SENTIMENT AND FORWARD PREMIUM PUZZLE

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JEL classifications:
G02
G14
G15
G17

Keywords:
Exchange rate , sentiment, forward premium puzzle

Abstract:
This analysis aims to investigate the extent to which sentiment plays a role in solving the forward premium puzzle. Sentiment is regarded as one of the variables that explain forward premium, as announcements of market sentiments would have impact on expectations about the future spot rate and consequently, would lead to pricing adjustments in the foreign exchange market. In order to measure sentiments in the bilateral market of interest, a new consumer sentiment index is constructed from the US as well as Australia. A Vector Error Correction Model (VECM) is used as the main econometric tool and unbiasedness hypothesis tests are conducted for two types of VECMs: one including sentiment and the other excluding it. Finally, the extent to which sentiment impacts on monthly spot returns is investigated. This analysis finds that sentiment is not enough to solve forward premium puzzle but it can play a significant role in improving estimation and providing better prediction of future exchange rate. Moreover, it finds that risk premium in the AUD/USD forward market differs from zero.

1. Introduction

The importance of having accurate predictions of the exchange rate is immeasurable. Having a precise outlook path for the exchange rate results in higher returns, lower uncertainty and risks, whereas having an inaccurate outlook escalates investment risks. Unfortunately, this gets much more complicated in the real world, as unlike typical financial assets such as bond and equity, the actual as well as the equilibrium level of exchange rate is determined not only by the decisions of financial market participants, but also affected by macroeconomic fundamentals that prevail in domestic and trading partner economy. On one hand, currency is considered as a financial asset that investors, speculators and hedgers are able to trade in order to manage their risks. On the other hand, exchange rate plays an adjustment role in ensuring macroeconomic equilibrium. For instance, exchange rate tends to appreciate during a period of economic boom and overheating, while it is likely to depreciate during economic downturn.

There are two main approaches for forecasting the exchange rate and determining its equilibrium. First, the fundamentals-based approach is aimed at determining the equilibrium level of exchange rate in a general context. The earliest version of this approach is the monetary model which is based on the relative growth

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of money supply and output in comparison with trading partner country. It is followed by several models, for examples the Dornbusch’s overshooting model, portfolio balance model and so on. The main issues with this approach are twofold: firstly, money supply and output are not the only variables that determine the exchange rate; secondly, accurate expectations of the fundamentals is necessary for forecasting the exchange rate. In addition, such models are not commonly supported by empirical tests[2].

In an asset pricing framework, a different approach based on the forward exchange rate is developed. Under this framework, the forward exchange rate is used as an unbiased predictor of future spot rates when efficient market hypothesis and rational expectation hypothesis hold. In other words, the probability limit of the estimated coefficients from regression of future spot rates on the forward rate should equal to one. In practice however, testing for unbiasedness of the forward rate is complicated and unlikely to be supported by majority of empirical literature aimed at solving the forward premium puzzle. [15] mentioned that a significant number of studies that tested for unbiasedness found that the estimated coefficient is reliably less than unity and even negative. For instance, the estimated coefficient averaged from 75 published estimations stood at -0.88 instead of 1.

Such empirical result could be backed by two potential arguments. Firstly, expectations of the investors are not rational. Failure to adhere to the rational expectation hypothesis violates core assumptions of the unbiasedness that forecasting errors must be purely random and uncorrelated with the current information set. As a consequence of irrational expectations, the estimated coefficient would be biased and differ from unity. Secondly, investors are not risk-neutral and risk-premium might be time-varying. Such argument based on the risk-premium is derived from the Lucas’s general equilibrium model and the portfolio balance model[3]. It suggests that a risk-averse investor would require positive additional returns when purchasing risky currency in the forward market and such risks would not be fully diversified. Consequently, it would lead to the forward rate being a biased predictor of future spot rates.

In this empirical study, the extent to which sentiment plays a significant role in solving the forward premium puzzle is examined. Specifically, it focuses on two main channels through which sentiments may provide better prediction of future spot rates.

