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A New Representation for the Foreign Currency Risk Premium

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A new representation for the foreign currency risk premium[1]

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Abstract

We provide new representations for the risk premium and expected exchange rate change. According to our representations they are a function of the term premium. In particular, we obtain that investors require higher interest rates on currencies expected to fall if the term premium is expected to stay constant. Moreover, our representations are such that the risk premium is very volatile and negatively correlated with the expected depreciation rate.

I. Introduction

According to the uncovered interest rate condition, investors require higher interest rates on currencies expected to depreciate. Empirical evidence, for instance Backus *et al*(2001), Bansal (1997), Engel (1995), and Hodrick (1987), rejects the uncovered interest rate condition. The data shows

[1] We would like to thank José Ferreira Machado e Carlos Robalo Marques for comments.

that high interest rate currencies appreciate. Thus, the interest rate differential alone cannot explain the exchange rate behavior.

Looking for that explanation has been one of the most unsuccessful research agendas in the literature. Many papers have attributed the rejection of the uncovered interest rate parity to a time-varying risk premium. Being the risk premium defined as the domestic price of a forward exchange contract, which is arranged today specifying a certain payment in the domestic currency in a future date and receipt of one unit of foreign currency, minus the expected domestic price of a unit of foreign currency in that future date. The most influential of these papers, Fama (1984b), shows that the risk premium has to be highly variable and negatively correlated with the expected rate of depreciation. This feature of the data has been described as a puzzle in international financial markets (see for instance Lewis (1995)). It is not our intention to offer an explanation for the puzzle. Instead, we provide a new representation of the risk premium.

It is widely accepted that exchanges rates do respond to interest rates but also to other macroeconomic fundamentals as output, inflation, or current account balances. For instance Bansal and Dahlquist (2000), using information from 28 developed and emerging economies, concluded that interest rate differentials are an increasingly biased predictor of currency depreciation as per capita GNP rises, and as both average inflation and inflation volatility drop. This suggests that the risk premium may be an unknown function of various macroeconomic fundamentals.

It would be preferable to have a simple measure of the risk premium that takes into account all the relevant economic variables. Although there is no consensus, a large number of studies document that there is a close association between the term structure of interest rates and both future real activity and future inflation (see for instance, Berk and Bergeijk (2000), Fama (1984a, 1990), Hu (1993), Miskin (1990a, 1990b), and for a recent survey Berk (1998)). In particular Hu (1993) verifies that from a sample of different variables as stock prices and lagged output growth, the yield spread is the most powerful predictor of future output growth.

Following this hint we verify how good a measure of the risk premium the term premium could be. Starting from the general asset pricing condition which relates pricing kernels and asset prices we derive that the risk premium is equal to the differential of the foreign and domestic term premiums. A unique and surprisingly weak assumption is sufficient to get this result. All that is needed is that in each country there is a positive short-run nominal interest rate.

In the literature usually the risk premium is a conditional covariance between two complex functions of future prices. For instance in Cox, Ingersoll and Ross (1981) the risk premium is the conditional covariance between the domestic price of a unit of foreign currency in the future and the product of a future stochastic discount kernel and a future interest rate. This way of expressing the risk premium is not very useful. It is intricate, difficult to compute and hard to interpret. For instance, it is not obvious that these conditional covariances can be very variable. On the other hand, our way of expressing the risk premium is simple and easy to compute. Moreover, it is easier to interpret. The formula we provide for the risk premium makes crystal clear that the risk premium can be highly variable, as the term premium changes frequently and not in the same direction in every country.

We show that the expected depreciation rate of the domestic currency is equal to the difference between the domestic short-term interest rate and the foreign short-term interest rate plus the difference between the foreign term premium and the domestic term premium. Thus, if the differential of term premiums remains constant, the intuition that investors require higher interest rates on the currencies that are expected to depreciate is correct.

The remainder of the paper proceeds as follows. In section 2 we summarize the properties of the interest rate differentials, changes in the exchange rates and excess return differentials for various countries. In section 3 we present the theoretical framework and deduce results. In section 4 we check whether our representation of the risk premium satisfies the referred Fama's requirements. Section 5 contains concluding remarks.

II. Empirical Regularities

In this section we present some empirical regularities for the exchange rates, interest rates and excess returns for the United States, Germany and Japan. We will focus on the main features of these variables to get a first assessment of the quality of our risk premium representation.

We collected daily data on spot exchange rates, interest money market rates and yields for the three countries from Bloomberg. The sample period covered is from November 1989 to July 2000. As the empirical work is undertaken on one-month interest rates and one-month holding returns on a 10 year bond, we previously estimated the entire term structure for those countries. The estimation of the term structure was carried out on a daily basis according either to the method in Nelson and Siegel (1987) or to the method in Svensson (1994). For each day the method chosen was the one that provided the best adjustment. Simple month averages were computed from the daily results.

The domestic currency is the dollar, S_t is the domestic price of a unit of foreign currency at date t, $\log(S_{t+1}/S_t) \equiv s_{t+1} - s_t$ is the change in the exchange rate, $r_{t,k}$ is the continuously compounded k-month nominal interest rate implicit on a domestic bond bought at date t with maturity at date $t+k$ and $r^*_{t,k}$ is the continuously compounded k-month nominal interest rate implicit on a foreign bond bought at date t with maturity at date $t+k$.

In Table 1 we report summary statistics on the changes in exchange rates, on the one-month and on the 10-year nominal interest rates.

