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Yu-chin Chen, Kwok Ping Tsang and Wen Jen Tsay

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Home Bias in Currency Forecasts*

Yu-chin Chen
University of Washington
Hong Kong Institute for Monetary Research

and

Kwok Ping Tsang
Virginia Tech
Hong Kong Institute for Monetary Research

and

Wen Jen Tsay
Academia Sinica

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Abstract

The "home bias" phenomenon states that empirically, economic agents often under-utilize opportunities beyond their country borders, and it is well-documented in various international pricing and purchase patterns. This bias manifests in the forms of fewer exchanges of goods and net equity-holdings, as well as less arbitrage of price differences across borders than theoretically predicted to be optimal. Our paper documents another form of home bias, where market participants appear to under-weigh information beyond their borders when making currency forecasts. Using monthly data from 1995 to 2010 for seven major exchange rates relative to the US dollar, we show that excess currency returns and the errors in investors' consensus forecasts not only depend on the interest differentials between the pair of countries, but they depend more strongly on interest rates in a broader set of countries. A global short interest differential and a global long interest differential are driving the results.

Keywords: Survey Data, Excess Currency Returns, Global Shock
JEL Classification: F31, G12, D84

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* This work was partly undertaken while the first two authors were visiting the Hong Kong Institute for Monetary Research (HKIMR). Chen: Department of Economics, University of Washington, Box 353330, Seattle, WA 98195; yuchin@u.washington.edu. Tsang: Department of Economics, Virginia Tech, Box 0316, Blacksburg, VA, 24061; byront@vt.edu. Tsay: Institute of Economics, Academia Sinica, Taipei, Taiwan; wtsay@econ.sinica.edu.tw.

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1. Introduction

Studies of cross-border empirics have generated various well-known puzzles that exhibit a home bias tendency. Since McCallum (1995), the trade literature systematically observes that, ceteris paribus, the extent of trade cross geographical locations is significantly reduced once a national border is crossed (see Wei 1996). On the international finance front, French and Poterba (1991) and Tesar and Werner (1995) similarly document that agents seem to hold a disproportionately large fraction of their equity portfolio in home assets, seemingly ignoring better opportunities to diversify risk in the broader international markets. Engel and Roger (1996) find much less price convergence across country borders than within. While subsequent research has put forth alternative explanations for each of these robust empirical patterns, the general observation is that economic agents tend to under-utilize opportunities or information from beyond their home borders.

This paper documents yet another "home bias puzzle" in forecasting currency returns. Using a panel of data on surveyed investors' forecasts, we show that investors systematically *under-weigh* information coming from the broader foreign markets, and that they could obtain quantitatively significantly better currency forecasts had they used this foreign information more efficiently. We show that one global short-term interest differential and one global long-term interest differential can forecast out of sample the forecast error that will be committed by the forecasters, outperforming the null of random walk. Forecasters are throwing away information that can improve their forecasts.

Our empirical exploration starts from the well-known forward premium or uncovered interest rate parity puzzle: the empirical regularity that currencies of high interest rate countries tend to appreciate, rather than depreciate according to the foreign market efficiency condition (UIP). Since Fama (1984), the pattern has been shown to be robust across countries and time periods. In their survey Froot and Thaler (1990) show that most empirical studies find that the coefficient on the UIP regress has the wrong sign. While various explanations have been put forth,[1] we focus on explaining the failure of the UIP by the expectations biases using survey data.[2] According to most of the explanations for the failure of the UIP, the UIP regression (ex post exchange rate change on the interest differential) suffers from the omitted variable problem. For example, if the risk premium is time varying and it is correlated with the interest differential, then the UIP regression is biased. If the expectations error is non-rational and is correlated with the interest differential, again the UIP regression is biased. The goal of this paper is to document how the expectations error can be explained by currently available variables, especially interest differentials of other countries.

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1 Alvarez, Atkeson and Kehoe (2009), Bekaert (2006), and Lustig and Verdelhan (2007) explain the failure by a time-varying risk premium. We also have the Peso problem argument by Kaminsky (1993) and the related rare events framework of Farhi and Gabaix (2009).

2 See Frankel and Froot (1989), Lewis (1989) and Gourinchas and Tornell (2004).

Frankel and Froot (1987, 1989) are among the first to make use of survey data to test for rationality in the foreign exchange market. In Frankel and Froot (1987), it is found that while the actual exchange rate behaves like a random walk, it is not true for the exchange rate survey forecast. The resulting bias in the forecast rejects rational expectations. Frankel and Froot (1989) use survey data to account for the failure of the UIP. They decompose the deviation from the UIP into the part that is due to forecast error and the part that is due to risk premium, and find that almost none of the deviation of the UIP can be attributed to risk premium. Chinn and Frankel (2006) is a recent update of the two studies with more currencies and more horizons, and they confirm the earlier results by Frankel and Froot.

This paper is related to Bacchetta, Mertens and van Wincoop (BMV, 2009) who find that for markets where there is substantial excess return predictability, expectation errors of excess returns (which is equivalent to forecast errors for exchange rate change) are also predictable. Hence they find predictability of forecast errors in foreign exchange, stock and bond markets, but not so for the money market, where there is no excess return predictability. The approach of this paper is similar to BMV, but instead of using the country pair's own interest differential only to predict excess return and forecast error, we emphasize 1) the informational content of term structure by adding the long interest differential and 2) the role of a latent global factor by adding the interest differentials of other country pairs. We find that the predictability of both excess return and forecast error is substantially higher with the extension.

We show that considering the other interest differentials improves the consensus forecasts both in and out of sample, which suggests that forecasters consistently neglect the information contained in the interest differentials of other country pairs. We then summarize the information in the interest differentials by extracting the first two principal components from the group of short-term interest differentials and two from the group of long-term interest differentials. The four principal components capture most of the movements of the interest differentials, but we find that the first principal component in each group is enough to improve the forecasters' performance. Factor analysis suggests the role of a few global factors, and we conclude the paper by proposing an explanation for the forecasters' neglect of the global factors.

2. The Consensus Economics Dataset

Since 1989, Consensus Economics (CE) has been polling forecasters to obtain their forecasts for the major macroeconomic indicators (e.g. real GDP growth, inflation, interest rates and exchange rate) in over 70 countries. The number of forecasters varies over countries and time periods. For most variables, forecasts are made for the current year and the following year. For example, the survey available in March 2009 provides forecasts for the GDP growth of 2009 (December to December) and that of 2010. For this paper we mainly make use of forecasts of exchange rates and interest rates, which come in a different format. In each month, forecasters are asked to predict the *level* of exchange rate at the 3, 12 and 24 months horizons, and the *level* of 3-month and 10-year interest rates at the 3 and 12 months horizons. The survey is done usually during the first half of the month.

With the United States as the home country, we study seven country pairs of the United Kingdom, Japan, Canada, Singapore, Switzerland, Australia and New Zealand. Forecasts for the first four countries are available since October 1989, and for Singapore, Switzerland, Australia and New Zealand they are available since January 1995. Actual exchange rates on the survey date are provided by Consensus Economics, and actual interest rates for 3-month and 10-year maturities are obtained from the Global Financial Data database.[3] All samples end in April 2010.