Firstly, sentiment may be able to capture systematic forecasting errors associated with irrational expectations. If new releases of the sentiment index comprise of unexpected information, a price adjustment is required in the foreign exchange market and thus, exchange rate moves to a new equilibrium that was not previously explained by the initial model. Furthermore, market sentiment might be a proxy for emotional and psychological factors that have significant impact on

[2] Hopper (1997)
[3] MacDonald (2007)

investment decisions, as it could be one of the metrics that measure market participants' pessimism or optimism about the future market conditions. A behavioral finance theory suggests that emotional and psychological factors could lead to irrational and unpredictable decisions that are inconsistent with the traditional finance theory. Therefore, inclusion of a sentiment factor into the model may be able to capture unexplained shocks associated with traditional models.

Secondly, market sentiment may be able to capture unexpected demand shocks in the foreign exchange market. On one hand, sentiment may drive speculative demand in the foreign exchange market. This view is supported by an alternative definition of market sentiment, which refers to it as the propensity to speculate. [3] mentioned that fluctuations in market sentiment may have significant impact on prices of stock with more subjective valuations. This could be the case in the foreign exchange market in which pricing is very subjective. For instance, it is challenging to estimate the equilibrium level of exchange rate, though economic theories suggest the use of certain explanatory variables such as money supply, interest rate, etc. On the other hand, sentiment may capture demand driven by macroeconomic fundamentals. Announcements of sentiment indicators may be able to adjust expectations regarding the macroeconomic outlook, as consumer sentiment is one of the barometers for demand side of the economy, which further results in adjustments in the foreign exchange market.

Finally, inclusion of a sentiment factor in the model may be able to counter the issue of omitted variables. As mentioned above, it clearly is insufficient to state that exchange rate is determined solely by forward rates. There could be other unobservable factors that affect the path of exchange rate developments. If this is the case, the traditional approach of modelling future exchange rate path based solely on forward rates is likely to be confronted with the issue of omitted variables.

In terms of the estimation techniques, a Vector Error Correction mechanism is employed to deal with non-stationary properties of the exchange rate data and its serially correlated forecasting errors. The Error Correction mechanism facilitates the estimation of an unbiased coefficient for the forward rate by making corrections to the short-term errors and simultaneously dealing with systematic forecasting errors that are associated with irrational expectations.

2. Literature review

In general, empirical studies aimed at solving forward premium puzzles could be classified into two main categories: those testing for the market efficiency hypothesis (MEH) and those testing for the unbiasedness hypothesis (UH). In addition, a separate group of studies attempt to improve the estimation methodology by choosing alternative econometric techniques.

Considerably few studies conducted earlier found supporting evidence for the UH. [12] concluded that average liquidity premium on the forward exchange rate of the US dollar against 7 major currencies is zero, therefore, forward rate could be

used as a good proxy for future spot exchange rates. Also, Kohlhagen (1979), Levich (1979) and Frenkel (1980) supported the unbiasedness of forward rates in forecasting future spot rates[4] with the use of regression models in levels. However, studies conducted later on, such as [5, 13, 14], put forward the idea that earlier studies conducted using level regression models could have been associated with the issue of spurious regression as a consequence of unit root characteristics in the exchange rate data. As such, they employed a different approach based on forward premium/discount. More precisely, their approach featured regression models whereby log differences of future spot rates are expressed as a function of log difference of forward premium. Unfortunately, these studies failed to find support for the UH, as well. A number of studies including [1, 11, 22, 27] which applied the co-integration approach reached mixed outcome. For instance, [4, 18] and the others did not find support for the UH, whereas [17, 25] found supporting evidence for the UH. [25] concluded that future spot and forward rates are co-integrated and the null hypothesis of $\beta = 1$ cannot be rejected, while these results remained robust with regards to the sample period.