Table 1: Properties of the Exchange Depreciation Rate and the Interest Rate Differential

Currency	Mean	Std Deviation	Autocorrelation
Depreciation Rate, $s_{t+1} - s_t$			
German mark	−0.480	13.433	0.311
Japanese yen	1.196	15.629	0.347
One-Month Interest Rate Differentials, $\log\left[(1+r_{t,1}) / \left(1+r^*_{t,1}\right)\right]$			
German mark	−0.086	1.211	0.996
Japanese yen	1.125	1.110	0.996

-Note: All the rates are annualized.

Table 1 shows that over the sample period the U.S. dollar has appreciated against the German mark and has depreciated against the Japanese yen. The short-term interest rate differential was on average negative for the German mark and positive for the Japanese yen.[2] The changes in the exchange rates were very volatile (both absolutely and relative to their means) and showed positive persistence, but the autocorrelations were small. Unlike exchange rates changes, interest rates displayed less volatility (the standard deviations of the interest rates are less than one-tenth of those of exchange rates changes), but they were very persistent, as they exhibited high first-order autocorrelations.

Figures 1 and 2 show the change of the German mark and the Japanese yen exchange rates and the one-month interest rate differentials. There were many subperiods in the sample in which the difference between the domestic interest rate and the foreign interest rate was increasing and

[2]Unlike the time series evidence, the cross section evidence favors the uncovered interest rate parity. For instance Backus et al (2001) compares the mean 1-month interest rate differentials with mean 1-month depreciation rates across currencies to conclude that currencies with average interest rates higher than the dollar have typically fallen in value relative to the dollar.

the domestic currency was appreciating. This confirms the result in the literature: the uncovered interest rate condition is not verified.

Let $R_{t,t+1}(t+k)$ be the holding gross return between date t and $t+1$ (one-month) on a domestic bond that matures at date $t+k$, and let $\mathfrak{h}_{t+1}(k)$ be the logarithm of the difference between the one-month gross holding return on a k-month domestic bond and the one-month gross domestic interest rate, which will be referred as the domestic excess return. Symbols pertaining to Foreign currencies are marked by asterisks. The one-month holding return on a k-month domestic bond between date t and $t+1$ is

$$R_{t,t+1}(t+k) = \left[\frac{(1+r_{t,k})^k}{(1+r_{t+1,k-1})^{k-1}} \right].$$

And the domestic excess return for a 10-year bond is,

$$\begin{aligned} \mathfrak{h}_{t+1}(120) &\equiv \log \left[\tfrac{R_{t,t+1}(t+120)}{R_{t,t+1}(t+1)} \right] \\ &\equiv z_t(120) - y_{t+1}(120), \end{aligned}$$

where $z_t(120) \equiv \log \left[\frac{1+r_{t,120}}{1+r_{t,1}} \right]$ and $y_{t+1}(120) \equiv \log \left[\frac{1+r_{t+1,119}}{1+r_{t,120}} \right]^{119}$. The variable $z_t(120)$ is known as the yield spread and the variable $y_{t+1}(120)$ is known as the 10-year interest rate change. In Table 2 we report the main properties of the excess return differentials and its main components: the 10-year interest rate change differentials and the yield spread differentials.

Table 2: Properties of the Excess Return Differentials

Currency	Mean	Std Deviation	Autocorrelation
Excess Return Differentials $\mathfrak{h}_{t+1}(120) - \mathfrak{h}^*_{t+1}(120)$			
German mark	-0.109	10.223	0.159
Japanese yen	-0.856	12.781	0.060
10-Year Interest Rate Change Differentials, $y^*_{t+1}(120) - y_{t+1}(120)$			
German mark	-0.259	10.130	0.146
Japanese yen	-0.954	12.737	0.058
Yield Spread Differentials, $z_{t+1}(120) - z^*_{t+1}(120)$			
German mark	0.150	1.073	0.993
Japanese yen	0.098	0.703	0.985

-Note: All the rates are annualized.

Table 2 shows that it is the 10-Year Interest Rate Change Differential that determines the standard deviation and autocorrelation of the Excess Return Differential. Table 2 and Figures 3 and 4 show that the excess returns $\mathfrak{h}_{t+1}(120)$ exhibit fairly similar patterns of volatility and autocorrelations to those of the depreciation rates.

Moreover, while the correlation coefficients between depreciation rates and short-term interest rate differentials are negative (-0.05 and -0.12 for the German mark and the Japanese yen, respectively), the correlations between depreciation rates and excess return differentials are positive (0.40 and 0.13 for the German mark and the Japanese yen, respectively).

Thus, the empirical evidence just discussed suggests that there might be an additional important link, which is related with the Excess Return Differential, between the expected depreciation rate and the interest rate differential.

III. Theory

Let $V_t(t+k)$ be the value at date t of a bond that pays one monetary unit of the domestic currency at $t+k$. The gross nominal domestic interest rate from maintaining between t and $t+1$ such a bond is

$$R_{t,t+1}(t+k) = \frac{V_{t+1}(t+k)}{V_t(t+k)}. \tag{1}$$

The pricing of the bond must be such that

$$V_t(t+k)M_t = E_t M_{t+k} \tag{2}$$

or

$$V_t(t+k) = \frac{E_t M_{t+k}}{M_t},$$

where $\frac{E_t M_{t+k}}{M_t}$ is known as the pricing kernel. In economies with a representative agent, M_t is the marginal utility at t over the price level at t, $\frac{M_{t+k}}{M_t}$ the product of the intertemporal marginal rate of substitution times the inverse of the gross inflation, and (2) is an intertemporal first order condition. More generally, there is a positive random variable, $\frac{M_{t+k}}{M_t}$, satisfying (2) for all traded assets if there are no pure arbitrage opportunities in the economy. If the financial markets in the economy are complete then there is a unique solution $\frac{M_{t+k}}{M_t}$ to equation (2), see Duffie (1988), otherwise there are many $\frac{M_{t+k}}{M_t}$'s that do satisfy (2) for all traded assets.[3]

We have

$$\begin{aligned} R_{t,t+1}(t+1) &= \frac{1}{V_t(t+1)} \\ &= \frac{1}{\frac{E_t M_{t+1}}{M_t}} \\ &= \frac{M_t}{E_t M_{t+1}}. \end{aligned} \tag{3}$$

Define

$$X_t = \prod_{k=1}^{t} R_{k-1,k}(k) M_k.$$

[3]Obviously, even when markets are complete, M_t does not need to be unique.

