UCD GEARY INSTITUTE

DISCUSSION PAPER

SERIES

Investigating Sources of Unanticipated Exposure in Industry Stock Returns

Investigating Sources of Unanticipated Exposure in Industry Stock Returns

Don Bredin
University College Dublin *

Stuart Hyde
University of Manchester†

Abstract

This paper investigates the degree of both foreign exchange rate and interest rate exposure of industry level portfolios in the G7. Our paper draws on the efficient market hypothesis and examines the extent of unexpected foreign exchange (and interest rate) exposure rather than the standard approach of focusing purely on the change in foreign exchange (and interest rate) exposure. The results from our baseline regressions are consistent with those previously found in the literature that there is little evidence of exchange rate exposure in most markets – this is the *exchange rate exposure puzzle*. The second critical element of our analysis is that we investigate the sources of the exposure and examine the existence of indirect levels of both foreign exchange and interest rate exposure. The findings of exposure to foreign exchange rates and interest rates are extensive for industry sectors in the G7 economies when we take account of the possible channels of influence. Results indicate key differences between countries in terms of the relative importance of these cash flow and discount rate channels.

Keywords: Foreign exchange, exposure, interest rates, stock returns, international finance
JEL Classification: F31, G15

* **Corresponding author**: Don Bredin, School of Business, University College Dublin, Blackrock, Dublin 4, Ireland. Tel: +353 1 716 8833. Fax: +353 1 283 5482. E-mail: don.bredin@ucd.ie. The authors would like to thank participants at the 2009 INFINITI Conference at Trinity College Dublin and Colm Kearney in particular for helpful comments.

† Stuart Hyde, Manchester Business School, University of Manchester, MBS Crawford House, Booth Street East, Manchester, UK M13 9PL. Tel: +44 161 275 4017. Fax: +44 161 275 4023. E-mail: stuart.hyde@mbs.ac.uk

1 Introduction

According to financial theory changes in exchange rates and interest rates should affect the value of the firm. Exchange (interest) rate exposure refers to the extent to which the value of the firm is affected by changes in exchange (interest) rates. The issue of exposure to both exchange rate and interest rate risk is of importance to individual investors and firms. For example, changes in exchange rates and interest rates affect an investor holding a portfolio consisting of securities from different countries. While changes in exchange rates naturally impact the cash flows of multinational firms with operations in different foreign locations, importers and exporters and even solely domestic firms through changes in the competitive environment and the terms of trade. For example, Bodnar, Dumas and Marston (2002) and Hutson and Stevenson (2009) highlight the fact that while local firms may not trade internationally, they may still be exposed to changes in exchange rates, if for example they are in competition with foreign firms in the domestic market. Hence there has been much interest in evaluating the level of exchange rate exposure a firm or industry faces. Similarly changes in interest rates will alter the firms' financing costs, affecting the amount of loan interest and principal payments and impacting cash flows of the firm. However, the vast majority of recent studies assessing exposure focus solely on foreign exchange exposure and relatively few take account of interest rate exposure.

In this paper we examine the level of exposure faced by industries to both interest rate and foreign exchange rate risk across all G7 countries using a very different approach to the previous studies in the literature. First, rather then focus solely on the extent of foreign exchange and interest rate exposure we examine the extent of unexpected levels of exposure. A number of theories based on the assumption of efficient markets would suggest that only unanticipated levels of exposure should influence firm or industry portfolio prices immediately. On the other hand, anticipated changes in exposure should not affect firm or industry portfolio prices, but instead such information should already be priced into the asset by market participants. Hence the EMH indicates that the unexpected component of foreign exchange (interest rate) movements is a more appropriate measure to examine the extent of exposure.[1] This empirical distinction has not been previously examined in the literature, but has been highlighted by a number of studies. Giddy and Dufey (1995) and Kanas (1996) highlight the issue regarding the nonlinear relationship between exchange rates and corporate cash flows. While, Bartram (2004) focus on complicated exposures through the potential effects on sales prices, production costs, and market share and the implications for the firms competitiveness (see, Levi, 1994).[2] A second important distinction between our paper and previous studies is that we also identify the sources of any possible exposure.[3] Rather than adopt a form of the Jorion (1990) approach which has been popular in the literature we use the rational valuation formula (RVF) for stock prices as our starting point to analyse the unexpected exposures. The RVF states that prices will equal the discounted present value of future dividends (cash flows) and discount rates. The metric we employ draws on the multi factor asset pricing model, the arbitrage pricing theory (APT), which indicates the sensitivity of the portfolio

[1] A further justification of our approach is that the vast majority of empirical studies find the intuitively unappealing result that global industries/firms are not particularly exposed to foreign exchange movements.

[2] A recent study by Bartram (2004) has identified significant levels of linear and nonlinear foreign exchange exposure for German corporations.

[3] Given the level of detail of our results in relation to the sources of possible exposure, we have chosen to restrict our analysis to industry rather than firm level analysis.

(β) to the particular factor (foreign exchange or interest rate). It is this approach that leads to the identification of possible drivers for the degree of exposure. The exposure to both foreign exchange and interest rates can be apportioned to revisions in expectations regarding future cash flows (cyclical effects), future interest rates (monetary policy effects) and future discount factors (i.e. risk premiums).[4] Naturally the value of industry returns may fall either because exchange rates affect expected cash flows, the discount rate or cost of capital applied to the cash flows changes.[5]

A pre-requisite for this approach to yield insights into the levels of exposure across our G7 portfolios, is that the model of returns is reasonable. To facilitate this we use a (linear) factor model which includes macroeconomic and financial variables known to help predict portfolio returns. Our results for the direct effects of both foreign exchange and interest rate exposure applied to industrial sectors in the G7 are weak, but fully consistent with those found previously in the literature. It is only when we adopt the decomposition that we identify the full extent of foreign exchange and interest rate exposure. Our results are intuitively appealing. Open markets such as France, Germany and Italy are particularly exposed to movements in foreign exchange. However, we also find that the U.S. has widespread exposure to foreign exchange movements. Our results are consistent with the previous finding that smaller and more open markets also have the largest dispersion in inter-industry foreign exchange exposure. Unanticipated changes in exchange and interest rates significantly impact expectations of both future cash flows and discount rates. Overall, however, there is greater evidence of transitory effects (through discount rates/future excess returns) than permanent cash flow effects.

Following the decomposition the extent of the exposure, in particular at the foreign exchange level, is considerable compared to the previous findings in the literature. The vast majority of the literature (using firm or industry level data) has typically established low levels of significant exposure giving rise to the *foreign exchange exposure puzzle*.[6] For instance, in his seminal paper, Jorion (1990) finds significance in only 15 of his sample of 287 U.S. multinational firms, this only slightly more than one would expect by pure chance alone. Additionally, Choi and Prasad (1995) find only limited evidence of exposure with only 15% of 409 U.S. multinational firms having a significant coefficient. Suggestions that such weak findings are due to the relatively closed nature of the U.S. economy are largely unconvincing. He and Ng (1998) find that approximately one quarter of the 171 Japanese multinational firms in their sample face significant exchange rate exposure with Nydahl (1999) establishing similar levels of significance for Swedish firms.[7] Khoo (1994) investigates the level of exposure to exchange rates of mining firms in Australia showing that the sensitivity of stock returns to movements in exchange rates is small. However, Doidge, Griffen and Williamson (2006) argue that levels of exchange rate exposure are economically meaningful. While, more positive evidence is provided by Kiymaz (2003) who finds high levels of exposure for a sample of 109 Turkish firms. Kiymaz (2003) reports that 47% of all firms face significant exchange rate risks although, for example, this rises to 82% of textile firms and 65% of financial firms.

[4] The importance of distinguishing between cash flow and interest rate effects is emphasized by Chow, Lee and Solt (1997) since they often produce offsetting effects masking the actual level of exposure.

[5] The distinction is important since Campbell and Vuolteenaho (2004) argue that cash flow shocks have permanent effects on wealth while news regarding discount rates has a transitory impact.

[6] See Muller and Verschoor (2006) and Bartram and Bodnar (2007) for comprehensive surveys of the exchange exposure puzzle literature.

[7] Friberg and Nydahl (1999) uncover little evidence of exposure in 11 national stock markets, while Kearney (2000) examines the determinants of the transmission of international stock market volatility.

Consistent findings are provided at the industry level. For example, Bodnar and Gentry (1993) measure the level of exchange rate exposure in the more open economies of Canada and Japan in addition to the U.S. but find only limited evidence, reporting that only 11 out 39 U.S. industries face significant exposure and only 4 out 19 industries in Canada although 7 out of 20 industries exhibit significant exposure in Japan.

