The Dollar Variance Risk Premium: A Tale of Two Investors*

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Abstract

This paper examines the pricing of the dollar variance risk premium (DVP) in the currency market. We argue that domestic currency appreciation risk is the main driver of investors' risk premium on foreign currency investments. By decomposing the DVP into upside and downside components, we find that the two components predict currency returns with opposite signs. The downside DVP (risk premium for US investors) predicts foreign currency appreciation. Conversely, the upside DVP (risk premium for foreign investors) predicts dollar appreciation. Our results strongly suggest these signed variance risk premiums contain valuable predictive information about currency returns.

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1 Introduction

The financial market of the United States plays a crucial role in the global market. According to the World Bank, as of 2023, the US accounts for approximately 26% of the world's total GDP, yet its share of global equity market capitalization exceeds 40%. The Securities Industry and Financial Markets Association estimates that the relative fraction of the U.S. bond market is comparable to that of the equity market. This ratio would be even higher after including dollar-denominated debt issued by non-U.S. entities (e.g., Shin, 2012; Bruno and Shin, 2017; Maggiori, Neiman, and Schreger, 2020).

Recent research suggests that the US maintains a dollar carry position, with a long position in foreign assets and a short position in dollar assets, which earns a premium for bearing global uncertainty risk.[1] Moreover, studies indicate that the US is highly exposed to global risk, and fluctuations in the dollar can drive global business cycles. For example, Maggiori (2017) presents an equilibrium model that demonstrates how the currency of a developed country becomes a global reserve currency through financial intermediaries. In his model, the intermediary of the developed market provides liquidity during crises, resulting in high exposure to the global business cycle. A related study by Bruno and Shin (2017) indicates that US dollar appreciation leads to tighter credit conditions, triggering a global credit cycle.

In this standard view, a higher variance in dollar returns should predict appreciation in foreign currencies. A significant fraction of the variation in the dollar factor is driven by the global business cycle, and therefore, a higher dollar variance is closely tied to increased global uncertainty. Specifically, since the dollar value tends to appreciate in periods of high global uncertainty, US investors who are highly exposed to global risk will demand a risk

[1] See, for example, Gourinchas and Rey (2007); Caballero, Farhi, and Gourinchas (2008); Lustig, Roussanov, and Verdelhan (2014); Jiang, Krishnamurthy, and Lustig (2021, 2024).

premium for investing in the riskier foreign currencies. Meanwhile, foreign investors may be willing to pay a convenience yield for holding safer, dollar-denominated assets that hedge against global risk.

However, foreign (non-US) market participants may also be concerned about dollar fluctuations, as they add uncertainty to their investment. For example, foreign investors investing in the US market may be concerned that their portfolio value may decrease with a local currency appreciation. Moreover, since the marginal utility of foreign market participants is likely to be dissimilar to the global factor relative to that of US market participants, the benefit of investing in a safe-haven currency may be slightly less critical. Hence, the risk premium required for the dollar investment may be higher when global uncertainty is high.

This paper demonstrates that US and foreign investors require distinct risk premiums for international investments, each tied to a specific component of the currency variance risk premium. By decomposing bilateral exchange rate returns into US dollar appreciation and foreign currency appreciation, we find that the variance risk premiums associated with each of the components have opposing effects on future currency returns. Specifically, the variance risk premium linked to dollar appreciation predicts higher foreign currency returns, aligning with the risk premium required by US investors. Conversely, the risk premium associated with foreign currency appreciation predicts higher future US dollar returns, which indicates that it is tied to the premium demanded by foreign investors.

These findings indicate that both US and foreign investors are likely to be primarily concerned about local currency appreciation risk. There are several reasons domestic currency appreciation might be detrimental to economic participants. First, domestic investors with foreign investments benefit from local currency depreciation, as it increases the value of their foreign portfolios when converted back into domestic currency (see, for example, Jansen, Shin, and von Peter (2024)). A weaker currency also stimulates economic growth by making exports more competitive (Rodrik, 2008) and can reduce the real debt burden for countries with substantial local-currency debt, such as the US. Finally, currency appreciation can be a consequence of monetary policy tightening, which attracts foreign capital and strengthens the currency (e.g., Dornbusch (1976), Miranda-Agrippino and Rey (2020)).

We present a structural model with two countries, the US and a foreign country, where the stochastic discount factors (SDFs) are driven by US and foreign variance factors, as in Lustig, Roussanov, and Verdelhan (2014). In this model, currency returns are determined by differences in the SDFs, with positive foreign variance shocks leading to foreign currency appreciation, and positive US variance shocks driving dollar appreciation.

Our specification relies on two unique assumptions: First, we assume that each country's discount factor is more sensitive to its own local risks, meaning domestic uncertainty has a larger impact on local investors' marginal utility than foreign shocks. Additionally, variance shocks are likely to have asymmetric effects, with positive shocks being more economically meaningful and damaging than negative ones. These two assumptions imply that foreign currency appreciation/dollar appreciation is likely to be driven by news from the foreign country, and dollar appreciation is driven by shocks in the US.

The US dollar is commonly considered a safe asset. When US uncertainty is high, foreign investments become risky. During this time, US investors should require a higher risk premium for investing in non-US currencies. Therefore, according to the standard view, a high variance risk premium on dollar returns should predict foreign currency appreciation.

Our model, however, suggests that the predictability of the dollar's variance risk premium on future foreign currency returns depends on the relative size of currency appreciation and depreciation pressure. An increase in US uncertainty should raise the value of the dollar, adding risk for the US investor. Likewise, a foreign uncertainty is associated with a US depreciation risk and the risk premium required for the foreign investor.

To operationalize this idea, we decompose the currency variance risk premium into upside (linked to foreign currency appreciation) and downside (linked to US dollar appreciation) components, following the idea of Segal, Shaliastovich, and Yaron (2015), among others. This decomposition aims to separate the risks stemming from the two sources and to identify the respective risk premiums required by US and foreign investors. Intuitively, when the cost of hedging dollar (foreign currency) appreciation risk increases, the downside (upside) variance risk premium will increase. Foreign currency (the dollar) is likely to appreciate if this happens.

The empirical analysis confirms the hypothesis that the upside and downside components of the currency variance risk premia are priced with opposite signs. First, using the total dollar variance risk premium (DVP), defined as the cross-sectional average of the currency variance risk premium of individual currency pairs, and the US equity variance risk premium as in Londono and Zhou (2017), we confirm their finding that a higher dollar variance risk premium leads to a US dollar appreciation. As noted, this result is counterintuitive looking from the standard view, given that the US dollar is typically regarded as a safe currency.

However, when decomposing the DVP into upside and downside components, with each representing the risk premium on semi-variance associated with foreign currency and dollar appreciation, we find that the two components are priced with opposite signs. The downside DVP, associated with dollar appreciation risk, results in higher foreign currency returns, while the upside component, corresponding to foreign currency appreciation risk, yields higher US dollar returns. As a result, the skewness risk premium (SRP), defined as the difference between upside and downside DVP, strongly negatively predicts dollar returns.

Our results indicate that the SRP most accurately captures the risk premium for a dollar carry trade. In our model, the downside risk premium reflects the risk premium associated with global or US-specific risk. Consistent with this, we observe that the downside risk premium increases during periods of significant global turmoil, such as the Global Financial Crisis of 2008, and in US-specific events, such as the US credit rating downgrade in 2012. The upside risk premium of European currency pairs with the US dollar tends to rise during major European economic episodes, such as during the Greek debt crisis and after the vote of the Brexit referendum.

Although quoted options prices are based on bilateral exchange rates and currency pairs are traded assets, conceptually, the two risk premia should predict the dollar index returns. Consistent with this expectation, the US dollar index computed from the trade-weighted basket of foreign currencies tends to appreciate (depreciate) following periods of higher downside (upside) dollar variance risk premium. The same patterns are obtained for a panel of currency index returns: downside (upside) dollar premia predict appreciation (depreciation) of trade-weighted currency indexes in panel regressions with rich fixed effects and controls.

Motivated by the generalized framework, we further categorize currencies into safe and ordinary currency groups based on their behavior relative to the dollar during increases in the volatility index (VIX). Specifically, a currency is classified as 'safe' if it appreciates and 'ordinary' or 'unsafe' if it depreciates relative to the dollar during such periods. We then construct the upside and downside dollar variance risk premia separately for these two groups. When focusing on ordinary currencies, the patterns observed in the upside and downside premia are consistent with those seen when using the full set of currencies. However, for safe currencies, we observe the opposite pattern.

Within the framework of this paper, the dollar downside variance risk premium summarizes the risk premia on global/US crash risk, while the upside component captures premia for non-US risk. The SRP's pricing content is largely driven by the downside leg, because non-US risk is diversified across currencies. Therefore, the cross-sectional pricing result of Li, Sarno, and Zinna (2025), who argue the SRP factor is driven by systematic global risk, follows naturally from our framework. While their focus is on the cross-section of currency returns, we focus on the ability to forecast currency excess returns in time series.

This study is related to the literature studying the dominance of the dollar carry trade and its link to the global business cycle. Lustig, Roussanov, and Verdelhan (2014) provide a model of two variance factors – country-specific and world variance to show that the US dollar premium is driven by US business cycle risk. The framework used in this paper resembles their two-factor model. Bruno and Shin (2017), Bruno and Shin (2023), and Gopinath and Stein (2021) also emphasize the role of US business cycle risk as a determinant of dollar carry trade returns. Maggiori, Neiman, and Schreger (2019) argue that the US dollar plays a greater role as the only safe currency.[2] This paper indicates that the dollar risk, which may represent the US or global business cycle risk, is captured by the downside dollar variance risk premium.

Our study extends Londono and Zhou (2017), who use the world currency variance risk premium and the U.S. stock variance risk premium to predict the returns of 22 currencies. They demonstrate that an increase in the currency variance risk premium predicts foreign currency depreciation, while an increase in the stock variance risk premium predicts appreciation. Their explanation suggests that the currency variance risk premium reflects inflation uncertainty, while the US equity variance risk premium captures US-specific risk. Our explanation offers an alternative perspective that complements their findings. We show that factors beyond the inflation risk premium drive the observed results. Brunnermeier, Nagel, and Pedersen (2008) connect risk-neutral skewness of exchange rates with the crash risk of the carry trade strategy. Della-Corte, Ramadorai, and Sarno (2016) and Della-Corte, Kozhan, and Neuberger (2021) report an inverse relationship between the currency variance risk premium and the values of currencies in the cross-section.

[2]See also, Hassan (2013), Maggiori (2017), Lustig and Krishnamurthy (2019), and He, Krishnamurthy, and Milbradt (2019) among others.

Within the context of the equity market, Feunou, Jahan-Parvar, and Okou (2018) studies the decomposition of the downside and upside variance risk premia. They document a significant positive relationship between the downside stock equity variance risk premium and future equity returns, while such a relationship does not exist for the upside component. Similarly, Kilic and Shaliastovich (2019) find that an increase in the downside stock variance risk premium predicts higher bond excess returns. In contrast, in the international context, Held, Kapraun, Omachel, and Thimme (2020) and Londono and Xu (2023) suggest that both the upward and downward equity variance risk premia positively predict global equity returns. While the concept is generally applicable across all asset classes, these studies primarily focus on the equity market.

The remainder of this paper is organized as follows: the next section introduces a framework that studies the relationship between the asymmetric variance risk premium and the currency risk premium. Section 3 describes the data, which is followed by the main empirical analysis in Section 4. We study the drivers of the skewness risk premium in Section 5. This paper concludes in Section 6.

2 The framework

2.1 Baseline setup

This section provides a simple framework for understanding the intuition behind the empirical analysis. We start with a two-country model, consisting of the US and a foreign country i. Any variables related to the foreign country will be marked with the superscript i, while those for the US will not have a superscript.

We assume that the US factor (z_t) and the foreign factor (z_t^i) both follow a mean-reverting processes:

$$z_t^i = \phi^i + \theta^i z_{t-1}^i + \sigma\sqrt{\frac{z_{t-1}^i}{2}}(v_t^i - 1)$$
$$z_t = \phi + \theta z_{t-1} + \sigma\sqrt{\frac{z_{t-1}}{2}}(v_t - 1),$$

where v_t^i and v_t are independent random errors that follow a Chi-square distribution with a degree of freedom 1. The variables z_t and z_t^i represent the variances of these processes and can be interpreted as the variance of some underlying factor, which will not be specified.[3] In this specification, the distribution of shocks to SDF is positively skewed. When shocks are positive, they are more likely to be large in magnitude compared to when shocks are negative.