Then (3) can be rewritten as

$$E_t\left[X_{t+1}-X_t\right]=0,$$

which asserts that X_t is a supermartingale. Because X_t is nonnegative, the supermartingale convergence theorem, see Doob (1953, p. 324), applies. It asserts that X_t converges almost surely to a nonnegative random variable X_∞. As we assume that the one period net nominal interest rate is strictly positive, $R_{t,t+1}(t+1)>1$, then M_t converges to zero almost surely.

Now we define the term premium as,

$$\begin{aligned}
h_t(k) &\equiv E_t\left\{\log\left[\frac{R_{t,t+1}(t+k)}{R_{t,t+1}(t+1)}\right]\right\} \\
&= E_t\left\{\log\left[\frac{\frac{E_{t+1}M_{t+k}}{M_{t+1}}}{\frac{E_tM_{t+k}}{M_t}}\frac{E_tM_{t+1}}{M_t}\right]\right\} \\
&= E_t\left\{\log\left[\frac{E_{t+1}M_{t+k}}{M_{t+1}}\frac{E_tM_{t+1}}{E_tM_{t+k}}\right]\right\} \\
&= E_t\left\{\log\left(E_tM_{t+1}\right)-\log\left(M_{t+1}\right)+\log\left(E_{t+1}M_{t+k}\right)-\log\left(E_tM_{t+k}\right)\right\}.
\end{aligned}$$

We assume that the sequence $R_{t,t+1}(t+k)$ converges in probability to $R_{t,t+1}(\infty)$. Moreover, as later it will be useful to have $Elim_{k\to\infty}R_{t,t+1}(t+k)=lim_{k\to\infty}ER_{t,t+1}(t+k)$, we assume that $R_{t,t+1}(t+k)$ is uniformly integrable.

Proposition 1 *The term premium* $h_t(\infty)\equiv\lim_{k\to\infty}h_t(k)=\log\left(E_t\frac{M_{t+1}}{M_t}\right)-E_t\log\left(\frac{M_{t+1}}{M_t}\right).$

Proof. As $\lim_{k\to\infty}E_{t+1}M_{t+k}=\lim_{k\to\infty}E_tM_{t+k}=0$,

$$\begin{aligned}
h_t(\infty) &= E_t\left\{\log\left(E_tM_{t+1}\right)-\log\left(M_{t+1}\right)\right\} \\
&= \log\left(E_t\frac{M_{t+1}}{M_t}\right)-E_t\log\left(\frac{M_{t+1}}{M_t}\right).
\end{aligned}$$

■

Bonds denominated in foreign currency are priced according to an equation similar to (2). We denote by $\{M_t^*\}$ the stochastic process that can be used to price them. Thus, for returns denominated in foreign currency we have an expression similar to (3)

$$R^*_{t,t+1}(t+1)=\frac{M_t^*}{E_tM_{t+1}^*}. \tag{4}$$

If agents can trade on foreign assets and currencies, then the following must be verified:

$$1 = E_t \left(\frac{M_{t+1}}{M_t} \left(\frac{S_{t+1}}{S_t} \right) R^*_{t,t+1}(t+1) \right). \tag{5}$$

Using (4), expression (5) can be rewritten as

$$E_t \left(\frac{M^*_{t+1}}{M^*_t} R^*_{t,t+1}(t+1) \right) = E_t \left(\frac{M_{t+1}}{M_t} \left(\frac{S_{t+1}}{S_t} \right) R^*_{t,t+1}(t+1) \right). \tag{6}$$

The following result relates the rate of depreciation of the domestic currency to the random variables M_t and M^*_t, when investors have access to both markets, implying that we can always find pricing kernels with the following property,

$$\frac{M^*_{t+1}}{M^*_t} = \frac{M_{t+1}}{M_t} \left(\frac{S_{t+1}}{S_t} \right). \tag{7}$$

Proposition 2 *If* $\frac{S_{t+1}}{S_t}$, $R^*_{t,t+1}(t+1)$ *and* $R_{t,t+1}(t+1)$ *do not admit arbitrage opportunities then we can choose the random variables* M^*_t *and* M_t *to satisfy equations (3), (4) and (7).*

Proof. The domestic currency returns, $\frac{S_{t+1}}{S_t} R^*_{t,t+1}(t+1)$, on foreign currency denominated assets are achievable. If these returns do not admit arbitrage opportunities, then there exists a pricing kernel satisfying (5). Thus, for any such $\frac{M_{t+1}}{M_t}$ the variable $\frac{M^*_{t+1}}{M^*_t} = \frac{M_{t+1}}{M_t} \left(\frac{S_{t+1}}{S_t} \right)$ automatically solves (4). ■

