Exchange Rates, Equity Returns, and Risk Appetite: A Modified Uncovered Equity Parity*

Sangwon Suh†, Dohoon Pyoun‡

October 2016

Abstract

In this paper, we emphasize the role of risk appetite in associating exchange rate movements with equity returns. By assuming that investors are affected by risk appetite in their international portfolio decision, we develop a modified uncovered equity parity (UEP) which incorporates risk appetite. We apply the modified UEP into multi-country real data and find empirical evidences that are supportive of the role of risk appetite. In particular, the relationship between exchange rate movements and equity returns is risk appetite contingent and thus time-varying. In addition, we explore its implications on financial market instability and find that financial market instability is likely to be associated with weaker risk appetite. This fact is useful not only for the characterization of financial market instability but also for its prediction.

Keywords: Exchange Rates, Equity Returns, Risk Appetite, Uncovered Equity Parity, Financial Instability.

JEL classification: F31, G11.

---

*We are grateful to Sangki Ahn, Hyun Jeong Kim, Kyunggeun Kim, Inseok Shin, Kilsung Song and other seminar participants at the Bank of Korea for their helpful comments. The first author gratefully acknowledges financial support from the Bank of Korea; however, the views expressed herein are those of the authors and do not necessarily reflect those of the Bank of Korea.

†Corresponding author. School of Economics, Chung-Ang University; Email: ssuh@cau.ac.kr.

‡The Bank of Korea; Email: dhpyoun@bok.or.kr.

1 Introduction

In spite of enormous efforts, exchange rate movements have been notoriously difficult to explain and predict (Meese and Rogoff, 1983; Cheung et al., 2005). As an early model, the uncovered interest parity (UIP) has been constructed based on a no-arbitrage argument for investments between riskless domestic and foreign assets and links exchange rate movements with interest rate differentials. Unfortunately, empirical evidences on the UIP have been unsatisfactory.[1]

Recently, a new parity condition has been proposed to better explain and predict exchange rate movements, the uncovered equity parity (UEP) proposed by Cappiello et al. (2005, 2007), Hau and Rey (2006), and Kim (2011). Unlike the UIP, the UEP is typically formed by modelling a portfolio choice among international risky assets and relates exchange rate movements with equity return differentials.[2] Advantageously, the riskiness of assets plays an important role under this portfolio model approach.[3]

This paper aims to adjust the UEP to better explain exchange rate movements by incorporating *risk appetite* (RA) instead of the usual *risk aversion* into a portfolio model. In general, investors dislike uncertainty over the future consumption implied by their portfolio investments. The risk aversion roughly refers to the degree to which investors dislike uncertainty and is typically assumed to be constant over time. By contrast, the risk appetite—the willingness of investors to bear risk—comprises not only risk aversion but also financial and macroeconomic uncertainty and therefore is likely to shift as investors respond to macroeconomic environment (Gai and Vause, 2006). Indeed, the level of uncertainty about future consumption depends on the financial and macroeconomic environment. Investors would

[1] Refer to Froot and Thaler (1990), Lewis (1995), Engel (1996), Sarno (2005), and Chinn (2006) for empirical evidences of the UIP, among others. For the empirical studies on emerging markets, refer to Bansal and Dalquist (2000), Flood and Rose (2002), Ferreira and Leon-Ledesma (2007), and Alper et al. (2009). Several econometric problems are considered in testing the UIP; for example, structural breaks dealt with by Bekaert et al. (2002) and Goh et al. (2006); peso problem by Flood and Rose (1996) and Sachsida et al. (2001); central bank's interventions by Chinn and Meredith (2004) and Poghosyan et al. (2008).

[2] Cappiello et al. (2005, 2007) consider no-arbitrage condition among risky assets to derive the UEP.

[3] For empirical evidences for the UEP, refer to Evans and Lyons (2002), Dunne et al. (2010), Filipe (2012), and Curcuru et al. (2014). Relatedly, Cho et al. (2016) and Reboredo et al. (2016) provide empirical evidences that currency returns are positively correlated with equity returns in emerging markets.

require higher expected excess returns to hold each unit of risk in adverse circumstances when RA is weak even though risk aversion remains constant.

Financial institutions and market practitioners have often explained international asset price movements on the basis of changes in RA. For example, the RA condition is used by BIS (2015) to explain equity market developments and by IMF (2015) to describe capital flows to emerging markets. RA has been theoretically and empirically studied (Kumar and Persaud, 2002; Gai and Vause, 2006; Misina, 2008; Pericoli and Sbracia, 2009). A variety of indicators have been proposed to measure the RA.

Although RA has been widely and successfully used to explain asset price movements, it has been rarely applied to the UEP. In this paper, we extend the UEP by adjusting a portfolio model with the RA instead of the usual risk aversion. Advantageously, the inclusion of RA may help the modified UEP to capture time-varying investor behaviors (or investors' sentiments) and thereby to better explain exchange rate movements. The modified UEP nests the UEP or the risk adjusted UEP (suggested by Kim (2011) as a special case. We then apply the modified UEP into multi-country real data. We find that the RA component included in the modified UEP plays a significant role in explaining exchange rate movements in most countries. The result is robust to several sensitivity analyses. In addition, we try to explore its implications on foreign equity investments. We find that although the RA plays an important role in contemporaneously associating exchange rate changes with equity returns, the RA does not have a predictive role. Next, we try to relate our findings with financial market instability. The dynamics between currency market and asset (equity) market differ according to the RA condition. Specifically, both markets tend to more closely co-move with weaker RA. Moreover, when the RA is weak, both financial markets simultaneously exhibit instability more frequently than otherwise. We also obtain a useful result that the current RA condition proves to be informative for predicting future financial market instability. Our findings have profound policy implications which will be discussed in a later section.

This paper is not only directly related to the UEP literature but also broadly related to a large literature about the effects of international equity investors behavior on currency return (Froot et al., 1992; Bohn and Tesar, 1996; Griffin et al., 2004; Chabot et al., 2014). Recently, Cenedese et al. (2016) employ an economic value approach of constructing a crosssectional portfolio trading strategy to show that exchange rate movements are unrelated to country-level equity return differentials.

The rest of this paper is organized as follows. Section 2 presents the modified UEP which follows a portfolio choice approach and incorporates RA instead of the usual risk aversion. In Section 3, we present our estimation model, explain the data to be used for our empirical analysis, show the estimation results and conduct several sensitivity analyses. In addition, we explore the implications of the modified model on foreign equity investments. In Section 4, we investigate into the role of the RA in the context of financial market instability. Lastly, Section 5 concludes. Appendix A presents a simple model to illustrate how risk appetite is related with macroeconomic environment. Appendix B provides a detailed derivation of the modified UEP model.

2 Model

In this section, we develop an UEP model in which RA plays an important role in determining the relationship between exchange rate changes and equity return differentials. To this end, we revise a portfolio choice model by Hau and Rey (2006) and Kim (2011) to theoretically derive a modified UEP by explicitly accounting for the role of RA in international portfolio investment decision. We consider a problem of international portfolio investments into two risky assets (equities) from two countries within a two-period framework. For simplicity, a currency hedging problem is abstracted away by assuming that currency hedging costs too high to implement. Domestic investors (h) make their investments into domestic and foreign equities with A_h and A_h^* units, respectively. Similarly, foreign investors (f) hold A_f and A_f^* units of domestic and foreign equities, respectively. Denote by dR and dR^* the one period stochastic (local currency terms) returns of domestic and foreign equities, respectively. We define the exchange rate (S) as the value of one unit of the foreign currency in terms of the domestic currency and denote by dS the domestic currency depreciation. Then, the (local currency terms) profits of the domestic (Π) and foreign (Π^*) investors are determined as

$$\Pi = A_h dR + SA_h^* (dR^* + dS) = A_h dR + SA_h^* d\widetilde{R}^*, \quad (1)$$

$$\Pi^* = \frac{1}{S} A_f (dR - dS) + A_f^* dR^* = \frac{1}{S} A_f d\widetilde{R} + A_f^* dR^*. \quad (2)$$

Here, the return on foreign asset in terms of domestic currency $d\widetilde{R}^*$ is the sum of foreign asset and foreign currency return[4]; i.e., $d\widetilde{R}^* = dR^* + dS$. Likewise, the return on domestic asset in terms of foreign currency $d\widetilde{R}$ is the difference between domestic asset return and domestic currency depreciation; i.e., $d\widetilde{R} = dR - dS$. The mean and variance of Π (Π^*) are denoted by $E\Pi$ ($E\Pi^*$) and σ_Π^2 ($\sigma_{\Pi^*}^2$), respectively.

Following Kumar and Persaud (2002), we assume that the domestic investors' risk appetite affects their portfolio decision. In particular, an increase in risk appetite leads to a change in portfolio along the efficient portfolio frontier with higher risk and higher return, which implies a flatter slope of the tangency line where the tangency point represents the chosen portfolio. In this regard, the RA is represented by the inverse of the slope of the tangency line. Letting K be the common RA level, the domestic investors decide their portfolio along the efficient frontier from the following condition

$$\frac{1}{K} = \frac{\partial E\Pi}{\partial \sigma_\Pi^2}.$$

Similarly,

$$\frac{1}{K} = \frac{\partial E\Pi^*}{\partial \sigma_{\Pi^*}^2}$$

[4] We take this return additivity approximation for analytical simplicity.

is the optimality condition for the foreign investors. By introducing the following notations

$$\begin{aligned}
\delta_{\widetilde{R}^*} &\equiv \frac{\sigma_{R,\widetilde{R}^*}}{\sigma^2_{\widetilde{R}^*}},\ \delta_R \equiv \frac{\sigma_{R,\widetilde{R}^*}}{\sigma^2_R},\ \delta_{R^*} \equiv \frac{\sigma_{\widetilde{R},R^*}}{\sigma^2_{R^*}},\ \delta_{\widetilde{R}} \equiv \frac{\sigma_{\widetilde{R},R^*}}{\sigma^2_{\widetilde{R}}}, \\
\Delta_R &\equiv \frac{1}{2}\left(\sigma^2_R - \frac{\sigma^2_{R,\widetilde{R}^*}}{\sigma^2_{\widetilde{R}^*}}\right)^{-1}, \Delta_{\widetilde{R}^*} \equiv \frac{1}{2}\left(\sigma^2_{\widetilde{R}^*} - \frac{\sigma^2_{R,\widetilde{R}^*}}{\sigma^2_R}\right)^{-1}, \\
\Delta_{\widetilde{R}} &\equiv \frac{1}{2}\left(\sigma^2_{\widetilde{R}} - \frac{\sigma^2_{\widetilde{R},R^*}}{\sigma^2_{R^*}}\right)^{-1}, \Delta_{R^*} \equiv \frac{1}{2}\left(\sigma^2_{R^*} - \frac{\sigma^2_{\widetilde{R},R^*}}{\sigma^2_{\widetilde{R}}}\right)^{-1},
\end{aligned}$$

we can express the optimal units of assets to invest as

$$A_h = K\Delta_R\left(EdR - \delta_{\widetilde{R}^*}Ed\widetilde{R}^*\right), \tag{3}$$

$$A_h^* = \frac{1}{S}K\Delta_{\widetilde{R}^*}\left(Ed\widetilde{R}^* - \delta_R EdR\right), \tag{4}$$

$$A_f = SK\Delta_{\widetilde{R}}\left(Ed\widetilde{R} - \delta_{R^*}EdR^*\right), \tag{5}$$

$$A_f^* = K\Delta_{R^*}\left(EdR^* - \delta_{\widetilde{R}}Ed\widetilde{R}\right). \tag{6}$$

Here, σ^2_R and $\sigma_{R,\widetilde{R}^*}$ denote the variance of dR and the covariance between dR and $d\widetilde{R}^*$, respectively. Other terms are similarly defined.

Some remarks are in order. The efficient portfolio frontier is typically described on the expected return and volatility plane. For analytical simplicity, however, we describe the efficient frontier on the transformed plane of the expected return and variance. Remarkably, this transform is innocuous because the variance of return is a monotonically increasing function of the volatility and there exists a one-to-one correspondence between the original frontier and the transformed one. Noteworthily, the risk appetite level K and (the inverse of) the usual risk aversion coefficient of the quadratic utility play the same role in the portfolio decision. However, they are not only conceptually different but also differently implemented. Similar to the way how the RA linearly affects the equity demands in (3) $\sim$ (6) , we present in the Appendix A a simple model to illustrate that a macroeconomic condition (which is related with the RA) affects portfolio weights for risky assets also in a linear way.

The above portfolio choice results are similar to those of Kim (2011). The δs are an increasing function of the covariance between two equity returns (including the currency return). The greater δ implies a higher degree of capital market integration between the two asset markets, and thus, less market risk. In this sense, the δs represent an inverse of market risk in international portfolio investments. The Δs are functions of the variance and covariance of returns and summarize how to account for riskiness in portfolio decision. Within this framework, a portfolio decision is made based not on the simple equity return differential but on the return differential adjusted with market risk (δ). Intuitively, the greater the adjusted return differential, the more investments into the relatively more attractive asset.

Unlike Kim (2011), however, RA explicitly affects the portfolio decision in the modified UEP. When RA is strong, the impact of an improvement in the market risk adjusted return differential on the demand for the asset is also strong, and vice versa. Because of this RA (or market sentiment) channel, the changes in relative attractiveness of assets affect asset demands in a time-varying manner. By contrast, instead of the RA term, a time-invariant risk aversion coefficient appears in Kim's (2011) model.

For the determination of the exchange rate, we assume that the supply of foreign exchange is inelastic and the exchange rate is expected to respond to the changes in the demand for foreign exchange.[5] The domestic currency depreciation would occur with a greater demand for foreign exchange, which is closely related with international portfolio investments. The net demand for foreign exchange is the difference between the demand for foreign assets by domestic investors and the demand for domestic assets by foreign investors. Then, the FX market clearing condition is specified as

$$EdS = \lambda \left(P^* A_h^* - \frac{1}{S} P A_f \right), \tag{7}$$

where λ indicates the net demand elasticity of foreign exchange given the inelastic supply of foreign exchange. P and P^* are the domestic and foreign equity prices, respectively. For simplicity, we normalize the unit prices of both assets to one and the current exchange rate

[5] For the discussion about the FX market microstructure which is relevant with our model, refer to Hau and Rey (2006) and Kim (2011).

to one. Substituting the optimal portfolio demands (3) $\sim$ (6) into (7), the expected domestic currency depreciation is related with asset returns as follows:

$$EdS = \frac{-\lambda K \Delta_2}{1 - \lambda K \Delta_1} \left[(EdR - EdR^*) + (1 - \eta) EdR^* \right], \tag{8}$$

where $\Delta_1 \equiv \Delta_{\widetilde{R}^*} - \Delta_{\widetilde{R}}$, $\Delta_2 \equiv \Delta_{\widetilde{R}} + \Delta_{\widetilde{R}^*} \delta_R$, and $\eta \equiv \Delta_2^{-1} \left(\Delta_{\widetilde{R}^*} + \Delta_{\widetilde{R}} \delta_{R^*} \right)$. Noteworthily, the domestic currency depreciation is expressed not only in terms of risk adjusted return differentials, variance and covariance of returns but also in terms of the RA.[6] To obtain an intuitive interpretation, we consider a special case of equal δs and Δs, where the modified UEP relation reduces to

$$EdS = -\lambda K \Delta (1 + \delta) \left[EdR - EdR^* \right]. \tag{9}$$

A positive return differential of the domestic equity would induce domestic currency appreciation. This domestic currency appreciation would be intensified when risk appetite is strong. Besides, demand elasticity of foreign exchange and risk components (δ and Δ) also affect the degree of the domestic currency appreciation.

