Risk Premium in Foreign Exchange Rates: Evidence from Firm Survey Data*

Rei Kanoh† Yoshiyuki Nakazono‡

Abstract

We estimate firm's time-varying risk premiums, which are one of the central concepts of behavioral economics. Using identified risk premium, we examine the determinants of risk premium and the effect of the size of each firm's risk premium on decision making. We first find that the measured risk premium is associated with *expected* interest rate differentials between home and foreign countries. Second, we find that firm size determines risk premium: each firm's market capitalization explains how a firm is risk-averse. Third, higher risk premium is associated with lower profitable exchange rate, significantly. This result may suggest conservative decision-making; risk-averse firms set profitable exchange rates to be lower than risk-lover firms do in order to avoid unexpected losses by an abrupt appreciation of the yen against the dollar.

JEL Classification: D81; D84; F31
Keywords: foreign exchange; risk premium

1 Introduction

A growing number of studies using firm survey data show that expectations play an important role in firms' behavior and in business cycles (Bachmann et al., 2013; Coibion et al., 2018). However, the value of information contained in firm surveys has not been well examined in the literature.

Using a unique panel of survey data of Japanese firms from 1989 to 2019, we estimate each firm's risk premium.[1][2] Our paper focuses on measuring firm's time-varying risk premiums, which are one of the central concepts of behavioral economics. Using identified risk premium, we examine the determinants of risk premium and the effect of the size of each firm's risk premium on decision making. We first find that the measured risk premium is associated with *expected* interest rate differentials between home and foreign countries. Second, we find that firm size determines risk premium: each firm's market capitalization explains how a firm is risk-averse. Third, higher risk premium is associated with lower profitable exchange rate, significantly. This result may suggest conservative decision-making; risk-averse firms set profitable exchange rates to be lower than risk-lover firms do in order to avoid unexpected losses by an abrupt appreciation of the yen against the dollar.

*We thank the Economic and Social Research Institute of the Cabinet Office of Japan for providing us with microdata from the "Annual Survey of Corporate Behavior." Nakazono acknowledges financial support from JSPS KAKENHI Grant Number 19K13649 and 21H04397.

†Yokohama City University, i180210c@yokohama-cu.ac.jp

‡Yokohama City University, nakazono@yokohama-cu.ac.jp

[1] Chionis and Frankel (1991) measures the foreign exchange risk premium using the survey by professional forecasters.

[2] According to Jongen et al. (2008), prominent issues on foreign exchange rate expectations are (1) forward premium puzzle and time-varying risk premiums, (2) heterogeneity of expectations and expectation formation, (3) market microstructure, and (4) forecast performance.

2 Data

We use the data of the "Annual Survey of Corporate Behavior" conducted by the Economic and Social Research Institute, Cabinet Office of Japan. The survey has been implemented for more than 25 years and covers approximately 1,000 firms each year, all of which are listed on the stock market in Japan. It is conducted annually between mid-December and mid-January and around 40% of firms respond to the survey among all the listed companies. The survey asks responding firms about their view regarding their business outlook and their demand forecasts, so that the data reflects the views of firms' managers. Specifically, respondents are asked to provide their forecasts of foreign exchange rates (Japanese yen per unit of U.S. dollar) over the next one year, the nominal and real growth rate of GDP and industry demand over the next one, three, and five years, and the annual average percentage change in capital investment and the number of employees over the next three years.

3 Estimation Strategy

Under UIP, interest rate differential (IRD) should be equal to change in exchange rates:

$$\frac{R_t}{R_t^*} = \frac{E_t[S_{t+1}]}{S_t}. \tag{1}$$

where S is nominal exchange rate[3] and R_t and R_t^* are one-period gross interest rates in home and foreign countries, respectively. Taking logarithms of the both sides in Equation (1) leads to Equation (2):

$$E_t[s_{t+1}] - s_t = i_t - i_t^*. \tag{2}$$

where s is (log) nominal exchange rate and i and i^* are one-period interest rates in home and foreign countries, respectively. By removing the expectation operator (E), Equation (2) is rewritten to the following equation:

$$s_{t+1} - s_t = i_t - i_t^* + \varepsilon_{t+1}. \tag{3}$$

Firm j requires risk premium (rp^i) for investing foreign assets:

$$R_t = R_t^* \times \frac{E_t^j[S_{t+1}]}{S_t} \times (1 + rp_t^j). \tag{4}$$

Taking logarithms of the both sides in Equation (1) leads to Equation (4)

$$E_t^j[s_{t+1}] - s_t = i_t - i_t^* - rp_t^j. \tag{5}$$

Subtracting Equation (5) from Equation (3) and rearranging them, we have

$$s_{t+1} - E_t^j[s_{t+1}] = rp_t^j + \varepsilon_{t+1}^j. \tag{6}$$

Using Equation (6), we can directly identify firm j's risk premium. By regressing expectational error ($s_{t+1} - E_t^j[s_{t+1}]$) in Equation (6) on time dummy with fixed effects, we obtain firm j's risk premium rp_t^j as the summation of fixed effects (c_j) and residuals ($\hat{\xi}_{t+1}^j$) as following:

$$s_{t+1} - E_t^j[s_{t+1}] = c_j + \delta_t + \xi_{t+1}^j. \tag{7}$$

In what follows, we test the rationality of the survey, examine the determinats of each firm's risk premium, and investigate whether the size of risk premium has some impacts on each form's decision-making.