A significant number of studies investigated the importance of sentiment in determining expected returns in asset pricing. For instance, as mentioned in [19], recent literature on capital markets namely, Brown and Cliff (2005), Baker and Wurgler (2006), Kumar and Lee (2006), and Schmeling (2007) concluded that sentiment plays an important role in determining future returns. [24] found relationships between investors’ sentiment and returns on the foreign exchange market in a longer time horizon as well as exchange rate fundamentals. Such relationships were able to improve exchange rate predictions as it featured characteristics similar to the Purchasing Power Parity (PPP)[5].

[24] went on to provide arguments for the improved forecasting capacity through inclusion of a sentiment factor. They argued that sentiment conveys information about mispricing due to uninformed investors’ demand shock and limits on arbitrage. In the most recent literature, [26] concluded that sentiment substantially improves the power of prediction of returns on the exchange rate, as it carries additional information regarding mispricing of the exchange rate. His findings also entailed forward premium having superior prediction powers of returns on the foreign exchange rate.

[2] investigated the asymmetric impact of announcements of Australian consumer confidence index on the AUD exchange rate against 13 other common currencies. In consistent with the behavioral finance theory, the effects of announcements of negative consumer sentiment were stronger than the effects of positive information.

[4] Aggarwal (2008)

[5] Menkhoff and Rebitzky (2008)

3. Data and summary statistics

3.1. Exchange rates

The sample size is constrained by the availability of data for AUD forward exchange rates and thus, chosen between May 1990 and July 2013. Forward rates of AUD against USD, which are only available from May 1990, are extracted from the Thomson Reuters Datastream; while spot rates of AUD against USD are obtained from the Reserve Bank of Australia (RBA).

In order to compare the sample selected in this analysis with other studies, summary of main data statistics is compiled. First-differenced logarithms of the spot and one-month forward rates, which implicitly measure continuously compounded returns, both average around 0.06%. Standard deviations of monthly returns for spot and forward rates are slightly higher relative to the mean returns and amount to 3.27% and 3.04%, respectively. While autocorrelation is significantly high at almost unity in levels in log and non-log terms, it is reduced considerably in log-differenced terms. Looking at the result of the Jarque-Bera test, the null hypothesis of normality cannot be rejected for monthly spot and forward returns. Furthermore, Augmented Dickey-Fuller (ADF) test for unit root indicates that spot and forward rates both are I(1) processes.

3.2. Consumer sentiment indices

The Australian consumer sentiment index is taken from the RBA statistical tables. This index, which is calculated by Westpac-Melbourne Institute of Applied Economic and Social Research, is based on surveys from Australian consumers with the purpose of evaluating their financial conditions, expectations about outlook, etc. The index equals to 1 when positive and negative responses of consumers are balanced. [2] stated that the Melbourne-Westpac consumer sentiment index is similar to the sentiment index produced by the University of Michigan in terms of the methodology.

The University of Michigan consumer sentiment index, which is downloaded from the Thomson Reuters Datastream, is employed as a measurement of the US consumers' sentiment. This index equals to 100 in 1966 as the base period. It focuses on the prospects of consumers regarding their financial conditions as a family and their expectations about economic conditions in short and long-term horizons.

Indices for Australian and the US consumer sentiment average at 102.56 and 86.17, their standard deviations amount to 12.07 and 13.25, respectively. While both indices in level terms are highly serially correlated, a significantly low autocorrelation is observed in log-differenced data. Looking at the result of the Jarque-Bera test, normality is rejected in either level and differenced data. Moreover, the ADF test result indicates that both indices are I(1) processes.

4. Methodology and model

4.1. Sentiment index

A newly constructed consumer sentiment index is used in the estimations in order to capture special characteristics of the exchange rate. As exchange rate is a relative valuation of one currency against another currency, it is influenced not only by factors in the domestic economy, but also by factors in the external economy. Assuming, hypothetically, that domestic economic conditions remain unchanged, a change in the worth of domestic currency could still occur, owing to unexpected events happening in trading partner countries. As such, both domestic and foreign economic factors may affect foreign exchange market conditions, and subsequently equilibrium prices are taken into account. For instance, even though positive (negative) news is released in the Australian market, expectations of future AUD spot rates against USD may not change if it coincides with positive (negative) news in the US market. Another possibility could be that expected AUD rates might appreciate (depreciate) by an even larger extent, if negative (positive) announcements in the US coincide with positive (negative) announcements in Australia.