Let F_t be the domestic price of a forward contract. A forward contract is a promise at t to deliver at $t+1$ the amount F_t of domestic currency in exchange for a unit of foreign currency. Since a forward contract specifies no payments at t, equation (2) implies:

$$0 = E_t \left(\frac{M_{t+1}}{M_t} \left(F_t - S_{t+1} \right) \right).$$

Dividing by S_t and using Proposition 2

$$\begin{aligned} \frac{F_t}{S_t} E_t \left(\frac{M_{t+1}}{M_t} \right) &= E_t \left(\frac{M_{t+1}}{M_t} \frac{S_{t+1}}{S_t} \right) \\ &= E_t \left(\frac{M^*_{t+1}}{M^*_t} \right). \end{aligned} \tag{8}$$

Define the forward premium as $\log F_t - \log S_t \equiv f_t - s_t$. From (8) we get,

$$f_t - s_t = \log E_t \left(\frac{M^*_{t+1}}{M^*_t} \right) - \log E_t \left(\frac{M_{t+1}}{M_t} \right). \tag{9}$$

Equation (9) and the definitions of interest rate (3) and (4) give

$$f_t - s_t = \log R_{t,t+1}(t+1) - \log R^*_{t,t+1}(t+1).$$

The familiar covered interest rate parity condition. Define the expected depreciation rate of the domestic currency as $E_t s_{t+1} - s_t$. We have from equation (7),

$$\begin{aligned} E_t s_{t+1} - s_t &= E_t \log \frac{S_{t+1}}{S_t} \\ &= E_t \log \left(\frac{M^*_{t+1}}{M^*_t} \right) - E_t \log \left(\frac{M_{t+1}}{M_t} \right). \end{aligned} \tag{10}$$

Define the risk premium as $f_t - E_t s_{t+1}$. From (9) and (10) we obtain,

$$f_t - E_t s_{t+1} = \left(\log E_t \frac{M^*_{t+1}}{M^*_t} - E_t \log \frac{M^*_{t+1}}{M^*_t} \right) - \left(\log E_t \frac{M_{t+1}}{M_t} - E_t \log \frac{M_{t+1}}{M_t} \right), \tag{11}$$

the difference between the "log of expectation" and the "expectation of the log" of the random variables $\frac{M^*_{t+1}}{M^*_t}$ and $\frac{M_{t+1}}{M_t}$.

Proposition 3 *The risk premium,* $f_t - E_t s_{t+1} = h^*_t(\infty) - h_t(\infty)$ *and the expected depreciation,* $E_t s_{t+1} - s_t = \log R(t+1) - \log R^*(t+1) + h_t(\infty) - h^*_t(\infty)$.

Proof. By Proposition 1 and (11) follows that $f_t - E_t s_{t+1} = h^*_t(\infty) - h_t(\infty)$. By Proposition 1, (10), (3) and (4) follows that, $E_t s_{t+1} - s_t = \log R(t+1) - \log R^*(t+1) + h_t(\infty) - h^*_t(\infty)$. ■

IV. Empirical Properties

In this section we check whether our representation of the risk premium and our representation of the expected exchange rate change give a highly variable risk premium and a negative covariance between the risk premium and the expected exchange rate change.

We need to consider the one-month holding-period returns on securities with infinite and short maturities. The short maturity is one month and the security with short maturity the 1-month deposit. As the yield curve for the region above 10 years is almost always horizontal, the 10-year bond yields provide a good approximation for the asymptotic rates.

The assumption of rational expectations implies

$$\mathfrak{h}_{t+1}(\infty) = h_t(\infty) + \upsilon_{t+1},$$

where υ_{t+1} is a random variable such that $E_t \upsilon_{t+1} = 0$. The relevant variable to compute both the forward premium and the expected exchange rate change is $h_t(\infty)$ but the variable we observe is $\mathfrak{h}_{t+1}(\infty)$. As such we consider two alternatives: (i) take υ_{t+1} to be negligible and (ii) use a VAR procedure to estimate $h_t(\infty)$. The first assumption is that agents have perfect foresight. The reasonability of this assumption increases with the frequency of the data and its temporal dimension. Behind it is the idea that the agents do not commit systematic errors of forecasting. The second assumption is that agents are rational and use all information available when they compute conditional expectations.

Under alternative (ii) we assume that at each date t and for each country the forecast about $\mathfrak{h}_{t+1}(\infty)$, which we denote by $\widehat{\mathfrak{h}}_{t+1}(\infty)$, is the fit of a regression that includes among its regressors domestic as well as foreign past values for: excess returns, exchange rate changes, changes in short term interest rates, changes in one-month holding returns on 10-year bonds, industrial production indices and inflation rates. The appendix describes in more detail this procedure.

Table 3 presents estimates of the risk premium and of the expected depreciation according to Proposition 3.3 when the $h_t(\infty)$ is replaced by $\mathfrak{h}_{t+1}(\infty)$. According to Table 1 the standard deviation of the monthly observed exchange depreciation is for the German mark 13.433 and for the Japanese yen 15.629. These values are comparable to the ones reported in Table 3 for the standard deviation of the expected depreciation.

Table 3: Risk premium and expected depreciation

of foreigner currencies vis-à-vis the U.S. dollar

when $h_t(\infty)$ is replaced with $\mathfrak{h}_{t+1}(\infty)$

Currency	$std\,(f_t - E_t s_{t+1})$	$std\,(E_t s_{t+1} - s_t)$	$corr\,(E_t s_{t+1} - s_t, f_t - E_t s_{t+1})$
German mark	10.223	10.171	−0.99
Japanese yen	12.781	12.780	−0.99

Table 4 shows the values for the risk premium and the expected depreciation when the formulas from Proposition 3.3 are used with $\widehat{\mathfrak{h}}_{t+1}(\infty)$ replacing $h_t(\infty)$.