3 Empirical analysis

In this section, we present our estimation model based on the above theoretical results and explain the data to be used for our empirical analysis. Then, we show the estimation results and also conduct several sensitivity analyses to check the robustness of the results.

3.1 Estimation model

Our theoretical result (equation (8)) postulates that expected domestic currency depreciation depends not only on expected equity returns but also on the RA condition. Further, the

[6]Supposing fixed equity supplies A (for domestic equity) and A^* (for foreign equity), and imposing market clearing conditions for both equity markets (i.e., $A_h + A_f = A$, $A_h^* + A_f^* = A^*$), we may solve for the equilibrium expected asset returns $E(dR)$ and $E(dR^*)$ and for the equilibrium expected domestic currency depreciation $E(dS)$. They are not of our interest and omitted here.

RA condition affects the relationship between expected exchange rate changes and equity returns in a non-linear way. For estimation, we first linearly approximate the modified UEP relation with respect to the RA which is specified as follows:

$$\begin{aligned} E_t dS_{t+1} &= a_0 + a_1 \left(E_t dR_{t+1} - E_t dR^*_{t+1} \right) + a_2 E_t dR^*_{t+1} \\ &\quad + a_3 K_t + a_4 K_t \left(E_t dR_{t+1} - E_t dR^*_{t+1} \right) + a_5 K_t E_t dR^*_{t+1}. \end{aligned} \tag{10}$$

Appendix B presents detailed explanations about (10) . The RAUEP model nests the RUEP proposed by Kim (2011). With $a_3 = a_4 = a_5 = 0$ in (10), the RAUEP model collapses to the RUEP; that is,

$$E_t dS_{t+1} = a_0 + a_1 \left(E_t dR_{t+1} - E_t dR^*_{t+1} \right) + a_2 E_t dR^*_{t+1}. \tag{11}$$

It also reduces to the UEP with $a_2 = a_3 = a_4 = a_5 = 0$; that is,

$$E_t dS_{t+1} = a_0 + a_1 \left(E_t dR_{t+1} - E_t dR^*_{t+1} \right). \tag{12}$$

Since the RAUEP nests both the RUEP and the UEP, we will formally test two hypotheses: whether time-varying RA condition plays a significant role in the relationship between exchange rate movements and return differentials unlike the UEP ($H_0 : a_2 = a_3 = a_4 = a_5 = 0$) or the RUEP ($H_0 : a_3 = a_4 = a_5 = 0$).

3.2 Data

We examine the relevance of the RAUEP for 29 countries from January 1 1999 to December 31 2015. We select the countries from the list of countries in Curcucu et al. (2014): 13 advanced countries (Australia, Canada, Denmark, Israel, Japan, Korea, Norway, Singapore, Sweden, Switzerland, Taiwan, United Kingdom, and Euro) and 16 emerging market countries (Brazil, Chile, Colombia, Czech Republic, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, and Turkey). The data commence with the birth of Euro. We will consider weekly returns and exchange rate changes, but other frequencies will also be examined. All equity indexes and exchange rates are obtained from Bloomberg. U.S. dollar is used as a base currency to express exchange rates. U.S. equity market is used as a representative foreign equity market. We use the VIX as a proxy variable for the RA condition.[7] The VIX is transformed to have zero mean and unity variance and then its sign is reversed so that an increase in the transformed VIX represent s a stronger RA.

3.3 Estimation of the RAUEP model

According to the RAUEP model, the RA condition affects the relationship between exchange rates and equity returns. Before estimating the RAUEP model, we provide preliminary evidences that are supportive for the RAUEP. Table 1 shows the correlation between exchange rate changes and equity return differentials with weekly frequency. For all sample days ('All'), we observe negative correlations, which implies that domestic currency appreciation tends to be associated with an outperformance of domestic equity market relative to foreign equity market, in 17 countries (out of 29 countries). We also show correlation coefficients for the days with weak RA (below the 20th percentile) ('Low') and the days with high RA (above the 80th percentile) ('High'). If the RAUEP model holds, we expect that the RA condition will systematically affect the three correlation coefficients for each currency. We take the difference in correlation coefficients between 'All' and 'Low', and 'High' and 'All' and calculate the product of the two differences to see whether the product is positive or not. The product with positive sign implies that the RA condition tends to affect correlation in the same direction. The result shows the occurrence of positive signs in most cases (22 out of 29), which the RA condition can play a role in associating exchange rate movements with equity returns.

We estimate the RAUEP using GMM. We believe that the GMM technique is appropriate because the RAUEP stipulates a first moment condition which can be efficiently utilized for estimation within the GMM framework. We use as instruments the lagged returns of equities from the sample countries.

[7]The VIX has been utlized as a proxy for the level of investor risk aversion or market sentiment. Refer to, for example, Brunnermeier et al. (2008) and Bekaert et al. (2013).

Table 2 shows the estimation results of the UEP (equation (12)) and the RUEP (equation (11)) with weekly frequency. The return differentials are statistically significant in 13 countries (out of 29 countries) in the estimation results of the UEP among which domestic currency depreciation is associated with negative return differentials in 10 countries. Hau and Rey (2006) argue that domestic currency depreciation is associated with higher returns in the domestic equity market relative to the foreign market (i.e., positive return differentials). Our estimation results show evidences that are not supportive for the prediction by Hau and Rey (2006).

The estimation results of the RUEP show that the variable added into the UEP is statistically significant in most countries (19 out of 29) which implies that the "market risk" plays a significant role in associating exchange rate changes with asset returns. This improvement of the RUEP relative to the UEP is consistent with Kim (2011).

Table 3 shows the estimation results of the RAUEP (equation (10)) and also the results of two hypothesis tests. The variables added into the (R)UEP to capture the role of the RA condition are statistically significant in many countries. While the variable K_t in (10) is statistically significant only in a small number of cases (7 out of 29), two interaction terms $K_t (r_t - r_t^*)$ and $K_t r_t^*$ are statistically significant in 11 and 15 countries out of 29 sample countries. We examine the relevance of the RAUEP by formally testing two hypotheses: $H_0 : a_2 = a_3 = a_4 = a_5 = 0$ for comparison with the UEP and $H_0 : a_3 = a_4 = a_5 = 0$ for comparison with the RUEP. The null hypothesis is rejected for comparison between the RAUEP and the UEP in most cases (21 out of 29 cases). The RAUEP also performs better than the RUEP in most cases (15 out of 29 cases).

For comparison, we also estimate the usual UIP model which links exchange rate changes with interest rate differentials according to the following estimation model:

$$s_t = a_0 + a_1 (i_t - i_t^*) + \varepsilon_t, \tag{13}$$

where domestic and foreign interest rates are denoted by i_t and i_t^*, respectively. Table 4 shows the estimation results of the UIP (equation (13)). Consistent with prior studies, domestic currency depreciation is associated with relatively higher domestic interest rates in only few cases (1 out of 27 countries).[8]

3.4 Robustness

The above estimation results imply the importance of the RA condition in the relationship between exchange rate changes and equity returns. In this subsection, we check the robustness of the results by conducting several sensitivity analyses.

3.4.1 Data frequency

Table 5 shows the estimation results of the RAUEP with monthly returns and domestic currency depreciations. The added variables in the RAUEP are statistically significant in fewer countries than the weekly frequency case: $K_t (r_t - r_t^*)$ and $K_t r_t^*$ are statistically significant in 8 and 13 countries. Interestingly, however, the RAUEP performs better than the UEP and the RUEP in more cases (28 and 18 out of 29 cases, respectively), compared to those with weekly frequency.

3.4.2 Alternative risk appetite measure

The transformed VIX is used as a proxy variable of the RA condition in our analysis. Even though the VIX has been a widely-used market sentiment indicator, other indicators have been proposed to measure RA conditions. Some are atheoretic but others are model-based.[9] For example, Gai and Vause (2006) propose a method of measuring RA based on the variation in the ratio of risk-neutral to subjective probabilities and use equity index option prices to calculate the measure. Kumar and Persaud (2002) propose the idea that the rank of excess returns of risky assets would change if risks change, but it would not change if RA changes and use several currency returns to calculate the measure. Misina (2008) and Pericoli and Sbracia (2009) investigate identification issues of the RA measure proposed by Kumar and Persaud (2002). In particular, Misina (2008) propose a new indicator (named as RAI-MI) by

[8] Due to data availability, two countries (Indonesia and Philippines) are excluded, and several countries are examined with shorter sample periods.

[9] For surveys of atheretic and model-based measures of risk appetite, refer to IMF (2002, box 3.1), Gai and Vause (2004), and Illing and Meyer (2005).

modifying the Kumar and Persaud's (2002) measure to overcome the identification problem. More recently, Bekaert and Hoerova (2016) propose a statistical method to uncover both time-varying risk aversion and economic uncertainty from observed asset prices.

In this sensitivity analysis, we calculate the RA measure proposed by Misina (2008) and use it to investigate whether or not the results would still hold for the alternative measure. For the implementation, we use daily exchange rates and three-month forward rates for 16 countries: Australia, Canada, Czech Republic, Denmark, Euro, Hong Kong, Great Britain, Japan, Mexico, Norway, New Zealand, the Philippines, Poland, South Africa, Sweden, and Switzerland. The sample countries are selected by following Kumar and Persaud (2002) and Misina (2008). To be consistent with the transformed VIX, we also transform the RAI-MI to have zero mean and unity variance and then reverse its sign.

Table 6-1 shows the estimation results of the RAUEP with the transformed RAI-MI. The RAUEP performs better than the UEP in most cases (18 out of 29 countries) but better than the RUEP in fewer cases (10 out of 29 countries). The added variables in the RAUEP also are statistically significant in fewer cases: the K_t, $K_t\left(r_t - r_t^*\right)$ and $K_t r_t^*$ are statistically significant in 4, 5, and 9 cases, respectively, out of 29 cases.

Differences in the dynamics of both RA measures may be attributable to the fact that the role of individual variables related with RA condition depends upon the choice of RA measure. Indeed, the transformed VIX and the transformed RAI-MI index exhibit weakly correlated movements as illustrated in Figure 1. For the whole sample period, the correlation coefficient between the two indicators is only 0.1415. Even though this positive correlation was accentuated during the global financial period (8/1/2007 - 12/31/2009) with correlation coefficient of 0.5928 while the correlation was only 0.0630 and 0.0633 during the pre- and post-crisis period, respectively. This difference in the dynamics of both RA measures may stem from their implementations: the VIX is constructed based on U.S. equity market while the RAI-MI index is constructed based on multiple currency markets.

We obtain similar results with another RA measure for which we use the market sentiment index proposed by Baker and Wurgler (2006). Table 6-2 shows the results with monthly frequency. With this alternative RA measure, the RAUEP performs better than the UEP in most cases (22 out of 29 countries) but better than the RUEP in fewer cases (11 out of 29 countries). The added variables in the RAUEP also are statistically significant in fewer cases: the K_t, $K_t(r_t - r_t^*)$ and $K_t r_t^*$ are statistically significant in 7, 10, and 8 cases, respectively, out of 29 cases.

Although this sensitivity analysis result poses us a problem: What is an appropriate RA indicator?, this issue is beyond the scope of this paper.

3.4.3 Alternative foreign equity return

We use U.S. equity (proxied by the S&P500 index) as a representative foreign asset in our analysis. In this sensitivity analysis, we change the representative foreign asset from the S&P500 index to the MSCI World stock index. Table 7 confirms that the baseline results are robust to this change. The added variables $K_t(r_t - r_t^*)$ and $K_t r_t^*$ in the RAUEP are statistically significant in 9 and 14 countries, respectively. The RAUEP also performs better than the UEP and the RUEP in 19 and 13 cases, respectively, out of 29 cases. These results are similar to those of the baseline case. This similarity in the results may stem from the fact that both equity indexes exhibit close co-movements as shown in Figure 2. Indeed, the correlation coefficient between the two equity returns is fairly high (0.8918) during the whole sample period.

3.4.4 Sub-period analysis

Our sample period includes the global financial crisis period, and we may suspect that structural breaks may occur during the sample period. We divide the sample period into three sub-periods: pre-crisis period (4/3/2000 - 7/31/2007), crisis period (8/1/2007 - 12/31/2009), and post-crisis period (1/1/2010 - 12/31/2015). Table 8 shows the estimation results of the RAUEP for each of three sub-periods. During the pre-crisis period (Table 8-1), the RAUEP performs better than the RUEP in only few cases (6 out of 29 cases). The added variables K_t, $K_t(r_t - r_t^*)$ and $K_t r_t^*$ in the RAUEP are statistically significant in 4, 5 and 3 countries, respectively. By contrast, the RAUEP performs better than the UEP and the RUEP in 28 and 26 countries during the crisis period and the post-crisis period. The added variables in the RAUEP are also statistically significant in more countries: 15, 20, and 15 countries for the K_t, $K_t\left(r_t - r_t^*\right)$ and $K_t r_t^*$, respectively. During the post-crisis period, the role of the RA is less significant than that during the crisis period but more significant than that during the pre-crisis period. the RAUEP performs better than the UEP and the RUEP in 22 and 11 countries, and the added variables in the RAUEP are also statistically significant in 8, 7, and 8 countries for the K_t, $K_t\left(r_t - r_t^*\right)$ and $K_t r_t^*$, respectively. Overall, this sensitivity analysis suggests that the RA condition tends to play a larger role when it exhibits volatile fluctuations.

3.4.5 Time-series regression

To supplement the estimation results with GMM, we present in Table 9 the estimation results with the following time-series regression:

$$s_t = a_0 + a_1\left(r_t - r_t^*\right) + a_2 r_t^* + a_3 K_t + a_4 K_t\left(r_t - r_t^*\right) + a_5 K_t r_t^* + \varepsilon_t, \tag{14}$$

where s_t denotes the domestic currency depreciation, and r_t and r_t^* are the returns of domestic and foreign equities, respectively. In the time-series regression, the RAUEP also performs better than the UEP and the RUEP in 29 and 9 countries with weekly data. The added variables K_t, $K_t\left(r_t - r_t^*\right)$ and $K_t r_t^*$ in the RAUEP are statistically significant in 1, 7 and 13 countries, respectively. Interestingly, the RAUEP more significantly outperforms the UEP and the RUEP with monthly data (i.e., in 27 and 18 countries, respectively). The added variables K_t, $K_t\left(r_t - r_t^*\right)$ and $K_t r_t^*$ in the RAUEP are also significant in 1, 6 and 17 countries, respectively.