In order to capture such effects, a new combined sentiment index (CoSI) is defined as the ratio of two indices:

$$CoSI_t = \frac{CCI_t^{AU}}{CCI_t^{US}}$$

where CCI_t^{AU} and CCI_t^{US} are Australian and American consumer sentiment indices announced in month t, respectively.

The new combined consumer sentiment index is able to capture the effects mentioned above. When two indices increase (decrease) by the same rate in both markets, the extent of shock observed in the foreign exchange market would be lower as the changes in the combined index is negligible. On the other hand, when two indices move in different directions (one increases while the other declines), the extent of appreciation (depreciation) of the currency would be greater in the market where announcements of good (bad) news are made and would be reflected through significant fluctuations in the combined index.

4.2. Econometric model

A Vector Error Correction Model (VECM) is a suitable estimation technique for time series analysis when variables are all I(1) and co-integrated. Let consider the following VECM with two variables to estimate long-run relationships between future spot rate and forward rate:

$$\begin{cases} \Delta s_t = \alpha_s(s_{t-1} - \gamma - \beta \cdot f_{t-2}) + \sum_{i=1}^{p-1} \Gamma_i^s \Delta s_{t-i} + \sum_{i=1}^{p-1} \Omega_i^f \Delta f_{t-i} + Bx_t + \epsilon_{s,t} \\ \Delta f_t = \alpha_f(s_{t-1} - \gamma - \beta \cdot f_{t-2}) + \sum_{i=1}^{p-1} \Gamma_i^s \Delta s_{t-i} + \sum_{i=1}^{p-1} \Omega_i^f \Delta f_{t-i} + Cx_t + \epsilon_{f,t} \end{cases} \quad (1)$$

where s_t and f_{t-1} are the logarithms of spot rate and one-period lagged forward rate, respectively, α is a coefficient for error correction, γ is a constant term in the co-integration equation and can represent constant risk premium, and β is a co-integration coefficient, while x_t represents deterministic variables such as seasonal factors, constant terms in the VAR and other exogenous variables.

4.3. Hypothesis testing

To make sure that the market efficiency hypothesis and the unbiasedness hypothesis hold, the following assumptions and restrictions are imposed on the VECM:

- *Assumption 1:* $\alpha_f = 0$ is imposed to ensure "weak exogeneity", which is derived from the theoretical assumption that forward rate is a predictor of future spot rates and not vice versa.
- *Assumption 2:* $\beta = 1$ is imposed to ensure that the unbiasedness hypothesis holds, which implies that forward rate is an unbiased predictor of future spot rates.
- *Assumption 3:* $\gamma = 0$ is imposed to ensure the implicit assumption of that the risk premium in the exchange rate market is zero.

4.4. Modifications to the model

Empirical tests are divided into two parts. In the first block of estimations, all three assumptions are imposed upon models which are later referred to as zero-risk premium models. By imposing Assumptions 1 and 3, the following simplified version of the VECM is derived, without intercept or trend in the co-integration and VAR equations:

$$\begin{cases} \Delta s_t = \alpha_s(s_{t-1} - \beta \cdot f_{t-2}) + \sum_{i=1}^{p-1} \Gamma_i^s \Delta s_{t-i} + \sum_{i=1}^{p-1} \Omega_i^f \Delta f_{t-i} + Bx_t + \epsilon_{s,t} \\ \Delta f_t = \sum_{i=1}^{p-1} \Gamma_i^s \Delta s_{t-i} + \sum_{i=1}^{p-1} \Omega_i^f \Delta f_{t-i} + Cx_t + \epsilon_{f,t} \end{cases} \quad (2)$$

Consequently, the long-run co-integration equation is derived as

$$s_{t-1} = \beta \cdot f_{t-2} + \varepsilon_t.$$

The null hypothesis from Assumption 2 is $\beta = 1$, which becomes one of the restrictions imposed on the restricted VECM. If H_0 cannot be rejected, it implies that

forward rate could be an unbiased predictor of future spot rates. This null hypothesis is tested in two different VECMs: one including the sentiment index and the other excluding it.

