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Are Japanese Stock Prices Important Deterministic Elements of Exchange Rate Returns?

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Abstract

This paper examines whether stock prices in Japan show indicator properties for the US-Japan exchange rate using an exchange rate premium model for the short-term. Empirical results show that changes in short-term interest rate flows, stock index differentials (US-Japan), and exchange rate premiums (Japanese yen/US dollar) exhibit consistent indicator properties for Japanese stock prices. The findings provide support for the arguments that financial variables exhibit indicator properties for exchange rate dynamics. In uncovered interest rate parity, there is a premium; however, the premium affects the spot exchange rate significantly. Exchange rates from the 2000s are determined by financial assets and show a strong difference from the 1990s.

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Keywords: Asset prices; Exchange rates; Premium; Stock prices

1 Introduction

Exchange rate theory has changed and developed continuously since the 1970s,when many countries adopted a floating exchange rate system. One of the traditional and an important approach to short-term exchange rate determination is the uncovered interest rate parity condition along with the covered interest rate parity. This theory has been employed not only in academic fields but also in the business and real world. In academia, this theory is best known and most commonly used as an exchange rate determination theory.

However, some empirical problems encountered with this theory have prompted a search for factors that can accurately account for departures and fluctuations in exchange rates. This problem has been cited and discussed along with the expansion of volumes in international capital flows and the worldwide surge in asset prices. The most typical asset is stock. These phenomena reflect the increased opportunity for investors to exploit

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arbitrage transactions across world financial markets. Along with this trend, exchange rates have become driven by asset prices rather than international trade. The role of the financial asset market now should be taken into account in the determination of exchange rates.

This paper evaluates the indicator properties of financial market variables for exchange rate returns (premiums). The set of indicators contains variables used in many studies, as well as factors used by financial market participants as determinants of short-term exchange rates. This paper's estimations show evidence of contemporaneous indicator relationships between financial market variables and exchange rate returns. Concretely, stock prices are considered. Exchange rate premium has been discussed and examined a lot in the literature; however, its use for this purpose has not reached a consensus and few studies have examined the relationship between exchange rate premium and stock prices.

In this paper, section 2 reviews existing studies. Section 3 provides a theoretical model that takes into account asset markets and premiums in exchange rate determination. Section 4 reports on the empirical analyses based on the previous section and evaluates the results. Finally, this paper ends with a brief conclusion and summary.

2 Related Studies

The typical and most used model for short-term exchange rate pricing has been uncovered interest parity. The importance of these determinations has been increasing as capital flow all over the world has been expanding rapidly. This relationship assumes that exchange rates instantaneously adjust to changes in relative interest rates between two currencies so as to eliminate arbitrage opportunities. The change in interest rates differences among worldwide financial markets, in turn, tends to reflect changes in expected future economic fundamentals that are related to exchange rate determination. However, many studies have indicated the existence of (positive/negative) premiums in the relationship among the variables.

Some researchers have tried to increase the set of financial variables that incorporate information on future fundamentals that could be used to explain short-term exchange rate movements. The reason that such analyses are used is that the empirical result of the uncovered interest parity is sometimes acceptable.

Pilbean and Olmo (2010) uses a Taylor rule and showed a negative bias in existing regressions of uncovered interest parity. Also, Olmo and Pilbeam (2011), employs bootstrap simulation experiment, and found the rejections of uncovered interest parity.

On the theoretical side, the role of information for the market and market structure in transmitting signals on expected future fundamentals has been put forward by the research in market microstructure, Lyons (2001), Evans and R.K. Lyons (2002). Bacchetta and Wincoop (2006) showed that exchange rate changes are a weak predictor of future economic fundamentals. Evans and Lyons (2002) indicated that forward puzzle is not a reflection of the market inefficiency. Kim (2011) found that the existence of risk premium depends on the frequency of consumer expectations for exchange rates and the degree of their risk aversion.

Recently, among asset/financial variables, stock prices have been considered quite often. Analysis of the role of stock prices and short-term financial flows has been increased by vast increases in cross-border countries, Broooks *et al.* (2001), Hau and Rey (2002). These studies argued that short-term stock flows could impact exchange rates if market imperfections do not allow transactions to be fully reflected in asset prices.