The SDF of the foreign country (m_{t+1}^i) depends on the US and country i's factors. That is, we let

$$m_{t+1}^i = a^i + b^i z_t^i + c^i z_t + \delta^i\sqrt{\frac{z_t^i}{2}}(v_{t+1}^i - 1) + \lambda^i\sqrt{\frac{z_t}{2}}(v_{t+1} - 1),$$

where z_t denotes the US and z_t^i a non-US factor variance. v_{t+1} and v_{t+1}^i are shocks to these variance factors, which have a variance of 2. Similarly, the SDF of the US (m_{t+1}) is defined as

$$m_{t+1} = a + bz_t^i + cz_t + \delta\sqrt{\frac{z_t^i}{2}}(v_{t+1}^i - 1) + \lambda\sqrt{\frac{z_t}{2}}(v_{t+1} - 1),$$

where the variables are defined as above. Without loss of generality, the US is exposed relatively more to US shocks ($\lambda > \lambda^i$), and relatively less to non-US shocks ($\delta < \delta^i$). This assumption, that US investors' marginal utility depends more on US risk, together with the

[3]The core intuition of this paper is insensitive to this assumption. One can also assume a Gamma distribution as in Bekaert, Engstrom, and Ermolov (2015). The independence assumption can also be relaxed by considering an orthogonalized foreign factor from the US factor z_t.

first assumption that SDF shocks are positively skewed, implies that investors are concerned about currency appreciation risk.

The two-factor representation considered in the baseline case is closely related to Lustig, Roussanov, and Verdelhan (2011, 2014) in that shocks are entirely determined by the variance processes of underlying factors. As a baseline, we do not include a global factor. The US factor may be closely related to the global factor, for example, if the US dollar becomes the single dominant currency as a result of an equilibrium (Maggiori, 2017; Gopinath and Stein, 2021). In this case, modeling a separate global factor may not be necessary. However, Verdelhan (2018) indicates that both US and global factors are needed to explain variations in the bilateral exchange rates. Later, we consider a generalized case with more than two factors.

When the market is complete, currency returns can be represented by the difference between the foreign SDF (m^i_{t+1}) and the US SDF (m_{t+1}). Denoting the log of foreign currency value relative to the US as q,

$$\Delta q^i_{t+1} = m^i_{t+1} - m_{t+1}, \tag{1}$$

where a higher value of q^i implies a currency appreciation for the foreign currency.

We define the risk premium of investing in foreign currency for the US investor as the covariance between the log SDF (m) and currency returns.[4] The risk premium depends on the variance of US and non-US factors, which can be expressed by:

$$\mathrm{Cov}_t\left(-m_{t+1}, \Delta q^i_{t+1}\right) = \delta(\delta - \delta^i) z^i_t + \lambda(\lambda - \lambda^i) z_t. \tag{2}$$

[4]We note that this approximates the excess returns for the US investor because the SDF is non-normal. The exact formula can also be derived, as in Feunou, Jahan-Parvar, and Okou (2018), which yields the same qualitative intuition through a more complicated computation.

Since by assumption $\delta < \delta^i$ and $\lambda > \lambda^i$, foreign currency is expected to appreciate when US variance (z_t) increases or when the foreign country's variance (z_t^i) decreases.

The object is to understand how the currency variance risk premium is related to the risk premium of the currency investment. In dollar terms, we define the currency variance risk premium (CVRP) of the exchange rate between country i and the US as

$$\mathrm{Cov}_t\left(m_{t+1}, (\sigma_{q,t+1}^i)^2\right) = (\delta^i - \delta)^2 \delta \sigma z_t^i + \lambda(\lambda - \lambda^i)^2 \sigma z_t, \tag{3}$$

where $(\sigma_{q,t+1}^i)^2$ is the variance of currency i's return against the USD, and the negative sign on the SDF is omitted following the literature on the equity variance risk premium (e.g., Bollerslev, Tauchen, and Zhou (2009)). Comparing Equations (2) and (3), the currency variance risk premium can either positively or negatively predict future currency returns depending on the relative size of variations in US versus non-US factors. Specifically, the equations imply that controlling for the US variance, CVRP should negatively predict foreign currency returns, which is a result that is consistent with Bakshi and Panayotov (2013) and Feunou, Jahan-Parvar, and Okou (2018), among others.

2.2 Decomposition of currency risk premium

According to the SDF representation in Equation (1), variance shocks in the foreign economy and the U.S. generate opposite effects on currency movements. This is driven by the model's structure, where shocks to marginal utility are positively skewed. They have a substantial upside from positive variance shocks but a limited downside. Consequently, when analyzing large currency fluctuations, a positive foreign variance shock is associated with an appreciation of the foreign currency, whereas a sharp rise in the U.S. factor variance is linked to a significant U.S. dollar appreciation.

Following this logic, we consider a decomposition of currency variance into upside and downside components as in Segal, Shaliastovich, and Yaron (2015). Ignoring small changes in currency values, the first component of Equation (3), $(\delta-\delta^i)^2 z_t^i$, represents the variance risk premium associated with a foreign currency appreciation. The second component, $(\lambda-\lambda^i)^2 z_t$, is the variance risk premium driven by US dollar appreciation.

Following the work of Feunou, Jahan-Parvar, and Okou (2018) and Bollerslev (2022) on the equity variance risk premium, we decompose the currency variance risk premium into upside and downside components. The total CVRP is the sum of the components associated with a foreign currency appreciation or depreciation:

$$CVRP = CVRP_t^U + CVRP_t^D,$$

where

$$\begin{aligned} CVRP_t^U &= \mathrm{Cov}_t(m_{t+1}, (\delta-\delta^i)^2 z_{t+1}^i) = \delta(\delta^i-\delta)^2 \sigma z_t^i \\ CVRP_t^D &= \mathrm{Cov}_t(m_{t+1}, (\lambda-\lambda^i)^2 z_{t+1}) = \lambda(\lambda-\lambda^i)^2 \sigma z_t. \end{aligned}$$

The upside CVRP ($CVRP^U$) is associated with the non-U.S. factor variance and indicates foreign currency appreciation risk. From a foreign investor's perspective, it captures the downside risk of investing in the U.S. market. The downside CVRP ($CVRP^D$) is driven by the U.S. factor variance and signals U.S. dollar appreciation risk. It reflects the downside risk for a U.S. investor investing in the international market. Because the downside CVRP captures the risk of dollar appreciation, a high downside CVRP predicts a foreign currency appreciation. Therefore, the dollar carry trade strategy is expected to be more successful when the downside CVRP is high.

2.3 The role of a global factor

While recent studies, such as Bruno and Shin (2017) and Maggiori (2017), suggest that the U.S. factor may be closely related to a global factor, the country most exposed to this global element might not be the U.S. itself. As Lustig, Roussanov, and Verdelhan (2011) notes, some countries may exhibit even higher exposure to the global factor than the U.S. These countries tend to provide funding to the global economy when global uncertainty peaks, effectively acting as a true safe haven. These safe-haven countries typically exhibit lower interest rates, and their currencies ('safe' currencies) function as the funding currency in carry trade strategies (Ranaldo and Söderlind, 2010).

We next consider a generalized model with more than two countries. This generalized model is useful in understanding the source of the semi-variance risk premium of safe currencies. In this generalized setting, the SDF for country i can be represented by:

$$m^i_{t+1} = a^i + \sum_{j \in \mathscr{I}} b^i_j z^j_t + c^i z_t + \sum_{j \in \mathscr{I}} \delta^i_j \sqrt{\frac{z^j_t}{2}}(v^j_{t+1} - 1) + \lambda^i \sqrt{\frac{z_t}{2}}(v_{t+1} - 1),$$

where $\mathscr{I}$ represents the set of all countries/regions in the world excluding the US and z_t represents the US factor (which may be closely related to the global factor), and v^j_{t+1}, $j \in \mathscr{I}$ and v_{t+1} follow a Chi-square distribution as described above.

For each currency j, the factors (z^j_t) follow an independent mean-reverting process similar to the baseline specification.

$$z^j_t = \phi^j + \theta^j z^j_{t-1} + \sigma \sqrt{\frac{z^j_{t-1}}{2}}(v^j_t - 1).$$

Under these dynamics, the unexpected currency return can be written as:

$$\sum_{j\in\mathscr{I}}(\delta_j^i-\delta_j)\sqrt{\frac{z_t^j}{2}}(v_{t+1}^j-1)+(\lambda^i-\lambda)\sqrt{\frac{z_t}{2}}(v_{t+1}-1), \tag{4}$$

where $\delta_i^i > \delta_i^j, \forall i \neq j$. This means that the exposure of currency i to its own factor is greater than that of the US. We additionally assume that safe currencies have a greater exposure to the global factor than the US ($\lambda^i > \lambda$). Therefore, the value of safe currencies will appreciate relative to USD when shocks originate from the world.

In this generalized framework, the risk premium of investing in country i for the US investor can be expressed by the sum of multiple variance factors:

$$\mathrm{Cov}_t\left(-m_{t+1},\Delta q_{t+1}^i\right)=\sum_{j\in\mathscr{I}}\delta(\delta_j-\delta_j^i)\sigma z_t^j+\lambda(\lambda-\lambda^i)\sigma z_t. \tag{5}$$

A special case arises where $\delta_j = \delta_j^i$, the US and the foreign country i have the same exposure to a third country ($j \neq i, US$). In this scenario, the generalized framework is equivalent to this special case.

The difference in the currency variance risk premium between safe and other currencies can be understood by examining the decomposition of variance and the variance risk premium. Specifically, the upside and downside variance risk premiums of a safe currency will contain different types of information compared to those of most other ordinary currencies.

$$
\begin{aligned}
&\text{Case 1 : Safe currencies}\\
&CVRP_t^U = \delta(\delta^i - \delta)^2 \sigma z_t^i + \lambda(\lambda - \lambda^i)^2 \sigma z_t + \sum_{j \neq i} \delta_j^i 1_{\delta_j^i > \delta_j} (\delta_j^i - \delta_j)^2 \sigma z_t^j\\
&CVRP_t^D = \sum_{j \neq i} \delta_j^i 1_{\delta_j^i < \delta_j} (\delta_j^i - \delta_j)^2 \sigma z_t^j\\
&\\
&\text{Case 2 : Most other currencies}\\
&CVRP_t^U = \delta_i(\delta_i^i - \delta_i)^2 \sigma z_t^i + \sum_{j \neq i} \delta_j^i 1_{\delta_j^i > \delta_j} (\delta_j^i - \delta_j)^2 \sigma z_t^j\\
&CVRP_t^D = \lambda(\lambda - \lambda^i)^2 \sigma z_t + \sum_{j \neq i} \delta_j^i 1_{\delta_j^i < \delta_j} (\delta_j^i - \delta_j)^2 \sigma z_t^j
\end{aligned}
$$

The equation $CVRP = CVRP_t^U + CVRP_t^D$ holds universally.

These structural decompositions highlight how a country's exposure to global and country-specific risks is reflected in the upside and downside components. Specifically, the global risk factor is captured by the upside CVRP for safe currencies and the downside CVRP for most other currencies. A high value for this global-factor component in either case suggests the dollar is expected to depreciate. Conversely, the US dollar will appreciate following periods of high upside CVRP for ordinary currencies or high downside CVRP for safe currencies.

3 Data and Estimation

3.1 Data

We focus on nine major currencies of developed markets against the US dollar: the Australian dollar (AUD), the Canadian dollar (CAD), the Swiss franc (CHF), the Euro (EUR), the

British pound (GBP), the Japanese Yen (JPY), the Norwegian Krone (NOK), the New Zealand dollar (NZD), and the Swedish Krone (SEK). For AUD, CAD, CHF, EUR, GBP, JPY, and NZD (seven currencies), the sample period is from January 2008 to December 2022, while for NOK and SEK (two currencies), the sample period covers October 2008 to December 2022. Currency returns, obtained from Bloomberg, are measured as the relative value of the currency to the US dollar. Consistent with the model, we adhere to the American quotation method so that a positive return always indicates an appreciation of the non-U.S. currency.

The option prices of currency pairs are obtained from Bloomberg. We use currency options quoted in US dollars. High-frequency data of the currencies and the SPX are sourced from histdata.com. The sample is mostly restricted by the existence of high-frequency data, which are available only from October 2008.

The interest rate data for these countries are from Du and Schreger (2016), with missing maturity rates interpolated whenever necessary. We compute the equity market variance risk premium (EVRP) directly using the volatility index (VIX), which is available at the Chicago Board Options Exchange.

In our empirical analysis, we use currency index returns as an alternative dependent variable. We use the trade-weighted dollar index of advanced economies downloaded from the Federal Reserve. Alternatively, the nominal effective exchange rate is obtained from the Bank of International Settlements (BIS). We use the narrow index for the US dollar and for other currency returns of interest relative to the USD.

We use the sovereign credit default swap (CDS) spread data obtained from Intercontinental Exchange. For each country, we use the mid-quote of the spread at the end of the month. The values for the Euro are matched to the two largest countries in terms of economic size in the Euro area, namely France and Germany.