Table 4: Risk premium and expected depreciation

of foreigner currencies vis-à-vis the U.S. dollar

when $h_t(\infty)$ is replaced with $\widehat{\mathfrak{h}}_{t+1}(\infty)$

Currency	$std\,(f_t - E_t s_{t+1})$	$std\,(E_t s_{t+1} - s_t)$	$corr\,(E_t s_{t+1} - s_t, f_t - E_t s_{t+1})$
German mark	7.417	7.450	−0.98
Japanese yen	9.240	9.072	−0.99

Although the variances of the expected depreciation rates, reported in Table 4, are smaller than the variances of the depreciation rates observed, they are yet much higher than the variability observed for the interest rate differentials.

The correlations between the risk premiums and the expected exchange rate changes are very large and negative in both Tables. That as to do with the fact that the variability of the interest rate differentials is very low relative to the variability of the risk premiums.

Thus, empirically our representation of the expected exchange depreciation yields better results than that implied by the uncovered interest rate parity.

V. Concluding Remarks

In this paper we provide new representations for the risk premium and expected exchange rate change. According to our representations they are a function of the term premium. The risk premium is equal to the difference between the foreign term premium and the domestic term premium. And the expected depreciation rate of the domestic currency is equal to the difference between the domestic interest rate and the foreign interest rate plus the difference between the domestic term premium and the foreign term premium. In particular, we obtain that investors require higher interest rates on currencies expected to fall if the term premium differential is expected to stay constant.

We also verify the empirical properties of our representations. According to them the covariance between the risk premium and the expected exchange rate depreciation is negative and the risk premium is very volatile. Moreover, our representation of the expected exchange rate depreciation has properties, volatility and first order autocorrelation, similar to the ones of the observed exchange rate depreciation.

VI. References

1. Backus, Davis, Silverio Foresi and Chris Telmer (2001): Affine Models of Currency Pricing: Accounting for the Forward Premium Anomaly, *The Journal of Finance* **56,** n^{o}1, Forthcoming.

2. Bansal, Ravi (1997) An Exploration of the Forward Premium Puzzle in Currency Markets, *The Review of Financial Studies* **10**, n^{o}2, 369-403.

3. Bansal, Ravi and Magnus Dahlquist (2000): The Forward Premium Puzzle: Different Tales from Developed and Emerging Economies, *Journal of International Economics* **51**, 115-144.

4. Berk, J.M. (1998): The Information Content of the Yield Curve for Monetary Policy: A Survey, *De Economist* **146**, 303-320.

5. Berk, J.M. and eter Van Bergeijk (2000): Is the Yield Curve a Useful Information Variable for

the Eurosystem?, *European Central Bank Working Paper* **11.**

6. Cox, J., J. Ingersoll and S. Ross (1981): The relation Between Forward Prices and Futures Prices, *Journal of Financial Economics* **9**, 321-346.

7. Doob, Joseph (1953): Stochastic Processes", Wiley.

8. Duffie, Darrell (1988): Security Markets, Academic Press.

9. Engel, Charles (1995): The Forward Discount Anomaly and the Risk Premium: A Survey of Recent Evidence, *Journal of Empirical Finance* **3**, 123-192.

10. Fama, Eugene F. (1984a): The Information in Term Structure, *Journal of Monetary Economics* **13**, 508-528.

11. Fama, Eugene F. (1984b): Forward and Spot Exchange Rates, *Journal of Monetary Economics* **14**, 319-338.

12. Fama, Eugene F. (1990): Term Structure Forecast of Interest Rates, Inflation and Real Returns, *Journal of Monetary Economics* **25**, 59-76.

13. Hodrick, Robert J. (1987): The Empirical Evidence on the Efficiency of Forward and Futures Foreign Exchange Markets (Harwood, Chur).

14. Hu, Zuliu (1993): The Yield Curve and Real Activity, *International Monetary Fund Staff Paper* **40**, 781-806.

15. Lewis, Karen K. (1995): Puzzles in International Financial Markets, in: Gene Grossman and Kenneth Rogoff, eds, The Handbook of International Economics, vol III, Elsivier Science.

16. Miskin, Frederic (1990a): What Does the Term Structure Tell Us About Future Inflation?, *Journal of Monetary Economics* **25**, 77-95.

17. Miskin, Frederic (1990b): The Information in the Longer-Maturity term Structure About Future Inflation, *Quarterly Journal of Economics* **105**, 815-28.

18. Nelson, Charles R. and Andrew F. Siegel (1987): Parsimonious Modelling of Yield Curves, *Journal of Business* **60**, 4.

19. Svensson, Lars E.O. (1994): Estimating and Interpreting Forward Interest Rates. Sweden

1992-4, *CEPR Discussion Paper Series* **1051**.

VII. Appendix

In this appendix we show the results of the regressions run. The typical regression was the following,