Following the development of theoretical models of exchange rate exposure (Alder and Dumas, 1984; Hekman, 1985) recent work has focussed on the relationship between exchange rate exposure and the degree of openness. Indeed there is much evidence on the link between exposure and the level of international activity/foreign sales (see, Jorion, 1990; Donnelly and Sheehy, 1996; He and Ng, 1999; Nydahl, 1999; Glaum, Brunner and Himmel, 2000; Faff and Marshall, 2005). Yet, using an 8 country sample of industrialized and emerging markets, Dominguez and Tesar (2001a, 2001b) find there is little if any link between international trade and exchange rate exposure.[8] However, in a recent study, Hutson and Stevenson (2009) provide a detailed and large sample analysis across 23 developed countries finding consistent evidence of a positive relationship between openness and foreign exchange exposure, using a number of openness proxies. Possible reasons why the literature has had difficulty in identifying any foreign exchange exposure may be due to issues such as time varying risks or possibly the asymmetric nature of exposure. Bartram (2004) indicates that foreign exchange rate exposure effects are likely to be non-linear and that this may be as a result of cash flows being a non-linear function of foreign exchange rates.

Clearly, firms are not only concerned with potential exchange rate exposure, but also possible exposure to interest rates. Sweeney and Warga (1986) establish the significance of interest rate risk for U.S. stock returns, while, using an international sample, Madura and Zurruk (1995) highlight the impact of interest rate risk on bank stocks. Although studies that simultaneously take account of both exchange rate and interest rate risk find mixed levels of exposure. Prasad and Rajan (1995) find levels of exposure to foreign exchange and interest rates is less than 5% for firms/industries in the G4 economies while Miller and Reuer (1998) find exchange rate exposure in 13-17% of U.S. manufacturing firms and interest rate exposure in 9-12% of firms. Choi, Elyasiani and Kopecky (1992) and Choi and Elyasiani (1997) investigate the sensitivity of U.S. bank stock returns to market, interest and exchange rate risks. The sensitivity to market risk is significantly positive for all banks, the sensitivity to interest rate risk is significant for less than half of the bank stocks and the exchange rate risk is significant for nearly all the banks (49 out of 59). Moreover they find that all the significant interest rate sensitivities are negative while the exchange rate response is mixed.

The remainder of the paper is set out as follows: section 2 introduces the modeling framework; the standard model, the Campbell decomposition and the forecasting approach. Section 3 discusses the data and empirical results and section 4 provides some concluding comments.

[8] Miller and Reuer (1998) show that firms engaged in foreign direct investment (FDI) face lower exchange rate exposure.

2 Theoretical Framework & Exposure Metrics

2.1 Campbell Decomposition

The standard starting point that has been adopted by the literature has been the Jorion (1990) approach;

$$R_{it} = \beta_0 + \beta_1 \Delta s_t + \beta_2 R_{mt} + \varepsilon_{it} \tag{1}$$

where β_0 is a constant term, R_{it} denotes the return on security/portfolio i in period t, Δs_t is the contemporaneous change in the real exchange rate, R_{mt} is the return on the market and ε_{it} is an error term. Rather than focusing solely on foreign exchange exposure, this model can be augmented to take into account a comprehensive set of exposures, i.e. market, foreign exchange and interest rate exposure. Equation (1) is extended to include changes in real interest rates, Δi_t:

$$R_{it} = \beta_0 + \beta_1 \Delta s_t + \beta_2 R_{mt} + \beta_3 \Delta i_t + \varepsilon_{it} \tag{2}$$

Models of the form of equation (2) can be viewed as extensions of the basic market model or CAPM to a three factor model. Similarly, a linear factor model (Burmeister and McElroy, 1988) is used to justify the use of market returns, interest rates and exchange rates as factors in the estimation of a model of state variables that impact all industry sectors. The log-linear representation of the present value model formulated by Campbell and Shiller (1988b) approximates the one-period log holding. Using the framework developed by Campbell (1991) it is possible to obtain a decomposition of the unexpected portfolio return (a detailed derivation is provided in appendix 1):

$$\begin{aligned} \tilde{e}_{i,t+1} &= (E_{t+1} - E_t) \left\{ \sum_{j=0}^{\infty} \rho^j \Delta d_{i,t+j+1} - \sum_{j=0}^{\infty} \rho^j r_{i,t+j+1} - \sum_{j=1}^{\infty} \rho^j e_{i,t+j+1} \right\} \\ &= \tilde{e}_{di,t+1} - \tilde{e}_{ri,t+1} - \tilde{e}_{ei,t+1} \end{aligned} \tag{3}$$

where ρ_i is $1/(1 + exp(\delta_i))$. The decomposition states that the unexpected excess return on portfolio i, $\tilde{e}_{i,t+1}$ is equal to the news about future dividends on portfolio i, $\tilde{e}_{di,t+1}$ (related to cyclical economic effects), minus the news about future real interest rates, $\tilde{e}_{ri,t+1}$ (related to monetary policy effects), and the news about future excess returns, $\tilde{e}_{ei,t+1}$ (related to risk premiums).

The sensitivity (beta) decomposition is defined by using the unconditional variances and covariances of the innovations in returns and factors. The beta with respect to the kth factor (e.g. exchange rate or interest rate changes) is defined as:

$$\beta_{i,k} = \frac{cov(\tilde{e}_i, \tilde{e}_k)}{var(\tilde{e}_k)} \tag{4}$$

which is simply the covariance between the unexpected excess return on portfolio or industry i, $\tilde{e}_i$, and the unexpected excess return on factor k, $\tilde{e}_k$, divided by the variance of the unexpected excess return on the kth factor. $\beta_{i,k}$ can then be decomposed into:

$$\begin{aligned}\beta_{i,k} &= \frac{cov(\tilde{e}_{di},\tilde{e}_k)}{var(\tilde{e}_k)} - \frac{cov(\tilde{e}_{ri},\tilde{e}_k)}{var(\tilde{e}_k)} - \frac{cov(\tilde{e}_{ei},\tilde{e}_k)}{var(\tilde{e}_k)} \\ &= \beta_{di,k} - \beta_{ri,k} - \beta_{ei,k}\end{aligned} \tag{5}$$

where $\beta_{di,k}$ is the beta between the innovation in the k^{th} factor (e.g. exchange rate changes) and news about portfolio i's future cash flows or dividends, $\beta_{ri,k}$ is the beta between the innovation in the k^{th} factor and news about future real interest rates and $\beta_{ei,k}$ is the beta between the innovation in the k^{th} factor and news about future industry excess returns. Given that we take both a cross country and industry perspective to identify the level of exposure our β terms may have very different implications. Commonalities in the cash flow factor for the same industries across different countries is likely to indicate the exposure of profits to, for example exchange rate movements. While for industries in the same country the cash flow factor may indicate the importance of national macro-economic issues. Industries in the same countries may also feed through via discount rates and imply country specific factors. Finally, common industries across different countries are likely to imply common risk premium effects.[9]

2.2 Forecasting Approach

In order to estimate the beta decomposition, it is necessary to construct empirical proxies for the news about future cash flows, excess returns and real interest rates. The excess return on each portfolio $\mathbf{e}_i$ under consideration is assumed to be a linear function of the chosen l state variables $\mathbf{x}_t$ (here $l = 3$) which are known to all participants in the market and which provide a summary of the state of the economy at the end of period t:[10]

$$\mathbf{e}_{i,t+1} = \mathbf{a}_i\mathbf{x}_t + \tilde{\mathbf{e}}_{i,t+1} \tag{6}$$

where $\tilde{\mathbf{e}}_i$ is the ith row of the vector $\tilde{\mathbf{e}}$ and $\mathbf{a}_i$ is the ith row of the l element coefficient vector. The state variables are assumed to be the real stock market excess return and changes in the real exchange rate and the real interest rate. Additionally, the vector of state variables is assumed to follow a first order vector autoregression (VAR) process:[11]

$$\mathbf{x}_{t+1} = \mathbf{\Pi}\mathbf{x}_t + \tilde{\mathbf{x}}_{t+1} \tag{7}$$

where $\tilde{\mathbf{x}}_{t+1}$ is the innovation in the vector of state variables. Hence the expectation in the current period of any future values of the state variables is:

$$E_t\mathbf{x}_{t+j+1} = \mathbf{\Pi}^{j+1}\mathbf{x}_t \tag{8}$$

[9] Ammer and Wongswan (2007) apply a similar approach to investigate industry and country effects to international stock market integration.

[10] The terms in bold represent a vector/matrix.