2.1 Properties of the Subjective Excess Currency Return

We begin with the definitions of the variables of interest. The goal of this paper is to provide evidence for the predictability of excess return and forecast error, and we can define *ex post* excess return as:

$$XR_{t+n} = i_t^{n*} - i_t^n + \frac{1200}{n}(s_{t+n} - s_t) \quad (1)$$

The n-period domestic and foreign interest rates, i_t^n and i_t^{n*}, are annualized and in percentage point. Exchange rate is defined as the US dollar price of the foreign currency, and the n-period change of its log, $s_{t+n} - s_t$, is multiplied by $\frac{1200}{n}$ to convert it into an annual rate. For this paper we have n= 3 months. Using the survey expectations $\hat{E}_t s_{t+n}$, we can rewrite (1) as:

$$XR_{t+n} = i_t^{n*} - i_t^n + \frac{1200}{n}\left(\hat{E}_t s_{t+n} - s_t\right) + \frac{1200}{n}\left(s_{t+n} - \hat{E}_t s_{t+n}\right) \quad (2)$$

We can interpret (2) as follows:

$$\underbrace{XR_{t+n}}_{ex\ post\ excess\ return} = \underbrace{\hat{E}_t XR_{t+n}}_{subjective\ \ ex\ ante\ excess\ return} + \underbrace{\epsilon_{t+n}}_{forecast\ error} \quad (3)$$

Ex post excess return XR_{t+n} is predictable either due to a predictable subjective *ex ante* excess return $\hat{E}_t XR_{t+n}$, a predictable forecast error ϵ_{t+n}, or both. Though most studies focus on coming up with theories to account for a time-varying *ex ante* excess return $\hat{E}_t XR_{t+n}$ and assume the forecast error to

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[3] We use the 5-year government bond rate for Singapore as the 10-year data are available for a very short sample only.

have a conditional mean of zero, we document below that most of the movement of *ex post* excess return can be attributed to the forecast error (as in Froot and Frankel 1989). Next, we provide in-sample and out-sample evidence of the predictability of excess return XR_{t+n} and forecast error ϵ_{t+n}. We show that a country pair's own interest differential only has modest predictive power, but adding 1) interest differential of longer maturity (Chen and Tsang 2009a) and 2) interest differentials of other country pairs substantially increase the forecasting power.

Notice that in the n-period forecast error ϵ_{t+n}, the expectation operator $\hat{E}_t$ refers to the CE forecast, and it may be different from the statistical forecast E_t, which is the rational expectations forecast made using time t information. The summary statistics for the three variables XR_{t+n}, $\hat{E}_t\ [XR_{t+n}]$ and ϵ_{t+n} are provided in Table 1. Ex post excess return has a standard deviation many times of its mean, in contrast to the much less volatile ex ante excess return. Due to the negative correlation between ex ante excess return and forecast error, forecast error has a larger standard deviation than ex post excess return. We can see from Table 1 that most of the fluctuations in ex post excess return are due to forecast error, not ex ante excess return.

Table 1 also shows the summary statistics for the interest differentials, and clearly they are a lot less volatile than the excess returns and forecast errors. Figure 1 plots the seven short-term (3-month) interest differentials and the long-term (mostly 10-year) interest differentials, and they are quite stable over time. Throughout most of the sample, Japan, Singapore and Switzerland have lower interest rates than the US, while Canada, New Zealand and United Kingdom are paying higher rates.

3. Surveyed Excess Returns, Ex Post Excess Returns and Forecast Errors

In this section we explain the movements in ex post excess returns, surveyed excess returns and the forecast errors using 1) interest differential of the country pair, 2) short-term and long-term interest differentials of all seven country pairs and 3) principal components extracted from the interest differentials. We first check the in-sample fit using overlapping and non-overlapping data, and we then see if using the principal components can improve the consensus forecasts out of sample.[4]

As documented in BMV, excess returns and survey forecast errors in the currency market are highly predictable. Fitting in the sample, they find that the interest differential $i_t^{n*} - i_t^n$ is highly significant in explaining forecast error $s_{t+n} - E_t s_{t+n}$ and excess return XR_{t+n} for $n = 3{,}6$ months. We extend their

[4] Our results are not driven by using the US as the home currency. The results are similar using any currency in the sample as the base currency. It clears us from the suspicion that what we will be discussing is simply "US factors".

result by including interest differentials of the other countries as explanatory variables. More precisely, we consider the regression of the form, for each country pair:

$$y_{t+n} = \alpha + \sum_{k=1}^{K} \beta_k \left(i_{t,k}^{n*} - i_{t,k}^{n} \right) + u_{t+n} \tag{4}$$

where y_{t+n} is either the excess return XR_{t+n} or forecast error $s_{t+n} - E_t s_{t+n}$, and K is the total number of country pairs (which is seven in this paper). As $n = 3$ is larger than the frequency of the data, y_{t+n} is overlapping over time. As a result, the error u_{t+n} is serially correlated and the F-statistic and R-sq of (4) using OLS will be biased upward (i.e. the results are biased toward finding the interest differentials to be relevant).

We do two robustness checks. First, we report the F-statistic and R-sq using non-overlapping quarterly data (last month of each quarter). Second, we do a simple Monte Carlo experiment to control for the upward bias, in a manner similar to Mark (1995): 1) we regress forecast error or excess return for each country on a constant and keep the estimated standard error of regression $\hat{\sigma}$, 2) we generate one step ahead forecast error u_t or excess return from the distribution $N(0, \hat{\sigma})$, 3) we create the 3-month ahead forecast error or excess return by the sum $u_{t+2} + u_{t+1} + u_t$, and 4) we estimate the own interest differential model or our model on the generated data, and keep the R-sq and F-statistic. The null of the experiment is that excess return or forecast error is pure random walk, and the experiment tells us the amount of bias induced by overlapping data for each model. We run the experiment 5000 times for each country, and subtract the mean of the generated R-sq and F-statistic from the actual ones to correct for the bias. Though we have found substantial bias in the R-sq, the results show that there is no bias in the F-statistic. In the results below we only report the correction for the former statistic.

Tables 2 and 3 report the results for excess returns. First, for regressions that only use the country pair's own interest differential, we only find some predictability, in contrast to BMV. Once we use non-overlapping data in Table 3 or correct for bias in the R-sq, the predictability mostly goes away. The model using all interest differentials are different: the R-sq is substantially higher and some are above 10% even after correction, and the F-statistic rejects for all country pairs the hypothesis that all the interest differentials are irrelevant. The results with all interest differentials survive with the non-overlapping data.

Tables 4 and 5 report the results for forecast errors. Again, we do not find as much predictability using each country pair's own interest differential as in BMV, and the results are even weaker with non-overlapping data and the bias correction, except perhaps Switzerland.[5] Once other interest differentials are added, the in-sample fit increases substantially, in both the overlapping and non-overlapping samples. Some of the corrected R-sq's are well above 10%.

