Japan and the World Economy 41 (2017) 34–44

Contents lists available at ScienceDirect

Japan and the World Economy

journal homepage: www.elsevier.com/locate/jwe

Research Paper

Can monetary policy cause the uncovered interest parity puzzle?

Cheolbeom Park, Sookyung Park*

Department of Economics, Korea University, Anam-dong, Seongbuk-gu, Seoul, 136-701, Republic of Korea

ARTICLE INFO

Article history:
Received 26 March 2016
Received in revised form 23 August 2016
Accepted 23 December 2016
Available online 29 December 2016

JEL classification:
F31
F41
F47

Keywords:
Interest rate
Exchange rate
Monetary policy rule
Uncovered interest parity

ABSTRACT

Using a typical open macroeconomic model, we show that the UIP puzzle becomes more pronounced when the monetary policy rule is stricter against inflation. To determine the empirical validity of our model, we examine (the Taylor-rule-type) monetary policy rules and the slope coefficient in the regression of future exchange rate returns on interest rate differentials before and after the recent global financial crisis. We find that economies that reduced the reaction of the policy interest rate to inflation in response to the crisis have positive slope coefficients in the UIP regressions after the crisis, which is consistent with our model. However, economies for which we cannot find clear break evidence for the reaction to inflation in the monetary policy rule do not show a clear directional change in the slope coefficient of the UIP regression. Moreover, the relation implied by our model holds robustly with longer time-series data during the periods prior to the crisis.

1. Introduction

Although the relationship between the exchange rate and interest rate differentials imposed by the uncovered interest rate parity (UIP) is widely used as a key assumption in theoretical models of international finance, few empirical studies have succeeded in providing supportive evidence for the UIP relation. Most studies have employed the predictive regression of future exchange rate changes on interest rate differentials to examine whether the slope coefficient in the predictive regression is equal to unity, as implied by the theoretical UIP. However, the average of the estimated slope coefficients from 75 published studies is −0.88 according to the survey by Froot and Thaler (1990). Other surveys, such as Isard (1995) and Lewis (1995), report similar results for the UIP.

This drastic failure of the UIP has generated extensive studies to explain what makes the exchange rate deviate from the UIP. Fama (1984) emphasizes the role of a volatile risk premium to resolve the UIP puzzle. Chinn and Frankel (2002) estimate highly positive slope coefficients for some currencies that depreciated during the 1992 ERM (exchange rate mechanism) crisis. Lothian and Wu (2011) examine ultra-long time series data and find that severe violations of the UIP are observed only when the sample period is dominated by the 1980s. Chinn and Frankel (2002) argue that the failure of the UIP can be considered as a Peso problem. Ito (1990) and Elliott and Ito (1999) report that expectations formed by traders in the currency market do not satisfy rationality; they have wishful expectations instead, suggesting that the failure of the rational expectation hypothesis is a reason for the failure of the UIP.

This study also attempts to propose an explanation for why an appealing UIP relation is not observed in the reduced-form predictive regression. We consider the monetary policy rule to fight inflation as a main source for the deviation of the UIP in empirical studies. In fact, McCallum (1994) shows that when central banks adjust the interest rate gradually to resist rapid movement in the exchange rate, the negative relation between future change in the exchange rate and the interest rate differential can be observed in the reduced form regression. Since our study relates the monetary policy rule to the UIP puzzle, it is similar to McCallum (1994), but is different in the sense that our theoretical model is based on a more typical open macroeconomic model consisting of the UIP relation augmented with risk premium, the expectations-augmented Phillips curve relation, an open economy IS relation, and the Taylor-rule-type monetary policy rule. Since

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* Corresponding author.
E-mail addresses: cbpark_kjs@korea.ac.kr (C. Park), soo62@korea.ac.kr (S. Park).

http://dx.doi.org/10.1016/j.japwor.2016.12.001

the interest rate differential and the exchange rate are simultaneously determined by the system of equations mentioned above, the relation between these two variables in the reduced-form predictive regression seems contradictory to the UIP in our model even without adding the exchange rate to the monetary policy rule.[1]

Stochastic simulations of the model are conducted to generate artificial data for exchange rates and interest rate differentials. Then, the reduced-form predictive regression of simulated exchange rate returns is run on simulated interest differentials to replicate UIP tests in empirical studies. In our simulations, we have varied values of the interest rate response to inflation in the monetary policy rule, and find that the estimated slope coefficients of artificial interest rate differentials depend on the values of the interest rate reaction coefficient in the monetary policy rule and the volatility of risk-premium shock. More specifically, as the value of the interest rate reaction to inflation in the monetary policy rule increases (i.e., as the central bank puts greater weight on inflation), the estimated slope coefficient is more likely to become negative. In addition, as the volatility of the risk-premium shock rises, the estimated slope coefficient is more likely to become negative. The result can be interpreted as follows: when a temporary risk-premium shock causes the exchange rate to depreciate, the inflation rate in the domestic country rises, which induces the central bank to raise the interest rate according to the monetary policy rule. In the next period, as the temporary shock disappears, the exchange rate appreciates, but the interest rate has already risen in the previous period. This mechanism will become more pronounced as the central bank puts greater importance on inflation and as the risk-premium shock becomes more dominant among other shocks. We ascertain this implication not only through the use of simulations but also through comparisons between the data before and after the recent global financial crisis, which has caused a break in the monetary policy regimes of many advanced economies. Moreover, we also show that the implication holds robustly with the data during the periods prior to the crisis. Therefore, we argue that the negatively estimated slope coefficient in the reduced form regression is the consequence of indirect interaction between interest rates and exchange rates.