[11] We tested the lag length in the VAR using the standard information criteria, Akaike information (AIC) and Schwartz Bayesian (SBC) and found a lag length of one. This is consistent with studies that have adopted this approach in the asset pricing literature, (see Cuthbertson and Nitzsche, 2005).

and the revision in long horizon expectations of $\mathbf{x}_t$ made between the current period and the next is:

$$(E_{t+1} - E_t)\, \mathbf{x}_{t+j+1} = \mathbf{\Pi}^j \tilde{\mathbf{x}}_{t+1} \tag{9}$$

Using the definitions of the news variables in equation (5) and the revision of expectations in the vector of state variables in equation (9), it is possible to derive the 'news' components of the portfolio returns:

$$\begin{aligned} \tilde{\mathbf{e}}_{di} &= \tilde{\mathbf{e}}_{i,t+1} + (\iota_r' + \rho \mathbf{a}_i')\,(\mathbf{I} - \rho\mathbf{\Pi})^{-1}\,\tilde{\mathbf{x}}_{t+1} \\ \tilde{\mathbf{e}}_{ei} &= \rho \mathbf{a}_i'\,(\mathbf{I} - \rho\mathbf{\Pi})^{-1}\,\tilde{\mathbf{x}}_{t+1} \\ \tilde{\mathbf{e}}_{r} &= \iota_r'\,(\mathbf{I} - \rho\mathbf{\Pi})^{-1}\,\tilde{\mathbf{x}}_{t+1} \end{aligned} \tag{10}$$

ι_r is a selection vector which 'picks out' the real interest rate from the VAR, i.e. $\iota_r' \mathbf{x}_{t+1} \equiv r_{t+1}$. The left hand side variables in equation (10) are the news about future dividends on portfolio i, (related to cyclical economic effects), news about future excess returns, (related to risk premiums) and finally news about future real interest rates, (related to monetary policy effects). The factor innovations are the residuals from the k individual VAR equations, i.e.:

$$\tilde{\mathbf{e}}_k = \tilde{\mathbf{x}}_{k,t+1} \tag{11}$$

where $\tilde{\mathbf{x}}_{k,t+1}$ is the kth row of the innovation vector $\tilde{\mathbf{x}}_{t+1}$. Having estimated equations (6), (7) and (9), and obtained the variables in equations (10) it is straightforward to calculate the relevant variances and covariances, and hence the betas in equation (5).

3 Data and Empirical Results

The degree of exchange rate and interest rate exposure is examined for the 9 industry portfolios (level 2 sectors) for G7 countries, Canada, France, Germany, Italy, Japan, U.K. and the U.S..[12] The sample runs from January 1975 to September 2007. Figure 1 plots market prices, short-term interest rates, effective foreign exchange rate and consumer price index (CPI) for all G7 countries. Overall trends are similar with the exception of foreign exchange movements. Table 1-2 reports the industry correlations across the different G7 countries. Correlations for the industry sectors are generally very high across countries, with the exception of Japan where the correlations are low for a number of industries including basic materials, consumer services, financial, oil and gas and utilities. The state vector contains the real market excess return, the real interest rate and the change in the real exchange rate. The real market excess return and industry excess returns are measured using the change in the log real total market and industry return indexes, incorporating prices and dividends, in excess of the real short term interest rate. The real interest rate is calculated using the three month interbank rate minus the rate of inflation calculated from the CPI,

[12] Given the level of detailed results from the variance decomposition approach and the number of countries studied, we chose to concentrate on the relatively broad measure of industry portfolios.

and the exchange rate is the real effective exchange rate. All data series are collected from Datastream.[13]

The three state variables enter the VAR as deviations from their mean and the VAR is estimated with a lag length of one. The constraint of the value of ρ to be the same across each industry portfolio restricts the impact of each factor innovation on revisions to expectations of future real interest rates $\beta_{ri,k}$ to be the same across all industry sectors.[14] Before addressing the extent of the foreign exchange and interest rate exposure, we investigate the general level of market exposure across the industry level portfolios for all G7 countries. Do the portfolios over or under react to events in the market and are there general levels of homogeneity in terms of levels of exposure?

Table 3 reports the market excess return sensitivities (betas) for each of the industrial sectors in the seven countries as well as industry and country averages. In all cases the betas are significant at the 5% level. As well as all the betas being statistically significant, there are broad similarities in the behavior of common portfolios to changes in market risk across G7 countries. This is particularly clear from the final row which indicates the averages by country. However, there are deviations in industry portfolio risk premia for each country, e.g. the beta range for the U.S. is 0.439 for utilities to 1.395 for technologies. Thus for every 1% increase in market risk, there is a wedge of close to 1% driven between the two U.S. sectors. However, as can be seen by the last column in table 3 (industry averages) the behavior of the portfolios appear to be consistent across countries, e.g. there are generally large betas for technology and small betas for utilities. Thus the G7 industry portfolios respond in approximately the same manner to changes in market risk, suggesting some degree of homogeneity between these industries. Given the level of homogeneity of market risk premia, to what extent is there likely to be homogeneity of foreign exchange and interest rate exposure across the G7 countries?

3.1 Levels of Foreign Exchange & Interest Rate Exposure

We now move on to the assessment of the degree of exposure to interest rates and exchange rates for the industry portfolios. In table 4, the results for the degree of foreign exchange exposure show that with the exception of Canada, there is little if any sensitivity. The industries that do show evidence of significance, indicate mixed signs in relation to the exposure. For example in Canada industries appears to heavily exposed, with a positive sign in each case. This would indicate that an unexpected appreciation of the Canadian Dollar coincides with a rise in current expected returns for all Canadian portfolios. The exposure results for Canadian industries are consistent with the results for such firms in Booth and Rotenberg (1990). In contrast, for Germany, the results indicate that an unexpected appreciation is consistent with a fall in portfolio returns. Although the extent of foreign exposure is not widespread as indicated by the industry averages, the country averages emphasize the severity of the exposure on particular industries.

[13] A detailed account of the data used in the paper is provided in appendix 2. A limited number of the industry portfolios are only available for a reduced sample and are therefore omitted. These are oil & gas and technology for Germany and utilities for France and the U.K.

[14] This assumption is adopted widely in the decomposition literature applied to stock returns, see Cuthbertson and Nitzsche, 2005.

The results for interest rate movements in table 5 are also mixed with Canada, Japan and the U.K. all showing evidence of widespread exposure, while France, Germany, Italy and the U.S. show very little. With the exception of two cases all significant findings have a negative sign. The results imply that a surprise increase in real interest rates will lead to a downward reduction in industry returns for Canada, Japan and the U.K. Overall our results to date indicate that G7 industry portfolio returns face considerable and homogenous levels of exposure to movements in market returns. While there is some evidence to suggest exposure to movements in interest rates, the exposure to foreign exchange movements is not widespread although there is some indications of the severity to certain industries. The results presented here on the foreign exchange exposure, although using a very different approach, are generally consistent with the results found to date in the literature (see Choi and Prasad, 1995; Bodnar and Gentry, 1993).

Although our findings are consistent with those reported in the exposure literature to date, there is an important distinction between our approach and previous papers. Our empirical model has concentrated solely on the extent of exposure via unexpected changes in exchange rates and interest rates. Although unexpected exposure, and in particular foreign exchange exposure, has not been empirically modeled previously, it could be thought of as an avenue for more complicated exposures. Bartram (2004) in particular highlights more complicated exposures through the potential effects on sales prices, production costs, and market share and the implications for the firms competitiveness. However, since the vast majority of the previous literature finds mixed results in terms of exposure to actual changes (i.e. aggregating expected and unexpected changes), it may be argued that the lack of any findings on foreign exchange exposure to unanticipated changes are not particularly surprising. By contrast, our results for the level of stock market return exposure faced by industries across the G7 is considerable and relatively homogenous. We now move to the key aspect of our empirical approach, the ability to decompose the avenues of exposure for both exchange rates and interest rates. Several studies highlight the importance of possible nonlinearities (Giddy and Dufey, 1995; Kanas, 1996; Bartram, 2004). This decomposition automatically takes account of potential nonlinear relations in the level of exposure.

3.2 Levels of Indirect Exposure

The decompositions of the sensitivity terms, news about future cash flows $\beta_{di,k}$ and news about future excess returns $\beta_{ei,k}$, as well as country and industry averages are reported for all the G7 countries in tables 6 to 8. The decomposition clearly identifies the extent of indirect foreign exchange and interest rate exposure for industries across the G7. It is only via the decomposition that the full extent of the foreign exchange exposure in particular is uncovered. Unexpected changes in excess market returns typically have a positive impact on revisions in expectations about both future cash flows and future excess returns. Moreover, the majority of estimated coefficients are statistically significant. Furthermore the absolute value of the cash flow (dividend) betas is much larger than that of the future excess return betas, suggesting changes in stock returns associated with a change in the market excess return are due more to revisions in expectations about future dividends than future excess returns.[15] Of particular note is the degree of homogeneity of the results across both industry

[15]This suggests, according to Campbell and Vuolteenaho (2004), that the permanent effects on wealth are greater than the transitory effects on wealth and so future investment opportunities are reduced. Campbell and Vuolteenaho (2004) refer to this as the 'bad' beta outweighs the 'good' beta.

and country and the consistency in relation to country-wide and industry-wide responses to market movements.

In relation to foreign exchange exposure, table 7, what is clear from the decomposition results is that there exists considerably greater levels of exposure than that identified solely by the initial regression analysis in table 4. The level of foreign exchange exposure is dramatic once we take into account the channels in which the influence occurs. As would be expected open markets, such as France, Germany and Italy are particularly sensitive, but also the U.S., where little if any exposure was previously identified, now shows consistent levels of exposure across all industry categories. In the majority of industry cases for the U.S., a Dollar appreciation has an adverse influence on future excess returns and this dominates any cash flow effect. Our results imply that the 'good' transitory effects outweigh the 'bad' permanent effects. The implication of the excess return channel bearing the brunt of the exposure is that any negative effect on wealth is likely to be transitory and the investment opportunities into the future are likely to be positive. Our results for the US is a further indication of potentially why previous studies have been unable to uncover the extent of foreign exchange exposure.