Finally, Tables 6 and 7 report the results for the surveyed excess return.

3.1 Using Principal Components

While we have shown that using all the fourteen interest differentials is clearly preferred to using the own interest differential, our model suffers from two problems: 1) the coefficients are hard to interpret, and the regression may have close to perfect collinearity, and 2) the large number of explanatory variables become a burden when we want to forecast out of sample in the next section. Here we reduce the dimension of our explanatory variables by using the first two principal components from the seven short interest differentials and two from the seven long interest differentials. The four factors are plotted in Figures 2 and 3.[6] The first components from both groups are very similar to the simple average. The two first principal components look similar as short rates and long rates usually move together, and their difference can be interpreted as the "global slope".

In the second-to-last column in Tables 2-7 we report the results using the first principal components, and in the last columns we use the first and second principal components. Since the two principal components only capture 80% of the seven interest differentials, we should expect a worse in-sample fit. For excess return and forecast error, using two factors seems inadequate, but with four factors the performance is quite close to the model using all fourteen interest differentials. In contrast, for the subjective excess return the factors perform much worse than the interest differentials.

We can from Table 8 show how the interest differentials are related to the principal components. For the short-term interest differentials, the first principal component is related to the seven interest differentials positively, and accounts for 63% of their variations. The second principal component (which, by definition, is uncorrelated to the first) only accounts for 17% of the variations, and it does not have a clear relationship with the interest differentials. It is worth mentioning that for Singapore the interest differential loads heavily on the second component and weakly on the first. For the long-term interest differentials, except for Singapore, all the interest differentials have a positive loading on the first principal component, and it accounts for 57% of the variations. The second component accounts for 21% of the variations, but

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5 If we drop the 2008-2009 data, we obtain the strong results in BMV. The large fluctuations of most currencies over 2008 and 2009 reduce the significance of their results.

6 For both the short and long interest differentials, the first two principal components explain about 80% of the variations.

again its relationship with the differentials is unclear. For Singapore the loading (which is negative) on the first component is small, while its loading on the second component is large.

Tables 9 and 10 report the coefficients on the principal components for the last two regressions in Tables 2-7.

3.2 Further Evidence Based on Bayesian Model Averaging (BMA)

Specification (4) is agnostic: all eight interest differentials are included for any excess return or forecast error. The BMA method (Raftery, Madigan and Hoeting 1997; Hoeting, Madigan, Raftery and Volinsky 1999) allows us to ask the question: given the data, what is the posterior probability that each interest differential should be included in a model for predicting forecast error or excess return? While we focus on in-sample fit in this section, see Wright (2008) for out-of-example exchange rate forecast using BMA.

Tables 11-13 show the BMA results for excess returns, forecast errors and the subjective excess returns. The posterior inclusion probabilities can be interpreted as the probability that a variable is included in the model, given the data. For example, if $prob(\beta \neq 0|data) > 50\%$, it means the probability that a variable (for which the coefficient is β) is larger than 50%. Or, it is more likely than not that the variable is in the model. There is some theoretical support for emphasizing variables that have inclusion probability larger than 50%: the "median probability model", which includes all variables with an inclusion probability larger than 50%, is often the optimal predictive model (Barbieri and Berger 2004). According to Tables 6 and 7, even under the conservative requirement that only variables with an inclusion probability larger than 80% are included, many interest differentials are found to be important for predicting forecast error and excess return.

4. Out-Sample Forecasting

As established by Meese and Rogoff (1983), good in-sample fit does not imply good out-sample prediction. To further support our results so far, we carry out a horse race in predicting 3-month exchange rate change between using the eight interest differentials and using the CE forecasts. First, we regress the actual 3-month exchange rate change on *each* of the eight interest differentials recursively, using the five years of data since January 1995 (so that all country pairs start at the same period). Next, we generate the first out-sample forecast from each of the eight regressions, and we take the average of the eight forecasts as our combined out-sample forecast. As explained in Timmerman (2006), simple combinations of forecasts dominate more complicated methods that aim at finding the optimal weights. The combined forecasting method is more efficient than having all eight interest differentials in a single regression as in (4).

Table 14 reports the results. We consider two forecast periods: the first period is March 2000 - October 2007 (i.e. the first forecast is for the exchange rate change between March 2000 and June 2000), roughly before the 2008-2009 financial crisis; the second period is March 2000 - January 2010 (i.e. the last forecast is for the exchange rate change between January 2010 and April 2010), which includes the financial crisis. In the first period, we significantly beat the CE forecasts for Australia, Canada, and Japan. We also forecast better than CE for Switzerland and UK, though not significantly so, and we perform worse than CE for Singapore. In the second period, during which we have large fluctuations in all the currencies, our combined forecast still performs reasonably well compared to the CE forecasts, and we beat the CE forecasts significantly for Australia and Japan.

On the other hand, using the country's own interest differential forecasts poorly compared to the CE forecasts. For both sample periods and for most currencies the interest differential forecast has a higher RMSE than the CE forecast, sometimes significantly so. That is, a forecaster who uses a simple "UIP model" will do worse than a group of professional forecasters.

We do a second out-sample exercise as a robustness check, making use of the principal components. We compare the model that forecast error is a random walk (possibly serially correlated due to the overlapping data) with the model that forecast error is a function of the principal components. A more parsimonious model, the random walk, is the null and the alternative is a larger model with principal components. The question we are asking is then: are the CE forecasters neglecting the global factors or, if they do look at the global factors, using them "wrongly"? Clark and West (2007) propose a test that takes into account the uncertainty involved in estimating the extra coefficients for the principal components. Table 15 gives the results using one principal component for the short-term differentials and one for the long-term. The random walk null is rejected for most currencies for both sample periods. When we move to four principal components in Table 16, the results are much less significant, suggesting that a model for the forecast error may contain two factors but not four.

5. Discussion

What have we seen so far? First, the short and long interest differentials are powerful predictors for excess returns, forecast errors and surveyed excess returns. While using a currency pair's own interest differential is not enough, we find that extracting one or two principal components from each of the short and long interest differentials is enough to capture the in-sample fit of using all the differentials. Second, we learn that either the differentials or their principal components are useful for improving upon the CE forecasts out of sample, while a currency pair's own interest differential does not help at all. What do these findings imply?

Forecasters do not neglect the global factors, but they are using global factors differently than the data would suggest.

One may be suspicious of the quality of the exchange rate forecast. The forecaster could just give a random guess, or give a biased answer under self interest (e.g. predict a rise in the UK pound when the forecaster or the forecaster's institution is holding UK pound). For either of the two reasons we have measurement error in the forecast, and the forecast cannot perfectly measure the "market's forecast". Since we do not use survey data in the right-hand side, a random measurement error that is uncorrelated with the interest differentials will just reduce the in-sample fit. Mechanically, for the true forecast error (the one using true "market's forecast") to be unpredictable but the survey forecast error to be predictable, we need the measurement error to be correlated with the interest differentials. As it is hard to argue for such a measurement error, and it is unreasonable to attribute all of our results to it, we conclude that our strong results are not due to the bad survey data.