$$
\begin{aligned}
\mathfrak{h}_{t+1}(\infty) \quad = \quad & c + \sum_{i=0}^{p} \alpha \mathfrak{h}_{t-i}(\infty) + \sum_{i=0}^{p^*} \alpha_i^* \mathfrak{h}_{t-i}^*(\infty) + \sum_{i=0}^{p^{**}} \alpha_i^{**} \mathfrak{h}_{t-i}^{**}(\infty) \\
& + \sum_{i=0}^{q} \beta_i \Delta R_{t-1-i,t-i}(t+1) + \sum_{i=0}^{q^*} \beta_i^* \Delta R_{t-1-i,t-i}^*(t+1) + \sum_{i=0}^{q^{**}} \beta_i^{**} \Delta R_{t-1-i,t-i}^{**}(t+1) \\
& + \sum_{i=0}^{m} \gamma_i \Delta R_{t-1-i,t-i}(\infty) + \sum_{i=0}^{m^*} \gamma_i^* \Delta R_{t-1-i,t-i}^*(\infty) + \sum_{i=0}^{m^{**}} \gamma_i^{**} \Delta R_{t-1-i,t-i}^{**}(\infty) \\
& + \sum_{i=0}^{n} \ell_i \mathfrak{i}_{t-i} + \sum_{i=0}^{n^*} \ell_i^* \mathfrak{i}_{t-i}^* + \sum_{i=0}^{n^{**}} \ell_i^{**} \mathfrak{i}_{t-i}^{**} \\
& + \sum_{i=0}^{o} \psi_i p_{t-i} + \sum_{i=0}^{o^*} \psi^* p_{t-i}^* + \sum_{i=0}^{o^{**}} \psi_i^{**} p_{t-i}^{**} \\
& + \sum_{i=0}^{v} \lambda_i \Delta s_{t-i} + \sum_{i=0}^{v^*} \lambda_i^j \Delta s_{t-i}^j + \sum_{i=0}^{v^{**}} \lambda_i^k \Delta s_{t-i}^k + u_t,
\end{aligned}
$$

where u_t is the disturbance term, * and ** denote the German and Japanese variables, respectively, $\mathfrak{i}$ and p denote, respectively, the monthly inflation rate and the industrial production indices and Δs and Δs^j denote the bilateral exchange rates in dollars per unit of German mark and Japanese yen, respectively, and Δs^kdenotes the bilateral exchange rate in marks per unit of Japanese yen. The number of lags were chosen according to the Schwartz Information Criterion. In the tables 5, 6 and 7 we show the regression run for each of the three countries.

Tabel 5 US dollar

variable	coefficient	std. error
$\mathfrak{h}_{t-1}(\infty)$	0.314	0.097
$\mathfrak{h}^{*}_{t-1}(\infty)$	-0.233	0.128
$\mathfrak{h}^{**}_{t-1}(\infty)$	0.202	0.081
$\Delta R^{*}_{t-1,t}(t+1)$	-11.248	4.931
$\Delta R^{*}_{t-2,t-1}(t+1)$	10.834	4.895
$\Delta R^{*}_{t-1,t}(\infty)$	0.112	0.040
$\mathfrak{i}_{t-1}$	0.638	0.355
$\mathfrak{i}_{t-2}$	-1.716	0.414
$\mathfrak{i}_{t-3}$	1.392	0.385
$\mathfrak{i}^{*}_{t-1}$	0.456	0.197
$\mathfrak{i}^{*}_{t-3}$	0.422	0.204
p^{*}_{t-1}	-0.111	0.048
p^{**}_{t-2}	-0.020	0.010
p^{**}_{t-4}	-0.025	0.010
Δs^{j}_{t-4}	-6.236	2.685

Tabel 6 German mark

variable	coefficient	std. error
c	0.004	0.001
$\mathfrak{h}_{t-2}(\infty)$	9.935	3.750
$\mathfrak{h}_{t-3}(\infty)$	−9.598	3.750
$\mathfrak{h}^{*}_{t-2}(\infty)$	−0.148	0.096
$\mathfrak{h}^{**}_{t-1}(\infty)$	0.326	0.071
$\mathfrak{h}^{**}_{t-2}(\infty)$	−10.673	2.533
$\mathfrak{h}^{**}_{t-3}(\infty)$	10.641	2.535
$\Delta R_{t-2,t-1}(\infty)$	−4.237	1.619
$\Delta R^{*}_{t-3,t-2}(\infty)$	0.060	0.027
$\Delta R^{**}_{t-2,t-1}(\infty)$	4.647	1.096
$\mathfrak{i}_{t-2}$	−0.739	0.332
$\mathfrak{i}^{*}_{t-3}$	0.297	0.155
p_{t-2}	−0.264	0.130
Δs^{j}_{t-2}	−6.915	2.523

Tabel 7 Japanese yen

variable	coefficient	std. error
c	0.002	0.001
$\mathfrak{h}_{t-1}(\infty)$	−10.688	4.487
$\mathfrak{h}_{t-2}(\infty)$	11.173	4.467
$\mathfrak{h}^{*}_{t-3}(\infty)$	−7.899	3.014
$\mathfrak{h}^{*}_{t-4}(\infty)$	7.778	3.015
$\mathfrak{h}^{**}_{t-1}(\infty)$	8.743	2.903
$\mathfrak{h}^{**}_{t-2}(\infty)$	−19.896	4.049
$\mathfrak{h}^{**}_{t-4}(\infty)$	11.093	3.627
$\Delta R_{t-1,t}(\infty)$	4.719	1.934
$\Delta R_{t-2,t-1}(\infty)$	−0.148	0.048
$\Delta R^{*}_{t-1,t}(\infty)$	−0.078	0.036
$\Delta R^{*}_{t-3,t-2}(\infty)$	3.372	1.307
$\Delta R^{**}_{t-1,t}(\infty)$	−3.638	1.257
$\Delta R^{**}_{t-2,t-1}(\infty)$	4.944	1.564
$\Delta R^{**}_{t-3,t-2}(\infty)$	4.809	1.565
p_{t-2}	−0.353	0.162
p_{t-4}	0.461	0.151
p^{*}_{t-4}	0.135	0.050
Δs_{t-2}	0.116	0.058
Δs_{t-3}	−0.124	0.059
Δs^{j}_{t-2}	−15.115	3.514
Δs^{j}_{t-3}	9.708	3.234

We conclude that the generality of the variables: past term premiums, past changes of long term rates and in exchange rates, past inflation rates and past industrial production indices are important to forecast the term premium. Besides, it seems clear that the agents in forecasting the term premium take into account foreign variables, namely the past foreign term premiums, change in one month holding returns of 10 year bonds, inflation rates and industrial production indices. In Figures 5, 6 and 7 we show the term premium observed, the forecast of the term premium and the error committed in the forecast. The three countries have forecast errors of the same magnitude: between -1.8 and 1.8 basis points. The forecast errors seem to be higher in periods of international financial instability, as for instances the Mexico crises at the end of 1994, the events in the Asian markets in 1997 and the Russian financial crisis in mid-august 1998.