Consistent signs are found for the European markets, but the influence on future cash flows dominates. While Canada (and to a lesser extent Japan) are certainly exposed to exchange rate risk, the influence is in the opposite direction. The exposure results for Canada are consistent with our results from stage 1, where Canadian industries were found to be consistently exposed to foreign exchange rate movements in such a manner. While we previously found a large degree of homogeneity to overall market movements, this is not the case in terms of exposure to foreign exchange movements. Although the sensitivity of G7 industry-wide exposure varies considerably, there is general consistency at the country level. The severity of the exposure on particular industries is emphasized by the country average effects, with all countries reporting a significant effect with the exception of the U.K.. The heterogeneity in foreign exchange exposures for small open markets is particularly significant and is consistent with the previous finding for inter-industry foreign exchange exposure. The influence of foreign exchange exposure appears to transmit via the cash flow channel for the case of Canada, Germany and to a lesser extent Japan. The implication is that foreign exchange represents a common risk factor faced by all industries in the economy in a similar fashion. The results for Italy and the U.K., imply the exposure to foreign exchange feeds through via the risk premium and so each country factors this exposure into the discount rate.

Finally, turning to the interest rate exposure, we find consistent results to those reported in table 5. There is widespread support for the finding that interest rate exposure exists and that both excess returns and cash flow channels are equally important. Generally, the movements of excess returns and cash flows are mixed across countries, with negative effects dominating the U.K. and positive effects dominating the U.S.

4 Conclusion

This study investigates the level of exchange rate and interest rate exposure faced by industries in the G7 economies: Canada, France, Germany, Italy, Japan, the U.K. and the U.S. We choose to address the levels of exchange and interest rate exposure on level 2 industry sector data. Using this well known data set, we specifically look to isolate two potentially critical issues that have been predominantly overlooked by the empirical literature. First, rather than taking account of the exposure to changes in exchange and interest rates, which includes both expected and unexpected changes, we focus solely on unexpected changes. Although this empirical distinction has not been made previously, it has been highlighted by Bartram (2004) as an avenue for more complicated levels of exposure through the effect on sales prices, production costs, and market share, for instance. A number of theories based on the assumption of efficient markets would suggest that only unanticipated levels of exposure should influence firm or industry portfolio prices immediately. On the other hand, anticipated changes in exposure should not affect firm or industry portfolio prices, but instead such information should already be priced into the asset by market participants. The second critical element of our analysis is that we investigate the existence of indirect levels of both foreign exchange and interest rate exposure. It is only via the detailed examination of the possible channels of influence, that we can observe the extent of the exposure and the degree of nonlinearity. As well as highlighting the evidence of foreign exchange and interest rate exposure, we also identify possible drivers in terms of our cross country comparison.

The Campbell (1991) decomposition approach adopted here, although novel in this literature, has proven successful in the finance asset pricing literature. Our results for the direct effects of both foreign exchange and interest rate exposure applied to the industry portfolios across the G7 economies are weak, but consistent with those documented previously in the literature. This would suggest that industries face little or no exposure to unexpected changes in exchange rates. It is only when we adopt the beta decomposition that we identify the true extent of foreign exchange and interest rate exposure.

The level of foreign exchange exposure is dramatic once we take into account the channel through which the influence occurs. We find intuitively appealing results that open markets, such as France, Germany and Italy are particularly sensitive to foreign exchange exposure. However, we also find evidence of widespread foreign exchange for U.S. industries. In the majority of industry cases for the U.S., a Dollar appreciation has an adverse influence on future excess returns and this dominates any cash flow effect. Consistent signs are found for European G7 markets, but the influence on future cash flows dominates. There is considerable variability in the sensitivity of G7 industry-wide exposures, although there is general consistencies at the country level. The heterogeneity in foreign exchange exposures for small open markets are particularly significant and is consistent with the previous finding for inter-industry foreign exchange exposure. The influence of foreign exchange exposure appears to transmit via the cash flow channel for the case of Canada, Germany and to a lesser extent Japan. The implication is that foreign exchange represents a common risk factor faced by all industries in the economy in a similar fashion. The results for Italy and the U.K., imply the exposure to foreign exchange feeds through via the risk premium and so each country factors this exposure into the discount rate.

References

Adler, M., Dumas, B., 1984. Exposure to currency risk: definition and measurement, Financial Management 13, 41-50.

Allayannis, G., Ihrig, J., 2001. Exposure and markups, Review of Financial Studies 14, 805-835.

Ammer, J., Wongswan, J., 2007. Cash flows and discount rates, industry and country effects and co-movement in stock returns, Financial Review 42, 211-226.

Bartram, S.M., 2004. Linear and nonlinear foreign exchange rate exposures of German non-financial corporations, Journal of International Money and Finance 23, 673-699.

Bartram, S.M., Bodnar, G.M., 2007. The exchange rate exposure puzzle, Managerial Finance 33, 642-666.

Bodnar, G.M., Gentry, W.M., 1993. Exchange rate exposure and industry characteristics: evidence from Canada, Japan, and the USA, Journal of International Money and Finance 12, 29-45.

Bodnar, G.M., Dumas, B., Marston, R.C., 2002. Pass-through and exposure, Journal of Finance 57, 199231.

Booth, L. and Rotenberg, W., 1990. Assessing Foreign Exchange Exposure: Theory and Applications using Canadian Firms, Journal of International Financial Management and Accounting 90, l-22.

Burmeister, E., McElroy, M.B., 1988. Joint estimation of factor sensitivities and risk premia for the Arbitrage Pricing Theory, Journal of Finance 43, 721-735.

Campbell, J.Y., 1991. A variance decomposition for stock returns, Economic Journal 101, 157-179.

Campbell, J.Y., Mei, J., 1993. Where do betas come from? Asset price dynamics and the sources of systematic risk, Review of Financial Studies 6, 567-592.

Campbell, J.Y., Shiller, R.J., 1988a. Stock prices, expected earnings and dividends, Journal of Finance 43, 661-676.

Campbell, J.Y., Shiller, R.J., 1988b. The dividend-price ratio and expectations of future dividends and discount factors, Review of Financial Studies 1, 195-228.

Campbell, J.Y., Vuolteenaho, T., 2004. Bad beta, good beta, American Economic Review 94, 1249-1275.

Choi, J.J., Elyasiani, E., 1997. Derivative exposure and the interest rate and exchange rate risks of U.S. banks, Journal of Financial Services Research 12, 267-286.

Choi, J.J., Elyasiani, E., Kopecky, K.J., 1992. The sensitivity of bank stock returns to market, interest and exchange risks, Journal of Banking and Finance 16, 983-1004.

Choi, J.J., Prasad, A.M., 1995. Exchange risk sensitivity and its determinants: A firm and industry analysis of U.S. multinationals, Financial Management 24, 77-88.

Chow, E.H., Lee, W.Y., Solt, M.E., 1997. The Exchange-Rate Risk Exposure of Asset Returns. Journal of Business 70, 105-123.

Cuthbertson, K., Nitzsche, D., 2005. Quantitative Financial Economics, Second Edition, Wiley.

Doidge, C., Griffen, J., Williamson, R., 2006. Measuring the economic importance of exchange rate exposure, Journal of Empirical Finance 13, 550-576.

Dominguez, K.M.E., Tesar, L.L., 2001a. A re-examination of exchange rate exposure, American Economic Review 91, 396-399.

Dominguez, K.M.E., Tesar, L.L., 2001b. Trade and exposure, American Economic Review 91, 367-370.

Dominguez, K.M.E., Tesar, L.L., 2006. Exchange rate exposure, Journal of International Economics 68, 188-218.

Donnelly, R., Sheehy, E., 1996. The share price reaction of UK exporters to exchange rate movements: an empirical study, Journal of International Business Studies 27, 157- 165.

Entorf, H. and G. Jamin, 2007. German exchange rate exposure at DAX and aggregate levels, international trade and the role of exchange rate adjustment costs, German Economic Review 8, 344-374.

Faff, R.W., Marshall, A., 2005. International evidence on the determinants of foreign exchange rate exposure of multinational corporations, Journal of International Business Studies 36, 539-558.

Friberg, R., Nydahl, S., 1999. Openess and the exchange rate exposure of national stock markets, International Journal of Finance and Economics 4, 55-62.

Giddy, I.H., Dufey, G., 1995. Uses and abuses of currency options, Journal of Applied Corporate Finance 8, 49-57.

Glaum, M., Brunner, M., Himmel, H., 2000. The DAX and the dollar: the economic exchange rate exposure of German corporations, Journal of International Business Studies 31, 715-724.

Griffen, J.M., Stulz, R.M., 2001. International competition and exchange rate shocks: A cross-country industry analysis of stock returns, Review of Financial Studies 14, 215-241.

He, J., Ng, L.K., 1998. The foreign exchange exposure of Japanese multinational corporations, Journal of Finance 53, 733-753.