What explain the results? As suggested in BMV, there are two types of explanations. First is to argue that, due to learning or other non-rational expectations mechanisms, forecast error is predictable and it results in a predictable excess return. Gourinchas and Tornell (2004) argue for this causal relationship. Second is to argue that there is a third factor contributing to the predictability of both variables. For example, Bacchetta and van Wincoop (2009) suggest that if the gain of active trading is small compared to the fees, portfolio decisions will be infrequent and deviation from the UIP will be left uncorrected.

We offer a related explanation for our results. Suppose the term structure in each country is driven by both domestic factors and global factors, with the domestic factors reflecting expectations of domestic macroeconomic fundamentals and the global factors reflecting those of global fundamentals. If the investors cannot distinguish between the two types of factors perfectly, and that they need to learn about the processes of the factors, expectations can be non-rational and can explain the predictability of the forecast error.

6. Conclusion

Excess return is predictable mainly because exchange rate forecast error is predictable. Exchange rate forecasts from the Consensus Economics dataset fail the rationality significantly: current interest differentials can explain future forecast errors, both in and out of sample.

We explain our results by the presence of latent global factors contained in the interest differentials that investors do not observe directly. If investors cannot distinguish between the domestic factors and global factors perfectly, and they need to learn about the processes of the factors, then forecasts can be non-rational and can explain the predictability of the forecast error. We leave a more careful modeling of the learning mechanisms for our other paper in progress (Chen, Tsang and Tsay 2010).

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Table 1. Properties of the Subjective Excess Return

	Ex post excess return XR_{t+3}		Ex ante excess return $\hat{E}_t(XR_{t+3})$		Forecast error $\frac{1200}{3}(s_{t+3} - \hat{E}_t s_{t+3})$		Short interest diff. $i_t^{s,us} - i_t^{s,f}$		Long interest diff. $i_t^{l,us} - i_t^{l,f}$	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Australia	3.283	26.457	4.757	11.226	-1.422	29.864	-2.529	1.983	-1.596	1.137
Canada	1.480	14.682	1.779	5.913	-0.346	16.218	-0.893	1.733	-0.523	0.802
Japan	-0.088	24.646	-2.385	10.390	2.236	26.729	2.331	2.173	2.824	0.913
New Zealand	3.597	27.125	2.236	12.765	1.503	30.760	-3.257	1.626	-1.594	0.877
Singapore	-1.749	12.788	-0.795	5.558	-0.843	13.623	2.040	1.474	2.399	0.827
Switzerland	-1.238	20.171	2.137	7.734	-3.425	21.994	1.027	2.172	1.816	0.667
United Kingdom	2.358	21.615	4.143	6.943	-1.886	21.806	-2.195	1.947	-0.867	1.076

Note: The sample for Canada, Japan and United Kingdom begins in October 1989, while that of the other countries begins in January 1995. Data for the first three variables are from Consensus Forecast, and the interest differentials are from Global Financial Data. Short rates have a 3-month maturity, and long rates have a 10-year maturity (except for Singapore which is 5-year).

Table 2. Predicting Excess Returns (3-Month Horizon, In Sample)

$$XR_{t+n} = i_t^{n*} - i_t^n + \frac{1200}{m}(s_{t+m} - s_t)$$

	Own Interest Diff.	All Interest Diff.	Global Factors (2)	Global Factors (4)
Australia	0.008	0.143	0.034	0.135
Canada	-0.005	0.039	-0.019	-0.010
Japan	0.074	0.049	0.073	0.081
New Zealand	-0.008	0.044	0.010	0.086
Singapore	0.047	0.133	0.022	0.046
Switzerland	0.062	0.118	0.052	0.070
United Kingdom	0.010	0.033	-0.004	0.027

Note: The sample period is October 1989 - April 2010 for Canada, UK and Japan. The sample period for New Zealand, Australia, Singapore and Switzerland is January 1995 - April 2010. Excess return is defined as $XR_{t+n} = i_t^{n*} - i_t^n + \frac{1200}{m}(s_{t+m} - s_t)$. The R^2 reported here is corrected for sample bias due to overlapping data. See the text for details on the Monte Carlo experiment that does the correction.

Table 3. Predicting Excess Returns (3-Month Horizon, In Sample, Non-overlapping Data)

$$XR_{t+n} = i_t^{n*} - i_t^n + \frac{1200}{m}(s_{t+m} - s_t)$$

	Own Interest Diff.	All Interest Diff.	Global Factors (2)	Global Factors (4)
Australia	0.007	0.140	0.047	0.145
Canada	-0.011	0.001	-0.017	-0.018
Japan	0.089	0.079	0.093	0.089
New Zealand	-0.015	0.006	0.026	0.062
Singapore	0.082	0.191	0.024	0.054
Switzerland	0.053	0.098	0.036	0.041
United Kingdom	0.003	-0.049	0.003	0.042

Note: The sample period is October 1989 - April 2010 for Canada, UK and Japan. The sample period for New Zealand, Australia, Singapore and Switzerland is January 1995 - April 2010. Excess return is defined as $XR_{t+n} = i_t^{n*} - i_t^n + \frac{1200}{m}(s_{t+m} - s_t)$. Non-overlapping data are constructed by picking the last month of each quarter.

Table 4. Predicting Forecast Errors (3-Month Horizon, In Sample)

$$s_{t+n} - \hat{E}_t s_{t+n}$$

	Own Interest Diff.	All Interest Diff.	Global Factors (2)	Global Factors (4)
Australia	0.012	0.234	0.056	0.235
Canada	-0.006	0.102	-0.007	0.034
Japan	0.031	0.062	0.013	0.035
New Zealand	-0.001	0.164	0.021	0.197
Singapore	0.011	0.134	0.009	0.043
Switzerland	0.094	0.229	0.118	0.169
United Kingdom	-0.012	0.003	-0.006	0.034

Note: The sample period is October 1989 - April 2010 for Canada, UK and Japan. The sample period for New Zealand, Australia, Singapore and Switzerland is January 1995 - April 2010. Forecast error is defined as $s_{t+n} - \hat{E}_t s_{t+n}$, where $n = 3$. The R^2 reported here is corrected for sample bias due to overlapping data. See the text for details on the Monte Carlo experiment that does the correction.

Table 5. Predicting Forecast Errors (3-Month Horizon, In Sample, Non-overlapping Data)

	$s_{t+n} - \hat{E}_t s_{t+n}$			
	Own Interest Diff.	**All Interest Diff.**	**Global Factors (2)**	**Global Factors (4)**
Australia	0.005	0.198	0.068	0.218
Canada	-0.012	0.063	-0.018	-0.001
Japan	0.019	0.086	0.011	0.020
New Zealand	-0.011	0.068	0.039	0.133
Singapore	0.039	0.194	0.013	0.060
Switzerland	0.091	0.222	0.115	0.152
United Kingdom	-0.012	-0.096	-0.010	0.051

Note: The sample period is October 1989 - April 2010 for Canada, UK and Japan. The sample period for New Zealand, Australia, Singapore and Switzerland is January 1995 - April 2010. Forecast error is defined as $s_{t+n} - \hat{E}_t s_{t+n}$, where $n = 3$. The R^2 reported here is corrected for sample bias due to overlapping data. See the text for details on the Monte Carlo experiment that does the correction. Non-overlapping data are constructed by picking the last month of each quarter.