As the exchange rate premium model or portfolio approach model has been prevailing, the existence of premium of foreign exchange market has been analyzed. Goodhart *et al.* (1992) showed that forward premiums provide no information about future changes in spot exchange rates. Bhar *et al.* (2001) provided evidence that the forward risk is stationary and has substantial time variation from 1 January 1990 to 31 December 1998. Wu (2007) provided empirical results that reject the restrictions on the exchange rate and interest rate imposed by the term structure model of interest rates. Azouzi *et al.* (2011) found that forward premium is crucial for short-term calculations. Srikanth and Kishor (2012) indicated that most market participants agree that forward premium influences exchange rates. Using data from six countries, Kim (2013) indicated that pricing revision errors of risk premium are significant.

Recently, expansion of the traditional premium models has been ongoing. Arminio (1986) provided a theoretical model for how the risk premium depends on the international shares of foreign assets and wealth, as well as on the variance-covariance matrix of prices and exchange rates. Beng and Siong (1993) showed that forward discounts reflect expectations of future changes in exchange rates, and expectations of the financial market are irrational. Basurto and Ghosh (2001) indicated that there was a little evidence that real interest rates contribute to a large risk premium. Landcon and Smith (2003) denied the rational expectations hypothesis and showed the existence of a time-varying risk premium. Corte and Tsiakas (2009) showed that risk-averse market participants prefer to pay a high performance fee to switch from a dynamic portfolio decision based on the random walk model to the decision that conditions on the forward premium with stochastic volatility model. Alain and Carmelo (2015) found that pricing error from ignoring the term structure of interest rates is smaller than the error that results from omission of the foreign exchange risk. Breoll *et al.* (2015) showed that uncovered interest rate parity did not hold when international firms were risk averse.

3 Theoretical Analysis

To analyze the properties of financial market variables that provide information on future fundamentals and to explain short-term exchange rate movements, this article uses the exchange rate model under the asset-pricing framework.

The log exchange rate s_t reflects the discounted value of private agent's expectations about future economic fundamentals f_{t+i}.

$$s_t = (1-\delta)\sum_{i=0}^{\infty} \delta i Et(ft + i \mid \Omega t)) \quad (1)$$

In equation (1), δ denotes the discounted factor, E the expectation operator, the Ω the agents' information set available at time t. Equation (1) has some theoretical formulations, including uncovered interest parity theory; however, short-term interest rate in (1) is replaced by long-term interest rate differential among financial markets. It examines the hypothesis that financial market data at time t+i could provide valuable information about exchange rate movement:

Following [3], to examine this empirically, this paper specifies an economic model that estimates the impact of contemporaneous leading or lagging changes in a set of k financial market variables on the current change in the log of exchange rate as follows:

$$\Delta s_t = \alpha + \sum_{k=1}^{n} \beta_k \Delta I_{k,t+j} + \varepsilon_t \quad (2)$$

The purpose of regression (2) is to examine the validity of the model and to evaluate how close the estimates of α are to zero and how close the estimates of β are to one. The estimates are run as multivariate regressions where the combinations of right-hand-side variables are selected according to particular model selection criteria.

ΔI is measured by a set of variables that stand for changes in net portfolio capital flows between the two markets (countries). The hypothesis is that an increase in net capital outflows from the home country would be associated with a depreciation of the home currency vis-à-vis the foreign currency. This would follow from the increased demand for foreign currency to finance international asset transactions, Broooks *et al.* (2001). Empirically, such transactions tend to be too small to affect exchange rates; however, as far as the associated order flows make information aggregation, Lyons (2001), the exchange rates could adjust.

4 Empirical Analyses

4-1 Data and methods

The sources of the various data are as follows. The bilateral currency pairs considered are Japanese yen (JPY) against the US dollar (USD). The figures are expressed in log differences. The data are daily as this transaction occurs on a daily basis or much shorter periods.

Turning to the explanatory variables, the short-term interest rates used in these calculations are the three-month currency rates for the yen and US dollar. Stock market data consist of local currency denominated on total return indices, NIKKEI 225 of Japan and the DOW for the United States. Data are from NIKKEI Telecom in Japan. All of the data are average daily figures.

This paper's estimation consists of two phases. First, estimations of exchange rates on various sets of financial market indicators that apply linear regression methods are run. Second, to measure the ability of the indicator variables to signal the probability of larger appreciation/depreciation episodes in a daily horizon, this paper later uses the binominal logit technique.

This paper uses the following equation:

$$JPY/USD = \alpha + \beta_1 STID + \beta_2 EID + \beta_3 RR \quad (3)$$

where STID denotes the short-term interest rate differential, EID the equity index differential, and RR the risk reversal (STID/forward premium rate).