3.5 Portfolio approach

In this subsection, we use a portfolio approach to provide additional evidences about the RAUEP model. We take the US as the reference investor country and calculate equity returns in the US dollar (i.e., domestic equity returns minus domestic currency depreciations) which are denoted by $y_{i,t}$ for country i at time t. We then construct the following three simple forecasting models for equity returns:

$$y_{i,t+1} = b_{i,0} + b_{i,1}y_{i,t} + b_{i,2}K_{t+1} + \epsilon_{i,t+1}, \tag{15}$$

$$y_{i,t+1} = b_{i,0} + b_{i,1}y_{i,t} + b_{i,2}K_{t} + \epsilon_{i,t+1}, \tag{16}$$

$$y_{i,t+1} = b_{i,0} + b_{i,1}y_{i,t} + \epsilon_{i,t+1}. \tag{17}$$

The forecasting model (17) (No-RA) utilizes only the current realized equity return of a country for predicting the country's next-period equity return. The forecasting model (16) (Predictive-RA) additionally utilizes the current RA level for the prediction. Lastly, the forecasting model (15) (Contemporaneous-RA) utilizes the next-period RA level for predicting the next-period equity return. Although the forecasting model (15) is unrealistic. Comparisons between (16) and (15) may shed some light about whether the RA plays a role in contemporaneously associating exchange rates changes and equity returns. Similarly, comparisons between (17) and (16) may be useful for judging a predictive role of the RA in associating exchange rates changes and equity returns. Once the next-period equity return forecasts are obtained for each country, we then form a zero-cost portfolio by taking equal-weighted long position on the equities belonging to top 20% (6 countries in our analysis) of the sorted equity return forecasts and also by taking equal-weighted short position on the equities belonging to the bottom 20%.

In addition, we also consider two popular non-parametric portfolio strategies: momentum and contrarian. The momentum portfolio is formed by buying top 20% and selling bottom 20% according to the current returns (instead of the forecasts) while the contrarian portfolio is oppositely formed by selling top 20% and buying bottom 20%. We rebalance the five portfolios every period (i.e., weekly or monthly). We calculate the portfolio returns net of transaction costs which are obtained from Cenedese et al. (2016).

Table 10 shows the summary statistics of the annualized returns (%) of the five portfolios for both weekly and monthly rebalances from January 2003 to December 2015. (For initial estimation for the prediction, we use the data for the first three years). Figure 3 illustrates the cumulative returns of the three portfolios (excluding both momentum and contrarian portfolios). A simple market-timing strategy (No-RA) generates annualized mean return of -0.31% for weekly and 2.17% for monthly rebalancing over the sample period. On the other hand, both of the popular non-parametric strategies incurred huge amount of losses for both rebalancing periods. Interestingly, the Predictive-RA portfolio yields negative net returns whereas the Contemporaneous-RA portfolio generates a high level of positive net returns: annualized mean returns of 7.69% and 7.21% for weekly and monthly rebalancing, respectively.

To judge whether the portfolios significantly differ from each other, we follow DeMiguel, Garlappi, and Uppal (2009) and utilize two measures for performance evaluation: certainty-equivalent return (CEQ) and Sharpe ratio (SR). Table 11 shows the p-values for null hypotheses that two portfolios equally perform and against alternative hypotheses that a portfolio outperforms the other.[10] The No-RA portfolio significantly outperforms the Predictive-RA portfolio for both rebalancing periods and for both performance measures (with $\gamma = 3$ for the CEQ measure). On the other hand, the Contemporaneous-RA portfolio performs better than both the Predictive-RA and the No-RA portfolios. These formal hypothesis testing results statistically confirm the results shown in Table 10 and Figure 3.

Overall, the evidences elicited from the portfolio approach imply that although the RA plays an important role in contemporaneously associating exchange rate changes with equity returns, the RA does not have a predictive role. Interestingly, this result is consistent with Egbers and Swinkels (2015) who also argue that the implied volatility of equity and currency market is a strong contemporaneous but weak predictive indicator of returns on currency carry investments.

4 Financial market instability

The above empirical results about the RAUEP model emphasizes the role of RA in associating exchange rate changes with equity returns. The importance of RA in the context of the dynamics of exchange rates and equity returns may have profound implications in several aspects. In this section, we explore its implications on financial market instability. The issue of financial market instability has been of great interest not only to market practitioners but

[10] The p-values are calculated using the method of DeMiguel, Garlappi, and Uppal (2009).

also to policy makers and, of course, academics.

We often observe that not only market participants but also policy makers are more concerned over financial market instability when multiple financial markets simultaneously plunge. To capture the simultaneous plunges in multiple financial markets, we employ the "coexceedances" proposed by Bae et al. (2003) and use it as an indicator of financial market instability. More specifically, we define a negative exceedance of domestic equity market if the equity return lies below the 5th percentile of the marginal return distribution. Likewise, the negative exceedance of domestic currency is defined if its depreciation lies below the 5th percentile. The positive exceedances are defined as the events of exceeding the 95th percentile. The negative (positive) coexceedances are defined by the events of simultaneous occurrences of the two negative (positive) exceedances. Clearly, negative coexceedances are of great interest in the context of financial market instability.

Table 12 shows the occurrences of negative and positive coexceedances not only for all sample days but also for the days with weak RA and for the days with strong RA. The (unconditional) negative coexceedances occurred on average 0.96% of the sample days. By contrast, the conditional negative coexceedances occurred on average 3.31% of the days with weak RA while they occurred only on average 0.13% of the days with strong RA. This result implies that RA condition plays an important role not only in associating exchange rates with equity returns but also in identifying financial market instability. Specifically, financial market instability is likely to occur when RA is weak, and therefore policy makers should pay more attention on the possibility of financial market instability during weak RA periods. Another policy implication may be elicited from this result. The RA is typically perceived as a common factor but not a country-specific factor, which implies that domestic financial markets cannot be fully insulated from foreign shocks but are subject to them. Therefore, policy makers should also be cautious about foreign shocks and their contagious effects on their domestic markets in order to maintain their financial market stability. Interestingly, the positive coexceedances also tend to occur more frequently during weak RA periods than during strong RA periods. This fact is attributable to a relatively high volatility during weak RA periods. Both negative and positive coexceedances can occur more frequently during highly volatile periods.

Our empirical results suggest that RA condition is closely linked with financial market instability. If the RA condition tends to persist, then the current RA condition may help us to predict future financial market instabilities. We construct a simple prediction model and use it to investigate whether the current RA condition is useful for predicting financial market instability. To this end, we first construct a dummy variable D_t for the occurrence of financial market instability which takes one if coexceedances occur at least once from $t - h$ to t and takes zero otherwise, given a fixed horizon h which is set as one week or one month in this analysis. Then, we employ a logistic regression as a prediction model as follows:

$$\log \frac{p_{t+h}}{1 - p_{t+h}} = a_0 + a_1 D_t + a_2 K_t + a_3 K_t D_t, \tag{18}$$

where p_{t+h} ($\equiv \Pr[D_{t+h} = 1]$) denotes the probability of the occurrence of financial market instability within the horizon, and the dependent variable represents the logit transform of the probability.

Table 13 shows the estimation results of the logistic prediction model (equation (18)) of financial market instability the horizon of one week and the p-value for hypothesis testing for the null hypothesis ($H_0 : a_2 = a_3 = 0$) to investigate whether or not the current RA condition is useful for predicting financial instability. The current RA condition is statistically significant in all cases, and the interaction term $K_t D_t$ is statistically significant in most cases (20 out of 29 cases). The null hypothesis is rejected in all cases. Overall, these empirical results provide evidences supporting the usefulness of the current RA condition for predicting financial instability. We also obtain similar results with one month horizon.[11]

5 Conclusion

In this paper, we emphasize the role of risk appetite in associating exchange rate movements with equity returns. Instead of the usual risk-averse investors, we assume investors who are affected by risk appetite in their international portfolio decision. The shift in risk appetite may amplify or dampen the impacts of equity return differentials on exchange rate changes.

[11] The results are omitted for brevity but are available from the authors upon request.

We apply our theoretical results into multi-country real data and find empirical evidences that are supportive of the role of risk appetite in the association of exchange rate changes with equity returns. In particular, the relationship between exchange rate movements and equity returns is dependent upon risk appetite condition and thus time-varying. Moreover, the empirical results are robust to several sensitivity analyses.

Our findings may have profound implications in several aspects. In this paper, we explore its implication on financial market instability. We find that financial market instability is more closely associated with weaker risk appetite. This fact is useful not only for the characterization of financial market instability but also for its prediction.

Our results can be extended in several directions in the future. First, our model suggests that risk appetite also plays a role in capital flows associated with international portfolio investments. Thus, it is worthwhile to examine the role of risk appetite in explaining international portfolio capital flows. Second, the role of risk appetite in the association of exchange rates and equity returns may greatly differ across countries. It would be beneficial to find out the determinants of differential impacts of risk appetite. Third, our model suggests that risk appetite affects exchange rate dynamics. This fact may be utilized for currency hedging decision or international portfolio decision. Thus, it would be of great interest to global equity investors to investigate whether or not the fact is useful to create a profitable trading strategy.

Appendix A. Risk Appetite and Portfolio Choice in an Endowment Economy

In this Appendix, we consider a decision problem of consumption and portfolio investments into assets for a representative agent in an endowment economy within a static framework. The representative agent receives the current endowment A_t and also will receive the next-period stochastic endowment A_{t+1}. Given a utility function $U(\cdot)$, the agent tries to maximize the sum of the discounted utilities which come from his/her inter-temporal consumptions by appropriately choosing the current consumption and investments. The decision problem is formalized as follows:

$$\max_{\{C_t,p,q\}} U(C_t) + E\beta U(C_{t+1}) \tag{A1}$$

subject to the following resource constraints:

$$\begin{aligned} C_t + pP_t + qQ_t &= A_t, & \text{(A2)} \\ A_{t+1} + pP_{t+1} + qQ_{t+1} &= C_{t+1}, & \text{(A3)} \end{aligned}$$

where C indicates consumption, $\beta\,(< 1)$ time discount rate, $E(\cdot)$ expectation operator conditional upon the information available to time t. Two risky assets are available for investments. Their current prices are denoted by P_t and Q_t, and p and q indicate the number of units to invest, respectively. In this setting, the current endowment level A_t may be interpreted as a macroeconomic condition. Although the expectation about A_{t+1} can affect the consumption-investment decision, we will focus on the effect of the current economic condition. Further, we argue that the RA is related with the current economic condition A_t in this setting. Indeed, Gai and Vause (2006) suggest that the RA is determined not only by the degree to which investors dislike uncertainty (*risk aversion*) but also by the level of uncertainty about consumption prospects which depends upon the macroeconomic condition. Although the risk aversion is unlikely to change over time, the RA may shift as investors respond to macroeconomic uncertainty.

The optimal decisions can be found by solving the following Euler equations:

$$E\left[\frac{U'(C_{t+1})}{U'(C_t)}\frac{P_{t+1}}{P_t}\right] = \beta^{-1}, \tag{A4}$$

$$E\left[\frac{U'(C_{t+1})}{U'(C_t)}\frac{Q_{t+1}}{Q_t}\right] = \beta^{-1}. \tag{A5}$$

For analytical tractability, we assume a log utility $U(C) = \log C$. Then, the intertemporal marginal rate of substitution (IMRS) $U'(C_{t+1})/U'(C_t)$ is simplified to C_t/C_{t+1}. Further, we approximate the IMRS as

$$\frac{C_t}{C_{t+1}} \approx 2 - \frac{C_{t+1}}{C_t}. \tag{A6}$$

Clearly, the approximation error is close to zero around unity IMRS.

By plugging the approximate IMRS into the Euler equations $(A4)$ and $(A5)$, we obtain

$$E\left[\left[2 - \frac{C_{t+1}}{C_t}\right]\frac{P_{t+1}}{P_t}\right] = \beta^{-1}, \tag{A7}$$

$$E\left[\left[2 - \frac{C_{t+1}}{C_t}\right]\frac{Q_{t+1}}{Q_t}\right] = \beta^{-1}. \tag{A8}$$

Substituting $(A3)$ into $(A7)$ and $(A8)$ and solving them for the risky asset demands p and q, we obtain

$$\begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} a_0 C_t + a_1 \\ b_0 C_t + b_1 \end{bmatrix} \tag{A9}$$

with

$$
\begin{aligned}
a_0 &\equiv \frac{E\left[Q_{t+1}^2\right]\left[2E\left[P_{t+1}\right]-P_t\beta^{-1}\right]-E\left[P_{t+1}Q_{t+1}\right]\left[2E\left[Q_{t+1}\right]-Q_t\beta^{-1}\right]}{E\left[P_{t+1}^2\right]E\left[Q_{t+1}^2\right]-E\left[P_{t+1}Q_{t+1}\right]^2}, \\
a_1 &\equiv \frac{E\left[Q_{t+1}^2\right]E\left[A_{t+1}P_{t+1}\right]-E\left[P_{t+1}Q_{t+1}\right]E\left[A_{t+1}Q_{t+1}\right]}{E\left[P_{t+1}^2\right]E\left[Q_{t+1}^2\right]-E\left[P_{t+1}Q_{t+1}\right]^2}, \\
b_0 &\equiv \frac{E\left[P_{t+1}^2\right]\left[2E\left[Q_{t+1}\right]-Q_t\beta^{-1}\right]-E\left[P_{t+1}Q_{t+1}\right]\left[2E\left[P_{t+1}\right]-P_t\beta^{-1}\right]}{E\left[P_{t+1}^2\right]E\left[Q_{t+1}^2\right]-E\left[P_{t+1}Q_{t+1}\right]^2}, \\
b_1 &\equiv \frac{E\left[P_{t+1}^2\right]E\left[A_{t+1}Q_{t+1}\right]-E\left[P_{t+1}Q_{t+1}\right]E\left[A_{t+1}P_{t+1}\right]}{E\left[P_{t+1}^2\right]E\left[Q_{t+1}^2\right]-E\left[P_{t+1}Q_{t+1}\right]^2}.
\end{aligned}
$$

We determine the current consumption C_t by substituting $(A9)$ into the resource constraint $(A2)$ as follows:

$$
C_t = \left[1 + P_t a_0 + Q_t b_0\right]^{-1}\left[A_t - P_t a_1 - Q_t b_1\right]. \tag{A10}
$$

Finally, we obtain the risky asset demands p and q by plugging $(A10)$ into $(A9)$ as follows:

$$
\begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} \widetilde{a}_0 A_t + \widetilde{a}_1 \\ \widetilde{b}_0 A_t + \widetilde{b}_1 \end{bmatrix}, \tag{A11}
$$

where

$$
\begin{aligned}
\widetilde{a}_0 &\equiv \frac{a_0}{1 + P_t a_0 + Q_t b_0}, \\
\widetilde{a}_1 &\equiv -\frac{a_0}{1 + P_t a_0 + Q_t b_0}\left[P_t a_1 + Q_t b_1\right] + a_1, \\
\widetilde{b}_0 &\equiv \frac{b_0}{1 + P_t a_0 + Q_t b_0}, \\
\widetilde{b}_1 &\equiv -\frac{b_0}{1 + P_t a_0 + Q_t b_0}\left[P_t a_1 + Q_t b_1\right] + b_1.
\end{aligned}
$$

Remarkably, the risky asset demands p and q linearly depend upon the current endowment level A_t (i.e., the RA in this setting).