Table 6. Predicting Surveyed Excess Return (3-Month Horizon, In Sample)

$$i_t^{n*} - i_t^n + \frac{1200}{n}\left(\hat{E}_t s_{t+n} - s_t\right)$$

	Own Interest Diff.	All Interest Diff.	Global Factors (2)	Global Factors (4)
Australia	-0.008	0.252	0.024	0.136
Canada	-0.012	0.139	0.005	0.091
Japan	0.012	0.223	0.049	0.064
New Zealand	0.002	0.323	0.016	0.151
Singapore	0.025	0.291	0.037	0.032
Switzerland	0.033	0.197	0.091	0.146
United Kingdom	0.196	0.253	0.184	0.184

Note: The sample period is October 1989 - April 2010 for Canada, UK and Japan. The sample period for New Zealand, Australia, Singapore and Switzerland is January 1995 - April 2010. Surveyed excess return is defined as $i_t^{n*} - i_t^n + \frac{1200}{n}\left(\hat{E}_t s_{t+n} - s_t\right)$, where $n = 3$. The R^2 reported here is corrected for sample bias due to overlapping data. See the text for details on the Monte Carlo experiment that does the correction.

Table 7. Predicting Surveyed Excess Return (3-Month Horizon, In Sample, Non-overlapping Data)

$$i_t^{n*} - i_t^n + \frac{1200}{n}\left(\hat{E}_t s_{t+n} - s_t\right)$$

	Own Interest Diff.	All Interest Diff.	Global Factors (2)	Global Factors (4)
Australia	-0.016	0.344	0.052	0.105
Canada	-0.010	0.154	-0.018	0.006
Japan	0.051	0.330	0.088	0.084
New Zealand	-0.002	0.361	-0.010	0.030
Singapore	0.013	0.398	0.064	0.037
Switzerland	0.041	0.216	0.122	0.134
United Kingdom	0.140	0.220	0.125	0.199

Note: The sample period is October 1989 - April 2010 for Canada, UK and Japan. The sample period for New Zealand, Australia, Singapore and Switzerland is January 1995 - April 2010. Surveyed excess return is defined as $i_t^{n*} - i_t^n + \frac{1200}{n}\left(\hat{E}_t s_{t+n} - s_t\right)$, where $n = 3$. The R^2 reported here is corrected for sample bias due to overlapping data. See the text for details on the Monte Carlo experiment that does the correction. Non-overlapping data are constructed by picking the last month of each quarter.

Table 8. Loadings of the Interest Differentials on the Factors

	Short-Term Principal Component 1 (63%)	Short-Term Principal Component 2 (17%)	Long-Term Principal Component 1 (57%)	Long -Term Principal Component 2 (21%)
Australia	0.413	-0.092	0.466	-0.062
Canada	0.412	-0.284	0.422	-0.239
Japan	0.426	0.296	0.402	0.340
New Zealand	0.363	-0.146	0.344	0.231
Singapore	0.126	0.842	-0.244	0.635
Switzerland	0.398	0.188	0.223	0.590
United Kingdom	0.415	-0.239	0.465	-0.134

Note: We extract two principal components each from 1) the seven short-term interest differentials and 2) the seven long-term interest differentials. The percentage in the first row is the proportion of variations in the variables explained by that component.

Table 9. Ex Post Excess Return, Forecast Error, and Surveyed Excess Return: Loadings on the Factors (2 Factors)

	Ex Post Excess Return				Forecast Error				Surveyed Excess Return			
	Short PC		Long PC		Short PC		Long PC		Short PC		Long PC	
Australia	-0.852	(1.657)	-4.181	(1.928)	0.388	(1.848)	-6.716*	(2.152)	-1.275	(0.707)	2.517*	(0.824)
Canada	0.477	(0.857)	-0.925	(0.904)	0.686	(0.942)	-1.592	(0.993)	-0.200	(0.341)	0.657	(0.359)
Japan	-6.325***	(1.372)	4.133*	(1.447)	-4.443*	(1.537)	3.411	(1.620)	-1.863*	(0.587)	0.704	(0.618)
New Zealand	-0.879	(1.698)	-4.279**	(1.977)	-0.358	(1.897)	-6.598*	(2.208)	-0.583	(0.807)	2.301	(0.940)
Singapore	-1.589	(0.806)	-0.381	(0.938)	-0.442	(0.864)	-1.534	(1.006)	-1.180**	(0.347)	1.142	(0.405)
Switzerland	-2.762	(1.250)	-1.392	(1.455)	-3.541	(1.316)	-2.678	(1.532)	0.775	(0.469)	1.282	(0.546)
United Kingdom	-2.544	(1.253)	1.711	(1.321)	-2.002	(1.265)	2.777	(1.334)	-0.502	(0.363)	-1.106*	(0.383)

Note: The coefficients and standard errors (in parentheses) are for the factors in the third regression (2 factors) reported in Tables 2-7. To correct for the overlapping data problem, we use the corrected critical values for the t-statistics: 2.86 for 10% (*), 3.40 for 5% (**) and 4.04 for 1% (***) (which is equivalent to dividing the t-statistic by the root of the horizon of the LHS, which is 3).

Table 10a. Ex Post Excess Return, Forecast Error, and Surveyed Excess Return: Loadings on the Factors (4 Factors)

	Ex Post Excess Return							
	Short PC 1		**Long PC 1**		**Short PC 2**		**Long PC 2**	
Australia	6.755*	(2.333)	-9.007***	(2.099)	-12.985***	(3.093)	0.274	(2.286)
Canada	1.390	(1.085)	-2.129	(1.138)	-2.442	(1.230)	0.447	(1.089)
Japan	-6.903**	(1.737)	4.132	(1.822)	-3.254	(1.969)	3.356	(1.743)
New Zealand	3.859	(2.461)	-7.468**	(2.214)	-11.135**	(3.263)	2.769	(2.412)
Singapore	0.651	(1.185)	-1.690	(1.066)	-1.970	(1.571)	-1.501	(1.161)
Switzerland	-0.759	(1.845)	-2.800	(1.660)	-5.684	(2.447)	2.003	(1.808)
United Kingdom	-1.289	(1.568)	1.188	(1.646)	3.769	(1.779)	-4.787*	(1.574)

Note: The coefficients and standard errors (in parentheses) are for the factors in the fourth regression (4 factors) reported in Tables 2-7. To correct for the overlapping data problem, we use the corrected critical values for the t-statistics: 2.86 for 10% (*), 3.40 for 5% (**) and 4.04 for 1% (***) (which is equivalent to dividing the t-statistic by the root of the horizon of the LHS, which is 3).