The global uncertainty data of Bekaert, Engstrom, and Xu (2022) is obtained from Nancy Xu's website. The global financial cycle data of Miranda-Agrippino and Rey (2020) is from Silvia Miranda-Agrippino's website. Since this factor is highly persistent, with the first-order serial correlation exceeding 0.96, we use the first-order difference in the raw factor in our analysis.

3.2 The dollar variance risk premium (DVP)

The risk premium on the quadratic variation of currency i returns between time t and $t+1$ can be approximated by the difference between the risk-neutral expectation (Q) and the physical expectation (P) of the quadratic variation, conditional on time t information. Carr and Wu (2009) show that the variance risk premium, defined as the negative covariance between the SDF and the variance, can be approximately expressed as the difference between the physical and the risk-neutral expectations. We follow the convention (e.g., Bollerslev, Tauchen, and Zhou (2009)) and define the risk premium as the risk-neutral minus the physical expectations.

We measure the currency variance risk premium of the currency pair between country i and USD by

$$CVRP_{i,t} = E_t^Q[QV_{i,t^+}] - E^P[QV_{i,t^+}], \tag{6}$$

where QV_{i,t^+} is the quadratic variation of currency return i aginst the USD during a one month period from time t.

The risk-neutral expectation of the quadratic variation is estimated using option prices. Due to the scarcity of strike prices for currency options, we interpolate the implied volatility curves, using the Vanna-Volga interpolation method of Castagna and Mercurio (2007). This method is advantageous in our setting because it only requires three option quotes to be available at a given maturity. After interpolation, we apply the Bakshi, Kapadia, and Madan (2003) method to compute the risk-neutral expectation of variance.

For the physical expectation, we first take the sum of the squared 30-minute returns. Then, we adopt the heterogeneous autoregressive realized variance (HAR-RV) model of Corsi (2009). Corsi (2009) suggests that the daily, weekly, and monthly sums of squared high-frequency returns perform well in capturing the long-memory feature of realized variance. To forecast the variance of S&P 500 Index returns, Bekaert and Hoerova (2014) propose including the square of VIX to improve out-of-sample predictability.

Based on these studies, we consider the model:

$$\sum_{j=1}^{22} RV_{i,\tau+j} = \beta_0 + \beta_d RV_{i,\tau} + \beta_w \sum_{j=0}^{4} RV_{i,\tau-j} + \beta_m \sum_{j=0}^{22} RV_{i,\tau-j} + \beta_q E_{\tau}^{Q}\left[QV_{i,\tau^+}\right] + \epsilon_{i,\tau+22}, \quad (7)$$

where $E_{\tau}^{Q}\left[QV_{i,\tau^+}\right]$ is the one-month option-implied variance of currency i at time τ. This model is estimated once using the entire sample, and the predicted values are used as a measure of the physical expectation of variance.[5]

The difference between the two expectations for currency returns is the currency variance risk premium (CVRP) for currency i. We note that this measure is defined for each currency against the USD. Similarly, the US equity variance risk premium (EVRP) of the S&P 500 Index is defined as the difference between the expectations on index return variance. The risk premium measures are annualized.

Following the approach of Feunou, Jahan-Parvar, and Okou (2018), and Bollerslev (2022), the upside and downside semi-variance risk premium is estimated for each currency, which we denote by CVRP_i^U and CVRP_i^D, for currency i. As in Barndorff-Nielsen, Kinnebrock, and

[5]We consider variants of the present model and confirm that the current model generates the best predictability for major currencies. The results of this paper are robust; for example, our results remain qualitatively unchanged if we assume a random walk in RV and simply take the value of the previous month.

Shephard (2010), the variance of currency returns is decomposed into upside and downside components. The variance of the two components, or the semi-variance, is defined as:

$$RV^U_{i,t} = \sum_{\forall s \in t} r^2_{i,s} \mathbf{1}_{r_{i,s}>0}$$
$$RV^D_{i,t} = \sum_{\forall s \in t} r^2_{i,s} \mathbf{1}_{r_{i,s}<0}$$

where $r_{i,s}$ is the intraday return of currency i against the US dollar and $\mathbf{1}_.$ is an indicator variable, which takes a value of 1 when the condition denoted by the subscript is true and 0 otherwise.[6]

Similar to the total CVRP for each currency, the risk-neutral expectation of upside and downside semi-variance can be derived from the equations:

$$E^Q_t \left[QV^U_{i,t^+} \right] = 2e^{r(i,t)} \int_{F_{i,t}}^{\infty} \frac{1}{K^2} C\left(i, t; K\right) dK \tag{8}$$
$$E^Q_t \left[QV^D_{i,t^+} \right] = 2e^{r(i,t)} \int_{0}^{F_{i,t}} \frac{1}{K^2} P\left(i, t; K\right) dK,$$

where C is the price of the call, P is the price of the put at time t with strike price K with an expiration date one month from time t, and r is the one month risk-free rate.

Also, the HAR-RV model with the risk-neutral expectation is applied to semi-variances. The full model considered is

$$\sum_{j=1}^{22} RV^k_{i,\tau+j} = \beta^k_0 + \beta^k_d RV_{i,\tau} + \beta^k_w \sum_{j=0}^{4} RV^k_{i,\tau-j} + \beta^k_m \sum_{j=0}^{22} RV^k_{i,\tau-j} + \beta^k_q E^Q_\tau \left[QV^k_{i,\tau^+} \right] + \epsilon^k_{i,\tau+22}, \tag{9}$$

[6] Da Fonseca and Dawui (2021) note that it may be more appropriate to define the realized variance from the realization of the entire interval. However, we choose to use the semi-variance, following Kilic and Shaliastovich (2019) and Londono and Xu (2023), among others, for practical reasons. Either the upside or the downside realized variance takes a value of zero in Da Fonseca and Dawui (2021).

where the model is estimated separately for each currency and both $k = U, D$. The one-step-ahead forecast formed each month is used to measure the physical expectation of upside and downside variance.

We measure the dollar variance risk premium (DVP) as the simple cross-country average of the individual CVRP. The motivation for taking the average follows Londono and Zhou (2017). They argue that the average captures global inflation uncertainty. In our model, the DVP should measure a combination of the risk premium associated with US and non-US global uncertainty.

We consider a decomposition of DVP. The upside DVP (DVP^U) is the risk premium on the semi-variance associated with foreign currency appreciation, and the downside DVP (DVP^D) is the risk premium on the semi-variance of US dollar appreciation. In our model, the upside component captures the risk premium associated with uncertainty in the foreign sector, and the downside component is related to that of the US sector.

Based on the dollar semi-variance risk premium, we also define the currency-level skew risk premium (CSRP), as in Feunou, Jahan-Parvar, and Okou (2018), by the difference between upside and downside currency VRP. The dollar skewness risk premium (SRP), defined similarly, captures the price of risk associated with foreign currency appreciation or dollar depreciation. Naturally, the following relationship holds:

$$DVP_t = DVP_t^U + DVP_t^D$$

$$SRP_t = DVP_t^U - DVP_t^D$$

The upside and downside DVP is illustrated in Panel (a) of Figure 1. The red line displays the downside DVP, and the blue line shows the upside DVP. This figure suggests that these two series are highly correlated, with the downside component fluctuating more than the upside component. This is a natural observation because the downside component captures the risk premium on US/global risk, and the upside captures the average of the risk premium on foreign risk.

Panel (b) displays the time-series plot of the SRP, which is the difference between the two lines in Panel (a). This panel shows that a downward spike in the SRP tends to move down with a major increase in global or US uncertainty. The upside spike seems to be related to shocks that originate outside the US, mostly related to European shocks. Because we take the average of the upside CVRP for all countries, the spike in the upside DVP is naturally smaller. This figure provides prima facie evidence that confirms the upside DVP is likely to reflect the risk premium on the foreign sector, and the downside is related to uncertainty arising globally or in the US.

To better understand the two components of the CVRP, we compute the SRP using only five European currency pairs against the US dollar – CHF/USD, EUR/USD, SEK/USD, NOK/USD, and GBP/USD. Figure 2 (a) illustrates the time series of the European SRP. This panel shows that the European SRP tend to spike upon events that mainly affected the European economy, such as the vote of the Brexit referendum and the Greek debt crisis. One reason this pattern is not observed in Figure 1(b) might be due to averaging when computing the upside DVP, which should include country-specific information according to the provided framework.

Figure 2 (b) displays the time series of the SRP computed from JPY/USD. The series tends to spike in response to shocks affecting the US, global, or Japanese economy. Notably, both Japanese-oriented and global shocks increase the SRP, a pattern that distinguishes it from the case of the European SRP.

Panel A of Table 1 provides the mean and the standard deviations of the CVRP and currency returns, which are annualized. For the variance risk premium, the total, upside, and downside CVRP are measured for each currency. The CVRP is predominantly negative, with the notable exception of CHF. A more detailed decomposition of the CVRP reveals that only the upside risk premium carries a negative value. This pattern suggests that only the variance associated with a dollar appreciation has a negative price of risk. Conversely, the variance risk of a foreign currency appreciating has a positive price, much like the "good variance" discussed in the literature (e.g., in the works of Segal, Shaliastovich, and Yaron (2015) Kilic and Shaliastovich (2019)).

Panel B of the table shows the summary statistics for the aggregate measures, the dollar and stock variance premiums, DVP_t and $EVRP_t$, respectively, as well as their up and down variance premiums, DVP_t^U, DVP_t^D, and the skewness risk premium (SRP).

In the presence of jumps, Patton and Sheppard (2015) demonstrate that the difference in upside and downside semi-variance captures the effect of the difference in positive and negative jumps. Although the possibility of positive and negative jumps is not considered in the model, it is implicitly assumed that large fluctuations in currency returns will determine the two DVP components. Therefore, the two components may capture information about signed jumps.

The SRP we consider does not exactly measure the risk premium on the third moment. Instead, it measures the difference in the risk premium required for downside and upside movements in currency returns. Controlling for the total DVP, the SRP should measure the asymmetry of the price of dollar appreciation and depreciation risk. Specifically, SRP is more negative when investors require relatively higher compensation for US dollar appreciation risk.

The SRP is closely related to the risk-neutral and physical skewness of dollar returns. In fact, Brunnermeier, Nagel, and Pedersen (2008) argue that the risk-neutral skewness predicts carry trade crashes. Therefore, it is useful to analyze if the main results we show are driven by the risk-neutral skewness. The analysis in the appendix shows that our results are robust even after controlling for the risk-neutral and the physical skewness of dollar returns.

3.3 The currency variance risk premium of safe currencies

In the baseline model, foreign countries are assumed to have a relatively smaller exposure to US variance shocks. Under this assumption, the risk premium required by US investors to make international investments should increase when the downside DVP is higher. In the extended model, when an additional global factor is introduced, we show that the risk premium of the global factor may be reflected in the upside or the downside components of the CVRP, depending on the country's exposure to global risk.

Earlier figures suggested that the SRP tends to decrease with higher global risk. While this pattern could be explained by the US's high exposure to global risk, as Maggiori (2017)'s model suggests, it is also possible that US variance is directly affected by global risk. Empirically, these two explanations are difficult to distinguish. Within the framework of Lustig, Roussanov, and Verdelhan (2011), some countries may have greater exposure to the global risk than the US.

The model suggests that currencies of countries with low exposure to US variance risk should depreciate with a positive US variance shock. Conversely, currencies of countries with a relatively higher exposure ("safe" currencies) should appreciate. Therefore, an increase in global risk leading to a dollar appreciation should be reflected in both the upside CVRP of safe currencies and the downside CVRP for most other ordinary currencies.

We measure this by the correlation between the first-order difference in the VIX and currency returns. Figure 3 displays the correlation estimated using weekly data from 2006–2022. This figure shows that most currencies tend to depreciate against the US dollar when

US variance increases. However, this correlation has the opposite sign for two currencies – CHF and JPY. This result is consistent with Brunnermeier, Nagel, and Pedersen (2008), who find that the funding currencies of carry trades tend to appreciate relative to investment currencies during periods of higher VIX.

Therefore, empirically, we select CHF and JPY as safe currencies, while the remaining seven are classified as ordinary or unsafe currencies. This classification aligns with research from Ranaldo and Söderlind (2010). Using this classification, two subversions of the DVP are considered, $DVP_{\text{Safe},t}$ and $DVP_{\text{Unsafe},t}$, respectively. The DVP_{Safe} is computed as the average of the CVRP of Japan and Switzerland, while DVP_{Unsafe} is the simple average of the CVRP of the remaining seven countries/regions. The up and down semi-variance risk premiums are also computed, which are denoted by superscripts ^{U} and ^{D}.