[3] Here, exchange rate (S) is quoted as home currency (Japanese yen) per unit of foreign currency (U.S. dollar).

4 Results

4.1 Rationality

We first test forecast rationality using the following equation:

$$s_{t+1} - s_t = c + \beta \times E_t^j \left[s_{t+1} - s_t \right] + e_t^j.$$

Under the rational expectation hypothesis, c and β should be zero and one, respectively. The estimation result shows that the null hypothesis is rejected.[4] The results suggest that the survey we use does not follow the naive hypothesis of full-information rational expectations (FIRE).

4.2 Determinants of risk premium: Baseline results

Rearranging Equation (5), we have

$$E_t^j[q_{t+1}] \equiv E_t^j[s_{t+1}] - s_t - (i_t - i_t^*) = -rp_t^j. \tag{8}$$

Equation (8) suggests that risk premium is identical to the (firm j's expected) excess return ($E_t^j[q_{t+1}]$) from investment in foreign assets when we derive risk premium from in the view of the international arbitrage in two different markets simultaneously. In spite of the theoretical prediction, a number of the literature report that the excess returns are (negatively) related to interest rate differentials (Bacchetta et al., 2009). In order to identify determinants of individual risk premium, we can derive the following equation using Fisher equation;

$$\begin{aligned} i_t - i_t^* &= (r_t - E_t[\pi_{t+1}]) - i_t^*, \\ E_t^j \left[(i_t - i_t^*) \right] &= E_t^j \left[r_t \right] + E_t^j \left[\pi_{t+1} \right] - i_t^*, \end{aligned} \tag{9}$$

where $E_t^j \left[r_t \right]$ and $E_t^j \left[\pi_{t+1} \right]$ are (survey-based) real interest rates and inflation expectations which firm i forecasts. Here, GDP forecasts for the next five years and GDP deflator for the next one year are used as proxies for a (survey-based) real interest rate $E_t^i \left[r_t \right]$ and inflation forecast $E_t^j \left[\pi_{t+1} \right]$. Using Equation (9), we regress risk premium on the *expectational* IRD:

$$rp_t^i = c + \beta \times E_t^i \left[(i_t - i_t^*) \right] + \mu_t^i.$$

Because IRD should have no explanatory power for risk premium, it is expected that β is equal to zero.

Table 1 shows the estimation results. It shows that $E_t^i \left[(i_t - i_t^*) \right]$ significantly influences risk premium. The table also shows that risk premium is determined by inflation expectation of firm i ($E_t^i \left[\pi_{t+1} \right]$). It is suggested that a firm which has lower inflation expectations requires higher risk premium for investment in foreign assets. This implies that expectation about the yen appreciation comes from lower inflation forecasts. It is consistent with the theoretical prediction that currencies in lower-inflation countries appreciate against currencies in higher-inflation countries.[5] The results are robust when we estimate a random effect model.

4.3 Determinants of risk premium: Size effects

In order to further examine determinants of risk premium, we also regress risk premium on firm i's (log) market capitalization. Table 2 shows the estimation results. It is shown that firm size explains the size of risk premium: larger (smaller) firms have lower (higher) risk premium. It is suggested that larger (smaller) firms are more risk-averters (risk-lovers). The results are supported when we use subsamples and regress risk-premium on marlet-based interest rate differentials.

[4] In order to save space, we do not report the results.

[5] Our results are similar to Dick et al. (2015) documenting that exchange rate forecasts are associated with expected fundamentals.

5 Risk premium and firm's decision-making

While it is found that inflation expectations are one of determinants of risk premium and the risk appetite differs in firm size, a question arises; does the risk appetite influence firm's decision making? In order to examine whether the size of risk premium has some impacts on each firm's choice, we analyze decision-making about exporting. Suppose that a firm which requires larger risk premium for investment in foreign assets plans on exporting its own products. If it is a risk-averter, the firm will not start to do unless exporting makes a solid profit. On the other hand, a firm, which is a risk-lover, will decide to do export even though export business is faced with high uncertainty.