In the second block of estimations, the zero-risk premium assumption is relaxed and a constant risk premium in the forward exchange market is assumed in order to compensate for risks, namely counterparty risks, etc. In these models which are later referred to as non-zero risk premium models, the VECM is transformed into the following version with intercepts (no trend) in the co-integration and VAR equations:

$$\begin{cases} \Delta s_t = \alpha_s(s_{t-1} - \gamma - \beta \cdot f_{t-2}) + \sum_{i=1}^{p-1} \Gamma_i^s \Delta s_{t-i} + \sum_{i=1}^{p-1} \Omega_i^f \Delta f_{t-i} + Bx_t + \epsilon_{s,} \\ \Delta f_t = \sum_{i=1}^{p-1} \Gamma_i^s \Delta s_{t-i} + \sum_{i=1}^{p-1} \Omega_i^f \Delta f_{t-i} + Cx_t + \epsilon_{f,t} \end{cases} \quad (3)$$

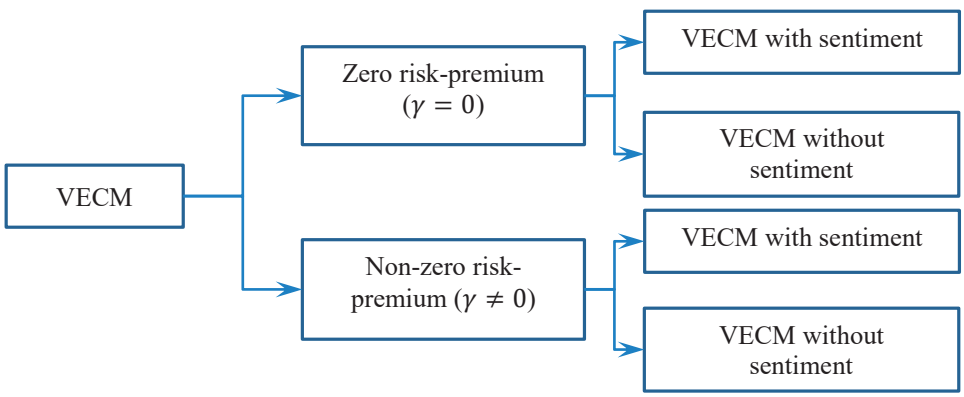
Consequently, the long-run co-integration equation is

$$s_{t-1} = \gamma + \beta \cdot f_{t-2} + \varepsilon_t.$$

Again, H_0 becomes $\beta = 1$ which is tested in two different VECMs: one including the sentiment index and the other excluding it.

Chart 1

Modifications to the VECM



It is useful to note again that restricted and unrestricted models are differentiated by the null hypothesis with regards to Assumptions 1 and 2. In other words, restricted model is created by posing the assumptions of weak exogeneity on forward exchange rate equation, zero coefficient of risk tolerance (γ) and unit coefficient of β.

4.5. Forecasting future spot rate

Long-run linear co-integration equations from the restricted and the unrestricted VECMs with zero or non-zero risk premium are solved in order to provide forecasts for one-month ahead spot rate, using updated information on the forward rate.