To see the validity of this classification of currencies, Table 2 provides the correlation between CSRP across currencies. First, focusing on the Canadian dollar (CAD), the SRP is positively correlated with most currencies except for CHF and JPY, which we classify as safe currencies. The SRP of CHF is positively related to most other currencies, but the correlation to each other is extremely low. The SRP of JPY is positively related to CHF but negatively related to all other currencies, which validates our classification of safe and unsafe currencies. These findings lend support to the classification of CHF and JPY as safe currencies.

Figure 4 displays the time series plots of the SRP computed separately for safe and unsafe currencies. The measure for safe currencies is illustrated in a blue line, whereas that for unsafe currencies is shown in a red line. Notably, these two series tend to move in opposite directions in market turmoils such as during the 2008–2009 Global Financial Crisis, or during recent high inflation periods.

4 Empirical Analysis

This section studies the relationship between dollar returns and the risk premia estimated from option prices and high-frequency data. We first begin by revisiting the analysis of Londono and Zhou (2017). Then, we decompose the DVP into upside and downside components and study how the SRP relates to future dollar returns.

4.1 Dollar variance risk premium

Londono and Zhou (2017) demonstrate that both the DVP and the EVRP of the US predict currency returns with opposite signs. They show that DVP predicts dollar returns negatively, while the EVRP predicts dollar returns positively. They argue that not only are these two premia priced, but they also help explain the forward premium puzzle.

We also consider the pooled ordinary least squares (OLS) following Londono and Zhou (2017) using our sample. The model we consider is:

$$\Delta q_{i,t+1} = b_0 + b_D DVP_t + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t} \right) + FE_i + e_{i,t+1}, \tag{10}$$

where $q_{i,t}$ represents the logarithm of the exchange rate in dollars per unit of currency i, $y_{US,t} - y_{i,t}$ is the interest rate differential between the US and the foreign country, and FE_i is to capture a country-fixed effect. We include country-fixed effects in all of our analyses, but the results are qualitatively similar without fixed effects. The coefficients of the explanatory variables are specified to be homogeneous across currencies, akin to Londono and Zhou (2017).

We study the predictability of currency returns for one-month, three-month, six-month, and twelve-month horizons. Currency returns for multi-periods are annualized, so that the specifications are comparable with each other.

Panel A of Table 3 provides the estimation results of panel regression (10) alongside the Newey-West adjusted t-statistics. Firstly, consistent with the uncovered interest parity (UIP), the regression coefficients for interest rate differentials are close to 1. Londono and Zhou (2017) report a positive coefficient on the interest rate differential, but they are statistically different from 1. In our sample, we fail to reject the hypothesis that the interest rate differential is different from 1. Our regressions suggest this finding is a characteristic of our sample period, rather than a result of the specific control variable used.

Second, similar to Londono and Zhou (2017), DVP exhibits consistently negative coefficients across all forecasting periods, while $EVRP$ showed positive coefficients across all forecast horizons. The coefficients are not necessarily always statistically significant, but the signs are consistent with Londono and Zhou (2017). The predictability is strongest at the three-month horizon.

Londono and Zhou interpret EVRP as the risk premium on stock market uncertainty, and DVP as a proxy for the premium on global inflation uncertainty. They argue that the DVP will represent a preference for safe US dollar investing. EVRP instead proxies for US stock market uncertainty. When stock market uncertainty is high, US investors will require a higher risk premium for foreign currency investment. While these explanations are plausible, it is unclear why US investors would not require a higher risk premium for international investments when the risk premium on their investment return volatility is high.

Relating these empirical patterns to the provided baseline model, DVP proxies for foreign uncertainty, while EVRP represents the risk premium on US uncertainty. The model suggests that when US uncertainty is high, US investors require a higher risk premium, while when uncertainty originates from a foreign sector, foreign investors will require a higher risk premium. Because non-US investors have greater exposure to foreign uncertainty, foreign investors will require a higher risk premium for US investments. US investors are exposed to US uncertainty risk, which implies they will require a higher risk premium for international investments when US uncertainty is high.

We next decompose the dollar variance risk premium into upside and downside components and study the role of each as a determinant of the currency risk premium.

4.2 Downside and upside dollar variance risk premium

The upside and downside components of the DVP correspond to semi-variance associated with dollar depreciation and appreciation risk, respectively. In the SDF representation, an increase in US uncertainty drives up the downside variance (dollar appreciation), while an increase in foreign uncertainty raises the upside variance (foreign currency appreciation). Therefore, if investors are concerned about currency appreciation risk, these two components directly represent the relevant variance risk premium for foreign and US investors.

For foreign investors in the US market, their downside risk corresponds to US dollar depreciation. Conversely, for US investors, their downside risk corresponds to US dollar appreciation. Consequently, a foreign investor would require a higher risk premium when their local currency appreciation risk is high. Conversely, a US investor would expect higher returns from foreign investment when dollar appreciation risk is high. Therefore, the downside DVP should represent the risk premium required by US investors, and the upside should reflect that of foreign investors.

This hypothesis is tested using a predictive regression after decomposing the DVP into upside and downside components. The specific model considered is

$$\Delta q_{i,t+1} = b_0 + b_U DVP_t^U + b_D DVP_t^D + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t}\right) + e_{i,t+1}, \tag{11}$$

where DVP^U and DVP^D are the upside and downside DVP, and other variables are defined as above. Similar to prior analyses, we consider forecast horizons between one and twelve months, where currency returns are always converted to annual terms.

Panel B of Table 3 summarizes the results of the pooled regressions. For all forecast horizons, DVP^U predicts a foreign currency depreciation, while DVP^D predicts a foreign currency appreciation. This finding is consistent with the model's prediction: a high premium for US dollar appreciation risk (downside) implies a dollar depreciation; conversely, a high premium for US dollar depreciation risk (upside) implies a dollar appreciation This effect is strong across both short- and long-term horizons.

The panel also shows that the upside DVP, the premium for potential US dollar depreciation risk, has a higher coefficient than the downside DVP. The negative sign on the total DVP in Panel A is a combination of the highly negative coefficient on the upside component and a slightly positive sign of coefficient on the downside component. The weaker statistical significance of the downside DVP coefficient is also a result of controlling for the EVRP, which may proxy for a similar type of information.

In the next specification, the SRP is used instead of using the upside and downside DVP separately. The specific model considered is

$$\Delta q_{i,t+1} = b_0 + b_S SRP_t + b_D DVP_t + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t}\right) + e_{i,t+1}, \tag{12}$$

Since SRP is defined as the difference between the upside and downside DVP, we expect a negative sign on SRP. The results of this alternative specification are provided in Panel C.

Panel C indicates that the SRP has a negative coefficient, implying that foreign currency appreciation risk leads to a higher future dollar value. The signs on SRP are all negative and statistically significant, before and after controlling for the DVP and the US EVRP.

To summarize, our findings align with the model's predictions. The downside DVP predicts foreign currency appreciation, while the upside DVP predicts foreign currency depreciation. These results suggest a compensation channel for risk-taking, where the upside DVP plays a more significant role in explaining the overall negative sign of the total DVP.

4.3 Dollar index predictability

We next extend our panel analysis of currency risk premiums using time-series regressions on aggregate dollar indices. There are two purposes of this analysis. The first purpose of the analysis is to examine if the empirical results align with the model's predictions, specifically that the upside DVP leads to a dollar appreciation and the downside DVP leads to a foreign currency appreciation. Although the analysis above documents this relationship using individual currency pairs, we expect this to hold if we use the dollar index instead.

The second purpose is to address a potential statistical weakness of the initial pooled OLS regression. The repeated use of the same independent variables (DVP, SRP, EVRP) for multiple currencies in the same month could lead to downward-biased standard errors. By using a time-series regression with a single, aggregate dollar index, the analysis eliminates this potential issue, providing a more reliable and statistically sound confirmation of the initial findings.

We first use the trade-weighted dollar index obtained from the BIS and supplement it with the index published by the Federal Reserve Bank of St. Louis. We estimate a time series regression with a single dependent variable, but the specification is similar to the panel regression (12). Also, to be consistent with how foreign currencies are quoted in other tables, we take the negative of the US dollar index returns.

Table 4 summarizes the result of the time-series regressions. Panel A shows the results using the trade-weighted dollar index of BIS, whereas Panel B describes those using the advanced economy dollar index of the Federal Reserve. Overall, the results of both panels are consistent with the model predictions.

Focusing on Panel A, a higher SRP predicts future dollar appreciation at all horizons. A relative increase in the variance risk premium associated with foreign currency appreciation leads to a dollar appreciation, whereas the risk premium related to dollar appreciation leads to a foreign currency appreciation. The one-month predictive coefficient is statistically insignificant after controlling for the EVRP, but all other coefficients are statistically significant. For longer-term forecasts, the coefficient is significant even after controlling for EVRP.

4.4 Foreign currency index returns

The framework suggests that the downside DVP contains information about global or US risk that could lead to a dollar appreciation. The upside DVP, on the other hand, is the average of foreign shocks and is associated with foreign currency appreciation risk.

While most options are quoted against the USD, making it reasonable to describe the variance risk premium relative to the dollar, the logic of this paper suggests that the upside CVRP for each currency should lead to an appreciation of that specific currency.

Therefore, we use the currency indices provided by the Bank for International Settlements (BIS) to test if this relationship holds at the individual currency level. We expect that an increase in an individual CSRP will lead to a depreciation of that non-US currency.

The specification we consider is a panel regression:

$$\Delta CX_{i,t+1} = b_0 + b_S CSRP_{i,t} + b_D CVRP_{i,t} + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t} \right) + e_{i,t+1}, \qquad (13)$$

where $CX_{i,t}$ is the index return of currency i, where a higher value of CX_i indicates a currency appreciation for currency i, CSRP is the currency level skewness risk premium, and CVRP is the individual currency level variance risk premium.

Table 5 describes the results of the panel regression estimated using each currency index. The panel demonstrates a strong relationship across all forecast horizons. A higher currency-level skewness risk premium (CSRP) is consistently associated with lower future index returns, which confirms our initial expectation that a higher upside variance risk premium leads to a depreciation of the non-US currency. These results provide robust evidence that our measures of signed variance and skewness risk premiums contain valuable predictive information about the currency risk premiums.

4.5 Safe currencies

To delve deeper into this relationship, we categorize non-US currencies into safe and unsafe groups. Our classification identifies the CHF and JPY as safe and the remaining currencies as unsafe. Research shows that these safe-haven currencies tend to appreciate against the US dollar when global risks are high, such as when US stock prices decline, and bond prices and foreign exchange market volatility increase.

According to our model, the downside CVRP of most currencies captures the risk premium of the global factor. However, for safe currencies, this information is captured in the upside component. Consequently, when global risk rises, the skewness risk premium (SRP) of safe currencies is expected to increase, while the SRP of ordinary currencies should decline. This suggests that the SRP for these two sets of currencies should move in opposite directions in response to an increase in global risk, a relationship further supported by Table 2.

We test whether the two measures predict future dollar returns with opposite signs. A similar form of predictive regression as in (12) is conducted by substituting DVP and SRP with those computed using safe and unsafe currencies. We first consider the results using unsafe currencies. The regression considered is

$$\Delta q_{i,t+1} = b_0 + b_S SRP_{\text{Unsafe},t} + b_D DVP^D_{\text{Unsafe},t} + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t}\right) + e_{i,t+1}, \quad (14)$$

where the skewness and variance premium of unsafe currencies are denoted by $SRP_{\text{Unsafe},t}$ and $DVP_{\text{Unsafe},t}$, respectively.

We expect that the semi-variance risk premium of a few safe currencies contains different information from most other currencies. Therefore, a similar result to our earlier finding is expected for the set of unsafe currencies. The results of this panel regression for unsafe currencies are provided in Panel A of Table 6.

For all specifications and forecast horizons considered in Panel A, the results are similar to those of the previous table. A higher skewness risk premium negatively predicts foreign currency returns. That is, a higher skewness premium of unsafe currencies leads to a dollar appreciation similar to what our earlier baseline tables suggest.

A more interesting case is when we construct the DVP and SRP using only safe currencies. We use the subscript $_{Safe}$ to denote the DVP and SRP computed only from JPY and CHF.

Therefore, we estimate an analogous regression as in Equation (14), but replace the DVP computed using unsafe currencies with the DVP computed using safe currencies.

Panel B summarizes the results of this regression. For a one-month prediction, we do not find any significant relationship between the lagged SRP and future dollar returns. However, for longer terms, the coefficient on the SRP term becomes positive and statistically significant for six months and above. The sign is opposite to what we observed in the baseline case, as well as when we consider unsafe currencies.

To further understand the drivers of the opposite sign on SRP, we regress future dollar returns and lagged upside and downside DVP constructed separately for safe and unsafe currencies. Panel C summarizes the results using unsafe currencies, whereas Panel D summarizes the results when we use safe currencies.