Appendix B. Linear Approximation of the Modified UEP Model

We will linearly approximate the modified UEP (8) with respect to the RA around the long-run RA level $\overline{K}$. By applying the first-order Taylor approximation, we obtain the following linear approximation:

$$\begin{aligned}\frac{-\lambda K_t \Delta_2}{1-\lambda K_t \Delta_1} &\approx \frac{-\lambda \overline{K} \Delta_2}{1-\lambda \overline{K} \Delta_1} - \frac{\lambda \Delta_2}{1-\lambda \overline{K} \Delta_1}\left(K_t - \overline{K}\right) + \frac{\lambda^2 \overline{K} \Delta_2 \Delta_1}{\left(1-\lambda \overline{K} \Delta_1\right)^2}\left(K_t - \overline{K}\right) \\ &= c_0 + c_1 K_t \qquad \text{(B1)}\end{aligned}$$

with

$$\begin{aligned} c_0 &\equiv -\frac{\lambda^2 \Delta_2 \Delta_1}{\left(1-\lambda \overline{K} \Delta_1\right)^2} \overline{K}^2, \\ c_1 &\equiv -\frac{\lambda \Delta_2}{1-\lambda \overline{K} \Delta_1} + \frac{\lambda^2 \overline{K} \Delta_2 \Delta_1}{\left(1-\lambda \overline{K} \Delta_1\right)^2}. \end{aligned}$$

The η and Δ terms in (8) are stable over time and thus assumed as time-invariant. By adding a constant term c_2 into the bracket in (8) and substituting $(B1)$ into (8), the modified UEP (8) is linearly approximated as follows:

$$\begin{aligned} E_t dS_{t+1} &= a_0 + a_1 \left(E_t dR_{t+1} - E_t dR^*_{t+1}\right) + a_2 E_t dR^*_{t+1} \qquad \text{(B2)} \\ &\quad + a_3 K_t + a_4 K_t \left(E_t dR_{t+1} - E_t dR^*_{t+1}\right) + a_5 K_t E_t dR^*_{t+1} \end{aligned}$$

with

$$\begin{aligned} a_0 &\equiv c_0 c_2;\ a_1 \equiv c_0;\ a_2 \equiv c_0 (1-\eta), \\ a_3 &\equiv c_1 c_2;\ a_4 \equiv c_1;\ a_5 \equiv c_1 (1-\eta). \end{aligned}$$

References

[1] Alper, C., O. Ardic, S. Fendoglu, 2009. The economics of the uncovered interest parity condition for emerging market. Journal of Economic Survey 23 (1), 115–138.

[2] Bansal, R., M. Dalquist, 2000. The forward premium puzzle: Different tales from developed and emerging economies. Journal of International Economics 51, 115–144.

[3] Bae, K-H., G.A. Karolyi, R.M. Stulz, 2003. A new approach to measuring financial contagion. Review fo Financial Studies 16 (3), 717-763.

[4] Baker, M., J. Wurgler, 2006. Investor sentiment and the cross-section of stock returns. Journal of Finance 61, 1645-1680.

[5] Bekaert, G., C. Harvay, R. Lumsdaine, 2002. Dating the integration of World equity markets. Journal of Financial Economics 62 (2), 203–247.

[6] Bekaert, G., M. Hoerova, M.L. Duca, 2013. Risk, uncertainty and monetary policy. Journal of Monetary Economics 60, 771–88.

[7] Bekaert, G., M. Hoerova, 2016. What do asset prices have to say about risk appetite and uncertainty? Journal of Banking and Finance 67, 103–118.

[8] BIS, 2015. BIS Quarterly Review - International Banking and Financial Market Developments, Bank for International Settlements, March, Basel.

[9] Bohn, H., L.L. Tesar, 1996. U.S. equity investment in foreign markets: Portfolio rebalancing or return chasing? American Economic Review 86, 77–81.

[10] Brunnermeier, M.K., S. Nagel, L.H. Pedersen, 2008. Carry trades and currency crashes. NBER Macroeconomics Annual 23, 313-347.

[11] Cappiello, L., R. De Santis, 2005. Explaining exchange rate dynamics: The uncovered equity return parity condition. ECB Working Paper 529.

[12] Cappiello, L., R. De Santis, 2007. The uncovered return parity condition. ECB Working Paper 812.

[13] Cenedese, G., R. Payne, L. Sarno, G. Valente, 2016. What does stock markets tell us about exchange rates? Review of Finance 20 (3), 1045-1080.

[14] Chabot, B., E. Ghysels, R. Jagannathan, 2014. Momentum trading, return chasing, and predictable crashes. National Bureau of Economic Research Working paper, Cambridge, MA.

[15] Cheung, Y-W., M.D. Chinn, A.G. Pascual, 2005. Empirical exchange rate models of the nineties: are any fit to survive? Journal of International Money Finance 24, 1150-1175.

[16] Chinn, M., 2006. The rehabilitation of interest parity in the floating rate Era: Longer horizons, alternative expectations, and emerging markets. Journal of International Money and Finance 25, 7–21.

[17] Chinn, M., G. Meredith, 2004. Monetary policy and long horizon uncovered interest parity. IMF Staff Papers 51 (3), 409–430.

[18] Cho, J-W., J.H. Choi, T. Kim, W. Kim, 2016. Flight-to-quality and correlation between currency and stock returns. Journal of Banking and Finance 62, 191-212.

[19] Cochrane, J., 2005. Asset Pricing. Princeton University Press, Princeton.

[20] Curcucu, S.E., C.P. Thomas, F.E. Warnock, J. Wongswan, 2014. Uncovered equity parity and rebalancing in international portfolios. Journal of International Money and Finance 47, 86-99.

[21] DeMiguel, V., Garlappi, L., Uppal, R., 2009. Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy? Review of Financial Studies 22, 1915–1953.

[22] Dunne, P., H. Hau, M. Moore, 2010. International order flows: Explaining equity and exchange rate returns. Journal of International Money and Finance 29, 358-386.

[23] Egbers, T., L. Swinkels, 2015. Can implied volatility predict returns on the currency carry trade? Journal and Banking anf Finance 59, 14-26.

[24] Engel, C., 1996. The forward discount anomaly and the risk premium: A survey of recent evidence. Journal of Empirical Finance 3, 123–192.

[25] Evans, M., R. Lyons, 2002. Order flow and exchange rate dynamics. Journal of Political Economy 110 (1), 170-180.

[26] Ferreira, A., M. Leon-Ledesma, 2007. Does the real interest rate parity hold? Evidence for emerging and developing countries. Journal of International Money and Finance 26 (3), 364–382.

[27] Filipe, S.F., 2012. Equity order flow and exchange rate dynamics. Journal of Empirical Finance 19 (3), 359-381.

[28] Flood, R., A. Rose, 1996. Fixes of the forward discount puzzle. Review of Economics and Statistics 78 (4), 748–752.

[29] Flood, R., A. Rose, 2002. Uncovered interest parity in crisis. IMF Staff Papers 49, 252–266.

[30] Froot, K., D.S. Scharfstein, J.C. Stein, 1992. Herd on the street: Informational inefficiencies in a market with short-term speculation, Journal of Finance 47, 1461–1484.

[31] Froot, K., R. Thaler, 1990. Anomalities: foreign exchange. Journal of Economic Perspectives 4, 179–192.

[32] Gai, P., N. Vause, 2004. Risk Appetite: Concept and measurement. Financial Stability Review, Bank of England, December, London.

[33] Gai, P., N. Vause, 2006. Measuring investors' risk appetite. International Journal of Central Banking 2, 167-188.

[34] Goh, S., G. Lim, N. Olekalns, 2006. Deviations from the uncovered interest parity in Malaysia. Applied Financial Economics 16, 745–759.

[35] Griffin, J.M., F. Nardari, R.M. Stulz, 2004. Are daily cross-border equity flows pushed or pulled?, Review of Economics and Statistics 86, 641–657.

[36] Hau, H., H. Rey, 2006. Exchange rates, equity prices, and capital flows. Review of Financial Studies 19, 273-317.

[37] Illing, M., M. Aaron, 2005. A brief survey of risk-appetite indexes. Bank of Canada Financial System Review, 37-43.

[38] IMF, 2002. Global Financial Stability Report. International Monetary Fund, March, Washington DC.

[39] IMF, 2015. Global Financial Stability Report. International Monetary Fund, April, Washington DC.

[40] Kim, H., 2011. The risk adjusted uncovered equity parity. Journal of International Money and Finance 30, 1491-1505.

[41] Kumar, M.S., A. Persaud, 2002. Pure contagion and investors' shifting risk appetite: Analytical issues and empirical evidence. International Finance 5, 401-436.

[42] Lewis, K., 1995. Puzzles in international financial markets. In: Grossman, G., Logoff, K. (Eds.), The Handbook of International Economics, vol III. Elsevier Science, Amsterdam, 1913–1971.

[43] Meese, R., K. Rogoff, 1983. Empirical exchange rate models of the seventies: do they fit out of sample? Journal of International Economics 14, 3-24.

[44] Misina, M., 2008. Changing investors' risk appetite: Reality or fiction? Eurpean Journal of Finance 14, 489-501.

[45] Newey, W., K. West, 1987. A simple, positive semi-definite heteroscedasticity and autocorrelation consistent covariance matrix. Econometrica 55 (3), 703–708.

[46] Pericoli, M., M. Sbracia, 2009. Capital asset pricing model and the risk appetite index: Theoretical differences, empirical similarities and implementation problems. International Finance 12, 123-150.

[47] Poghosyan, T., E. Kocenda, P. Zemcik, 2008. Modeling foreign exchange risk premium in Armenia. Emerging Markets Finance and Trade 44 (1), 41–61.

[48] Reboredo, J.C., M.A. Rivera-Castro, A. Ugolini, 2016. Downside and upside risk spillover between exchange rates and stock prices. Journal of Banking and Finance 62, 76-96.

[49] Sachsida, A., R. Ellery Jr., J. Teixeria, 2001. Uncovered interest rate parity and the peso problem: the Brazilian case. Applied Economics Letters 8, 179–181.

[50] Sarno, L., 2005. Towards a solution to the puzzles in exchange rate economics: Where do we stand. Canadian Journal of Economics 38, 673–708.

Figure 1. The VIX and the RAI-MI.

The figure shows the VIX and the RAI-MI. Both measures are transformed to have zero mean and unity variance for comparison. The sign of the both measure are reversed to associate an increase in the measure with an increase in risk appetite. Refer to the text for the explanation about the RAI-MI indicator.

Figure 2. The S&P500 index and the MSCI World index.

The figure shows the U.S. S&P500 stock index and the MSCI World stock index. Both are normalized to 100 on January 1, 1999.

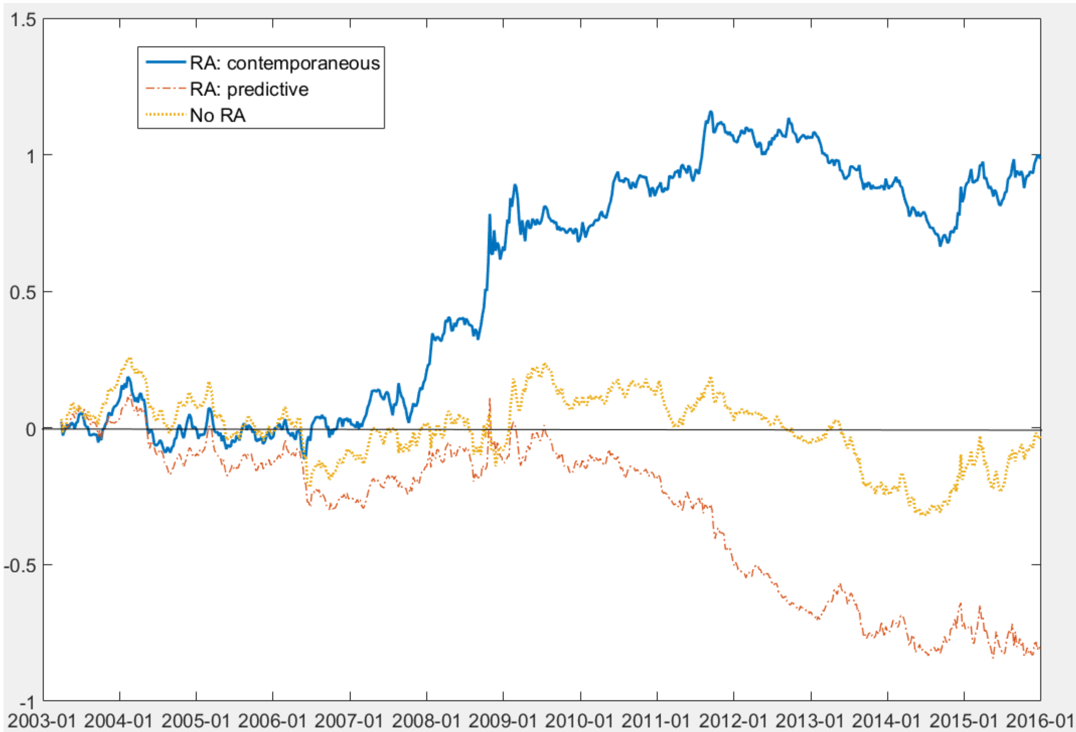

Figure 3-1. Cumulative portfolio returns: Weekly

The figure shows the cumulative returns of the three portfolios (excluding both momentum and contrarian portfolios). Refer to the text for the explanations about the portfolios.

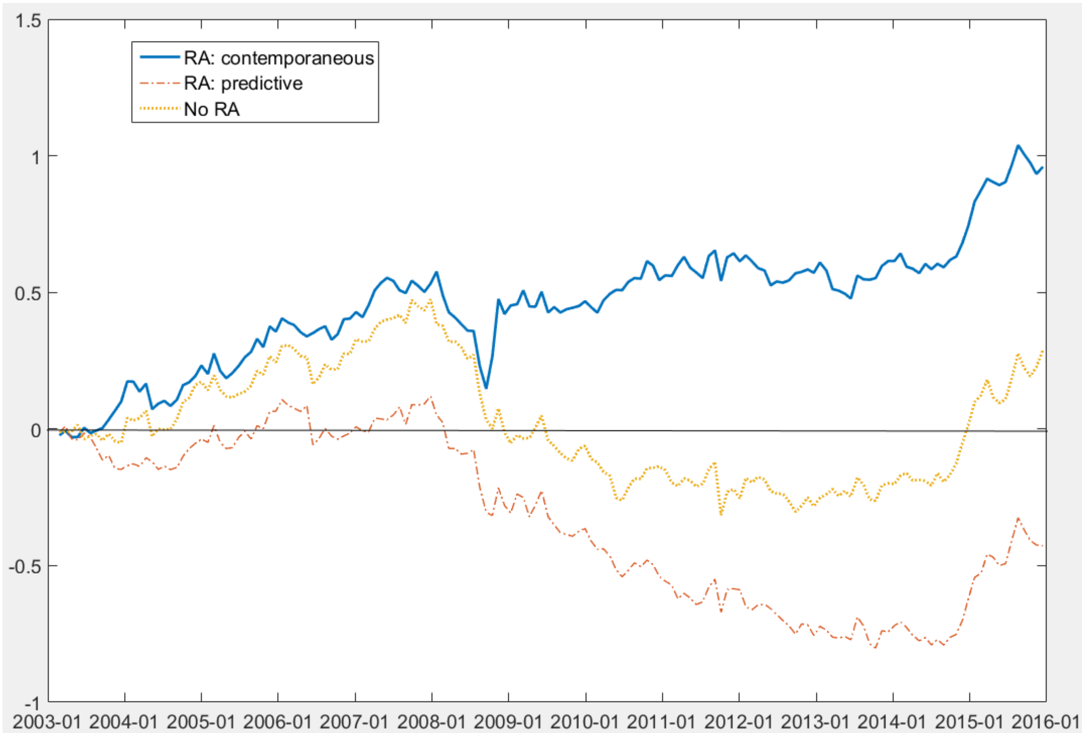

Figure 3-2. Cumulative portfolio returns: Monthly

The figure shows the cumulative returns of the three portfolios (excluding both momentum and contrarian portfolios). Refer to the text for the explanations about the portfolios.