Forecasting capacity of the models are measured by the Symmetric Mean Absolute Percentage Error (sMAPE), which encompasses several advantages in comparing the accuracy of forecast errors. Unlike the Mean Absolute Error, this measure is free from scaling effect, and unlike the Mean Absolute Percentage Error, it is unlikely to impose heavier penalty on positive errors than negative errors.

$$\text{sMAPE} = \text{mean}\left(200 \cdot \frac{\text{Y}_t - \text{F}_t}{(\text{Y}_\text{t} + \text{F}_\text{t})}\right)$$

where Y_t refers to the actual value of variable Y at time t and F_t refers to the forecast of variable Y at time t.

A potential issue with the calculation of sMAPE arises when the value assigned to a variable equals zero and the denominator approaches zero. Fortunately, zero values are not observed in the sample data used in this analysis, as forward and spot rates certainly do not equal zero.

5. Empirical results

In the empirical tests conducted, one-month ahead spot rate is used as a proxy for one-month future spot rate. A valid estimation of the VECM requires all series to be non-stationary in level, their first-differenced series to be stationary, and the series to be co-integrated. As mentioned in the data and summary statistics section, results of the ADF tests indicate that both spot and forward rates are I(1) processes.

All criteria, including AIC and SIC, except for modified likelihood ratio (LR) indicate that maximum lag is 1 at the 5% significance level. However, lag indicated by the LR is employed in the estimations, as it provides improved results in terms of autocorrelation compared with lag of 1. The trace and Maximum Eigenvalue tests cannot reject the null hypothesis of that series has at most one co-integration vector, which further implies that one-month ahead spot rate and current forward rate could feature a long-run linear relationship.

5.1. Zero-risk premium model

Estimation of the unrestricted VECM (no restriction on any coefficients except for gamma) indicates that the co-integration coefficient is 0.998626 (very close to 1) and statistically significant, though the error correction parameter is statistically insignificant at 5%. As expected, the hypothesis of market efficiency[6], jointly imposed with zero-risk premium and weak-exogeneity, is rejected by the LR test at the 1% significance level in the restricted VECM and the error correction

[6] H_0: $\alpha_f = \gamma = 0 \; and \; \beta = 1$

parameter remains insignificant at 5%. As such, it is inconclusive to state that forward rate is an unbiased predictor of future spot rates.

With regards to testing for significance of consumer sentiment in price adjustments in the foreign exchange market, equation (2) that includes the sentiment index is estimated. Though this estimation features an additional factor of combined sentiment index in the unrestricted VECM, its result does not differ considerably from the previous VECM that excludes the sentiment factor. For instance, the co-integration vector is almost equal to unity (1.003225) and the error correction parameter remains insignificant. The only difference is that the error correction parameter turns significant at 5%, after imposing joint hypothesis restrictions on the VECM. Also, it is important to note that deviation of the coefficient (β) from unity is slightly smaller in the model featuring sentiment compared to the no-sentiment model. Unfortunately, the joint hypothesis of market efficiency and unbiasedness is rejected in this estimation.

5.2. Non-zero risk premium model

Considerable differences in the estimation results are not observed, compared to the zero-risk premium model. The joint hypothesis of market efficiency and unbiasedness is rejected in both VECMs with and without the sentiment factor. However, it is noticeable that the sentiment factor is able to reduce deviations of the coefficient from unity and its factor loading is statistically significant.

An important finding derived through relaxation of the zero-risk premium assumption is that the constant risk premium parameters are statistically significant at 5% in all of the estimations conducted, including those restricted or unrestricted versions and with or without the sentiment factor. Specifically, these estimated coefficients range between 0.21% and 0.37%, which implies that investors tend to require 0.21%-0.37% of additional returns in order to compensate for risks when investing in the forward foreign exchange market. Moreover, the combined sentiment index is statistically significant in all of the estimations conducted.

It is crucial to note that the issues encountered in the restricted models, either with or without the sentiment factor, are with regards to autocorrelation. A significantly high contemporaneous correlation around 0.99 between spot and forward rates is observed. The VECM fails to capture such a high contemporaneous correlation when weak exogeneity is imposed. As the normality test for residuals in the estimated models rejects the null hypothesis at the 5% significance level, it could imply a reduced validity of the estimated models.