For unsafe currencies, we observe a similar pattern to the baseline table of Table 3. The upside component has a negative coefficient, and the downside has a positive coefficient, despite some being statistically insignificant. One potential reason for the insignificance may be related to both the downside DVP and EVRP capturing information about US risk. This can be inferred from the lower coefficient and t-statistics we observe after controlling for the EVRP.

For safe currencies, the coefficient on the downside DVP is insignificant. This is consistent with the model that suggests that the downside component of CVRP contains obscure information. The upside component of CVRP of these currencies contains the risk premium related to US/global in addition to local risk in these countries; therefore, the model suggests an overall dollar appreciation following periods with high upside DVP for safe currencies.

In conclusion, the appreciation risk of the dollar against unsafe currencies is undesirable for US investors investing internationally. Likewise, the risk of foreign currency appreciation requires compensation from foreign investors. This is the opposite for safe currencies, where appreciation risk in these safe currencies requires risk compensation to US investors.

5 Drivers of the skewness risk premium

In this section, we further study the drivers of the skewness risk premium, both at the aggregate level and currency level. From our model, we hypothesize that the skewness risk premium increases when global risk is high. We also test whether greater country-level risk leads to an increase in the skewness risk premium at the currency level.

5.1 Skewness risk premium and global risk aversion

We test the hypothesis that the aggregate SRP decreases with heightened global or US risk. To do so, we employ three proxies for global uncertainty: the global uncertainty from Bekaert, Engstrom, and Xu (2022), the sovereign credit default swap (CDS) of the United States, and the global financial cycle factor (GFC) from Miranda-Agrippino and Rey (2020).

We test this relationship using a time-series regression where the SRP is regressed on the three global uncertainty proxies in addition to several control variables. The main time-series regression considered is:

$$SRP_t = \alpha_0 + \alpha_1 GUNC_t + \gamma_S SRP_{t-1} + \epsilon_t,$$

where $GUNC$ is one of the three global uncertainty proxies. As an alternative specification, we replace the lagged SRP with the lagged upside and downside DVP.

Panel A of Table 7 summarizes the results of this time-series regression. The first two columns show the results for global risk aversion, followed by the results using the CDS of the US, and finally, the GFC. Overall, there is a clear indication that SRP is negatively related to global or US risk. All coefficients are statistically significant. The coefficient on GFC is positive because GFC is negative when global risk is highest.

The proposed framework implies that it is the upside DVP that contains non-US risk, while the downside DVP captures global risk. In Panel B, we test this hypothesis more directly by using the upside and downside DVP as the dependent variables in our regression. As control variables, we use the contemporaneous counterparts of the DVP (e.g., upside DVP for the downside regression and vice-versa) in addition to its own lagged variable.

The results of this time-series regression are summarized in Panel B. The first three columns show that the downside DVP is positively explained by global uncertainty measures, which is consistent with the framework. In contrast, the upside DVP is negatively influenced by global uncertainty. While our framework does not necessarily imply a specific sign for this relationship, this strong inverse connection supports the hypothesis that the upside DVP is primarily influenced by non-US-specific risk.

The results presented in Panel B confirm the framework's central prediction: the downside DVP serves as a measure of global risk, showing a positive correlation with global uncertainty proxies. Simultaneously, the upside DVP appears to capture a different risk dimension, exhibiting a negative relationship with these same global uncertainty measures. This distinction is crucial, as it validates the separation of risk components as hypothesized in our theoretical model.

5.2 The currency-level skewness risk premium and local risk

Building on the findings of the previous table on the upside DVP, we hypothesize that the upside CVRP for individual currencies is positively influenced by non-US-specific risk. We test this by examining the relationship between the CSRP or upside/downside CVRP of individual currencies and proxies for non-US risk. This analysis aims to demonstrate that country-specific or regional risk outside the US can drive an increase in the CSRP for those individual currencies.

We use the one-year sovereign CDS spreads for each country. We estimate a panel regression of the currency-level SRP on these local risk measures with and without the currency fixed effects. Specifically, we regress the excess SRP on the contemporaneous shock to the CDS and the lagged CSRP. We include time-fixed effects to remove the common global variation in the CSRP and the CDS spread. We also cluster the standard errors by time to remove the cross-country correlation that may exist due to the common time variation.

The first panel of Table 8 provides the results of this analysis. In the first four columns, we take the first-order difference in local CDS spreads (Δ CDS), and in the last four columns, we include both the contemporaneous and lagged CDS spreads. Focusing first on the initial four columns, the coefficients on the change in local CDS spreads are consistently positive and statistically significant. This finding holds across various specifications, including those with and without controls for lagged CVRP and fixed effects. Furthermore, the last four columns suggest that the CSRP increases with a contemporaneous increase in the CDS spread. This supports the notion that investors demand a higher premium for bearing the tail risk associated with that specific country's currency.

Panel B reinforces these findings by focusing on the upside and downside components of the CVRP separately. The first four columns of the table confirm that an increase in the local CDS spread is associated with an increase in the upside CVRP. Conversely, the next four columns suggest that an increase in the CDS spread reduces the downside CVRP. The coefficients on the CDS spreads are identical for the last four columns because we control for the contemporaneous CVRP, which is the sum of the upside and downside CVRP.[7]

In conclusion, local sovereign risk, as proxied by excess CDS spreads, is a significant and positive driver of the CSRP. Crucially, it is entirely channeled through an increase in the upside CVRP, while the downside CVRP simultaneously decreases. This clear distinction in how local risk is priced in the upside versus the downside components validates our framework and demonstrates that non-US, country-specific risks are priced primarily in the premium for upside CVRP.

6 Conclusion

This study decomposes the dollar variance risk premiums into their respective upside and downside components. Specifically, an increase in the upside dollar variance risk premium signifies an increased premium for the dollar's depreciation risk, while a rise in the downside dollar variance risk premium indicates a similar premium for the depreciation of foreign currencies. The empirical analysis demonstrates a significant negative (positive) relationship between upside (downside) currency variance risk premiums and future changes in exchange rates. Notably, they represent the risk premium of different types of investors and are priced with opposite signs.

We further categorize foreign currencies against the US dollar as either safe or unsafe. We aggregate the currency variance risk premium separately for safe and unsafe currencies, including their upside and downside components. For unsafe currencies, results are similar to the baseline: a higher downside DVP (pricing dollar-appreciation risk) precedes foreign-

[7]That the coefficients on the control variables are exactly symmetric is natural. If we let V=U+D, for random variables U and D, the conditional relationship between a control variable Z and U given V is exactly the negative of the relationship between Z and V-U given V.

currency appreciation, while a higher upside DVP (pricing foreign-appreciation risk) precedes dollar appreciation. For safe currencies, the direction flips: the upside component loads on global/US risk and forecasts dollar strength, whereas the downside component carries little incremental signal. Consequently, the SRP moves in opposite directions across the two groups.

In the globalized financial market, both major and minor shocks from within and outside a country can easily disrupt the financial markets of each country. Consequently, especially in smaller economies, rapid inflows or outflows of foreign currency frequently occur, resulting in significant fluctuations in exchange rates. The findings of this study suggest that we can classify whether external shocks stem from increased upside volatility or downside volatility. This classification could enhance the likelihood of predicting future changes in exchange rates.

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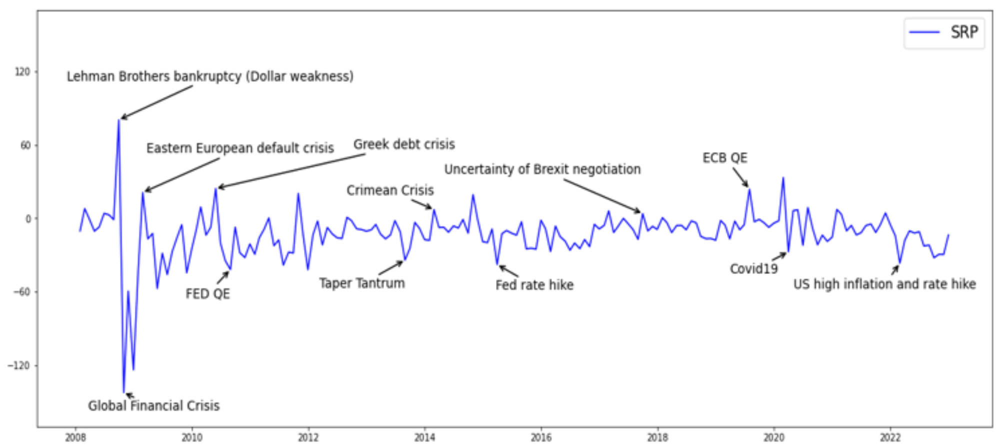
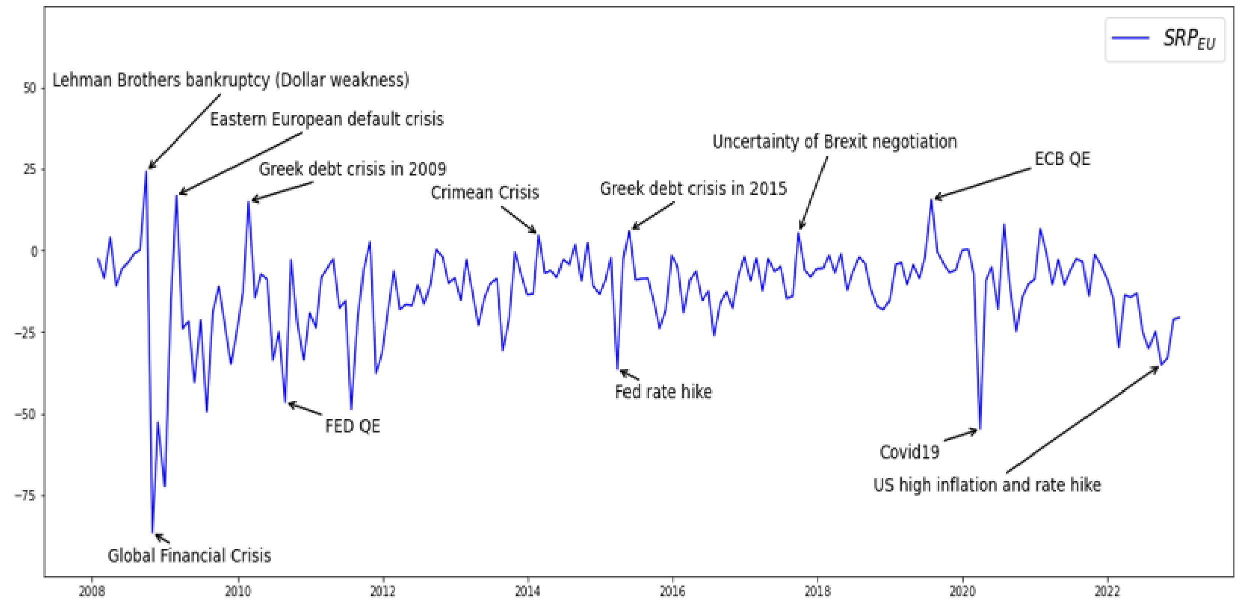
(a) Time series of upside and downside DVP



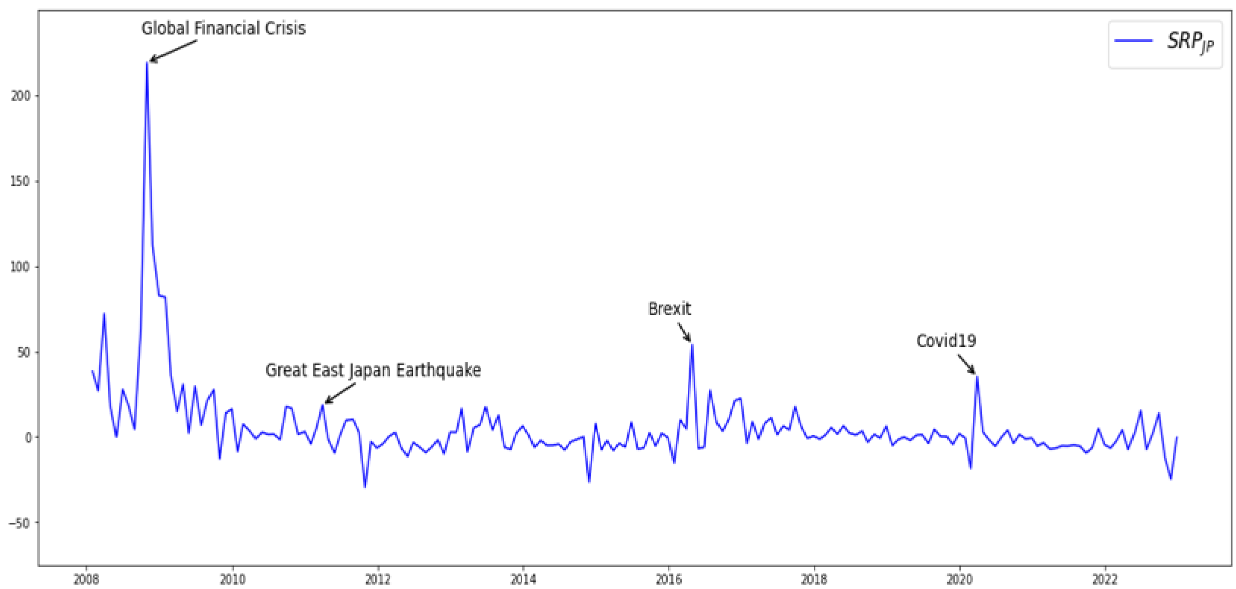
(b) Time series of world SRP

Figure 1: Time-series of skewness risk premium

This figure displays the time series of the upside and downside dollar variance risk premium (DVP). Panel (a) depicts the two series separately in a single graph. Panel (b) shows the figure of the skewness risk premium (SRP) defined as the difference between the upside and downside DVP. Major economic events that happened during this time are marked in Panel (b).