Table 1. Correlation between exchange rate changes and equity return differentials

This table shows the correlation coefficient between exchange rate changes and equity return differentials for all sample days ('All'), for days with weak RA (below the 20th percentile) ('Low'), and for days with high RA (above the 80th percentile) ('High') with weekly frequency. * indicates statistical significance at 5% level. The difference in correlation coefficients between 'All' and 'Low', and 'High' and 'All', and the product of the two differences are also reported.

	All (a)	Low (b)	High (c)	All-Low (d=a-b)	High-All (e=c-a)	(All-Low)*(High-All) (d*e)
Australia	-0.2311*	-0.3513*	-0.0153	0.1202	0.2158	0.025946
Canada	0.0510	0.0946	-0.1453	-0.0436	-0.1964	0.008557
Denmark	0.1155*	0.0767	0.2084*	0.0388	0.0929	0.003606
Israel	0.0871*	0.2017*	-0.1066	-0.1146	-0.1937	0.022191
Japan	-0.0706*	-0.0023	-0.0883	-0.0683	-0.0177	0.001206
Korea	-0.1559*	-0.1260	-0.2739*	-0.0299	-0.1180	0.003523
Norway	-0.0835*	-0.1227	0.0397	0.0393	0.1232	0.004837
Singapore	-0.0140	0.0836	-0.1754*	-0.0977	-0.1614	0.015762
Sweden	0.0645	0.0945	0.2824*	-0.0300	0.2179	-0.006537
Switzerland	0.3142*	0.2737*	0.3600*	0.0405	0.0458	0.001856
Taiwan	-0.1947*	-0.1130	-0.3748*	-0.0817	-0.1800	0.014715
United Kingdom	0.1814*	0.1519*	0.3162*	0.0294	0.1348	0.003969
Euro	0.2872*	0.2862*	0.4747*	0.0011	0.1874	0.000199
Brazil	-0.4298*	-0.4308*	-0.4168*	0.0010	0.0129	0.000013
Chile	0.0953*	0.0773	0.0591	0.0180	-0.0362	-0.000650
Colombia	-0.0804*	0.0779	-0.1867*	-0.1583	-0.1063	0.016825
Czech Republic	0.0107	-0.0123	-0.0150	0.0230	-0.0257	-0.000590
Hungary	-0.1446*	-0.0944	-0.1977*	-0.0503	-0.0531	0.002668
India	-0.2476*	-0.2876*	-0.3388*	0.0401	-0.0913	-0.003656
Indonesia	-0.2577*	-0.2432*	-0.4484*	-0.0144	-0.1907	0.002754
Malaysia	0.1126*	0.2619*	-0.2963*	-0.1493	-0.4088	0.061051
Mexico	-0.0467	0.0158	-0.2621*	-0.0625	-0.2154	0.013466
Peru	0.0247	0.0030	-0.0291	0.0217	-0.0538	-0.001167
Philippines	-0.1302*	0.0152	-0.2955*	-0.1455	-0.1653	0.024050
Poland	-0.0905*	-0.0263	-0.2752*	-0.0642	-0.1847	0.011859
Russia	-0.4179*	-0.3774*	-0.3701*	-0.0405	0.0478	-0.001938
South Africa	0.2244*	0.2161*	0.0127	0.0083	-0.2117	-0.001764
Thailand	-0.2156*	-0.1194	-0.3579*	-0.0962	-0.1423	0.013693
Turkey	-0.2943*	-0.2311*	-0.5654*	-0.0632	-0.2711	0.017135

Table 2. Estimation results of the UEP and the RUEP.

This table shows the estimation results of the UEP (equation (12)) and the RUEP (equation (11)). * indicates statistical significance at 5% level. P-values of the J-statistic are reported.

	UEP			RUEP			
	a0	a1	p-value	a0	a1	a2	p-value
Australia	0.0006	0.1175	0.5042	0.0001	0.3741*	0.4737*	0.2931
Canada	-0.0004	-0.0305	0.4931	-0.0002	-0.2668*	-0.2069*	0.5043
Denmark	-0.0001	-0.1631*	0.6152	0.0001	-0.1655*	-0.1741*	0.4651
Israel	0.0000	0.0387	0.6540	0.0003	-0.1301*	-0.2937*	0.7042
Japan	0.0002	-0.0741	0.5228	0.0001	-0.0339	0.1527*	0.3769
Korea	-0.0002	-0.0954*	0.6418	0.0002	-0.0888*	-0.3076*	0.8122
Norway	-0.0004	0.0000	0.4999	0.0001	-0.3218*	-0.2240*	0.2909
Singapore	-0.0004*	-0.0481	0.6573	-0.0002	-0.0669*	-0.1936*	0.5632
Sweden	-0.0004	0.1335	0.7322	-0.0005	0.1501	0.0807	0.7202
Switzerland	-0.0008	0.1547	0.3415	-0.0011*	0.1539	0.2586*	0.5064
Taiwan	-0.0001	-0.0691*	0.9041	-0.0001	-0.0731*	-0.0209	0.8691
United Kingdom	-0.0002	-0.0672	0.7839	-0.0002	-0.0581	0.0204	0.7370
Euro	-0.0001	0.2449*	0.5561	-0.0001	0.2510*	-0.0373	0.4753
Brazil	0.0006	-0.3267*	0.8517	0.0009	-0.3314*	-0.3295*	0.7958
Chile	0.0002	0.1656	0.9352	0.0003	0.0876	-0.1951*	0.9373
Colombia	0.0003	-0.1555*	0.9110	0.0006	-0.1603*	-0.2034*	0.9190
Czech Republic	-0.0010	0.1216	0.7393	-0.0012*	0.1498	0.1390	0.7818
Hungary	-0.0007	0.0551	0.4122	-0.0001	0.0304	-0.2772*	0.3793
India	0.0002	0.0304	0.7825	0.0003	0.0114	-0.0692*	0.7526
Indonesia	0.0004	-0.1053*	0.9537	0.0005	-0.1436*	-0.0975	0.9469
Malaysia	-0.0001	0.0118	0.9963	-0.0001	0.0097	-0.0260	0.9912
Mexico	0.0000	0.2326*	0.8065	0.0005	0.1214	-0.2590*	0.8324
Peru	0.0001	0.1782*	0.8524	0.0006	0.0466	-0.2473*	0.8238
Philippines	-0.0001	0.0105	0.7593	-0.0001	0.0144	0.0108	0.7242
Poland	-0.0002	-0.3522*	0.8560	0.0008	-0.4923*	-0.5984*	0.6709
Russia	0.0007	-0.1571*	0.9921	0.0009*	-0.1785*	-0.1163	0.9798
South Africa	0.0004	0.0425	0.6162	0.0009	0.0186	-0.3044*	0.5191
Thailand	-0.0001	-0.0693*	0.3448	-0.0002	-0.0551*	0.0338	0.3420
Turkey	0.0010	-0.1257*	0.5368	0.0018*	-0.2048*	-0.3673*	0.4506

Table 3. Estimation results of the RAUEP.

This table shows the estimation results of the RAUEP (equation (10)). P-values for hypothesis testing for the null hypothesis ($H_0 : a_2 = a_3 = a_4 = a_5 = 0$) are denoted by 'UEP' and for the null hypothesis ($H_0 : a_3 = a_4 = a_5 = 0$) by 'RUEP'. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	0.0018*	0.1265	0.1182	-0.0015	-0.2391	-0.2254*	0.5086	0.0000*	0.0060*
Canada	-0.0004	-0.1756	-0.2194*	0.0019	0.1375*	-0.0012	0.6563	0.0000*	0.2029
Denmark	-0.0013*	-0.0118	0.0691	0.0009	0.0028	0.1523*	0.4251	0.0151*	0.0217*
Israel	0.0003	-0.0793	-0.2749*	-0.0006	0.0546	0.0238	0.5554	0.0020*	0.5423
Japan	0.0010*	-0.1172	-0.1566	0.0002	0.0078	-0.1358*	0.5504	0.0057*	0.0064*
Korea	-0.0011	0.0372	-0.0624	0.0035	0.2619*	0.1238*	0.8948	0.0000*	0.0000*
Norway	-0.0037*	-0.1807	0.0635	0.0052	0.4605*	0.5381*	0.9639	0.0300*	0.0344*
Singapore	-0.0009*	0.0147	0.0344	0.0023*	0.2049*	0.0846*	0.9916	0.0031*	0.0012*
Sweden	-0.0012	0.1169	0.0118	0.0038	0.5438*	0.0146	0.8049	0.0005*	0.0002*
Switzerland	-0.0017*	0.1135	0.3964*	0.0001	-0.0506	0.0938*	0.4259	0.0187*	0.0766
Taiwan	-0.0007	-0.0501	0.0390	0.0025*	0.0511	0.0940*	0.9122	0.0261*	0.0245*
United Kingdom	-0.0001	0.1400	0.0130	-0.0012	0.2641*	0.0440	0.7000	0.3546	0.2368
Euro	-0.0022*	0.3803*	0.2389	0.0046*	0.5529*	0.2380*	0.8998	0.0010*	0.0004*
Brazil	0.0023*	-0.3201*	-0.4438*	-0.0044*	0.0968	-0.1331*	0.8056	0.0337*	0.0479*
Chile	0.0012	0.0681	-0.2489	-0.0013	0.0774	-0.0954	0.8414	0.0387*	0.0430*
Colombia	0.0012	-0.1859*	-0.2503*	-0.0005	0.0956*	-0.0382	0.8081	0.0333*	0.0310*
Czech Republic	-0.0023*	0.1202	0.1483	0.0038	0.0035	0.1612*	0.6808	0.1232	0.0894
Hungary	-0.0026*	0.0182	0.0010	0.0064*	-0.0951	0.2574*	0.6157	0.0019*	0.0035*
India	0.0012*	-0.0355	-0.1792*	-0.0007	-0.0227	-0.1162*	0.9204	0.0705	0.1312
Indonesia	0.0009	-0.1009	-0.1285	-0.0005	0.0514	-0.0788	0.9007	0.3834	0.2446
Malaysia	-0.0008*	0.0678	0.0701	0.0012	0.0921	0.1270*	0.9831	0.1398	0.1237
Mexico	0.0011*	0.0637	-0.3916*	-0.0012	-0.0458	-0.0394	0.7823	0.0016*	0.3549
Peru	0.0017*	-0.0545	-0.4896*	-0.0024	-0.0505	-0.0565	0.9041	0.0093*	0.1567
Philippines	-0.0004	0.0314	-0.0117	0.0007	0.0566	0.0497	0.7450	0.2231	0.2454
Poland	-0.0019*	-0.3022	-0.0071	0.0058*	0.3909*	0.2885*	0.9563	0.0000*	0.0061*
Russia	0.0004	-0.1387*	-0.0268	0.0015	0.0275	0.0477	0.9780	0.3192	0.3336
South Africa	0.0011	0.2048	-0.4608*	0.0019	0.2322*	-0.1352	0.5799	0.0013*	0.0038*
Thailand	0.0001	-0.0185	-0.0292	-0.0001	0.0761*	-0.0316	0.4877	0.1892	0.1056
Turkey	0.0018*	-0.2677*	-0.3173*	0.0038*	0.0940	0.0081	0.5481	0.0011*	0.1044

Table 4. Estimation results of the UIP

This table shows the estimation results of the UIP (equation (13)). * indicates statistical significance at 5% level. P-values of the J-statistic are reported.

	UIP		
	a0	a1	p-value
Australia	-0.0034	0.5417	0.5202
Canada	0.0043	-2.8054*	0.8685
Denmark	0.0002	-0.5583	0.6082
Israel	-0.0002	-0.0185	0.8745
Japan	0.0009	0.1887	0.5223
Korea	0.0041	-0.8342	0.5185
Norway	0.0012	-0.4334	0.5356
Singapore	-0.0009	-0.3100	0.7060
Sweden	0.0016	-1.3722*	0.7256
Switzerland	0.0011	1.0213	0.3313
Taiwan	-0.0002	0.0106	0.4945
United Kingdom	0.0022	-0.7598	0.8456
Euro	0.0000	-0.3574	0.5530
Brazil	-0.0160	0.6525	0.8907
Chile	0.0002	0.0564	0.9782
Colombia	0.0062	-0.4909	0.7559
Czech Republic	-0.0002	-1.3857	0.8420
Hungary	0.0249*	-2.0395*	0.8704
India	0.0034	-0.1909	0.8250
Malaysia	-0.0006	0.1615	0.9979
Mexico	0.0049	-0.4602	0.8343
Peru	-0.0001	0.1090	0.9716
Poland	-0.0069*	0.5841	0.7222
Russia	-0.0049*	0.2843*	0.8208
South Africa	0.0126	-0.7716	0.7158
Thailand	0.0033	-0.4807	0.9526
Turkey	0.0086	-0.1799	0.6470

Table 5. Estimation results of the RAUEP: Monthly frequency.