Table 10b. Ex Post Excess Return, Forecast Error, and Surveyed Excess Return: Loadings on the Factors (4 Factors)

	Forecast Error							
	Short PC 1		**Long PC 1**		**Short PC 2**		**Long PC 2**	
Australia	11.900***	(2.474)	-13.932***	(2.226)	-18.224***	(3.281)	-0.803	(2.425)
Canada	2.860	(1.173)	-4.130	(1.231)	-3.752	(1.330)	-0.498	(1.177)
Japan	-5.227	(1.932)	3.338	(2.028)	-4.865	(2.191)	4.893	(1.939)
New Zealand	9.341**	(2.613)	-12.826***	(2.351)	-17.804***	(3.465)	1.413	(2.561)
Singapore	2.279	(1.265)	-3.132	(1.138)	-2.524	(1.677)	-1.711	(1.240)
Switzerland	-0.070	(1.902)	-5.074*	(1.711)	-9.126**	(2.522)	2.855	(1.864)
United Kingdom	-1.069	(1.576)	2.718	(1.653)	4.874	(1.787)	-5.129*	(1.581)

Note: The coefficients and standard errors (in parentheses) are for the factors in the fourth regression (4 factors) reported in Tables 2-7. To correct for the overlapping data problem, we use the corrected critical values for the t-statistics: 2.86 for 10% (*), 3.40 for 5% (**) and 4.04 for 1% (***) (which is equivalent to dividing the t-statistic by the root of the horizon of the LHS, which is 3).

Table 10c. Ex Post Excess Return, Forecast Error, and Surveyed Excess Return: Loadings on the Factors (4 Factors)

	Surveyed Excess Return							
	Short PC 1		**Long PC 1**		**Short PC 2**		**Long PC 2**	
Australia	-4.944***	(0.988)	4.713***	(0.887)	4.480**	(1.265)	1.345	(0.961)
Canada	-1.456**	(0.414)	1.986***	(0.434)	1.301	(0.460)	0.933	(0.415)
Japan	-1.703	(0.740)	0.836	(0.775)	1.724	(0.822)	-1.564	(0.741)
New Zealand	-5.203***	(1.110)	5.060***	(0.997)	5.540**	(1.421)	1.781	(1.080)
Singapore	-1.528*	(0.518)	1.336*	(0.465)	0.163	(0.663)	0.353	(0.504)
Switzerland	-0.610	(0.675)	2.191**	(0.606)	3.142**	(0.864)	-0.745	(0.657)
United Kingdom	-0.281	(0.461)	-1.419*	(0.483)	-0.726	(0.513)	0.216	(0.462)

Note: The coefficients and standard errors (in parentheses) are for the factors in the fourth regression (4 factors) reported in Tables 2-7. To correct for the overlapping data problem, we use the corrected critical values for the t-statistics: 2.86 for 10% (*), 3.40 for 5% (**) and 4.04 for 1% (***) (which is equivalent to dividing the t-statistic by the root of the horizon of the LHS, which is 3).

Table 11. Bayesian Model Averaging (BMA) Posterior Results (Excess Return XR_{t+3})

		Australia	Canada	Japan	New Zealand	Singapore	Switzerland	United Kingdom
Short $i - i^*$	Australia	36.5	8.8	13.7	9.5	5.3	44.1	4.5
	Canada	2.3	57	**80.2**	4	**96.2**	24.2	6
	Japan	4.2	26.1	14.6	8.1	9.2	0.9	9.9
	New Zealand	5.1	24.5	5.7	5.6	17.4	**98.7**	4
	Singapore	**100**	23.7	**84.5**	**96.9**	15.3	**90.2**	**97.3**
	Switzerland	11.2	4.9	24.2	4.2	3.9	14.4	6.8
	UK	**99.1**	**98.2**	4.9	**96.8**	**95.9**	**97.5**	71.6
Long $i - i^*$	Australia	7.2	6.1	4	4.3	12.8	7.2	4.2
	Canada	**100**	27.5	9.2	**100**	4.1	23.7	**96.4**
	Japan	6.6	0.5	1.9	4.1	4	**82.8**	3.8
	New Zealand	18.5	**99.6**	15.3	1.4	**96.2**	25.7	15.2
	Singapore	7.3	0.7	7.1	4.1	**88.7**	2.8	3.3
	Switzerland	6.5	25.1	71.2	11.4	**93.9**	26.1	**99.8**
	UK	3.8	6.1	6.7	3.6	8.9	1	4.3

Note: The numbers reported are posterior probabilities (in percentage point) that the coefficient is zero. Probabilities higher than 80% are in bold.

Table 12. Bayesian Model Averaging (BMA) Posterior Results (Forecast Error $\frac{1200}{3}(s_{t+3} - \hat{E}_t s_{t+3})$)

		Australia	Canada	Japan	New Zealand	Singapore	Switzerland	United Kingdom
Short $i - i^*$	Australia	**93.5**	1.8	71.1	**95.1**	37.8	**98.9**	4.9
	Canada	28.9	12.9	**96.2**	5.5	**92.5**	18.5	6.8
	Japan	11.7	**93.9**	39.4	46.6	8.7	11.3	5.4
	New Zealand	3.8	43.8	8.3	3.5	4.6	**99.4**	0.2
	Singapore	**98.3**	1.6	63.7	**96.8**	7.2	**93.7**	**98.3**
	Switzerland	11.9	19.1	0.5	7.1	6.6	3.4	4.2
	UK	56.1	**100**	24.5	12.5	**96.5**	81	20.2
Long $i - i^*$	Australia	27.6	5.3	2.9	**94.4**	6.9	11	5
	Canada	63.4	6.6	0.6	14.4	14.7	38.3	**87.7**
	Japan	**94.1**	6.3	49.3	25.8	14.6	36.6	4.4
	New Zealand	40.7	**100**	26.5	1.4	**99.3**	**95.3**	1.1
	Singapore	29.6	6.4	5.5	3.7	76.3	30.7	3.4
	Switzerland	46	27.6	16.5	29	**87.2**	3.3	**99.8**
	UK	5.7	4	4.9	2.3	28.2	4.5	23.5

Note: The numbers reported are posterior probabilities (in percentage point) that the coefficient is zero. Probabilities higher than 80% are in bold.