Hekman, C., 1985. A financial model of foreign exchange exposure, Journal of International Business Studies 16, 83-99.

Hutson, E., Stevenson, S., 2009. Openness and foreign exchange exposure: A firm-level multi-country study, forthcoming in Journal of International Business Studies.

Jorion, P., 1990. The exchange rate exposure of U.S. multinationals, Journal of Business 63, 331-346.

Jorion, P., 1991. The pricing of exchange rate risk in the stock market, Journal of Financial and Quantitative Analysis 26, 363-376.

Kanas, A., 1996. Exchange rate economic exposure when market share matters and hedging using currency options, Management International Review 36, 67-84.

Kearney, C., 2000. The determination and international transmission of stock market volatility, Global Finance Journal 11, 31-52.

Khoo, A., 1994. Estimation of foreign exchange exposure: An application to mining companies in Australia, Journal of International Money and Finance 13, 342-363.

Kiymaz, H., 2003. Estimation of foreign exchange exposure: an emerging market application, Journal of Multinational Financial Management 13, 71-84.

Levi, M.D. 1994. Exchange rates and the valuation of firms, in Amihud, Y., Levich, R.M., (Eds.) Exchange Rates and Corporate Performance, Irwin, Homewood, IL, 37-48.

Madura, J., Zarruk, E.R., 1995. Bank exposure to interest rate risk: A global perspective, Journal of Financial Research 18, 1-13.

Marston, R., 2001. The effects of industrial structure on economic exposure, Journal of International Money and Finance 20, 149-164.

Miller, K.D., Reuer, J.J., 1998. Firm strategy and economic exposure to foreign exchange movements, Journal of International Business Studies 29, 493-514.

Muller, A., Verschoor, W.F.C., 2006. Foreign Exchange Risk Exposure: Survey and Suggestions, Journal of Multinational Financial Management 16, 385-410.

Nydahl, S., 1999. Exchange rate exposure, foreign involvement and currency hedging of firms: Some Swedish evidence, European Financial Management 5, 241-257.

Prasad, A.M., Rajan, M., 1995. The role of exchange and interest risk in equity valuation: A comparative study of international stock Markets, Journal of Economics and Business 47, 457-472.

Sweeney, R.J., Warga, A.D., 1986. The pricing of interest-rate risk: Evidence from the stock market, Journal of Finance 41, 391-410.

5 Appendix 1

This appendix drives the Campbell-Shiller linearised formula for stock returns and dividend price ratio and the Campbell variance decomposition. For a more detailed derivation see Cuthbertson and Nitzsche (2005) which this summary draws on. The one period real holding period return (portfolio i) is derived as ;

$$H_{i,t+1} = \frac{P_{i,t+1} - P_{i,t} + D_{i,t+1}}{P_{i,t}} \tag{12}$$

where P_t is the real industry portfolio price at the end of period t and D_{t+1} is the real dividend paid during period $t+1$. Taking the log of one plus the real holding period return;

$$h_{i,t+1} = ln(1 + H_{i,t+1}) = ln(P_{i,t+1} + D_{i,t+1}) - ln(P_{i,t}) \tag{13}$$

Re-writing where lower cases denote logs;

$$h_{i,t+1} = ln[exp(p_{i,t+1}) + exp(d_{i,t+1})] - p_{i,t} \tag{14}$$

The term in square brackets is a non-linear function in $p_{i,t+1}$ and $d_{i,t+1}$ and can be linearized by taking a first order Taylor series expansion around a geometric mean of P and D;

$$h_{i,t+1} \approx k + \rho_i p_{i,t+1} + (1-\rho) d_{i,t+1} - p_{i,t} \tag{15}$$

where $\rho_i = P/(P+D)$ and k is a constant.[16] Imposing the terminal condition that $\lim_{j\to\infty} E_t \rho^j p_{i,t+j} = 0$,[17] equation (3) can be solved forward to give:

$$p_{i,t} = \frac{k}{1-\rho} + (1-\rho)\, E_t \sum_{j=0}^{\infty} \rho^j d_{i,t+j+1} - E_t \sum_{j=0}^{\infty} \rho^j h_{i,t+j+1} \tag{16}$$

This enables the effect on the portfolio price of a change in the expected portfolio returns to be calculated. Campbell (1991) shows that it is possible to obtain a decomposition of the unexpected return:

$$\begin{aligned} \tilde{h}_{i,t+1} &\equiv h_{i,t+1} - E_t h_{i,t+1} \\ &= (E_{t+1} - E_t) \left\{ \sum_{j=0}^{\infty} \rho^j \Delta d_{i,t+j+1} - \sum_{j=1}^{\infty} \rho^j h_{i,t+j+1} \right\} \end{aligned} \tag{17}$$

by substituting $p_{i,t}$ and $p_{i,t+1}$ out of equation (1). Although equation (4) is written in terms of real log portfolio returns, it is possible to define the excess portfolio return over a

[16]Following Cuthbertson and Nitzsche (2005) $\rho = 0.99$ is adopted for all the countries.
[17]This condition prevents explosive behavior and rules out "rational bubbles".

short term interest rate as $e_{i,t+1} \equiv h_{i,t+1} - r_{i,t+1}$ where $h_{i,t+1}$ is the expected return and $r_{i,t+1}$ is the real interest rate, such that the innovation in the excess return is given by:

$$\begin{aligned}\tilde{e}_{i,t+1} &= (E_{t+1} - E_t)\left\{\sum_{j=0}^{\infty} \rho^j \Delta d_{i,t+j+1} - \sum_{j=0}^{\infty} \rho^j r_{i,t+j+1} - \sum_{j=1}^{\infty} \rho^j e_{i,t+j+1}\right\} \\ &= \tilde{e}_{di,t+1} - \tilde{e}_{ri,t+1} - \tilde{e}_{ei,t+1}\end{aligned} \tag{18}$$

This states that the unexpected excess return on portfolio i, $\tilde{e}_{i,t+1}$ is equal to the news about future dividends on portfolio i, $\tilde{e}_{di,t+1}$, minus the news about future real interest rates, $\tilde{e}_{ri,t+1}$, and the news about future excess returns, $\tilde{e}_{ei,t+1}$.

6 Appendix 2

	Market	Interest Rates	Foreign Exchange	Prices
Canada	price index (TOTMKCNRI)	money market return (CNI60B)	effective exchange rate (CNI..NEUE)	CPI (CNI64...F)
France	price index (TOTMKFRRI)	Paris IBOR/EURIBOR (FRINTER3)	effective exchange rate (FRI..NEUE)	CPI (FRI64...F)
Germany	price index (TOTMKBDRI)	Frankfurt IBOR/EURIBOR (BDINTER3)	effective exchange rate (BDI..NEUE)	CPI (BDI64...F)
Italy	price index (TOTMKITRI)	inter bank deposit rate/EURIBOR (ITINTER3)	effective exchange rate (ITI..NEUE)	CPI (ITI64...F)
Japan	price index (TOTMKJPRI)	money market return (JPI60B)	effective exchange rate (JPI..NEUE)	CPI (JPI64...F)
UK	price index (TOTMKUKRI)	inter bank rate (UKINTER3)	effective exchange rate (UKI..NEUE)	CPI (UKI64...F)
US	price index (TOTMKUSRI)	inter bank rate (USINTER3)	effective exchange rate (UKI..NEUE)	CPI (UKI64...F)

Figures in parenthesis are Datastream codes.