This table shows the estimation results of the RAUEP (equation (10)). P-values for hypothesis testing for the null hypothesis ($H_0 : a_2 = a_3 = a_4 = a_5 = 0$) are denoted by 'UEP' and for the null hypothesis ($H_0 : a_3 = a_4 = a_5 = 0$) by 'RUEP'. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	0.0027	-0.0034	0.2771*	-0.0120*	-0.0310	-0.0931	0.9879	0.0000*	0.0122*
Canada	-0.0017	0.1360	-0.1021*	0.0031	0.1702*	0.1052*	0.9590	0.0000*	0.0006*
Denmark	-0.0020	0.3745*	-0.0958	-0.0095	-0.0415	0.0530	0.6642	0.0000*	0.0071*
Israel	-0.0022	-0.1804	-0.1553*	0.0023	-0.0660	0.1178*	0.6745	0.0000*	0.0132*
Japan	0.0041*	0.0746	-0.1022	-0.0090*	0.0412	-0.1674*	0.6450	0.0001*	0.0191*
Korea	-0.0013	0.2219	-0.1667	0.0001	0.2416*	0.0318	0.9888	0.0390*	0.0584
Norway	0.0018	-0.0747	-0.1704	0.0005	-0.0093	-0.0095	0.9253	0.0560	0.9907
Singapore	-0.0018	-0.0428	-0.0373	0.0007	0.0512	0.0474	0.8670	0.0009*	0.1006
Sweden	-0.0015	0.0796	-0.1613	0.0017	-0.0120	0.1313*	0.8538	0.0000*	0.0061*
Switzerland	-0.0029	0.8758*	0.1481	0.0026	0.2785*	0.0965	0.9343	0.0426*	0.0761
Taiwan	0.0014	-0.0639*	-0.1954*	-0.0020	0.0082	-0.0127	0.8308	0.0000*	0.5597
United Kingdom	0.0044*	0.3323*	-0.0559	-0.0092*	-0.0395	-0.1859	0.9685	0.0433*	0.0349*
Euro	0.0005	0.6184*	-0.0899	-0.0063	0.0969	0.0973*	0.8345	0.0000*	0.0095*
Brazil	-0.0095*	-0.5168*	0.1679	0.0150	0.2793	0.7844*	0.9026	0.0001*	0.0046*
Chile	0.0020	0.1719*	-0.2125*	-0.0010	-0.0502	0.0221	0.7291	0.0031*	0.5312
Colombia	-0.0014	-0.0519	-0.0669	0.0039	-0.0206	0.2539*	0.9617	0.0000*	0.0115*
Czech Republic	-0.0037	0.2246*	0.0278	0.0103*	0.2597*	0.0648	0.8760	0.0000*	0.0000*
Hungary	0.0023	-0.1437	-0.2437	-0.0047	0.2277*	-0.0881	0.7925	0.0000*	0.0011*
India	0.0021*	-0.0017	-0.2172*	0.0016	0.0287	-0.0063	0.7673	0.0000*	0.6884
Indonesia	-0.0028	-0.1913*	0.1269	0.0175*	0.0575	0.3115*	0.9983	0.0000*	0.0000*
Malaysia	-0.0010	-0.0638	-0.0822*	0.0034*	-0.0134	0.0394	0.9484	0.0000*	0.0795
Mexico	-0.0041*	-0.1482*	-0.3121*	0.0145*	0.0087	0.2852*	0.9447	0.0000*	0.0031*
Peru	-0.0042	0.0481	-0.1679	0.0127*	0.0734*	0.2366*	0.9371	0.0000*	0.0024*
Philippines	-0.0013	0.0125	-0.1249*	0.0082*	0.0830	0.0613*	0.8089	0.0010*	0.0237*
Poland	-0.0029	-0.5981*	-0.0206	0.0011	0.2653*	0.2065*	0.8303	0.0000*	0.0011*
Russia	0.0015	-0.0159	-0.0416	0.0004	-0.0372	0.0346	0.9548	0.4824	0.7340
South Africa	0.0007	-0.2371	-0.1146	-0.0153	0.7471*	0.3847*	0.9824	0.0014*	0.0097*
Thailand	-0.0002	-0.0807*	-0.1014*	-0.0024	0.0122	0.0331	0.8045	0.0000*	0.0888
Turkey	0.0063*	-0.3051*	-0.1591	0.0010	-0.0625	0.1230	0.7625	0.0000*	0.3310

Table 6-1. Estimation results of the RAUEP: Alternative RA measure.

This table shows the estimation results of the RAUEP (equation (10)) with an alternative RA measure which is proposed by Misina (2008). For the implementation of the RA measure, refer to the text. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	-0.0004	0.6502*	0.7037*	-0.0120*	-0.2659	-0.0924	0.7089	0.0001*	0.0025*
Canada	0.0000	-0.2927*	-0.2220*	0.0054*	0.0831	0.1001	0.7161	0.0057*	0.0845
Denmark	0.0002	-0.1531	-0.0759	0.0051*	-0.0571	-0.0504	0.4411	0.0761	0.2186
Israel	0.0003	-0.1285*	-0.2627*	0.0005	0.0337	-0.0115	0.5359	0.0012*	0.8936
Japan	0.0008	-0.0585	-0.1615	-0.0025	-0.1266	-0.3169*	0.7914	0.0648	0.1045
Korea	0.0003	-0.1229*	-0.2991*	0.0031	0.0438	-0.1099	0.8080	0.0000*	0.1115
Norway	0.0004	-0.3682*	-0.1380	0.0087*	0.0838	0.0627	0.5103	0.0267*	0.0306*
Singapore	-0.0001	-0.1221*	-0.1328*	0.0020	-0.0607	-0.0989*	0.7506	0.0001*	0.0180*
Sweden	-0.0011	-0.0743	0.2064	0.0011	0.0791	0.5087*	0.9094	0.0125*	0.0404*
Switzerland	-0.0013*	0.1918	0.4693*	0.0052	0.3191	0.1279	0.8383	0.0010*	0.1494
Taiwan	0.0000	-0.0853*	-0.0905*	0.0021	-0.0340	-0.0919*	0.9350	0.0000*	0.0009*
United Kingdom	-0.0001	-0.1324	-0.0289	0.0021	-0.0402	0.1206	0.7864	0.3804	0.2440
Euro	-0.0003	0.0676	0.1076	0.0042	-0.0484	0.1569	0.6968	0.0926	0.0930
Brazil	0.0009	-0.3763*	-0.2148	-0.0042	-0.0417	0.1612	0.7983	0.2994	0.3142
Chile	0.0004	0.0649	-0.1074	0.0015	0.1450	0.0283	0.9200	0.3153	0.5462
Colombia	0.0007	-0.2241*	-0.2118*	-0.0039	-0.1811*	-0.2361*	0.7889	0.0000*	0.0351*
Czech Republic	-0.0006	0.0924	-0.0347	0.0063	-0.0592	-0.1942*	0.3985	0.0047*	0.0034*
Hungary	-0.0006	0.0215	-0.0345	0.0052	0.3509*	0.2722	0.6301	0.0040*	0.0016*
India	0.0004	-0.0064	-0.1143*	-0.0001	0.0312	0.1077*	0.8847	0.0533	0.1110
Indonesia	0.0007	-0.1654*	-0.1548	0.0031	-0.1338	0.0537	0.9550	0.0978	0.1249
Malaysia	-0.0002	0.0194	-0.0297	0.0000	-0.0054	-0.0510	0.9122	0.2794	0.5207
Mexico	0.0005	0.1181	-0.2551*	0.0018	0.2494*	-0.0032	0.8744	0.0018*	0.0635
Peru	0.0007	0.0421	-0.3016*	0.0006	0.0639	0.0419	0.7706	0.0186*	0.8833
Philippines	-0.0003	0.0305	-0.0087	0.0000	-0.0712	0.0817	0.8690	0.1320	0.0727
Poland	0.0017*	-0.5917*	-0.6047*	-0.0032	-0.5980*	-0.3337*	0.9108	0.0000*	0.0623
Russia	0.0011*	-0.1745*	-0.1110	0.0017	0.0456	-0.0027	0.9806	0.3758	0.5542
South Africa	0.0006	0.0375	-0.3442*	0.0079	-0.1388	-0.0787	0.7264	0.0007*	0.2110
Thailand	0.0000	-0.0909*	-0.0701	0.0001	-0.1268*	0.1118*	0.7128	0.0032*	0.0017*
Turkey	0.0020*	-0.2127*	-0.2970*	0.0050	-0.1343	-0.1865	0.4154	0.0000*	0.0137*

Table 6-2. Estimation results of the RAUEP: Alternative RA measure.

This table shows the estimation results of the RAUEP (equation (10)) where we use the market sentiment index by Baker and Wurgler (2006) as an alternative RA measure. Monthly data are used for the estimation. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	0.0024	0.3722*	0.5783*	0.0071	-0.2929	0.0058	0.7829	0.0000*	0.1793
Canada	-0.0017	0.0707	-0.1698*	0.0020	-0.2507	-0.1496	0.8460	0.0003*	0.1533
Denmark	0.0002	-0.1773*	-0.2547*	-0.0003	-0.1885	0.1246	0.7967	0.0006*	0.2534
Israel	-0.0014	0.0256	-0.0739	0.0036	-0.0135	-0.0497	0.8118	0.0320*	0.3446
Japan	0.0011	0.2042*	0.0266	-0.0048	0.0208	0.1849	0.7592	0.4313	0.3069
Korea	-0.0009	-0.0875	-0.1873*	-0.0032	-0.0276	-0.1585	0.8201	0.0055*	0.1222
Norway	0.0000	-0.1910	-0.3169*	0.0007	0.3268*	-0.0047	0.8827	0.0000*	0.0084*
Singapore	-0.0013*	0.0141	-0.0350	0.0011	-0.0652*	0.0006	0.7699	0.1017	0.0712
Sweden	-0.0010	0.1799	-0.5665*	-0.0061	-0.1952*	0.2772*	0.9382	0.0000*	0.0071*
Switzerland	-0.0012	0.1268	-0.0218	0.0022	-0.1947	-0.0247	0.7463	0.4486	0.3364
Taiwan	0.0002	-0.0048	-0.1762*	0.0052*	0.0395	0.1075*	0.8564	0.0000*	0.0000*
United Kingdom	0.0000	0.3122*	-0.0809	-0.0002	-0.1615	0.0362	0.8873	0.0669	0.0381*
Euro	-0.0020	0.5618*	-0.3359*	-0.0081	-0.3861*	0.0800	0.8535	0.0009*	0.0137*
Brazil	0.0022	-0.4162*	-0.4570*	0.0069*	0.0545	0.0593	0.9789	0.0000*	0.2166
Chile	0.0054*	-0.4890*	-0.5373*	0.0046	-0.0871	0.1033	0.9190	0.0000*	0.2033
Colombia	-0.0006	0.0903	-0.1486	0.0075	0.1830*	-0.0456	0.9799	0.0143*	0.1393
Czech Republic	-0.0073*	0.2486*	0.0310	-0.0046	-0.2974*	-0.1734	0.8832	0.0045*	0.0020*
Hungary	0.0018	-0.2070*	-0.5328*	-0.0015	0.0745	0.2957*	0.9789	0.0000*	0.0720
India	-0.0002	-0.0132	-0.1453*	0.0009	-0.0181	0.1030*	0.9939	0.0001*	0.0016*
Indonesia	0.0010	-0.0809	-0.2160*	-0.0050	0.0646*	0.1334*	0.9726	0.0006*	0.0423*
Malaysia	-0.0006	0.0014	-0.0078	0.0001	0.0124	0.0088	0.9677	0.9331	0.8525
Mexico	0.0013	-0.0900	-0.1508*	0.0060*	0.1768*	0.0162	0.7861	0.0113*	0.0299*
Peru	-0.0007	0.1107*	-0.1221	0.0067	0.0065	0.0275	0.9378	0.1809	0.3745
Philippines	0.0011	-0.0912*	-0.0711	0.0088*	0.0424	-0.1313*	0.7944	0.0021*	0.0008*
Poland	-0.0026	-0.1969	-0.3346*	-0.0182*	-0.3401*	-0.0074	0.9767	0.0422*	0.1048
Russia	0.0008	-0.0055	-0.0382	-0.0012	0.0185	0.0388	0.9569	0.5238	0.5344
South Africa	0.0034	-0.3416*	-0.5948*	-0.0060	0.0422	0.2052	0.9440	0.0000*	0.3649
Thailand	-0.0002	-0.1888*	-0.1353*	0.0071*	-0.0760*	-0.2098*	0.7554	0.0002*	0.0023*
Turkey	0.0037	-0.2208*	-0.4226*	-0.0175*	-0.0449	0.3300*	0.9866	0.0000*	0.0939

Table 7. Estimation results of the RAUEP: MSCI World stock index.

This table shows the estimation results of the RAUEP (equation (10)) with MSCI World stock index as the benchmark foreign equity. For the implementation of the RA measure, refer to the text. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	0.0012*	-0.1133	0.2977	-0.0011	-0.0402	-0.1030*	0.2036	0.0000*	0.0241*
Canada	-0.0007	-0.1069	-0.2274*	0.0025*	0.1258	0.0326	0.5388	0.0000*	0.1171
Denmark	-0.0006	0.0311	-0.1699	-0.0006	-0.1132	0.1199*	0.5600	0.0009*	0.0369*
Israel	0.0003	-0.0235	-0.2797*	-0.0011	0.0665	0.0191	0.5367	0.0002*	0.3484
Japan	0.0003	-0.1301	0.0649	0.0015	0.0408	-0.0782*	0.5224	0.0012*	0.0306*
Korea	-0.0023*	0.0802	0.0061	0.0049*	0.3432*	0.3343*	0.9852	0.0000*	0.0000*
Norway	-0.0041*	-0.1560	-0.0314	0.0059	0.5584*	0.6189*	0.9792	0.0181*	0.0403*
Singapore	-0.0009*	0.0394	-0.0175	0.0022*	0.2263*	0.0757*	0.9830	0.0013*	0.0016*
Sweden	-0.0010	0.3561	-0.0858	0.0034	0.9872*	0.0445	0.8623	0.0000*	0.0001*
Switzerland	-0.0003	0.4996*	0.0246	-0.0023	-0.0198	-0.0221	0.2810	0.2023	0.2946
Taiwan	-0.0007	-0.0832*	-0.0914	0.0023*	0.0174	0.0977*	0.8891	0.0008*	0.0454*
United Kingdom	0.0001	0.3337	-0.0255	-0.0026	0.1884	0.0400	0.6765	0.2182	0.2225
Euro	-0.0013*	0.6840*	0.0087	0.0029	0.7494*	0.1278*	0.7715	0.0011*	0.0009*
Brazil	0.0021*	-0.3124*	-0.4862*	-0.0041	0.0817	-0.0955*	0.8014	0.0096*	0.1140
Chile	-0.0005	0.1269	-0.0986	0.0032	-0.0374	0.0367	0.8750	0.0039*	0.2052
Colombia	-0.0008	-0.0912	-0.1541	0.0034	0.0142	0.1082*	0.8541	0.0001*	0.0130*
Czech Republic	-0.0020*	0.0887	-0.0470	0.0045*	-0.0643	0.1369*	0.7675	0.0558	0.0844
Hungary	-0.0030*	0.0578	-0.1384	0.0095*	-0.1769*	0.3226*	0.8181	0.0005*	0.0013*
India	0.0010*	-0.0084	-0.1545*	-0.0004	-0.0168	-0.0981*	0.9135	0.0733	0.1997
Indonesia	0.0004	-0.0886	-0.0809	-0.0001	0.0747	-0.0103	0.9172	0.4340	0.4806
Malaysia	-0.0007	0.0671	0.0391	0.0011	0.0673	0.1054	0.9758	0.1665	0.2394
Mexico	0.0010*	0.0224	-0.2989*	-0.0008	-0.0084	-0.0360	0.3628	0.0152*	0.5019
Peru	0.0007	0.0401	-0.2580*	-0.0006	-0.0209	-0.0138	0.4149	0.0658	0.8380
Philippines	0.0000	-0.0188	-0.0346	-0.0006	-0.0910*	-0.0033	0.7125	0.1411	0.1022
Poland	-0.0015	-0.3996*	-0.1512	0.0052	0.3645*	0.2653*	0.9308	0.0000*	0.0223*
Russia	0.0005	-0.1459*	-0.0984	0.0010	0.0082	0.0540	0.9562	0.0892	0.4632
South Africa	0.0009	0.2747	-0.4475*	0.0039	0.1870	-0.2039	0.6842	0.0004*	0.0020*
Thailand	0.0003	-0.0515	-0.0823	-0.0003	0.0912*	-0.0332	0.2486	0.1053	0.0547
Turkey	0.0018*	-0.2717*	-0.2655	0.0035	0.1330	0.0198	0.5948	0.0069*	0.0834

Table 8-1. Estimation results of the RAUEP: Sub-period analysis (pre-crisis period).