We examine the relationship between the size of risk premium and decision-making about export business. Specifically, we use the survey data about profitable exchange rates which firms are asked to answer with regard to their main product, and study whether risk premium of each firm influences its choice about a profitable exchange rate.[6] To this end, we estimate the simple equation:

$$bfx_t^i = c + \delta \times rp_t^i + \mu_t^i,$$

where bfx_t^i is firm i's profitable exchange rate for exporting at time t. If δ is negative, then firms which have higher risk premium are conservative in exporting, in the sense that they tend not to do export unless their profitable exchange rate is enough low to make a profit from exporting. Our estimation results show that this is the case. Table 3 shows that higher risk premium is associated with lower profitable exchange rate, significantly. This result does not change when firm size is added to the equation. In sum, profitable exchange rates of risk-averse firms are significantly lower than those of risk-lover firms.[7]

6 Conclusion

Using unique data, this paper examines how risk premium for investment in foreign assets is determined and influences economic agent's decision-making. By identifying each firm's individual risk premium, we first find that the measured risk premium is associated with *expected* interest rate differentials between home and foreign countries. The estimation results imply that higher expected inflation rates in home countries drive the *expected* interest rate differentials. Second, we find that firm size determines risk premium: each firm's market capitalization explains how a firm is risk-averse. Third, higher risk premium is associated with lower profitable exchange rate, significantly. This result may suggest conservative decision-making; risk-averse firms set profitable exchange rates to be lower than risk-lover firms do in order to avoid unexpected losses by an abrupt appreciation of the yen against the dollar.

References

Bacchetta, Philippe, Elmar Mertens, and Eric van Wincoop (2009) "Predictability in financial markets: What do survey expectations tell us?," *Journal of International Money and Finance* 28 (3), pp.406–426.

Bachmann, Rüdiger, Steffen Elstner, and Eric R. Sims (2013) "Uncertainty and economic activity: Evidence from business survey data," *AMERICAN ECONOMIC JOURNAL: MACROECONOMICS* 5 (2), pp.217–49.

Chionis, Dionysios, and Ronald MacDonald (2002) "Aggregate and disaggregate measures of the foreign exchange risk premium," *International Review of Economics & Finance* 11, pp. 57–84.

[6] To collect the survey about a profitable exchange rate, firms are asked to answer the following question; "Up to how many yen to the dollar is a profitable exchange rate at this point in time? Please reply with regard to your main product if conditions vary significantly between products and plants and it is difficult to make."

[7] Our results may imply wishful expectation, as shown in Ito (1990).

Coibion, Olivier, Yuriy Gorodnichenko, and Saten Kumar (2018) "How do firms form their expectations? New survey evidence" *American Economic Review* 108 (9), pp.2671–2713.

Dick, Christian D., Ronald MacDonald, and Lukas Menkhoff (2015) "Exchange rate forecasts and expected fundamentals," *Journal of International Money and Finance* 53, pp. 235–256.

Ito, Takatoshi (1990) "Foreign exchange rate expectations: Micro survey data," *American Economic Review* 80(3), pp.434–449.

Jongen, Ron, Willem F. C. Verschoor, and Christian C. P. Wolff, (2008) "Foreign exchange rate expectations: Survey and synthesis," *Journal of Economic Surveys* 22, pp. 140–165.

Table 1: Determinants of risk premium

Specifications (1) :

$$rp_t^j = c + \beta_1 \times E_t^j \left[(i_t - i_t^*) \right] + \mu_t^j$$

Specifications (2) :

$$rp_t^j = c + \beta_2 \times E_t^i \left[r_t^e \right] + \beta_3 \times E_t^j \left[\pi_{t+1}^e \right] + \mu_t^j$$

Specification	(1)	(2)
$\beta_1 :\quad E_t^j[(i_t - i_t^*)]$	−0.2744***	
	(0.0643)	
$\beta_2 :\quad E_t^j[r_t^e]$		−0.3775***
		(0.0854)
$\beta_3 :\quad E_t^j[\pi_{t+1}^e]$		−0.1566**
		(0.0785)
Observations	12,296	12,296
Year Dummy	YES	YES
Sector Dummy	YES	YES

Note: Robust standard errors are in parentheses, and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 2: Determinants of risk premium: Size effects

$$rp_t^j = c + \gamma \times \ln Size_t^j + \mathbf{X}\beta + \mu_\mathbf{t}^\mathbf{j}$$

	(1)	(2)	(3)
$\ln(Size_t^j)$	0.0011***	0.0009***	0.0008***
	(0.0003)	(0.0003)	(0.0003)
$E_t^j[(i_t - i_t^*)]$		−0.2962***	
		(0.0718)	
$E_t^j[r_t^e]$			−0.4343***
			(0.0965)
$E_t^j[\pi_{t+1}^e]$			−0.1398
			(0.0854)
Observations	14,665	10,480	10,480
Year Dummy	YES	YES	YES

Note: Robust standard errors are in parentheses, and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 3: Risk premium and exporting: Beneficial exchange rates

$$bfx_t^j = c_j + \delta_1 \times rp_t^j + \delta_2 \times \ln Size_t^j + \mu_t^j$$

	(1)	(2)
δ_1: Risk premium	−0.156***	−0.154***
	(0.0171)	(0.0167)
δ_2: $\ln Size_t^j$		−1.895***
		(0.336)
Observations	11,425	11,222
Year Dummy	YES	YES
Fixed Effect	YES	YES
# of groups	1,482	1,452

Note: Robust standard errors are in parentheses, and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.