Figure 1

State Variable Components

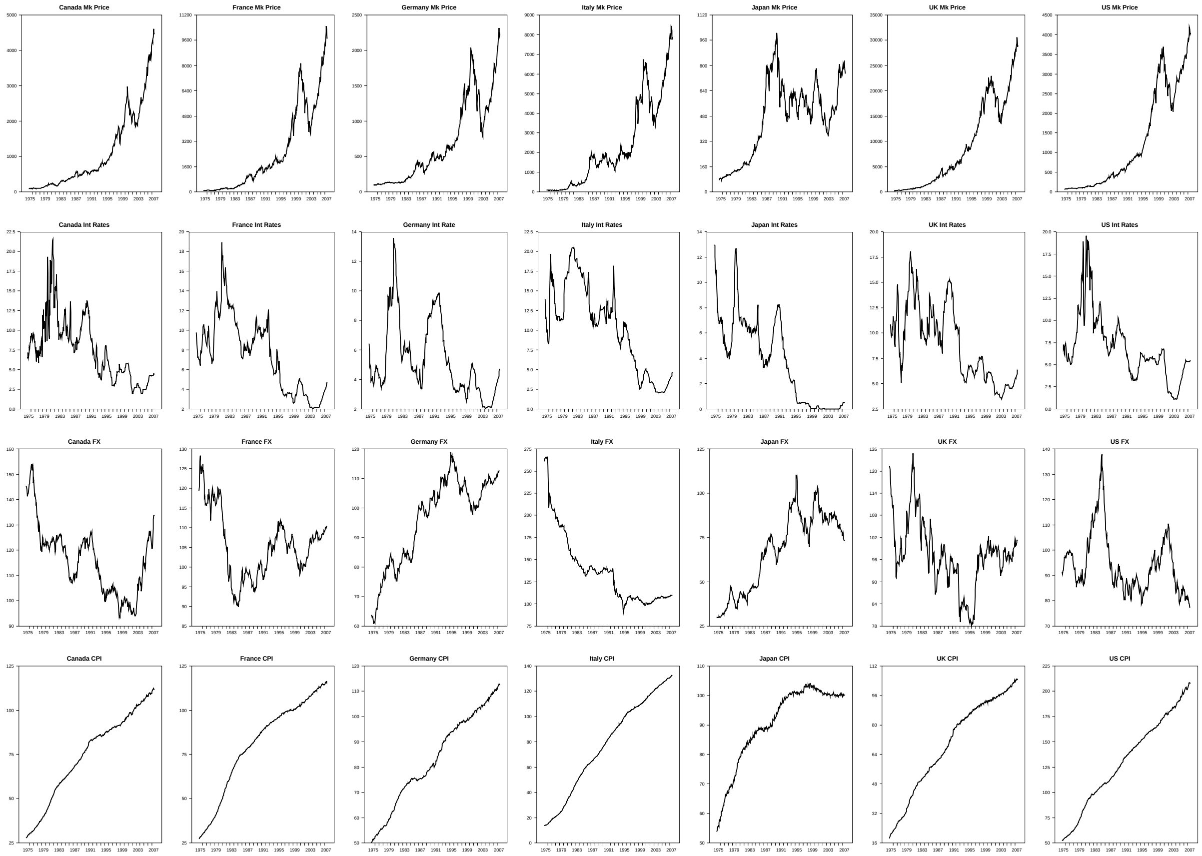

Table 1: Industry Correlations

Basic Materials	**Canada**	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00						
France	0.968	1.00					
Germany	0.972	0.980	1.00				
Italy	0.904	0.952	0.907	1.00			
Japan	0.487	0.440	0.426	0.551	1.00		
U.K.	0.983	0.983	0.968	0.945	0.513	1.00	
U.S.	0.983	0.952	0.977	0.858	0.413	0.963	1.00

Consumer Goods	**Canada**	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00						
France	0.878	1.00					
Germany	0.897	0.967	1.00				
Italy	0.849	0.887	0.898	1.00			
Japan	0.776	0.944	0.917	0.884	1.00		
U.K.	0.904	0.987	0.962	0.876	0.924	1.00	
U.S.	0.963	0.941	0.941	0.899	0.880	0.953	1.00

Consumer Services	**Canada**	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00						
France	0.950	1.00					
Germany	0.954	0.962	1.00				
Italy	0.918	0.954	0.916	1.00			
Japan	0.464	0.506	0.526	0.513	1.00		
U.K.	0.961	0.947	0.971	0.882	0.544	1.00	
U.S.	0.982	0.957	0.967	0.913	0.460	0.978	1.00

Financial	**Canada**	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00						
France	0.979	1.00					
Germany	0.782	0.853	1.00				
Italy	0.921	0.966	0.941	1.00			
Japan	0.075	0.168	0.251	0.254	1.00		
U.K.	0.954	0.963	0.913	0.967	0.116	1.00	
U.S.	0.971	0.966	0.879	0.956	0.086	0.994	1.00

Health Care	**Canada**	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00						
France	0.974	1.00					
Germany	0.910	0.957	1.00				
Italy	0.843	0.886	0.874	1.00			
Japan	0.666	0.713	0.750	0.7932	1.00		
U.K.	0.952	0.984	0.963	0.932	0.752	1.00	
U.S.	0.960	0.982	0.957	0.915	0.716	0.993	1.00

Industrials	**Canada**	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00						
France	0.756	1.00					
Germany	0.805	0.986	1.00				
Italy	0.590	0.716	0.712	1.00			
Japan	0.553	0.960	0.774	0.850	1.00		
U.K.	0.775	0.973	0.982	0.680	0.789	1.00	
U.S.	0.844	0.969	0.980	0.651	0.693	0.957	1.00

Table 2: Industry Correlations

Oil & Gas	**Canada**	**France**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00					
France	0.953	1.00				
Italy	0.976	0.982	1.00			
Japan	0.430	0.286	0.369	1.00		
U.K.	0.932	0.987	0.971	0.311	1.00	
U.S.	0.978	0.983	0.986	0.369	0.975	1.00
Technology	**Canada**	**France**	**Italy**	**Japan**	**U.K.**	**U.S.**
Canada	1.00					
France	0.922	1.00				
Italy	0.281	0.223	1.00			
Japan	0.810	0.865	0.347	1.00		
U.K.	0.964	0.916	0.221	0.815	1.00	
U.S.	0.867	0.935	0.182	0.856	0.888	1.00
Utilities	**Canada**	**Germany**	**Italy**	**Japan**	**U.S.**	
Canada	1.00					
Germany	0.974	1.00				
Italy	0.936	0.912	1.00			
Japan	0.574	0.530	0.510	1.00		
U.S.	0.943	0.915	0.978	0.594	1.00	

Table 3: Real Stock Market Return Exposure

	Canada	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**	**Industry Average**
Basic	1.087*	0.928*	0.885*	0.967*	0.990*	1.053*	1.081*	0.999*
Materials	(0.06)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.06)	(0.03)
Consumer	0.932*	1.085*	1.064*	1.115*	0.869*	1.101*	1.016*	1.026*
Goods	(0.13)	(0.05)	(0.08)	(0.06)	(0.04)	(0.05)	(0.05)	(0.04)
Consumer	0.840*	0.999*	0.854*	0.942*	0.876*	1.050*	1.159*	0.960*
Services	(0.04)	(0.04)	(0.05)	(0.06)	(0.02)	(0.03)	(0.03)	(0.04)
Financial	0.827*	0.783*	1.088*	0.997*	1.149*	1.073*	1.015*	0.990*
	(0.05)	(0.05)	(0.04)	(0.02)	(0.06)	(0.03)	(0.04)	(0.05)
Health	0.791*	0.820*	0.614*	0.841*	0.691*	0.854*	0.796*	0.772*
Care	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)
Industrials	1.224*	1.061*	1.013*	1.007*	0.978*	1.072*	1.115*	1.066*
	(0.05)	(0.04)	(0.03)	(0.05)	(0.04)	(0.04)	(0.03)	(0.03)
Oil &	0.987*	0.861*		0.759*	0.857*	0.961*	0.768*	0.865*
Gas	(0.07)	(0.07)		(0.10)	(0.08)	(0.04)	(0.06)	(0.04)
Technology	1.254*	1.344*		0.970*	1.127*	0.935*	1.395*	1.171*
	(0.12)	(0.08)		(0.11)	(0.07)	(0.10)	(0.06)	(0.08)
Utilities	0.431*		0.348*	0.806*	0.628*		0.439*	0.530*
	(0.05)		(0.04)	(0.06)	(0.07)		(0.05)	(0.08)
Country Average	0.930*	0.985*	0.838*	0.934*	0.907*	1.012*	0.976*	
	(0.08)	(0.06)	(0.10)	(0.04)	(0.06)	(0.03)	(0.09)	

Results of the sensitivity of each of the 9 industry portfolios to the market return in the G7 countries. All figures in parenthesis are standard errors. A * denotes significance at 5%.

Table 4: Real Foreign Exchange Rate Exposure

	Canada	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**	**Industry Average**
Basic Materials	0.902*	-0.606	-0.677*	1.081*	0.093	-0.0170	0.100	0.125
	(0.25)	(0.42)	(0.29)	(0.50)	(0.16)	(0.20)	(0.19)	(0.22)
Consumer Goods	0.315	-0.875	-0.737*	0.410	-0.041	-0.014	0.431*	-0.073
	(0.43)	(0.57)	(0.38)	(0.49)	(0.15)	(0.299)	(0.20)	(0.18)
Consumer Services	0.596*	-0.900	-0.710*	0.266	0.087	0.177	0.301	-0.026
	(0.20)	(0.50)	(0.32)	(0.50)	(0.13)	(0.22)	(0.19)	(0.18)
Financial	0.577*	-0.717*	-0.559	0.221	0.068	0.004	0.220	-0.027
	(0.19)	(0.365)	(0.35)	(0.37)	(0.181)	(0.21)	(0.20)	(0.15)
Health Care	0.305	-0.860	-0.612*	0.864*	0.012	-0.038	0.015	-0.045
	(0.21)	(0.45)	(0.253)	(0.381)	(0.13)	(0.17)	(0.15)	(0.20)
Industrials	0.670*	-1.327*	-0.591	0.392	-0.029	0.208	0.278	-0.057
	(0.25)	(0.42)	(0.31)	(0.44)	(0.16)	(0.22)	(0.19)	(0.25)
Oil & Gas	0.559*	-0.455		0.132	0.309	-0.005	0.005	0.091
	(0.25)	(0.47)		(0.60)	(0.21)	(0.24)	(0.178)	(0.14)
Technology	1.271*	-0.717		0.679	0.107	0.185	0.266	0.299
	(0.50)	(0.62)		(0.63)	(0.19)	(0.307)	(0.24)	(0.27)
Utilities	0.070		-0.154	0.895*	0.311*		-0.124	0.199
	(0.16)		(0.19)	(0.395)	(0.16)		(0.13)	(0.20)
Country Average	0.585*	-0.807*	-0.577*	0.549*	0.102*	0.062	0.166*	
	(0.120)	(0.09)	(0.08)	(0.11)	(0.04)	(0.04)	(0.06)	

Results of the sensitivity of each of the 9 industry portfolios to the changes in the real exchange rate in the G7 countries. All figures in parenthesis are standard errors. A * denotes significance at 5%.