This table shows the estimation results of the RAUEP (equation (10)) during the pre-crisis period (4/3/2000 - 7/31/2007). For the implementation of the RA measure, refer to the text. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	0.0022*	-0.0873	0.0073	0.0013	-0.4004*	-0.2248*	0.8638	0.0138*	0.0218*
Canada	-0.0003	-0.1454	0.0014	0.0001	-0.1174	-0.0591	0.7486	0.8371	0.7182
Denmark	-0.0009	-0.0250	0.1192	-0.0004	0.2308	-0.0583	0.7494	0.3332	0.3737
Israel	-0.0001	-0.2324*	-0.3280*	0.0041*	0.1122	-0.0274	0.9603	0.0000*	0.0002*
Japan	0.0013	-0.1371	-0.1715	0.0002	-0.2115	-0.0304	0.8494	0.0820	0.3249
Korea	-0.0019*	-0.0588	-0.0074	0.0013	0.2209*	0.1494*	0.9462	0.0038*	0.0016*
Norway	-0.0018	-0.0009	-0.0055	0.0020	0.1755	-0.0460	0.7974	0.1751	0.1638
Singapore	-0.0001	-0.0687	-0.0661	-0.0009	0.1356*	-0.0400	0.9268	0.0125*	0.0143*
Sweden	-0.0016	0.2064*	0.0474	0.0012	0.2066	0.0088	0.8282	0.4795	0.4043
Switzerland	-0.0013	0.1798	0.3246*	-0.0004	0.2045*	0.0238	0.7998	0.0003*	0.1284
Taiwan	-0.0002	-0.0460	0.0443	0.0016	0.0487	-0.0086	0.8113	0.0313*	0.0944
United Kingdom	0.0003	0.0393	-0.0662	-0.0010	0.0036	-0.1621	0.8180	0.1809	0.1339
Euro	-0.0011	0.2791*	0.1963	0.0000	0.2619	-0.0332	0.6926	0.0237*	0.2041
Brazil	0.0002	-0.1905*	-0.5862*	-0.0018	0.2065*	-0.1204	0.6582	0.0002*	0.0098*
Chile	0.0013	0.0514	-0.1924	-0.0023	0.0582	-0.1364	0.8232	0.1793	0.1171
Colombia	0.0021*	-0.1670*	-0.2222*	-0.0042*	0.0837	0.0253	0.9894	0.0169*	0.0581
Czech Republic	-0.0022*	-0.0486	0.0711	0.0030	0.2086	0.0092	0.7931	0.1813	0.1983
Hungary	-0.0021*	-0.0735	0.0693	0.0022	0.0203	0.1094	0.6064	0.7654	0.6235
India	0.0001	-0.0513*	-0.1096*	-0.0015*	0.0042	-0.0298	0.8743	0.0025*	0.0626
Indonesia	0.0018	-0.0954	-0.0860	-0.0035	0.0006	-0.1306	0.9185	0.3107	0.1976
Malaysia	-0.0001	-0.0068	-0.0036	-0.0001	-0.0087	-0.0050	0.9755	0.7736	0.6353
Mexico	-0.0007	0.1301	-0.1342	0.0035	-0.0352	-0.0299	0.8049	0.0558	0.1877
Peru	-0.0002	0.2140*	0.0208	0.0005	-0.1688	-0.1808	0.6636	0.4481	0.3111
Philippines	0.0007	-0.0617	-0.0697	-0.0018	-0.0189	-0.0409	0.4864	0.0882	0.3010
Poland	-0.0013	-0.0161	-0.0657	-0.0008	0.1966	0.0774	0.6718	0.6125	0.5194
Russia	0.0002	-0.0143	-0.0665*	-0.0005	-0.0224	-0.0548	0.8282	0.2606	0.2806
South Africa	-0.0012	0.2701	0.0521	0.0028	0.1534	-0.0932	0.9375	0.2533	0.3042
Thailand	-0.0005	-0.0192	-0.1288*	0.0000	0.0621	-0.0521	0.5344	0.0163*	0.0746
Turkey	0.0055*	-0.1117*	-0.0822	-0.0087*	-0.0423	-0.4661*	0.7882	0.0179*	0.0155*

Table 8-2. Estimation results of the RAUEP: Sub-period analysis (crisis period).

This table shows the estimation results of the RAUEP (equation (10)) during the crisis period (8/1/2007 - 12/31/2009). For the implementation of the RA measure, refer to the text. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	0.0030	0.5188*	0.3581*	0.0011	0.1674*	-0.0528	0.9104	0.0000*	0.0005*
Canada	-0.0054*	-0.3465*	-0.5519*	-0.0084*	-0.4710*	-0.2948*	0.9338	0.0000*	0.0016*
Denmark	0.0048*	-0.0885	-0.1574	0.0056*	-0.0185	0.0160	0.8348	0.0002*	0.0043*
Israel	-0.0023	0.5057*	0.0366	-0.0006	0.1029*	0.0188	0.8784	0.0123*	0.0057*
Japan	-0.0054*	-0.1991*	-0.0258	-0.0072*	-0.0941*	-0.1126*	0.8491	0.0000*	0.0000*
Korea	-0.0045	0.1196	-0.5983*	-0.0062*	0.1840*	-0.0247	0.9952	0.0000*	0.0000*
Norway	0.0025	-0.2759*	-0.0815	0.0033	-0.1770*	0.0929*	0.8286	0.0000*	0.0000*
Singapore	0.0011	-0.0443	-0.0293	0.0030*	0.0350*	0.0800*	0.8834	0.0000*	0.0001*
Sweden	-0.0030	-0.4419*	-0.9375*	-0.0054*	-0.1238*	-0.2484*	0.9647	0.0000*	0.0000*
Switzerland	-0.0012	0.3249*	-0.0483	-0.0002	0.1222*	0.0263	0.8832	0.1225	0.0797
Taiwan	-0.0026*	-0.0108	-0.0792	-0.0022*	0.0291*	0.0363*	0.9624	0.0000*	0.0016*
United Kingdom	0.0066*	-0.2158	0.3053*	0.0077*	-0.3691*	0.1312*	0.9071	0.0000*	0.0000*
Euro	0.0044*	-0.1826	-0.1770	0.0055*	-0.0377	0.0129	0.8371	0.0001*	0.0047*
Brazil	0.0062*	-0.4380*	-0.5822*	0.0062*	-0.0767	-0.0484	0.9579	0.0000*	0.0013*
Chile	0.0016	-0.1109	0.0450	0.0039	0.0189	0.1598*	0.9827	0.0000*	0.0105*
Colombia	0.0011	0.6692*	-0.4430*	0.0034	0.3734*	0.1239	0.9550	0.0000*	0.0005*
Czech Republic	0.0065*	-0.3849*	-0.6080*	0.0066*	-0.2477*	-0.2412*	0.9752	0.0000*	0.0000*
Hungary	0.0040	-0.3314*	-0.7919*	0.0066*	0.0413	-0.0168	0.9634	0.0000*	0.0066*
India	0.0019	-0.1277*	0.1385	0.0021	-0.0194	0.1295*	0.9412	0.0000*	0.0001*
Indonesia	-0.0010	-0.0525	-0.2250*	-0.0012	0.0457*	-0.0508*	0.9402	0.0000*	0.0000*
Malaysia	0.0002	0.1033	0.0120	0.0014	0.1167*	0.1470*	0.9311	0.0010*	0.0113*
Mexico	-0.0007	0.2110	-0.2276*	-0.0009	0.3106*	0.1373*	0.9865	0.0000*	0.0000*
Peru	0.0045*	0.0749	-0.1339	0.0060*	0.1251*	0.1420*	0.9578	0.0000*	0.0000*
Philippines	-0.0009	-0.1938*	-0.3252*	-0.0004	-0.0196	0.0011	0.9103	0.0000*	0.3014
Poland	0.0010	-0.4648*	-0.3683*	0.0040	-0.3157*	0.0446	0.9587	0.0000*	0.0000*
Russia	0.0011	-0.0778*	-0.1078	0.0010	-0.0009	0.0012	0.9468	0.0078*	0.7630
South Africa	0.0098*	-0.5999*	-0.1729	0.0095*	-0.1691*	0.0542	0.8934	0.0000*	0.0008*
Thailand	-0.0023*	-0.0371	-0.0991*	-0.0021*	0.0108	0.0070	0.9722	0.0003*	0.0076*
Turkey	0.0022	-0.2255*	-0.3293	0.0034	-0.2776*	0.1443*	0.8981	0.0000*	0.0000*

Table 8-3. Estimation results of the RAUEP: Sub-period analysis (post-crisis period).

This table shows the estimation results of the RAUEP (equation (10)) during the post-crisis period (1/1/2010 - 12/31/2015). For the implementation of the RA measure, refer to the text. Refer to the note in Table 2 for other explanations.

	RAUEP							p-value	
	a0	a1	a2	a3	a4	a5	J-stat	UEP	RUEP
Australia	0.0014	0.0457	0.4633*	-0.0017	0.1199	-0.3318*	0.9567	0.0000*	0.0141*
Canada	0.0005	-0.2239	-0.4214*	0.0017	-0.1713	-0.0498	0.6327	0.0000*	0.4027
Denmark	-0.0029	0.4887*	0.1563	0.0010	-0.4433*	0.4488*	0.8862	0.1009	0.0526
Israel	0.0013	0.0175	-0.0366	-0.0037	0.0382	0.0126	0.8744	0.1442	0.3721
Japan	-0.0046*	-0.2675*	-0.2884	0.0101*	0.1056	0.1197	0.7760	0.0245*	0.0113*
Korea	-0.0010	-0.3444*	-0.5785*	0.0044	0.4260*	0.2263	0.9455	0.0000*	0.0021*
Norway	0.0038*	-0.0552	-0.4454*	-0.0053	0.2524	-0.0503	0.9627	0.0006*	0.1875
Singapore	-0.0010	-0.0618	-0.1806	0.0030	0.2355*	0.1938*	0.8793	0.0113*	0.0560
Sweden	0.0037*	-0.0760	-0.1916	-0.0065*	0.1543	-0.1511	0.7916	0.1172	0.1744
Switzerland	-0.0012	0.6455*	0.2281	-0.0003	-0.9243*	0.1037	0.8323	0.0005*	0.0003*
Taiwan	-0.0001	-0.0960*	-0.1535*	0.0006	0.0636	0.0185	0.4638	0.0002*	0.6368
United Kingdom	0.0023*	0.1524	-0.1709	-0.0028	-0.0786	-0.1589	0.9265	0.3428	0.2642
Euro	0.0002	0.3304*	0.0740	-0.0005	-0.2025	0.1388	0.5216	0.2964	0.2156
Brazil	-0.0027	-0.3655*	-0.0547	0.0090*	0.0619	0.0647	0.9151	0.2158	0.1231
Chile	0.0006	-0.1275	-0.2968*	0.0006	-0.1536	-0.0629	0.9871	0.0253*	0.6747
Colombia	0.0007	-0.0314	-0.3997*	0.0064*	-0.2240	-0.3498*	0.5020	0.0001*	0.0034*
Czech Republic	0.0007	0.2441	0.2883	-0.0029	-0.4392*	0.1598	0.8436	0.0314*	0.0159*
Hungary	0.0059*	-0.2551*	-0.6296*	-0.0038	-0.2639*	-0.5595*	0.9448	0.0054*	0.0193*
India	0.0039*	-0.2144*	-0.3127*	-0.0065*	-0.1139	-0.1870*	0.7831	0.0004*	0.0313*
Indonesia	-0.0017	-0.1084*	-0.0921	0.0078*	0.1236	0.1776*	0.8831	0.0000*	0.0001*
Malaysia	-0.0008	-0.1845	-0.3275*	0.0049*	0.1465	0.2217	0.8754	0.0020*	0.1402
Mexico	0.0017	0.0412	-0.5010*	-0.0005	-0.2136	-0.0889	0.9869	0.0000*	0.4520
Peru	0.0011	0.0422	-0.4167*	-0.0002	-0.1393	0.0148	0.9829	0.0000*	0.2827
Philippines	-0.0015*	-0.1091*	-0.1431*	0.0051*	-0.0475	0.0441	0.7928	0.0000*	0.0007*
Poland	0.0035*	-0.3051	-0.3312	-0.0033	-0.2182	-0.2636	0.9835	0.1042	0.2464
Russia	0.0045*	-0.3208*	-0.4887*	-0.0042	-0.0738	-0.2252*	0.7245	0.0001*	0.0251*
South Africa	0.0029	-0.3168*	-0.5924*	0.0039	0.3285	0.0556	0.6882	0.0012*	0.0571
Thailand	0.0007	-0.1720*	-0.1502*	-0.0005	0.0533	0.0359	0.6994	0.0427*	0.4290
Turkey	0.0016	-0.4017*	-0.4639*	0.0036	-0.1827*	-0.0844	0.9608	0.0000*	0.0550

Table 9-1. Time-series regression of the RAUEP: Weekly frequency.

This table shows the estimation results of the time-series regression of the RAUEP (equation (14)) with weekly frequency. Newey and West (1983) HAC standard errors are used to measure statistical significance. Refer to the note in Table 3 for other explanations.

	RAUEP							Hypo testing	
	a0	a1	a2	a3	a4	a5	R2	UEP	RUEP
Australia	0.0007	0.1309*	0.3182*	-0.0013*	-0.0027	-0.0961*	0.3595	0.0000*	0.0001*
Canada	-0.0003	-0.0883*	-0.2107*	0.0002	0.0023	0.0394*	0.3056	0.0000*	0.0208*
Denmark	-0.0006	0.0836*	-0.0034	0.0002	0.0292	0.0402*	0.0492	0.0079*	0.0089*
Israel	0.0000	-0.0563	-0.1442*	-0.0003	-0.0009	0.0091	0.1132	0.0000*	0.3292
Japan	0.0004	-0.0351	0.0249	-0.0002	-0.0204*	-0.0363*	0.0412	0.0000*	0.0001*
Korea	-0.0003	-0.0907*	-0.1892*	-0.0001	0.0419*	0.0743*	0.3176	0.0000*	0.0000*
Norway	-0.0001	-0.0677*	-0.1746*	0.0003	0.0282	0.0281*	0.1248	0.0000*	0.0794
Singapore	-0.0003	-0.0585*	-0.0890*	-0.0001	-0.0108	0.0103	0.1414	0.0000*	0.0689
Sweden	-0.0003	0.0373	-0.1598*	0.0004	0.0247	0.0495*	0.1443	0.0000*	0.0013*
Switzerland	-0.0007	0.3301*	0.1409*	-0.0005	0.0190	0.0149	0.1368	0.0020*	0.4576
Taiwan	0.0000	-0.0742*	-0.0880*	-0.0001	-0.0120*	0.0033	0.1968	0.0000*	0.1154
United Kingdom	-0.0002	0.1449*	-0.0006	-0.0007	0.0710*	0.0586*	0.0947	0.0007*	0.0017*
Euro	-0.0003	0.2781*	-0.0038	0.0001	0.0515	0.0375*	0.1056	0.0299*	0.0329*
Brazil	0.0016*	-0.2949*	-0.3840*	-0.0018	0.0103	-0.0428	0.3592	0.0000*	0.2639
Chile	0.0005	-0.0405	-0.2208*	-0.0003	0.0881*	0.0526	0.1728	0.0000*	0.0751
Colombia	0.0010	-0.1197*	-0.3177*	-0.0001	0.0150	-0.0040	0.1894	0.0000*	0.8429
Czech Republic	-0.0007	-0.0194	-0.0936*	0.0001	0.0052	0.0331*	0.0494	0.0003*	0.0603
Hungary	0.0001	-0.1580*	-0.2564*	0.0001	-0.0052	0.0189	0.1441	0.0000*	0.6364
India	0.0008*	-0.0883*	-0.1694*	-0.0003	0.0178	-0.0060	0.2650	0.0000*	0.1849
Indonesia	0.0009	-0.1903*	-0.1832*	-0.0001	0.0008	0.0387*	0.2093	0.0000*	0.1995
Malaysia	0.0003	-0.0888*	-0.1855*	0.0000	-0.0200	-0.0170	0.1772	0.0000*	0.6073
Mexico	0.0010*	-0.0625*	-0.2859*	-0.0008	0.0186	0.0013	0.3049	0.0000*	0.2955
Peru	0.0010*	-0.0453*	-0.3071*	-0.0006	0.0141	-0.0057	0.3086	0.0000*	0.3249
Philippines	0.0004	-0.0967*	-0.1507*	-0.0002	-0.0133*	-0.0066	0.1709	0.0000*	0.0970
Poland	-0.0003	-0.1782*	-0.2622*	-0.0002	0.0391	0.0650*	0.1968	0.0000*	0.0625
Russia	0.0015*	-0.1835*	-0.2144*	-0.0004	-0.0249	-0.0098	0.2702	0.0000*	0.2213
South Africa	0.0007	0.1393*	-0.2889*	0.0003	0.0607	0.0409*	0.1784	0.0000*	0.1275
Thailand	0.0001	-0.0881*	-0.0822*	-0.0004	-0.0188*	-0.0104	0.1191	0.0000*	0.0306*
Turkey	0.0024*	-0.1973*	-0.4007*	-0.0009	-0.0001	0.0009	0.2490	0.0000*	0.6210

Table 9-2. Time-series regression of the RAUEP: Monthly frequency.