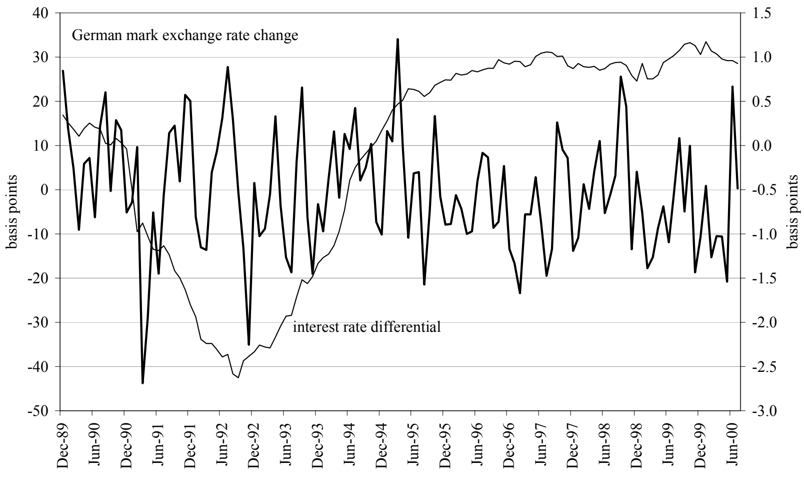

Figure 1: German mark exchange rate change and annualized interest rate differential

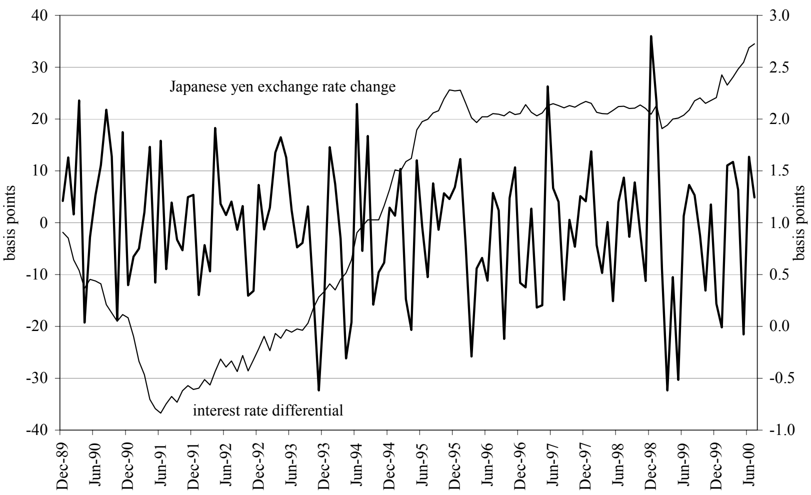

Figure 2: Japanese yen exchange rate change and annualized interest rate differential