Table 5: Real Interest Rate Exposure

	Canada	**France**	**Germany**	**Italy**	**Japan**	**U.K.**	**U.S.**	**Industry Average**
Basic	-1.834*	-3.261*	-3.136*	-2.151	-1.854*	-1.652*	-1.517	-2.201*
Materials	(0.72)	(1.08)	(0.65)	(1.53)	(0.57)	(0.65)	(1.17)	(0.44)
Consumer	-1.571	-2.471	-2.885*	0.490	-1.539*	-2.858*	-0.347	-1.597*
Goods	(1.33)	(1.32)	(0.88)	(1.86)	(0.59)	(0.757)	(1.04)	(0.54)
Consumer	-2.3531*	-3.706*	0.858	2.461	-1.408*	-1.590*	0.150	-0.798
Services	(0.56)	(1.27)	(0.75)	(1.65)	(0.47)	(0.70)	(1.02)	(0.78)
Financial	-1.109	-1.041	-1.463	-2.366	-1.394*	-1.380*	-0.425	-1.311*
	(0.58)	(0.95)	(0.77)	(1.27)	(0.57)	(0.70)	(0.97)	(0.37)
Health	-1.163*	-0.731	0.766	-1.811	-1.632*	0.816	-0.579	-0.619
Care	(0.59)	(1.09)	(0.61)	(1.99)	(0.50)	(0.60)	(0.72)	(0.39)
Industrials	-2.225*	2.340	-2.345*	-0.781	-1.590*	1.167	1.511	-0.275
	(0.86)	(1.27)	(0.60)	(1.58)	(0.61)	(0.69)	(0.94)	(0.64)
Oil &	-2.506*	-1.999		-1.478	-1.719*	-2.017*	-6.087*	-2.634*
Gas	(0.71)	(1.32)		(2.07)	(0.81)	(0.85)	(1.04)	(0.71)
Technology	-0.080	3.673		-0.418	-1.704*	-3.258*	-0.380	-0.361
	(1.83)	(1.93)		(3.08)	(0.77)	(1.04)	(1.28)	(0.94)
Utilities	-1.304*		-1.410	-1.677	1.04		-2.23*	-1.116
	(0.42)		(0.46)	(1.43)	(0.60)		(0.86)	(0.65)
Country Average	-1.572*	-0.899	-1.373*	-0.859	-1.311*	-1.346*	-1.101	
	(0.25)	(0.93)	(0.62)	(0.51)	(0.30)	(0.56)	(0.71)	

Results of the sensitivity of each of the 9 industry portfolios to changes in the real interest rate in the G7 countries. All figures in parenthesis are standard errors. A * denotes significance at 5%.

Table 6: Decomposition of the Real Stock Market Return Beta

Variable	Canada		France		Germany		Italy		Japan		U.K.		U.S.		Industry Average	
	$\beta_{di,m}$	$\beta_{ei,m}$	$\beta_{di,m}$	$\beta_{ei,m}$	$\beta_{di,m}$	$\beta_{ei,m}$	$\beta_{di,m}$	$\beta_{ei,m}$	$\beta_{di,m}$	$\beta_{ei,m}$	$\beta_{di,m}$	$\beta_{ei,m}$	$\beta_{di,m}$	$\beta_{ei,m}$	$\beta_{di,m}$	$\beta_{ei,m}$
Basic	1.119*	0.049*	0.960*	0.049*	0.913*	0.048*	1.070*	0.116	1.049*	0.201*	1.055*	0.127	1.075*	0.001	1.034*	0.085*
Mat.	(0.06)	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)	(0.05)	(0.01)	(0.04)	(0.01)	(0.05)	(0.02)	(0.06)	(0.01)	(0.03)	(0.03)
Cons.	1.144*	0.230*	1.100*	0.033*	1.243*	0.199*	1.318*	0.216*	0.925*	0.066*	1.345*	0.277*	1.158*	0.150*	1.176*	0.167
Goods	(0.13)	(0.01)	(0.05)	(0.00)	(0.08)	(0.01)	(0.06)	(0.08)	(0.05)	(0.01)	(0.05)	(0.01)	(0.06)	(0.04)	(0.05)	(0.03)
Cons.	0.852*	0.029*	1.089*	0.108*	0.912*	0.078*	1.158*	0.078*	0.940*	0.074*	1.196*	0.180*	1.255*	0.103*	1.057*	0.093*
Serv.	(0.04)	(0.01)	(0.04)	(0.00)	(0.05)	(0.00)	(0.05)	(0.00)	(0.03)	(0.01)	(0.03)	(0.01)	(0.04)	(0.01)	(0.06)	(0.02)
Fin.	0.876*	0.066*	0.874*	0.108*	1.168*	0.101*	1.118*	0.135*	1.251*	0.113	1.142*	0.102*	1.078*	0.070*	1.072*	0.099*
	(0.06)	(0.01)	(0.05)	(0.00)	(0.04)	(0.01)	(0.02)	(0.01)	(0.06)	(0.02)	(0.03)	(0.00)	(0.05)	(0.01)	(0.06)	(0.01)
Health	0.787*	0.013*	0.814*	0.011	0.671*	0.078*	0.864*	0.038*	0.707*	0.026	0.926*	0.105*	0.754*	-0.035*	0.789*	0.034
Care	(0.05)	(0.01)	(0.04)	(0.01)	(0.05)	(0.00)	(0.06)	(0.01)	(0.04)	(0.01)	(0.04)	(0.01)	(0.05)	(0.01)	(0.03)	(0.02)
Ind.	1.438*	0.231*	1.176*	0.133*	1.031*	0.038*	1.147*	0.151	1.019*	0.050*	1.291*	0.253*	1.153*	0.046*	1.179*	0.129*
	(0.05)	(0.01)	(0.04)	(0.01)	(0.03)	(0.01)	(0.05)	(0.01)	(0.04)	(0.00)	(0.04)	(0.01)	(0.04)	(0.01)	(0.06)	(0.03)
Oil &	0.915*	-0.055*	1.028*	0.184*			0.738*	-0.005	0.949*	0.102*	1.055*	0.127*	0.751*	-0.010*	0.906*	0.057
Gas	(0.07)	(0.01)	(0.07)	(0.02)			(0.10)	(0.01)	(0.08)	(0.02)	(0.05)	(0.02)	(0.06)	(0.02)	(0.06)	(0.04)
Tech.	1.278*	0.042*	1.430*	0.103*			0.844*	-0.111*	1.207*	0.090*	1.136*	0.233*	1.398*	0.011	1.215*	0.061
	(0.12)	(0.01)	(0.08)	(0.00)			(0.12)	(0.03)	(0.07)	(0.00)	(0.10)	(0.01)	(0.06)	(0.01)	(0.09)	(0.05)
Util.	0.272*	-0.141*			0.400*	0.072*	0.853*	0.060*	0.591*	-0.027*			0.392	-0.041*	0.501*	-0.015
	(0.05)	(0.01)			(0.04)	(0.00)	(0.06)	(0.00)	(0.07)	(0.01)			(0.05)	(0.01)	(0.10)	(0.04)
Country	0.964*	0.052	1.059*	0.091*	0.905*	0.088*	1.012*	0.075*	0.960*	0.077*	1.143*	0.176*	1.002*	0.033		
Average	(0.11)	(0.04)	(0.07)	(0.02)	(0.11)	(0.02)	(0.06)	(0.03)	(0.07)	(0.02)	(0.05)	(0.03)	(0.10)	(0.02)		

Decomposition of the real stock market return beta into cash flow and future excess return (discount rate) components of the 9 industry portfolios in each of the G7 countries. All figures in parenthesis are standard errors. A * denotes significance at 5%.