Table 13. Bayesian Model Averaging (BMA) Posterior Results (Subjective Excess Return $\widehat{E}_t XR_{t+3}$)

		Australia	Canada	Japan	New Zealand	Singapore	Switzerland	United Kingdom
Short	Australia	76.6	3.2	72.7	24.5	**100**	**82.7**	50.1
$i - i^*$	Canada	14.5	10.7	5.4	13.3	2.4	49.1	10.4
	Japan	35	24.6	**87.2**	26.8	**100**	**100**	77.7
	New Zealand	5.4	6.1	**99.1**	43.9	4.4	12	15.8
	Singapore	2.3	5.8	9.3	17.7	**100**	2.1	25.3
	Switzerland	15.9	0.6	**81.3**	6.1	3.3	**91.4**	4
	UK	11.3	**96**	5.7	2.8	11.8	3.4	8.3
	Australia	9.2	**100**	10.4	15.9	5.1	2.9	5.1
Long	Canada	39.9	**98.9**	**100**	75.1	2.2	33.4	**93.4**
$i - i^*$	Japan	**100**	**83.9**	**99.7**	**100**	14.5	3.4	1.9
	New Zealand	3	3.2	13.6	3.4	15.8	**89.1**	16.2
	Singapore	25.7	3.2	6.1	3.7	39.8	5.7	1.7
	Switzerland	**86.5**	2.8	**99**	**98.6**	14.2	5.8	1.8
	UK	28.2	8.3	6.3	63.1	**99.8**	62.6	**100**

Note: The numbers reported are posterior probabilities (in percentage point) that the coefficient is zero. Probabilities higher than 80% are in bold.

Table 14. Do the Interest Differentials Beat the Consensus Forecasts?

Last Forecast Made For: Jan 2010-April 2010

	RMSE (own/CE)	Diebold-Mariano p-value	RMSE (all/CE)	Diebold-Mariano p-value
Australia	0.944	0.342	0.900*	0.098
Canada	0.920*	0.060	0.929	0.102
Japan	1.617**	0.026	0.904*	0.066
New Zealand	0.943	0.421	0.895	0.194
Singapore	1.026	0.788	0.930	0.390
Switzerland	1.081	0.386	0.957	0.451
UK	1.018	0.632	1.012	0.758

Last Forecast Made For: Oct 2007-Jan 2008

	RMSE (own/CE)	**Diebold-Mariano p-value**	**RMSE (all/CE)**	**Diebold-Mariano p-value**
Australia	1.005	0.961	0.829**	0.043
Canada	0.915**	0.047	0.920**	0.049
Japan	1.821**	0.014	0.851**	0.029
New Zealand	1.005	0.955	0.848	0.113
Singapore	1.263*	0.053	1.086	0.332
Switzerland	1.121	0.325	0.977	0.753
UK	1.044	0.361	0.981	0.686

Table 15. Out-Sample Forecasting for 3-Month Forecast Error (2 Factors)

Forecast Comparison End Period	May 2009		October 2007	
	CW Statistic	***p*-value**	**CW Statistic**	***p*-value**
Australia	361.279**	0.021	167.853**	0.043
Canada	99.247*	0.061	32.925	0.175
New Zealand	104.261*	0.096	162.596**	0.042
Japan	379.654**	0.014	272.126**	0.019
Singapore	30.558**	0.047	12.875	0.139
Switzerland	160.399***	0.010	137.368**	0.037
United Kingdom	-11.686	0.381	1.832	0.480

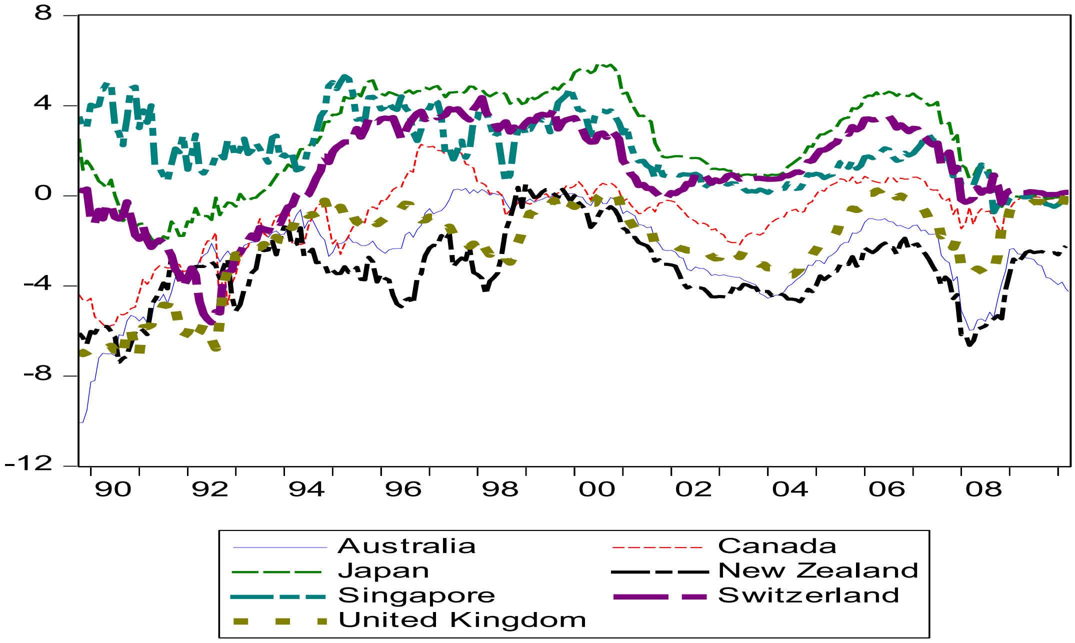
Note: Starting with the 5 years of data since January 1995, we regress recursively the 3-month forecast error on the factors. We consider two ending periods, the first (October 2007) is before the 2008-2009 financial crisis while the second is after. The Clark-West (2007) statistics are reported, and a positive number means the test is in favor of the model that the error depends on the factors instead of a random walk. The p-value tells us whether the preference of our model is statistically significant. * is for 10%, ** is for 5% and *** is for 1%.

Table 16. Out-Sample Forecasting for 3-Month Forecast Error (4 Factors)

Forecast Comparison End Period	May 2009		October 2007	
	CW Statistic	***p*-value**	**CW Statistic**	***p*-value**
Australia	626.569*	0.095	101.901	0.131
Canada	209.660*	0.052	21.715	0.312
New Zealand	-9.981	0.462	90.602	0.199
Japan	647.881*	0.067	184.239*	0.080
Singapore	37.777	0.257	-9.860	0.182
Switzerland	154.491	0.138	155.703*	0.070
United Kingdom	-71.779	0.232	37.826	0.154

Note: Starting with the 5 years of data since January 1995, we regress recursively the 3-month forecast error on the factors. We consider two ending periods, the first (October 2007) is before the 2008-2009 financial crisis while the second is after. The Clark-West (2007) statistics are reported, and a positive number means the test is in favor of the model that the error depends on the factors instead of a random walk. The p-value tells us whether the preference of our model is statistically significant. * is for 10%, ** is for 5% and *** is for 1%.