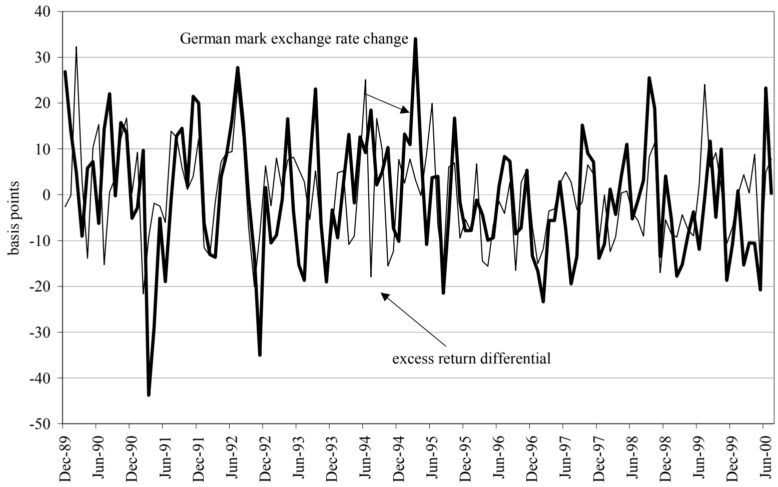

Figure 3: German mark exchange rate change and excess return differential

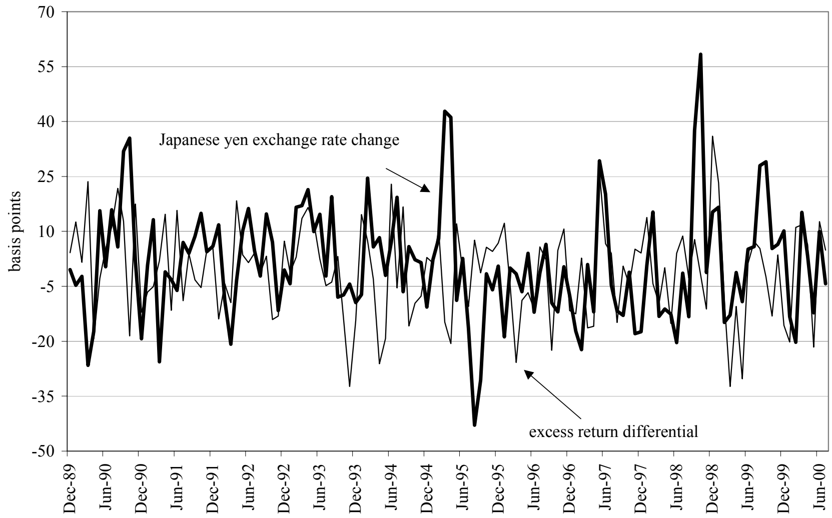

Figure 4: Japanese yen exchange rate change and excess return differential

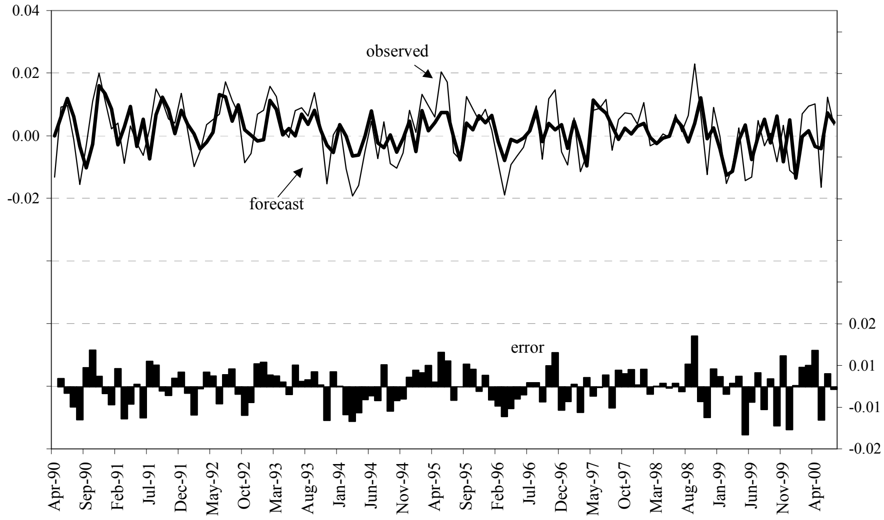

Figure 5: US dollar excess return: observed, forecast and error

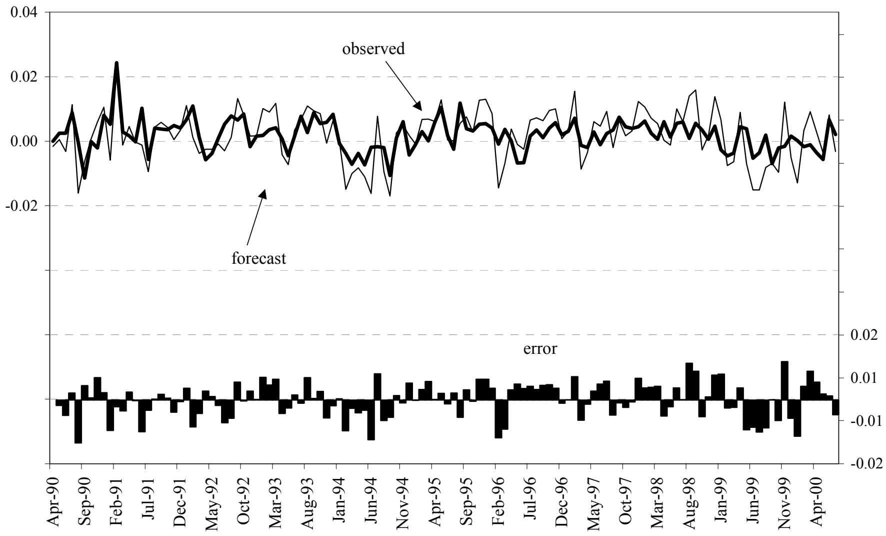

Figure 6: German mark excess return: observed, forecast and error

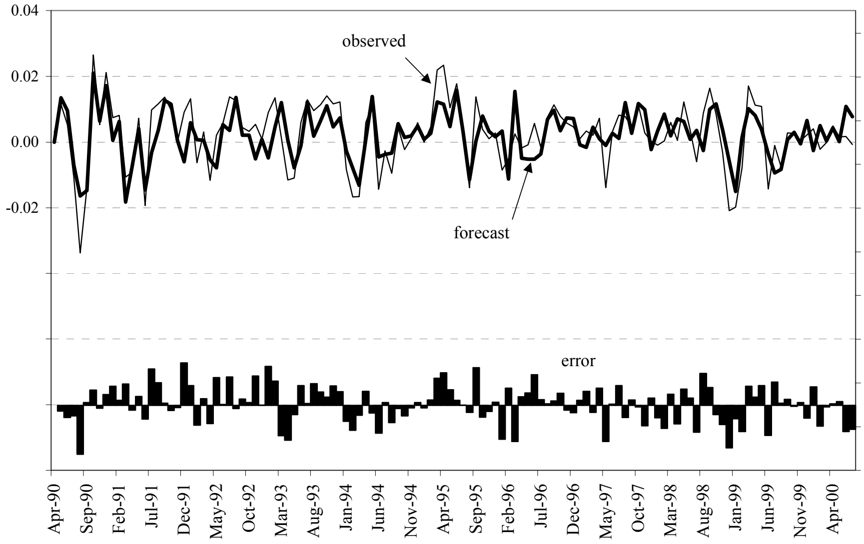

Figure 7: Japanese yen excess return: observed, forecast and error

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