(a) Time series of skewness risk premium (Europe)



(b) Time series of skewness risk premium (JPY)

Figure 2: Skewness risk premium by region

This figure displays the time series of the skewness risk premium (SRP). Panel (a) is when the SRP is computed using only three European currency pairs against USD (CHF/USD, EUR/USD, SEK/USD, NOK/USD, and GBP/USD). Panel (b) is when the SRP is computed using only JPY against the USD. Major economic events that happened during this time are marked in both panels.

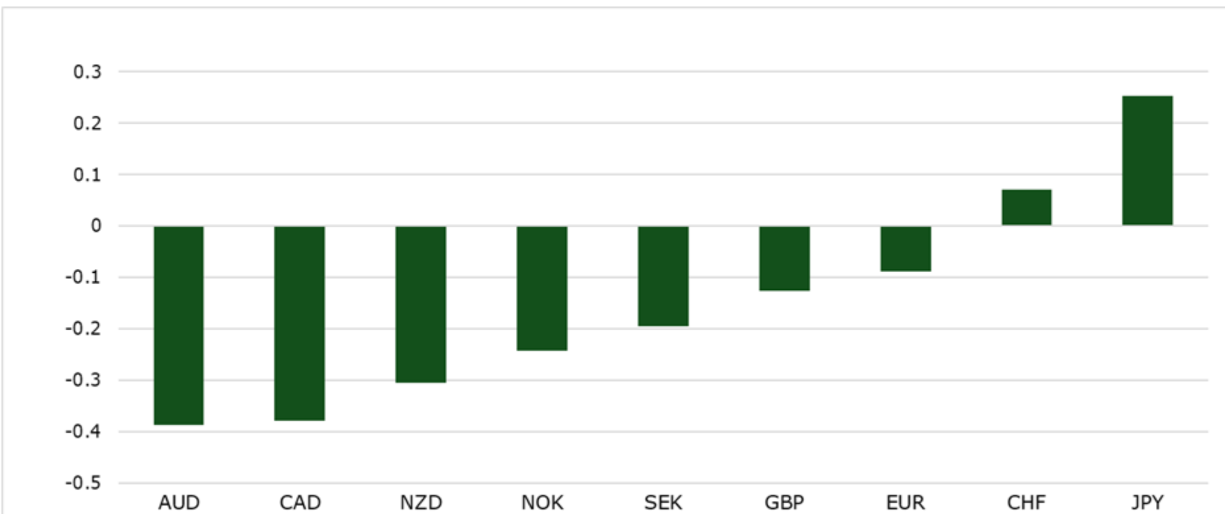


Figure 3: Correlation between currency returns and changes in VIX

This figure displays the correlations between currency returns and the first-order difference in VIX computed for each currency.

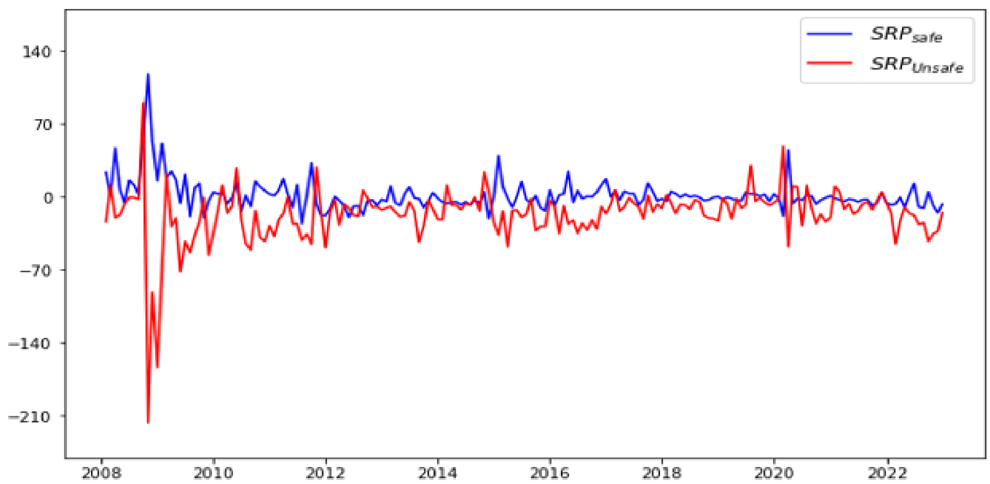


Figure 4: Skewness risk premium of safe and unsafe currencies

This figure displays the time series of the skewness risk premium (SRP) computed separately for safe (JPY, CHF) and unsafe (EUR, GBP, AUD, NZD, CAD) currencies. The blue line shows the result for the safe currencies. The red line is the SRP computed using unsafe currencies.

Table 1: Summary statistics

This table describes the summary statistics for the sample considered in this paper. Panel A summarizes the average and standard deviations of the annualized returns of the currency, the total, upside, and downside currency variance risk premium computed for each currency multiplied by 10,000. Panel B presents the means and standard deviations for the aggregate measures: DVP, DVP^U, DVP^D, SRP, and EVRP, each multiplied by 10,000. DVP is the cross-currency average of the total currency variance risk premium, and DVP^U and DVP^D are the cross-currency averages of the upside and downside components, respectively. SRP is the difference between DVP^U and DVP^D. EVRP is the equity variance risk premium computed using the S&P 500 Index.

Panel A. Currency-by-currency measure

Currency	Currency	Currency return (%)	CVRP (X10000)		
			Total	Up	Down
AUD	Mean	-1.596	-2.796	-2.628	-0.144
	St. Dev.	45.612	124.692	42.612	79.284
CAD	Mean	-1.884	0.240	-0.348	0.600
	St. Dev.	32.124	26.220	8.928	18.876
CHF	Mean	1.104	-0.360	-0.312	-0.036
	St. Dev.	35.304	43.392	17.976	17.868
EUR	Mean	-2.088	1.140	0.072	1.080
	St. Dev.	34.092	41.376	16.212	25.200
GBP	Mean	-3.192	-0.108	-0.528	0.420
	St. Dev.	32.112	22.308	6.372	16.668
JPY	Mean	-1.332	0.996	0.792	0.204
	St. Dev.	33.552	35.196	28.236	11.544
NOK	Mean	-2.772	-3.540	-2.868	-0.684
	St. Dev.	41.100	72.564	29.220	37.356
NZD	Mean	-1.344	-2.640	-2.568	-0.060
	St. Dev.	47.280	82.284	38.736	44.640
SEK	Mean	-2.088	-1.224	-1.632	0.420
	St. Dev.	38.244	39.312	13.992	25.236

Panel B. Aggreagate Measures

	DVP	DVP^U	DVP^D	SRP	EVRP
Mean	-9.228	-11.004	1.824	-12.828	137.394
St. Dev	36.132	9.576	22.788	20.052	520.966

Table 2: Correlation matrix of the currency level skewness risk premium

This table describes the correlation matrix for the currency level skewness risk premium (CSRP) computed for each currency pair. CSRP is defined as the difference between the upside and downside currency variance risk premium. The correlation is computed from the entire sample considered in this paper.

	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK
AUD	0.471	0.145	0.512	0.366	-0.494	0.464	0.709	0.508
CAD		-0.026	0.568	0.562	-0.551	0.417	0.511	0.613
CHF			0.180	-0.117	0.147	0.116	0.053	0.039
EUR				0.376	-0.396	0.499	0.614	0.754
GBP					-0.476	0.343	0.471	0.414
JPY						-0.319	-0.637	-0.536
NOK							0.492	0.604
NZD								0.602

Table 3: Predicting currency returns using the dollar semi-variance and skewness risk premium

This table describes the results of the pooled regressions

$$\Delta q_{i,t+1} = b_0 + b_F DVP_t + b_E EVRP_t + b_I (y_{US,t} - y_{i,t}) + FE_i + e_{i,t+1},$$
$$\Delta q_{i,t+1} = b_0 + b_U DVP_t^U + b_D DVP_t^D + b_I (y_{US,t} - y_{i,t}) + FE_i + e_{i,t+1},$$
$$\Delta q_{i,t+1} = b_0 + b_S SRP_t + b_D DVP_t + b_I (y_{US,t} - y_{i,t}) + FE_i + e_{i,t+1},$$

where q represents the logarithm of the exchange rate in dollars per unit of currency i, $y_{US,t} - y_{i,t}$ is the interest rate differential between the US and the foreign country, with the maturity matched to the forecast horizon of the dependent variable, DVP is the dollar variance risk premium, DVP^U and DVP^D are upside and downside semi-variance risk premium, SRP is the skewness risk premium defined as the difference between the upside and downside semi-variance risk premium, EVRP is the US S&P 500 equity variance risk premium, and FE_i is the currency-fixed effect. Panels A, B, and C provide the results of each of the panel regressions described above. The regression coefficients and the Newey-West adjusted standard errors (with a lag of 20) are reported in the table.

A. Using the dollar variance risk premium

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
DVP	0.947	-3.129	-4.771***	-6.253***	-2.133	-3.405**	-1.494	-2.395**
	(0.300)	(0.917)	(2.990)	(3.516)	(1.487)	(2.555)	(1.336)	(2.277)
EVRP		1.005***		0.365***		0.312***		0.219***
		(4.913)		(5.634)		(2.929)		(2.954)
$y_{US} - y_i$	1.847**	2.302***	1.600*	1.765**	1.437*	1.577*	0.764	0.857
	(2.173)	(2.782)	(1.933)	(2.153)	(1.733)	(1.891)	(1.362)	(1.538)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	-0.001	0.015	0.013	0.020	0.017	0.027	0.022	0.033

B. Using the dollar semi-variance risk premium

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
DVP^U	-34.566***	-31.455***	-42.100***	-41.303***	-45.385***	-44.821***	-30.262***	-29.864***
	(3.108)	(2.811)	(4.921)	(4.871)	(6.917)	(6.892)	(7.147)	(7.118)
DVP^D	15.001**	8.673	8.230***	6.609**	13.938***	12.785***	9.475***	8.657***
	(2.446)	(1.349)	(2.779)	(2.217)	(4.452)	(4.291)	(5.002)	(5.024)
EVRP		0.889***		0.228***		0.161*		0.113*
		(4.228)		(4.196)		(1.656)		(1.656)
$y_{US} - y_i$	2.150***	2.484***	1.854**	1.940**	1.764**	1.823**	0.975*	1.014*
	(2.734)	(3.150)	(2.354)	(2.466)	(2.258)	(2.313)	(1.855)	(1.931)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.006	0.019	0.034	0.036	0.081	0.083	0.089	0.092

C. Using the dollar skewness risk premium

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
SRP	-20.758***	-16.699**	-19.292***	-18.046***	-23.807***	-22.884***	-16.315***	-15.658***
	(3.098)	(2.453)	(4.620)	(4.400)	(6.081)	(5.956)	(7.128)	(7.064)
DVP	-5.783*	-8.244**	-11.026***	-11.781***	-9.867***	-10.426***	-6.817***	-7.215***
	(1.782)	(2.427)	(4.866)	(5.049)	(6.688)	(7.076)	(6.449)	(6.875)
EVRP		0.931***		0.286***		0.211**		0.149**
		(4.396)		(5.038)		(2.190)		(2.224)
$y_{US} - y_i$	2.184***	2.539***	1.913**	2.022**	1.820**	1.899**	1.016*	1.069**
	(2.794)	(3.266)	(2.424)	(2.567)	(2.318)	(2.399)	(1.921)	(2.027)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.005	0.019	0.033	0.037	0.077	0.081	0.088	0.093

Table 4: Dollar index return predictability

This table summarizes the regression results using the US dollar index returns as the dependent variable. The regression specification considered is:

$$-\Delta DX_{t+1} = b_0 + b_S SRP_t + b_D DVP_t + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t}\right) + e_{t+1},$$

where SRP_t is the skewness risk premium and DVP_t is the dollar variance risk premium. Panel A describes the results using the dollar index as provided by the Bank of International Settlements (BIS), and Panel B shows the results using the dollar index against advanced economies provided by the Federal Reserve (FED). The regression coefficients and the Newey-West adjusted standard errors are reported in the table.