The table below illustrates performance of the models in terms of their forecasting capacity. Long-run linear equations from the VECMs with the sentiment variable are able to provide better predictions than those models without the sentiment variable, while the VECMs restricted by null of $\beta = 1$ outperforms those unrestricted.

Table 1

Summary statistics of projection

	Spot rate	Forward	Zero risk premium				Non zero risk premium			
			Excluding sentiment		Including sentiment		Excluding sentiment		Including sentiment	
intercept			0				0.003721	0.002095	0.002802	0.002095
slope			1.004015	1	1.002407	1	1.005292	1	1.002301	1
					Forecasting					
2012M12		1.03724								
2013M01	1.0394	1.0408	1.0414	1.0372	1.0397	1.0372	1.0465	1.0393	1.0424	1.0393
2013M02	1.0275	1.0192	1.0450	1.0408	1.0433	1.0408	1.0501	1.0429	1.0460	1.0429
2013M03	1.0426	1.0396	1.0233	1.0192	1.0217	1.0192	1.0284	1.0213	1.0244	1.0213
2013M04	1.0368	1.0346	1.0438	1.0396	1.0421	1.0396	1.0488	1.0417	1.0448	1.0417
2013M05	0.9649	0.9551	1.0387	1.0346	1.0371	1.0346	1.0438	1.0367	1.0397	1.0367
2013M06	0.9275	0.9117	0.9590	0.9551	0.9574	0.9551	0.9639	0.9572	0.9601	0.9572
2013M07	0.9037	0.8962	0.9154	0.9117	0.9139	0.9117	0.9203	0.9138	0.9166	0.9138
					sMAPE					
2013M01	1.0394	1.0408	0.1927	0.2080	0.0324	0.2080	0.6760	0.0063	0.2910	0.0063
2013M02	1.0275	1.0192	1.6896	1.2890	1.5294	1.2890	2.1717	1.4900	1.7870	1.4900
2013M03	1.0426	1.0396	1.8653	2.2659	2.0256	2.2659	1.3757	2.0606	1.7622	2.0606
2013M04	1.0368	1.0346	0.6685	0.2678	0.5082	0.2678	1.1510	0.4691	0.7662	0.4691
2013M05	0.9649	0.9551	7.3681	6.9679	7.2080	6.9679	7.8516	7.1699	7.4669	7.1699
2013M06	0.9275	0.9117	3.3348	2.9342	3.1746	2.9342	3.8485	3.1533	3.4562	3.1533
2013M07	0.9037	0.8962	1.2842	0.8835	1.1239	0.8835	1.8165	1.1131	1.4195	1.1131
sMAPE			***2.3433***	***2.1166***	***2.2289***	***2.1166***	***2.6987***	***2.2089***	***2.4213***	***2.2089***

6. Conclusion

Through this paper, an attempt to determining the extent to which consumer sentiment factor plays a role in solving the forward premium puzzle is made. When making conclusions regarding the empirical findings of this analysis, considerable caution is taken as estimation results may be biased through autocorrelation in the VECM that is restricted by joint hypothesis. More precisely, a significantly high contemporaneous correlation between spot and forward rates in the restricted VECM is observed after imposing unity and weak exogeneity hypotheses, which is an issue the model is unable to deal with. One of the ways to improve robustness of the model could be to solve for serial correlation in the residuals of the restricted VECM, which would subsequently require controlling for a variable that is able to capture the contemporaneous correlation.

Estimation results of the VECM indicate that there is a long-run linear relationship between forward rate and one-month ahead spot rate, though the unbiasedness hypothesis is rejected at the 5% significance level. Furthermore, even though inclusion of consumer sentiment improves the estimation in general, unbiasedness is still rejected. However, sentiment factor improved the performance of the model in terms of the projection of future spot rate.

Another finding that this paper entails is the risk premium differing from zero in the forward foreign exchange market, which effectively implies that investors require additional rate of return to compensate for risks when investing in the forward foreign exchange market.

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