Figure 1. Short-Term and Long-Term Interest Differentials



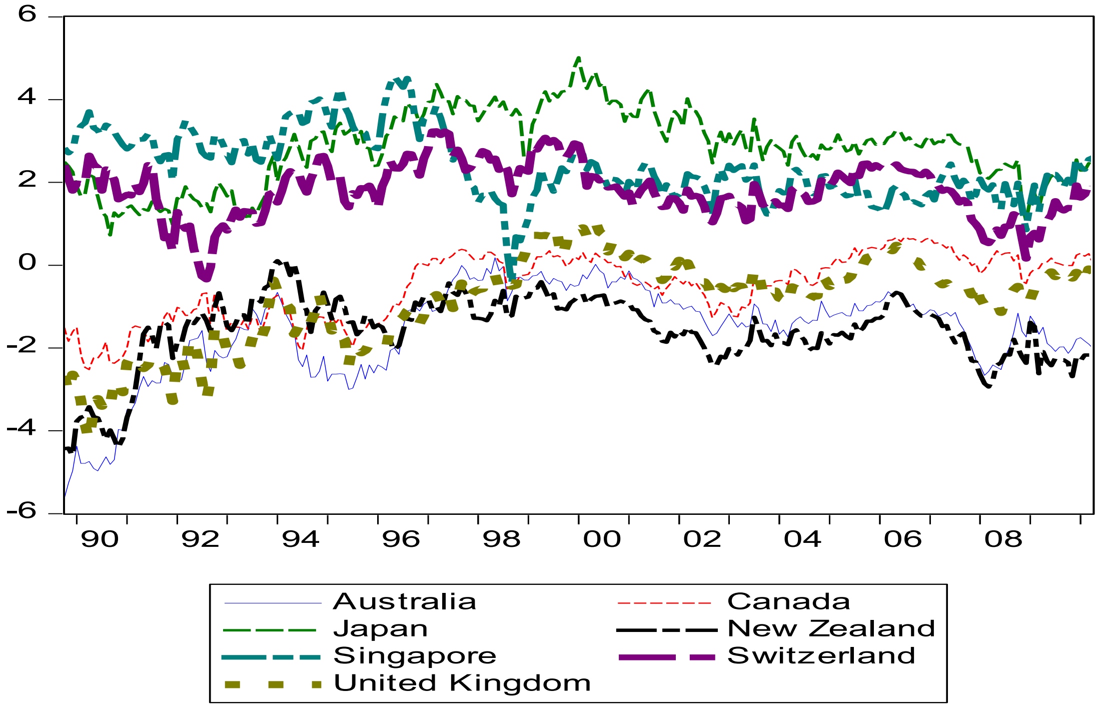
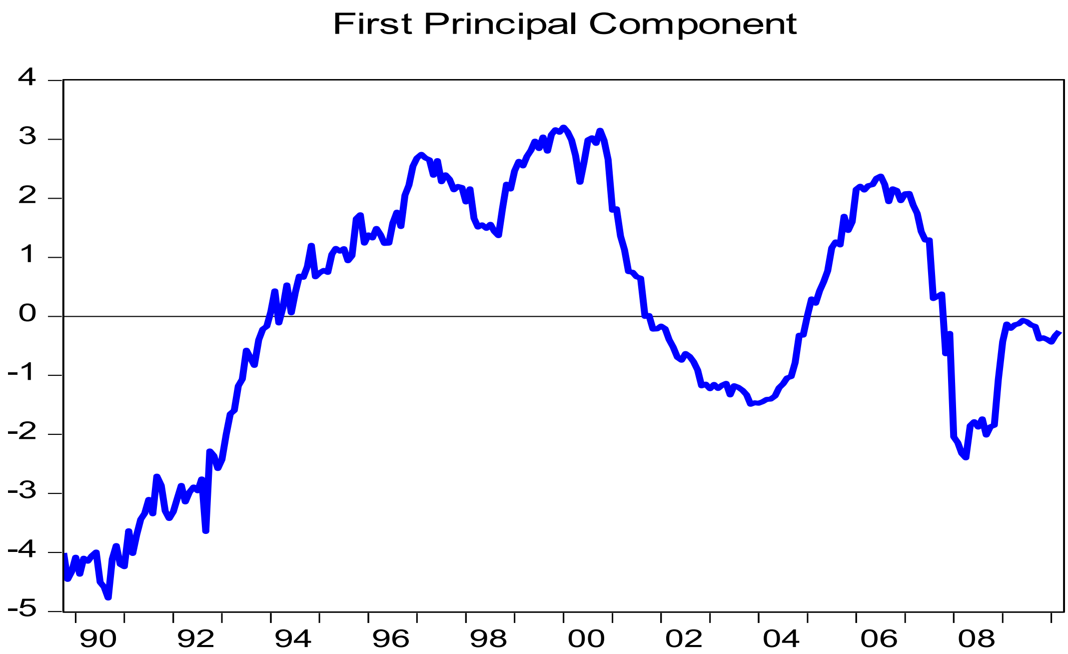


Figure 2. First and Second Principal Components for Short Interest Differentials



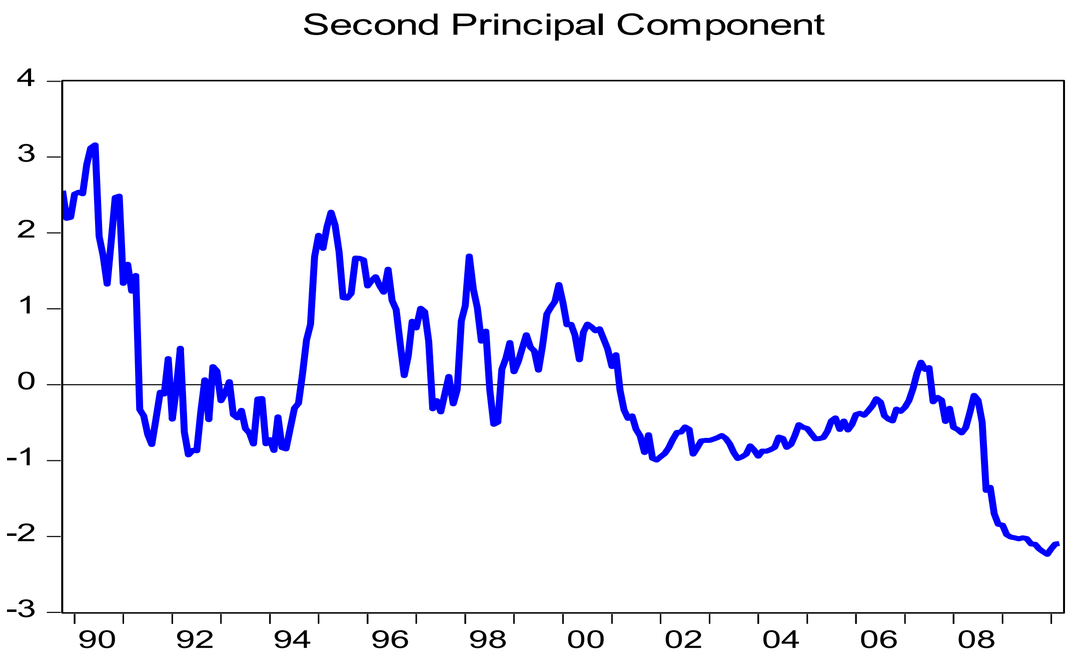


Figure 3. First and Second Principal Components for Long Interest Differentials