Panel A. Nominal Effective Exchange Rate (NEER) Narrow Index (BIS)

	Dependent variable: Negative dollar index returns							
	1-month		3-month		6-month		12-month	
SRP	-26.381*	-23.925	-17.651***	-17.124***	-19.820***	-19.291***	-12.872***	-12.468***
	(1.830)	(1.623)	(2.933)	(2.830)	(4.300)	(4.150)	(3.886)	(3.768)
DVP	-5.855	-7.391	-8.728**	-9.059**	-7.339***	-7.670***	-5.233***	-5.486***
	(0.894)	(1.073)	(2.303)	(2.342)	(2.775)	(2.991)	(2.685)	(2.935)
EVRP		0.595***		0.128		0.128		0.096
		(2.559)		(1.322)		(0.671)		(0.682)
$\overline{y_{us} - y_i}$	2.210*	2.496*	2.014	2.075*	1.975*	2.035*	1.270	1.313
	(1.766)	(1.928)	(1.652)	(1.726)	(1.658)	(1.680)	(1.422)	(1.488)
Adj R^2	0.019	0.027	0.049	0.045	0.109	0.107	0.111	0.111

Panel B. Trade-weighted Dollar Index of Advanced Economies (FED)

	Dependent variable: Negative dollar index returns							
	1-month		3-month		6-month		12-month	
SRP	-20.543	-18.615	-17.298***	-16.683***	-19.885***	-19.354***	-13.056***	-12.606***
	(1.562)	(1.375)	(2.844)	(2.709)	(4.003)	(3.866)	(3.806)	(3.690)
DVP	-2.205	-3.411	-8.505**	-8.890**	-7.253***	-7.586***	-5.401***	-5.683***
	(0.327)	(0.482)	(2.244)	(2.297)	(2.700)	(2.941)	(2.705)	(2.960)
EVRP		0.467**		0.149		0.128		0.107
		(2.019)		(1.458)		(0.603)		(0.741)
$\overline{y_{us} - y_i}$	2.285*	2.510*	2.171*	2.243*	2.214*	2.274*	1.453	1.501
	(1.693)	(1.825)	(1.710)	(1.790)	(1.771)	(1.788)	(1.576)	(1.650)
Adj R^2	0.010	0.013	0.045	0.042	0.108	0.106	0.118	0.119

Table 5: Predicting currency index returns

This table summarizes the results of the pooled panel regression

$$\Delta CX_{i,t+1} = b_0 + b_S CSRP_{i,t} + b_V CVRP_{i,t} + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t}\right) + e_{i,t+1},$$

where CX_i is the log of trade-weighted currency index of currency i with a higher value indicating a currency appreciation, $CSRP_i$ is the currency-level skewness risk premium against the USD, $CVRP_i$ is the currency-level variance risk premium against the USD, and EVRP is the equity variance risk premium estimated from the S&P 500 Index. For the currency index, a higher value implies an appreciation of the currency. The t-statistics are adjusted for heteroscedasticity and autocorrelation using Newey-West method.

	Dependent variable:Index returns							
	1-month		3-month		6-month		12-month	
CSRP	-5.460*	-4.930*	-3.053*	-2.858*	-5.028***	-4.857***	-3.403***	-3.270***
	(1.885)	(1.707)	(1.772)	(1.674)	(4.235)	(4.163)	(3.955)	(3.892)
CVRP	2.390	1.904	-1.152	-1.331	-1.980**	-2.135**	-1.462**	-1.581**
	(1.486)	(1.117)	(0.975)	(1.122)	(2.202)	(2.402)	(2.122)	(2.325)
EVRP		0.433**		0.160***		0.138**		0.105**
		(2.173)		(2.735)		(2.274)		(2.388)
$y_{US} - y_i$	1.185**	1.402***	0.866	0.946*	0.788	0.856	0.334	0.382
	(2.351)	(2.874)	(1.642)	(1.787)	(1.535)	(1.640)	(0.989)	(1.128)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.009	0.015	0.010	0.012	0.047	0.051	0.068	0.073

Table 6: The skewness risk premium of safe and unsafe currencies

Panel A of this table summarizes the results of the regressions

$$\Delta q_{i,t+1} = b_0 + b_S SRP_t + b_D DVP_t + b_E EVRP_t + b_I\,(y_{US,t} - y_{i,t}) + e_{i,t+1},$$
$$\Delta q_{i,t+1} = b_0 + b_U DVP_t^U + b_D DVP_t^D + b_E EVRP_t + b_I\,(y_{US,t} - y_{i,t}) + e_{i,t+1},$$

where q represents the logarithm of the exchange rate in dollars per unit of currency i, and DVP^U and DVP^D are the upside and downside dollar variance risk premia, SRP and DVP are the dollar skewness and variance risk premiums, respectively. The two regressions are estimated separately after averaging the CVRP and CSRP for safe (CHF and JPY) and unsafe (the remaining) currencies. EVRP is the US S&P 500 equity variance risk premium, and $y_{US,t} - y_{i,t}$ is the interest rate differential between the US and the foreign country. Panels A and B summarize the results of the first panel regression, and Panels C and D show the output of the second panel regression. Panels A and C are the results for the unsafe/ordinary currencies, whereas Panels B and D are those computed using safe currencies only. The regression coefficients and the Newey-West adjusted standard errors are reported in parentheses.

A. Using the skewness risk premium of unsafe currencies

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
SRP_{Unsafe}	-13.829***	-10.458**	-15.531***	-14.479***	-19.689***	-18.914***	-14.454***	-13.896***
	(2.657)	(2.013)	(5.450)	(5.211)	(6.798)	(6.699)	(7.991)	(7.962)
DVP_{Unsafe}	-4.008	-5.965*	-10.811***	-11.422***	-10.383***	-10.830***	-7.873***	-8.187***
	(1.218)	(1.723)	(6.026)	(6.165)	(8.476)	(8.685)	(8.876)	(9.139)
EVRP		0.926***		0.289***		0.211**		0.149**
		(4.353)		(5.109)		(2.214)		(2.267)
$y_{US} - y_i$	2.319***	2.676***	2.197***	2.308***	2.114**	2.195***	1.214**	1.268**
	(2.992)	(3.475)	(2.657)	(2.795)	(2.564)	(2.635)	(2.269)	(2.370)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.004	0.018	0.042	0.046	0.102	0.106	0.133	0.138

B. Using the skewness risk premium of safe currencies

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
SRP_{Safe}	-5.135	-9.378	3.768	2.908	8.406***	7.722**	10.042***	9.679***
	(0.676)	(1.288)	(0.749)	(0.576)	(2.765)	(2.463)	(3.854)	(3.596)
DVP_{Safe}	3.784	2.642	4.02**	3.788**	5.984***	5.800***	4.457***	4.359***
	(1.357)	(0.944)	(2.181)	(2.086)	(3.241)	(3.305)	(3.549)	(3.652)
EVRP		0.965***		0.196***		0.154		0.079
		(4.990)		(3.191)		(1.395)		(1.022)
$y_{US} - y_i$	1.930**	2.289***	2.082**	2.154**	2.046**	2.103**	1.202**	1.230**
	(2.501)	(3.020)	(2.419)	(2.512)	(2.260)	(2.297)	(2.035)	(2.074)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	-0.001	0.015	0.013	0.014	0.049	0.051	0.089	0.090

C. Using the semi-variance risk premium of unsafe currencies

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
DVP^U_{Unsafe}	-19.328*	-16.257	-35.246***	-34.505***	-40.725***	-40.225***	-30.139***	-29.790***
	(1.829)	(1.532)	(5.769)	(5.696)	(8.174)	(8.169)	(8.630)	(8.632)
DVP^D_{Unsafe}	9.509**	4.506	3.473	2.267	7.918***	7.111***	5.530***	4.978***
	(1.995)	(0.898)	(1.562)	(1.008)	(3.672)	(3.464)	(4.342)	(4.355)
EVRP		0.879***		0.212***		0.141		0.096
		(4.182)		(4.003)		(1.505)		(1.470)
$y_{US} - y_i$	2.327***	2.644***	2.268***	2.344***	2.194***	2.244***	1.255**	1.287**
	(3.052)	(3.464)	(2.699)	(2.795)	(2.622)	(2.658)	(2.329)	(2.386)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.004	0.016	0.043	0.044	0.112	0.113	0.144	0.146

D. Using the semi-variance risk premium of safe currencies

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
DVP^U_{Safe}	-0.699	-6.265	8.394**	7.322*	15.173***	14.402***	15.015***	14.631***
	(0.105)	(0.984)	(2.032)	(1.754)	(5.103)	(4.813)	(6.130)	(5.855)
DVP^D_{Safe}	7.219	8.906	2.863	3.188	4.630	4.865	-0.901	-0.783
	(0.716)	(0.912)	(0.410)	(0.463)	(0.894)	(0.943)	(0.246)	(0.213)
EVRP		0.969***		0.187***		0.133		0.065
		(4.962)		(3.159)		(1.293)		(0.888)
$y_{US} - y_i$	1.958**	2.266***	2.212**	2.272**	2.307**	2.349**	1.373**	1.393**
	(2.508)	(2.966)	(2.505)	(2.581)	(2.470)	(2.493)	(2.297)	(2.319)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	-0.002	0.014	0.014	0.015	0.061	0.062	0.101	0.102

Table 7: Aggregate skewness risk premium and global risk

This table describes the results of the time-series regressions:

$$SRP_t = \alpha + \beta_g \text{Global UNC}_t + \beta_1 SRP_{t-1} + \beta_u DVP^U_{t-1} + \beta_d DVP^D_{t-1} + \epsilon_t$$
$$DVP^{U/D}_t = \alpha + \beta_g \text{Global UNC}_t + \beta_U DVP^U_t + \beta_D DVP^D_t + \beta_u DVP^U_{t-1} + \beta_d DVP^D_{t-1} + \epsilon_t,$$

where Global UNC_t is either the global uncertainty from Bekaert, Engstrom, and Xu (2022), and the sovereign CDS spread of the United States, or the global financial cycle factor from Miranda-Agrippino and Rey (2020). Panel A summarizes the results of the first regression, while Panel B provides the results for the second regression specification. The standard errors are corrected for heteroscedasticity and serial correlation.

Panel A. Explaining the SRP

	Dependent variable: SRP					
Uncertainty	-45.194***	-32.611***				
	(3.58)	(3.90)				
CDS_{us}			-0.006**	-0.005***		
			(2.47)	(2.87)		
GFC					0.003**	0.003***
					(2.06)	(2.63)
Lag SRP	0.075		0.219		0.197***	
	(0.88)		(1.13)		(3.44)	
Lag DVP^U		0.534*		0.854**		0.915***
		(1.76)		(2.28)		(2.75)
Lag DVP^D		-0.069		-0.049		-0.136**
		(0.97)		(0.76)		(2.31)
Adj R^2	0.190	0.221	0.131	0.192	0.079	0.196

Panel B. Semi-variance risk premium

	Dependent variable: DVP^D			Dependent variable: DVP^U		
Uncertainty	45.548***			-30.932***		
	(3.45)			(7.21)		
CDS_{us}		0.006***			-0.003*	
		(3.01)			(1.91)	
GFC			-0.003**			0.001**
			(2.14)			(2.09)
DVP^U	-0.474	-0.830**	-0.832**			
	(1.56)	(2.02)	(2.15)			
DVP^D				0.088	0.401***	0.171***
				(0.83)	(6.74)	(6.66)
Lag DVP^U				0.169***	0.175***	0.423***
				(8.60)	(5.82)	(8.70)
Lag DVP^D	1.371***	1.039***	1.001***			
	(4.56)	(4.98)	(4.43)			
Adj R^2	0.258	0.242	0.255	0.181	0.527	0.299

Table 8: Drivers of the currency level skewness risk premium

This table summarizes the results of the panel regressions

$$CSRP_{c,t} = \alpha_1 + \beta_c \Delta CDS_{c,t} + \beta_1 CSRP_{t-1} + \beta_2 CVRP_{t-1} + \epsilon_t$$
$$CVRP_{c,t}^{U/D} = \alpha_2 + \beta_c \Delta CDS_{c,t} + \beta_v CVRP_{c,t} + \beta_u CVRP_{t-1}^{U} + \beta_d CVRP_{t-1}^{D} + \epsilon_t,$$

where CRSP is the currency-level skewness risk premium, ΔCDS is the first order difference in the country-level CDS spread, CVRP is the currency-level currency variance risk premium, $CVRP^{U/D}$ is the currency-level up and down semi-variance risk premium for currency c. In some specifications, the first-order difference in CDS spread is replaced by the contemporaneous and lagged values of the CDS spread. The standard errors are clustered by month.