One problem in equations that use the OLS method is the existence of unobservable specific effects and also lagged dependent variables. This problem can be overcome with the use of the generalized methods of moments (GMM). This method requires a decision on which variables to use as instrumental variables. A j-test is also performed. This test checks whether or not the model's moment matches the data. In a GMM context, when there are more moment conditions than parameters to be estimated, this chi-square test can be used to test the over-identifying restrictions. In this analysis, the lagged values of the dependent variables are used as instrumental variables.

4-2 Results

The results from the regressions are summarized in Table 1.

Table 1. Results from the Regressions <OLS>

	1992–2014	1992–1999	2000–2014
Const.	105.556	110.108	126.367
	(261.307)	(223.733)	(104.374)
	[0.000]	[0.000]	[0.000]
Interest	-36.317	-25.697	-49.458
	(-37.060)	(-22.301)	(-26.629)
	[0.000]	[0.000]	[0.000]
Stock	0.034	-0.014	0.140
	(18.828)	(-3.868)	(26.031)
	[0.000]	[0.000]	[0.000]
Risk	43.974	32.911	59.073
	(34.952)	(23.116)	(24.583)
	[0.000]	[0.000]	[0.000]
Adj.R2	0.370	0.261	0.494
F-statistic	849.504	212.227	829.578
	[0.000]	[0.000]	[0.000]
Durbin-Watson	0.201	0.272	0.034

Note.Figures in parentheses ( ) are t-statistics and those in square brackets [ ] are probability.

Table 2. Results from the Regressions <GMM>

	1992–2014	1992–1999	2000–2014
Const.	107.825	105.124	137.717
	(94.051)	(72.312)	(44.834)
	[0.000]	[0.000]	[0.000]
Interest	-67.491	-64.086	-73.684
	(-13.706)	(-10.103)	(-11.374)
	[0.000]	[0.000]	[0.000]
Stock	0.046	0.098	0.183
	(7.892)	(6.164)	(122.522)
	[0.000]	[0.000]	[0.000]
Risk	83.656	78.070	89.939
	(13.327)	(10.038)	(10.763)
	[0.000]	[0.000]	[0.000]
Adj.R2	0.203	-0.407	0.444
J-statistic	155.092	42.033	111.002
	[0.000]	[0.000]	[0.000]

Note.Figures in parentheses ( ) are t-statistics and those in square brackets [ ] are probability.

The signs of the coefficients suggest that the domestic currency appreciates when domestic interest rates and equity returns increase, when risk reversals move to predict future domestic currency appreciation. It is interesting to note that the coefficient of equity return is negative and significant. The main reason is that the movements of Japanese stock prices and US stock prices were opposite.

In the asset return equations, risk reversals tend to receive the highest coefficients apart from the yen-dollar currency pair, where the change in relative equity returns have the highest sign.

Durbin-Watson values are low. In such cases, Newey-West consistent estimates are sometimes employed to solve the results of heteroscedasticity and autocorrelation. However, the results are almost same asthoseshown in Table 1. So, first-order serial correlation of the residual error is hypothesized to exist. The results are in Table 3.

Table 3. Results from the Regressions<first-order serial correlation of the residual error>

	1992–2014	1992–1999	2000–2014
Const.	105.907	109.891	103.665
	(12.963)	(14.321)	(7.781)
	[0.000]	[0.000]	[0.000]
Interest	-0.099	-0.107	-0.090
	(-1.058)	(-0.990)	(-0.208)
	[0.289]	[0.322]	[0.834]
Stock	0.0003	0.0003	0.002
	(1.288)	(1.120)	(0.577)
	[0.197]	[0.262]	[0.563]
Risk	0.571	0.135	0.475
	(3.028)	(0.301)	(0.990)
	[0.002]	[0.763]	[0.321]
AR(1)	0.998	0.996	0.998
	(1176.517)	(543.525)	(1064.224)
	[0.000]	[0.000]	[0.000]
Adj.R2	0.996	0.993	0.997
F-statistic	331243.3	74189.51	261095.8
	[0.000]	[0.000]	[0.000]
Durbin-Watson	2.009	1.925	2.107

Note. Figures in parentheses ( ) are t-statistics and those in square brackets [ ] are probability.

Although some of the coefficients are insignificant, the results are almost the same with the results of Table 1. On the other hand, the Durbin-Watson values increased appropriately.

5 Conclusions

It can be concluded that news in asset prices are useful indicators for monitoring and analyzing exchange rates.

This paper suggests some interesting points. It examined whether stock prices in Japan show indicator properties for the US-Japan exchange rate and found positive effects that focus on foreign exchange market premiums. Empirical results showed that changes in stock index differentials and short-term flows exhibit consistent indicator properties. The findings provide some support for the arguments that financial variables exhibit indicator properties for exchange rate dynamics.

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