This table shows the estimation results of the time-series regression of the RAUEP (equation (14)) with monthly frequency. Newey and West (1983) HAC standard errors are used to measure statistical significance. Refer to the note in Table 3 for other explanations.

	RAUEP							Hypo testing	
	a0	a1	a2	a3	a4	a5	R2	UEP	RUEP
Australia	0.0023	0.1740*	0.3745*	-0.0064*	0.0364	-0.1042*	0.3643	0.0000*	0.0000*
Canada	-0.0007	-0.1713*	-0.2766*	0.0017	0.0262	0.0490*	0.3787	0.0000*	0.0067*
Denmark	-0.0033	0.1874*	-0.0147	0.0011	0.0079	0.0886*	0.1519	0.0000*	0.0002*
Israel	-0.0004	-0.0441	-0.1093*	-0.0002	-0.0653	0.0123	0.1367	0.0000*	0.0582
Japan	0.0024	-0.0717*	0.0484	-0.0020	-0.0453	-0.0820*	0.1050	0.0000*	0.0006*
Korea	-0.0020	-0.0606	-0.1568*	-0.0008	0.0425	0.1306*	0.3757	0.0000*	0.0000*
Norway	-0.0018	-0.0438	-0.0977	0.0027	-0.0019	0.1142*	0.1688	0.0000*	0.0000*
Singapore	-0.0014	-0.0931*	-0.0698*	0.0001	0.0253	0.0243*	0.1695	0.0000*	0.0270*
Sweden	-0.0015	0.1824*	-0.1911*	0.0026	0.0072	0.0939*	0.2641	0.0000*	0.0002*
Switzerland	-0.0031	0.6465*	0.1951*	-0.0025	0.0378	0.0328	0.3120	0.0635	0.2655
Taiwan	0.0003	-0.0857*	-0.1088*	-0.0005	-0.0203	-0.0038	0.1989	0.0000*	0.3165
United Kingdom	-0.0009	0.3333*	0.0126	-0.0002	-0.0643	0.0791*	0.2996	0.0000*	0.0000*
Euro	-0.0012	0.4313*	-0.0067	0.0006	0.0225	0.0774*	0.2462	0.0000*	0.0002*
Brazil	0.0046	-0.2389*	-0.3561*	-0.0025	-0.0050	0.0344	0.3622	0.0000*	0.3660
Chile	0.0014	-0.0306	-0.2430*	-0.0001	0.0826*	0.0827	0.2245	0.0000*	0.0867
Colombia	0.0031	-0.1055*	-0.3212*	0.0012	-0.0731*	0.0093	0.2444	0.0000*	0.2422
Czech Republic	-0.0041	-0.0454	-0.0079	0.0000	0.0436	0.0937*	0.0946	0.0000*	0.0037*
Hungary	-0.0005	-0.2007*	-0.1640*	0.0010	0.0980*	0.0591	0.2665	0.0000*	0.0000*
India	0.0030*	-0.0980*	-0.1826*	0.0005	-0.0144	0.0082	0.2509	0.0000*	0.9517
Indonesia	0.0030	-0.1943*	-0.1792*	0.0013	0.0697	0.1188*	0.2901	0.0000*	0.0251*
Malaysia	0.0011	-0.1255*	-0.1952*	0.0016	-0.0633	-0.0262	0.2078	0.0000*	0.1702
Mexico	0.0028	-0.0575	-0.2407*	0.0000	-0.0526	0.0519*	0.3366	0.0000*	0.0147*
Peru	0.0027	-0.0218	-0.2376*	-0.0011	0.0506*	0.0530*	0.3568	0.0000*	0.0029*
Philippines	0.0013	-0.1040*	-0.1197*	-0.0006	-0.0009	0.0084	0.1819	0.0001*	0.7927
Poland	-0.0021	-0.2186*	-0.1857*	-0.0014	0.0861	0.1225*	0.2823	0.0000*	0.0006*
Russia	0.0060*	-0.1553*	-0.1228*	-0.0017	0.0085	-0.0219	0.2165	0.0595	0.8985
South Africa	0.0006	0.1797	-0.1449	0.0036	-0.0544	0.1286*	0.1858	0.0000*	0.0006*
Thailand	0.0005	-0.1291*	-0.1038*	-0.0002	-0.0483*	-0.0102	0.2349	0.0000*	0.1334
Turkey	0.0080*	-0.2169*	-0.3235*	-0.0010	-0.1200*	0.0948*	0.3189	0.0000*	0.0023*

Table 10. Summary statistics of portfolio returns

Table 10 shows the summary statistics of the annualized returns (%) of the five portfolios for both weekly and monthly rebalances from January 2003 to December 2015. Refer to the text for the explanations about the portfolios. AC(1) indicates the first-order autocorrelation.

	Cont. RA	Pred. RA	No RA	Contrarian	Momentum
			Weekly		
Mean	7.69	-6.31	-0.31	-6.28	-46.75
Median	-0.39	-7.42	2.85	-14.46	-38.78
S.d.	17.61	16.42	16.32	18.29	18.18
Skewness	0.47	-0.21	-0.58	0.73	-0.70
Kurtosis	9.55	11.12	6.40	8.10	8.12
AC(1)	-0.03	-0.06	-0.01	-0.09	-0.03
			Monthly		
Mean	7.20	-3.20	2.17	-3.66	-9.05
Median	10.48	-4.22	1.95	-3.40	-11.19
S.d.	14.79	14.30	15.37	15.01	15.06
Skewness	0.38	-0.33	-0.72	0.02	0.00
Kurtosis	6.13	4.24	5.08	3.07	3.08
AC(1)	0.00	-0.02	-0.05	-0.08	-0.04

Table 11. Hypothesis tests of portfolio performances.

This table shows the p-values for null hypotheses that two portfolios equally perform and against alternative hypotheses that a portfolio outperforms the other. Portfolio performances are measured by certainty-equivalent return (CEQ) or the Sharpe ratio (SR). Refer to the text for the explanations about the portfolios. P-values are provided for the alternative hypothesis that a portfolio in the row outperforms another portfolio in the column.

	CEQ	p-value				
		Cont. RA	Pred. RA	No RA	Contrarian	Momentum
				Weekly		
Cont. RA	0.0006		0.0012	0.0512	0.0172	0.0000
Pred. RA	-0.0020	0.9988		0.9757	0.4436	0.0000
No RA	-0.0008	0.9488	0.0243		0.1374	0.0000
Contrarian	-0.0022	0.9828	0.5564	0.8626		0.0000
Momentum	-0.0099	1.0000	1.0000	1.0000	1.0000	
				Monthly		
Cont. RA	0.0033		0.0008	0.0645	0.0427	0.0007
Pred. RA	-0.0052	0.9992		0.9734	0.4523	0.1027
No RA	-0.0011	0.9355	0.0266		0.1989	0.0128
Contrarian	-0.0058	0.9573	0.5477	0.8011		0.2550
Momentum	-0.0104	0.9993	0.8973	0.9872	0.7450	
	SR	p-value				
		Cont. RA	Pred. RA	No RA	Contrarian	Momentum
				Weekly		
Cont. RA	0.0606		0.0007	0.0422	0.0194	0.0000
Pred. RA	-0.0533	0.9993		0.9744	0.5425	0.0000
No RA	-0.0026	0.9578	0.0256		0.1897	0.0000
Contrarian	-0.0477	0.9806	0.4575	0.8103		0.0000
Momentum	-0.3568	1.0000	1.0000	1.0000	1.0000	
				Monthly		
Cont. RA	0.1409		0.0008	0.0670	0.0436	0.0008
Pred. RA	-0.0649	0.9992		0.9844	0.4822	0.1284
No RA	0.0408	0.9330	0.0156		0.1908	0.0114
Contrarian	-0.0705	0.9564	0.5178	0.8092		0.2566
Momentum	-0.1741	0.9992	0.8716	0.9886	0.7434	

Table 12. Coexceedances in currency and equity markets

This table shows the coexceedances of domestic currency depriciation and equity return plunge for all sample days ('All'), for days with weak RA (below the 20th percentile) ('Low'), and for days with hjgh RA (above the 80th percentile) ('High'). The coexceedances is calculated based on Bae et al. (2003) and are represented as percentage (%) of the sample days. Refer to the text for the detailed explanations.

	RA					
	All	Low	High	All	Low	High
	A. Negative coexceedances			B. Positive coexceedances		
Australia	0.27	0.97	0.00	0.24	0.97	0.00
Canada	1.61	6.93	0.00	1.22	4.50	0.12
Denmark	0.68	2.79	0.00	0.58	1.82	0.00
Israel	1.00	2.92	0.24	0.83	2.07	0.12
Japan	0.37	1.09	0.00	0.29	0.97	0.00
Korea	1.00	3.77	0.00	0.83	3.04	0.12
Norway	1.34	5.10	0.36	0.92	3.16	0.00
Singapore	0.73	2.55	0.12	0.73	1.82	0.12
Sweden	1.19	4.62	0.00	0.92	3.28	0.00
Switzerland	0.29	1.09	0.00	0.24	0.85	0.00
Taiwan	0.88	3.16	0.12	0.54	2.07	0.00
United Kingdom	0.61	2.31	0.00	0.61	2.07	0.12
Euro	0.58	2.43	0.00	0.49	1.46	0.00
Brazil	1.65	5.71	0.12	1.61	4.74	0.24
Chile	0.92	3.52	0.12	0.75	3.28	0.12
Colombia	1.05	2.67	0.48	0.85	2.07	0.24
Czech Republic	1.00	4.25	0.12	0.54	2.31	0.00
Hungary	1.29	4.25	0.00	1.00	3.04	0.12
India	1.14	3.77	0.24	1.00	2.92	0.24
Indonesia	1.12	3.04	0.24	0.88	2.43	0.24
Malaysia	0.71	2.55	0.24	0.63	1.94	0.24
Mexico	1.29	4.50	0.00	1.14	3.65	0.48
Peru	0.95	3.52	0.00	1.02	3.65	0.24
Philippines	0.71	1.82	0.24	0.49	0.73	0.73
Poland	1.10	4.13	0.24	1.02	3.16	0.24
Russia	1.31	3.77	0.12	1.48	2.92	0.48
South Africa	0.88	3.40	0.12	0.71	2.79	0.00
Thailand	0.58	1.46	0.24	0.61	1.22	0.48
Turkey	1.53	4.01	0.48	1.44	3.89	0.12

Table 13. Prediction of financial market instability

This table shows the estimation results of the logistic prediction model (equation (18)) of financial market instability which is defined by the occurrence of the coexceedances of domestic currency depriciation and equity return within the next one week. The p-value for hypothesis testing for the null hypothesis ($H_0 : a_2 = a_3 = 0$) is also reported. * indicates statistical significance at 5% level. Refer to the text for the detailed explanations.

	a0	a1	a2	a3	pval
Australia	-4.8189*	0.4306	-0.7183*	-0.1151	0.0000*
Canada	-3.4208*	1.2330*	-1.2748*	0.5984*	0.0000*
Denmark	-4.1810*	1.6461*	-0.9213*	0.4134*	0.0000*
Israel	-3.3185*	0.6626	-0.5917*	0.1269	0.0000*
Japan	-4.1186*	-0.0482	-0.3863*	0.4757	0.0000*
Korea	-3.7236*	0.9485*	-1.2209*	0.5613*	0.0000*
Norway	-3.3731*	1.4018*	-1.0440*	0.5874*	0.0000*
Singapore	-3.7293*	-0.0241	-0.8627*	0.1443	0.0000*
Sweden	-3.8170*	2.5775*	-1.3536*	1.1153*	0.0000*
Switzerland	-4.6495*	1.0230	-0.7270*	0.9975	0.0000*
Taiwan	-3.5053*	1.2458*	-0.7899*	0.6058*	0.0000*
United Kingdom	-4.1888*	1.6351*	-1.0328*	0.6066*	0.0000*
Euro	-4.2390*	2.6295*	-0.8364*	0.5850*	0.0000*
Brazil	-2.9204	0.8816*	-0.7081*	0.1038	0.0000*
Chile	-3.8933*	2.6862*	-0.8127*	0.7141*	0.0000*
Colombia	-3.4484*	2.3489*	-0.2770*	0.0249	0.0000*
Czech Republic	-3.9262*	2.2020*	-0.9944*	0.4838*	0.0000*
Hungary	-3.2613*	1.4139*	-0.8343*	0.4671*	0.0000*
India	-3.2960*	1.4616*	-0.6293*	0.2568*	0.0000*
Indonesia	-3.3079*	1.5447*	-0.7573*	0.6865*	0.0000*
Malaysia	-3.7400*	2.0748*	-0.7214*	0.8454*	0.0000*
Mexico	-3.1656*	0.9147*	-0.8172*	0.3653*	0.0000*
Peru	-3.6175*	1.5589*	-0.7075*	0.2435	0.0000*
Philippines	-3.5838*	1.2420*	-0.5887*	0.3812*	0.0000*
Poland	-3.6425*	1.9803*	-1.0250*	0.7054*	0.0000*
Russia	-3.2337*	2.2328*	-0.6964*	0.8255*	0.0000*
South Africa	-3.6143*	0.9529*	-0.8322*	0.2678*	0.0000*
Thailand	-3.7713*	1.4977*	-0.3884*	0.2770	0.0000*
Turkey	-3.0559*	1.9217*	-0.6580*	0.4375*	0.0000*