Our paper is also similar to recent studies such as Backus et al. (2010) and Tambakis and Tarashev (2012) in the sense that we are relating the UIP puzzle to monetary policy rules. Backus et al. (2010) examine variants of the Taylor rules to ascertain which type of Taylor rule can resolve the UIP puzzle. Tambakis and Tarashev (2012) address a similar question using a battery of monetary policy rules spanning from strict inflation targeting to a Taylor-rule type monetary policy rule. The question addressed in this study is slightly different from those addressed in both aforementioned studies. In a departure from those works, we utilize one type of monetary policy rule which does not depend on the exchange rate and does not hold a forward-looking assumption. We show via stochastic simulations that the degree of UIP violations depends on the weight placed on inflation in the Taylor-rule type monetary policy rule, and further provide empirical evidence for our argument using the data around the global financial crisis.

The role of the monetary policy rule in our model to resolve the UIP puzzle can also provide coherent explanations for seemingly unrelated findings in other studies. Bansal and Dahlquist (2000) estimate positive UIP slope coefficients using high-inflation countries. Flood and Rose (2002) report that the UIP appears to hold better during the crisis-strewn 1990s than it did before. Since the weight on inflation is likely to be low in high-inflation countries and crisis-experienced countries, our model predicts that the UIP in the reduced form regression is more likely to hold in these countries. In addition, Chinn and Meredith (2004) argue that the UIP works better with longer-maturity bonds than with short-horizon data. Since the impact of the monetary policy becomes weaker as the bond maturity increases, it is natural to observe more supportive results for the UIP when long-horizon data are used.[2]

To present these ideas and evidence, the remainder of the paper is organized as follows: Section 2 briefly presents our model and the simulation method and results. Section 3 provides empirical evidence for implications from our model. Concluding remarks are offered in Section 4.

2. The model and simulation

In order to relate the UIP puzzle to the monetary policy rule, the model employed in this study is similar to a typical open macroeconomic model. The model can be described by the following six equations:

$$\hat{i}_t = \gamma\hat{i}_{t-1} + (1-\gamma)\left(\phi_\pi\hat{\pi}_t + \phi_y\hat{y}_t\right) \tag{1}$$

$$\hat{\pi}_t = \beta_\pi\hat{\pi}_{t-1} + (1-\beta_\pi)\hat{\pi}^e_{t,t+1} + \beta_y\hat{y}_t + \beta_s\Delta(s_t - \hat{p}_t) + \nu_t \tag{2}$$

$$\hat{y}_t = \alpha_s(s_t - \hat{p}_t) + \alpha_r\left(\hat{i}_t - \hat{\pi}^e_{t,t+1}\right) + \alpha_y\hat{y}_{t-1} + \varepsilon_t \tag{3}$$

$$\hat{p}_t = \hat{p}_{t-1} + \hat{\pi}_t \tag{4}$$

$$s^e_{t,t+1} - s_t = \hat{i}_t - RP_t \tag{5}$$

$$RP_t = \rho RP_{t-1} + \eta_t \tag{6}$$

where i_t is the interest rate, π_t is the inflation rate, y_t is the output gap, s_t is the log exchange rate, p_t is the log price level, RP_t is the risk premium, superscript e denotes the expectation operator, and ^ denotes a domestic variable relative to the same foreign variable (i.e. the same US variable). Eqs. (1)–(6) reflect the monetary policy rule, the expectations-augmented Phillips curve relation, an open economy IS relation, the price level identity, the standard UIP relation, and the process for the risk premium, respectively. According to Eqs. (5) and (6), deviations from the UIP can occur due to the risk premium, and the risk premium is driven by shocks η with autocorrelation ρ. We assume AR(1) dynamics for the risk premium to reflect Engel (2014)'s argument that a persistent stationary process is needed for the risk premium to explain the hump-shaped pattern of the exchange rate predictability based on Taylor-rule fundamentals from short horizons to long horizons. η_t, ν_t, and ε_t represent the risk-premium shock, the inflation shock, and the output shock, respectively, and are assumed to be serially uncorrelated and independent of each other.

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[1] McCallum (1994) includes the exchange rate in the monetary policy rule, but Mark and Wu (1997) report that the reaction of the interest rate to the exchange rate is small and insignificant. Molodtsova and Papell (2009) also show that out-of-sample exchange rate predictability by Taylor-rule fundamentals is high under the Taylor rule without the exchange rate.

[2] In addition to the monetary policy, the volatility of the risk-premium shock plays an important role in generating the UIP puzzle in our simulation. However, this implication is not tested in the empirical analysis because of the difficulty in quantifying the risk-premium shock with the data.