Table 7: Decomposition of the Real Exchange Rate Beta

Variable	Canada		France		Germany		Italy		Japan		U.K.		U.S.		Industry Average	
	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$	$\beta_{di,\Delta s}$	$\beta_{ei,\Delta s}$
Basic Mat.	1.371* (0.25)	0.477* (0.01)	-0.668 (0.43)	-0.065 (0.05)	-1.572* (0.29)	-0.953 (0.01)	1.134 (0.60)	-0.098 (0.10)	0.310 (0.17)	0.201* (0.01)	0.326 (0.26)	-0.325 (0.07)	-0.158 (0.20)	-0.300* (0.01)	0.106 (0.39)	-0.152 (0.17)
Cons. Goods	0.809 (0.45)	0.514* (0.05)	-0.736 (0.58)	0.136* (0.02)	-1.996* (0.41)	-1.316* (0.05)	-0.016 (0.56)	-0.577* (0.08)	-0.400* (0.16)	-0.375* (0.01)	-0.283 (0.34)	-0.273* (0.06)	0.462* (0.22)	-0.010 (0.03)	-0.309 (0.34)	-0.272 (0.22)
Cons. Serv.	1.162* (0.19)	0.574* (0.00)	-1.283* (0.53)	-0.386* (0.05)	-1.095* (0.33)	-0.443* (0.02)	-1.095* (0.33)	-0.443* (0.02)	0.375* (0.14)	0.273* (0.01)	0.337 (0.24)	0.156* (0.04)	0.517* (0.22)	0.174 (0.03)	-0.155 (0.37)	-0.014 (0.15)
Fin.	1.151* (0.19)	0.582* (0.01)	-0.844* (0.40)	-0.130* (0.05)	-1.109* (0.37)	-0.607* (0.03)	0.115 (0.41)	-0.258* (0.08)	0.722* (0.20)	0.059 (0.15)	-0.147 (0.22)	-0.155* (0.02)	0.308 (0.21)	0.047* (0.03)	0.028 (0.31)	-0.066 (0.14)
Health Care	0.846* (0.21)	0.549* (0.00)	-0.352 (0.46)	0.505* (0.03)	-1.808* (0.26)	-1.253* (0.01)	0.392 (0.39)	-0.477* (0.04)	0.300* (0.13)	0.272* (0.00)	-0.425* (0.18)	-0.391* (0.03)	-0.111 (0.16)	-0.167* (0.03)	-0.165 (0.32)	-0.138 (0.24)
Ind.	1.804* (0.27)	1.142* (0.03)	-1.810* (0.46)	-0.486* (0.07)	-1.531* (0.31)	-0.998* (0.01)	-0.008 (0.49)	-0.550* (0.11)	-0.105 (0.17)	-0.092* (0.01)	0.318 (0.26)	0.107* (0.06)	0.211 (0.20)	-0.109* (0.02)	-0.160 (0.46)	-0.141 (0.26)
Oil & Gas	1.030* (0.24)	0.478* (0.03)	-0.882 (0.55)	0.430* (0.15)			-0.080 (0.60)	-0.217* (0.04)	-0.416 (0.22)	0.092* (0.04)	-0.326 (0.26)	-0.325* (0.07)	-0.432* (0.18)	-0.479* (0.04)	-0.184 (0.27)	-0.004 (0.16)
Tech.	1.844* (0.50)	0.581* (0.02)	-0.678 (0.64)	0.066 (0.05)			0.354 (0.64)	-0.331* (0.16)	0.085 (0.21)	-0.038* (0.01)	0.375 (0.33)	0.186* (0.05)	-0.005 (0.25)	-0.312* (0.018)	0.329 (0.34)	0.025 (0.14)
Util.	0.394* (0.15)	0.332* (0.03)			0.136 (0.20)	0.233* (0.02)	1.429* (0.41)	0.383* (0.02)	0.843* (0.16)	0.517* (0.01)			-0.289* (0.13)	-0.206* (0.01)	0.503 (0.30)	0.252* (0.123)
Country Average	1.157* (0.16)	0.581 (0.08)	-0.907* (0.16)	0.009* (0.12)	-1.282* (0.27)	-0.762* (0.02)	0.247 (0.21)	-0.285* (0.10)	0.191 (0.15)	0.101 (0.09)	0.022 (0.12)	-0.128 (0.09)	0.056 (0.11)	-0.151* (0.07)		

Decomposition of the real foreign exchange rate beta into cash flow and future excess return (discount rate) components of the 9 industry portfolios in each of the G7 countries. All figures in parenthesis are standard errors. A * denotes significance at 5%.

Table 8: Decomposition of the Real Interest Rate Beta

Variable	Canada		France		Germany		Italy		Japan		U.K.		U.S.		Industry Average	
	$\beta_{di,r}$	$\beta_{ei,r}$	$\beta_{di,r}$	$\beta_{ei,r}$	$\beta_{di,r}$	$\beta_{ei,r}$	$\beta_{di,r}$	$\beta_{ei,r}$	$\beta_{di,r}$	$\beta_{ei,r}$	$\beta_{di,r}$	$\beta_{ei,r}$	$\beta_{di,r}$	$\beta_{ei,r}$	$\beta_{di,r}$	$\beta_{ei,r}$
Basic	-0.991	-0.301*	-3.917*	-0.668	-1.722*	-0.953	-3.130	-3.516*	-0.908	-0.171*	-4.075*	-3.559*	1.840	0.947*	-1.843*	-1.174
Mat.	(0.73)	(0.08)	(1.10)	(0.43)	(0.70)	(0.01)	(1.64)	(0.14)	(0.61)	(0.05)	(0.90)	(0.09)	(1.20)	(0.09)	(0.79)	(0.65)
Cons.	0.953	1.416*	-0.425	-0.197*	-3.252*	-1.589*	3.541	0.514	-0.889	-0.467*	-3.479*	-2.122*	3.117*	1.055*	-0.062	-0.199
Goods	(1.38)	(0.14)	(1.34)	(0.05)	(1.02)	(0.22)	(2.09)	(0.32)	(0.63)	(0.09)	(0.88)	(0.18)	(1.14)	(0.12)	(1.06)	(0.50)
Cons.	-1.130*	0.079	-3.445*	-1.982*	-0.050	-0.413*	-0.050	-0.413*	-0.377	-0.087	-1.657*	-1.568*	5.980*	0.174*	-0.104	-0.601
Serv.	(0.58)	(0.10)	(1.35)	(0.11)	(0.75)	(0.08)	(0.75)	(0.08)	(0.51)	(0.07)	(0.79)	(0.10)	(1.11)	(0.03)	(1.11)	(0.32)
Fin.	-0.446	-0.481*	-0.620*	-1.821*	0.558	0.800*	-2.873*	-3.044*	-0.218	0.059	-0.426	-0.547*	4.866*	2.882*	0.120	-0.308
	(0.61)	(0.10)	(1.02)	(0.10)	(0.76)	(0.11)	(1.42)	(0.17)	(0.64)	(0.15)	(0.76)	(0.07)	(1.02)	(0.06)	(0.89)	(0.71)
Health	-0.001	0.018	-0.736	-2.247*	0.315	-0.140	2.267	1.521*	-0.419	0.096	-0.489	-1.174*	5.366*	3.536*	0.900	0.230
Care	(0.58)	(0.10)	(1.09)	(0.09)	(0.60)	(0.21)	(2.04)	(0.22)	(0.51)	(0.06)	(0.66)	(0.11)	(0.73)	(0.06)	(0.84)	(0.71)
Ind.	-0.927	0.154	-3.211*	-3.114*	-1.650*	-0.525*	-3.110	-4.867*	-0.723	-0.250*	-2.120*	-2.544*	2.373*	1.474*	-1.338	-1.382
	(0.95)	(0.20)	(1.38)	(0.13)	(0.61)	(0.16)	(1.72)	(0.22)	(0.64)	(0.03)	(0.80)	(0.14)	(0.98)	(0.06)	(0.72)	(0.83)
Oil &	-2.867*	-1.504*	-8.434*	8.678*			-1.240	-2.320*	-4.189*	-3.587*	-4.075*	-3.559*	-8.907*	-5.229*	-4.952*	-1.254
Gas	(0.69)	(0.10)	(1.42)	(0.15)			(2.04)	(0.10)	(0.82)	(0.03)	(0.90)	(0.09)	(1.03)	(0.121)	(1.255)	(2.053)
Tech.	1.953	0.889*	-2.443	-1.102*			11.454*	9.315*	-0.604	-0.017	-3.305*	-1.548*	4.098*	2.069*	1.859	1.601
	(1.84)	(0.10)	(2.01)	(0.11)			(2.89)	(0.25)	(0.81)	(0.05)	(1.10)	(0.13)	(1.31)	(0.10)	(2.22)	(1.63)
Util.	-0.490	-0.330*			-0.403	-0.215*	1.614	0.754*	1.059	0.517*			1.724*	1.549*	0.701	0.455
	(0.40)	(0.11)			(0.48)	(0.06)	(0.62)	(0.01)	(0.16)	(0.01)			(0.86)	(0.07)	(0.48)	(0.34)
Country	-0.438	-0.007	-2.904*	-0.307	-0.886	-0.434	0.941	-0.228	-0.807	-0.434	-2.453*	-2.078*	2.273	0.940		
Average	(0.45)	(0.28)	(0.93)	(1.32)	(0.52)	(0.28)	(1.55)	(1.40)	(0.47)	(0.40)	(0.53)	(0.39)	(1.49)	(0.84)		

Decomposition of the real interest rate beta into cash flow and future excess return (discount rate) components of the 9 industry portfolios in each of the G7 countries. All figures in parenthesis are standard errors. A * denotes significance at 5%.