0.65	1.46	0.97	-0.07	0.02
Japan	0.77	0.86	1.04	-0.04	-0.01
Netherlands	0.70	0.85	2.54	-0.04	-0.03
Norway	0.82	-1.65	6.76	0.14	0.01
Spain	0.58	1.65	0.47	-0.04	-0.01
Sweden	0.60	2.73	6.31	-0.01	0.01
Switzerland	0.72	1.51	2.03	-0.07	-0.02
United Kingdom	1.01	2.04	3.84	-0.06	-0.01
United States	0.91	1.25	2.27	-0.08	-0.02

Notes: All stock returns are measured in dollars as the excess over the treasury bill rate. The dividend yield is based on dividends paid on the world index over the previous 12 months. Inflation and industrial production growth are averages for the 15 countries using GDP (at purchasing power parity) weights from OECD (1992). All data units are percent per month.

Table 5

World Stock Market Cash Flow News Betas of National Stock Market Cash Flow News

January 1972 - December 1990

national stock market	$\beta_{di,dm}$
world portfolio	1.00
Austria	2.48
Belgium	1.15
Canada	0.34
Denmark	0.65
France	0.28
Germany	0.02
Italy	0.24
Japan	1.14
Netherlands	-0.18
Norway	2.25
Spain	2.12
Sweden	-0.28
Switzerland	0.52
United Kingdom	-0.45
United States	0.55

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