Panel A. Currency-level skewness risk premium

	Dependent variable: CSRP							
ΔCDS	0.082**	0.070**	0.074**	0.070**				
	(2.21)	(2.16)	(2.37)	(2.19)				
CDS					0.071**	0.067*	0.071**	0.067*
					(2.04)	(1.96)	(2.14)	(1.97)
Lag CDS					-0.079**	-0.074**	-0.077**	-0.074**
					(1.99)	(1.98)	(2.22)	(2.03)
Lag CSRP	0.425***	0.202***	0.309***	0.210***	0.275***	0.202***	0.309***	0.210***
	(5.06)	(3.55)	(5.01)	(3.01)	(5.49)	(3.55)	(5.00)	(3.00)
Lag CVRP			0.084*	0.013				0.013
			(1.72)	(0.25)				(0.25)
Country FE	N	Y	N	Y	N	Y	N	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.076	0.130	0.087	0.130	0.076	0.130	0.878	0.130

Panel B. Semi-variance risk premium

	Dependent variable: $CVRP^U$				Dependent variable: $CVRP^D$			
ΔCDS	0.033**	0.030*			-0.033**	-0.030*		
	(2.12)	(1.77)			(2.12)	(1.77)		
CDS			0.031*	0.025			-0.031*	-0.025
			(1.93)	(1.39)			(1.93)	(1.39)
Lag CDS			-0.034**	-0.033*			0.034**	0.034*
			(1.98)	(1.67)			(1.98)	(1.67)
CVRP	0.350***	0.325***	0.351***	0.325***	0.650***	0.675***	0.650***	0.675***
	(10.34)	(9.48)	(10.33)	(9.47)	(19.19)	(19.71)	(19.41)	(19.70)
Lag $CVRP^U$	0.280***	0.157***	0.279***	0.157***	-0.280***	-0.157***	-0.279***	-0.157***
	(5.46)	(3.11)	(5.66)	(3.11)	(5.46)	(3.11)	(5.66)	(3.11)
Lag $CVRP^D$	-0.082**	-0.063*	-0.082**	-0.063*	0.082**	0.063*	0.082**	0.063*
	(2.58)	(1.88)	(2.58)	(1.87)	(2.58)	(1.88)	(2.58)	(1.87)
Country FE	N	Y	N	Y	N	Y	N	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.608	0.648	0.608	0.648	0.785	0.807	0.785	0.807

A Additional Results

A.1 Testing the asymmetric reaction of currency to variance shocks

The model suggests that the marginal utility of investors responds more to positive variance shocks and less to negative shocks. Part of the reason stems from the nature of variance shocks, which the literature shows are priced across multiple asset classes. It is natural to assume that when the underlying process (consumption growth in consumption-based models, returns in stochastic volatility models applied to equities, among others) follows a normal distribution, the shocks to variance will follow a Chi-squared distribution with one degree of freedom.

This section studies whether currency values empirically react more to positive variance shocks. We use the first-order difference in the square of VIX to proxy US and world variance risk. Since the VIX primarily reflects changes in global or US uncertainty, the model suggests that foreign currency values should generally depreciate in response, except for certain safe currencies.

Moreover, for most currencies, we expect large appreciations to occur when the VIX increases, while significant depreciations are less likely to be tied to VIX movements. Safe currencies may appreciate in response to positive VIX shocks, with depreciation being less likely linked to VIX changes.

This hypothesis is tested from a regression:

$$\Delta q^i_{t+1} = \alpha_i + \beta_i \Delta VIX^2_{t+1} + \gamma_i 1_{\Delta VIX^2_{t+1}>0} \Delta VIX^2_{t+1} + \epsilon_{i,t+1},$$

where q^i is the log currency value of country i, VIX is the volatility index of the S&P 500 Index, and $1_{\Delta VIX^2_{t+1}>0}$ is an indicator variable that takes a value of 1 if VIX is increasing. This regression is estimated currency-by-currency, using weekly returns and the index. In this regression, we expect the same sign for the two slope coefficients. The slope of the asymmetry term should be negative ($\gamma_i < 0$) for most currencies, and it should be positive ($\gamma_i > 0$) for Japan, among others.

The results of this regression are provided in Table A1. The regressions indicate that most currencies tend to depreciate in response to increases in VIX, except Japanese Yen and Swiss Franc. The simple coefficient for the Japanese Yen is positive and statistically significant, whereas that of the Swiss Franc is insignificant. Notably, the asymmetry term (γ_i) is negative for all currencies except the Japanese Yen. This finding supports the model's assumption that a large depreciation of foreign currencies is associated with an increase in U.S. or global variance.

A.2 The relationship to risk reversal

In the paper, we show that two components of DVP carry a risk premium that is priced in the opposite direction. The findings also suggest that skewness is priced in the currency market.

The risk reversal (RR) strategy is a common trading strategy implemented by forex traders. For example, RR25 is calculated as the difference between the 25-delta call and put implied volatilities. Brunnermeier, Nagel, and Pedersen (2008) argue that the crash risk of the carry trade is predictable by RR. They argue that the risk-neutral skewness is related to the interest-rate differential predicting future carry trade returns.

Our measure of SRP is the difference between the risk-neutral and physical expectation of a proxy for skewness. Brunnermeier, Nagel, and Pedersen (2008) also find a close relationship between the physical skewness and RR. In this section, we investigate whether our result can be explained by the risk-neutral skewness or its physical counterpart of dollar returns. We estimate the pooled panel regression where currency returns are regressed on SRP, RR, and the physical counterpart. The regression is given by:

$$\Delta q_{i,t+1} = b_0 + b_I \left(y_{US,t} - y_{i,t}\right) + b_D DVP_t + b_S SRP_t + b_Q RR25_t + b_P Skew_t + e_{i,t+1},$$

where q represents the logarithm of the exchange rate in dollars per unit of currency i, $y_{US,t} - y_{i,t}$ is the interest rate differential between the US and the foreign country, DVP is the dollar variance risk premium, SRP is the skewness risk premium, RR25 is the 25-

delta risk reversal, Skew is the physical counterpart of the risk-neutral skewness of dollar returns, defined as the cross-country average of the difference between upside and downside semi-variance.

Table A2 summarizes the result of this regression. The regressions clearly indicate that the SRP remains negative and statistically significant, while RR and physical skewness show no predictive power for dollar returns.

A.3 Time-series regression for individual currencies

We further show the time-series regression for individual currency returns against the USD regressed on the SRP and DVP$^{U/D}$ in Table A3.

Table A1: Testing for asymmetric reaction to variance shocks

This table provides the results of the regression

$$\Delta q^i_{t+1} = \alpha_i + \beta_i \Delta VIX^2_{t+1} + \gamma_i 1_{\Delta VIX^2_{t+1}>0} \Delta VIX^2_{t+1} + \epsilon_{i,t+1},$$

where q^i is the log currency value of country i, VIX is the volatility index of the S&P 500 Index, and $1_{\Delta VIX^2_{t+1}>0}$ is an indicator variable that takes a value of 1 if the condition in the subscript is true. The regression is estimated currency-by-currency, using weekly returns and the index. The regression coefficients and the Newey-West adjusted standard errors are reported in the table.

Currency	β_i	γ_i	Adj-R^2	Currency	β_i	γ_i	Adj-R^2
AUD	-14.182	-14.991	0.322	JPY	5.414	7.183	0.094
	(3.781)	(3.403)			(3.018)	(2.540)	
CAD	-8.933	-10.531	0.269	NOK	-6.356	-14.027	0.135
	(4.076)	(5.451)			(2.815)	(2.276)	
CHF	0.722	-4.353	0.003	NZD	-10.711	-13.246	0.194
	(0.269)	(1.452)			(2.895)	(3.343)	
EUR	-1.412	-6.979	0.041	SEK	-5.853	-7.976	0.084
	(0.527)	(2.479)			(1.968)	(1.992)	
GBP	-2.279	-11.602	0.101				
	(0.984)	(4.150)					

Table A2: Robustness tests

This table summarizes the results of the regressions:

$$\Delta q_{i,t+1} = b_0 + b_U DVP_t^U + b_D DVP_t^D + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t}\right) + \mathrm{B} \cdot \mathrm{Controls}_{i,t} + e_{i,t+1},$$

where q represents the logarithm of the exchange rate in dollars per unit of currency i, $y_{US,t} - y_{i,t}$ is the interest rate differential between the US and the foreign country, EVRP is the US S&P 500 equity variance risk premium, and DVP^U and DVP^D are the upside and downside dollar variance risk premia. For control variables, we use the risk-reversal at 25 delta, the physical skewness (PSKEW), and the The regression coefficients and the Newey-West adjusted standard errors are reported in the table.

A. Using the dollar semi-variance risk premium

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
DVP^U	-42.683**	-38.345**	-55.299***	-54.475***	-64.908***	-64.456***	-55.852***	-55.659***
	(2.433)	(2.214)	(5.169)	(5.148)	(7.227)	(7.270)	(8.324)	(8.403)
DVP^D	24.941**	17.321	23.001***	21.554***	34.925***	34.133***	36.251***	35.913***
	(2.101)	(1.539)	(3.437)	(3.297)	(6.142)	(6.174)	(7.909)	(8.022)
EVRP		0.822***		0.156***		0.085		0.036
		(3.963)		(2.925)		(0.954)		(0.629)
RR25	-0.023	-0.019	-0.007	-0.006	0.008	0.008	0.024**	0.024**
	(0.872)	(0.740)	(0.352)	(0.315)	(0.502)	(0.525)	(2.272)	(2.277)
PSKEW	-16.282	-13.412	-22.167**	-21.622**	-30.308***	-30.006***	-37.779***	-37.647***
	(1.070)	(0.908)	(2.518)	(2.471)	(5.143)	(5.123)	(7.961)	(7.983)
$y_{US} - y_i$	2.912***	3.091***	2.544***	2.578***	2.450***	2.468***	1.540***	1.547***
	(4.050)	(4.160)	(3.375)	(3.406)	(3.027)	(3.029)	(2.978)	(2.986)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.011	0.022	0.051	0.052	0.125	0.125	0.215	0.215

B. Using the dollar skewness risk premium

	Dependent variable: currency returns							
	1-month		3-month		6-month		12-month	
SRP	-30.037**	-24.642**	-33.726***	-32.399***	-44.498***	-43.664***	-42.837***	-42.391***
	(2.300)	(1.977)	(4.660)	(4.586)	(6.748)	(6.756)	(8.268)	(8.338)
DVP	-4.972	-7.403**	-10.377***	-10.975***	-9.292***	-9.665***	-6.384***	-6.580***
	(1.501)	(2.149)	(4.624)	(4.745)	(6.885)	(6.919)	(7.423)	(7.318)
EVRP		0.861***		0.212***		0.132		0.069
		(4.107)		(3.650)		(1.459)		(1.201)
RR25	-0.022	-0.018	-0.005	-0.004	0.009	0.010	0.025**	0.025**
	(0.841)	(0.678)	(0.267)	(0.209)	(0.591)	(0.634)	(2.349)	(2.366)
PSKEW	-16.483	-13.502	-22.522**	-21.789**	-30.630***	-30.165***	-37.975***	-37.722***
	(1.082)	(0.917)	(2.569)	(2.503)	(5.182)	(5.139)	(7.955)	(7.964)
$y_{US} - y_i$	2.939***	3.124***	2.586***	2.632***	2.492***	2.519***	1.568***	1.581***
	(4.111)	(4.233)	(3.409)	(3.446)	(3.050)	(3.059)	(3.006)	(3.026)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Adj R^2	0.011	0.022	0.050	0.052	0.121	0.122	0.214	0.215

Table A3: Regression of individual currency pairs

This table summarizes the results of the time-series regressions:

$$\Delta q_{i,t+1} = b_0 + b_U DVP_t^U + b_D DVP_t^D + b_I\left(y_{US,t} - y_{i,t}\right) + e_{i,t+1}$$
$$\Delta q_{i,t+1} = b_0 + b_S SRP_t + b_V DVP_t + b_I\left(y_{US,t} - y_{i,t}\right) + e_{i,t+1},$$

where q represents the logarithm of the exchange rate in dollars per unit of currency i, $y_{US,t} - y_{i,t}$ is the interest rate differential between the US and the foreign country, and DVP^U and DVP^D are the upside and downside dollar variance risk premia, respectively, estimated separately for each currency returns against the USD. In the second specification, the upside and downside DVP is replaced by the skewness risk premium (SRP) and the total dollar variance risk premium (DVP). The regression coefficients and the Newey-West adjusted standard errors are reported in the table.

		Dependent variable: currency returns							
		1-month		3-month		6-month		12-month	
	DVP^U	-57.998		-84.091***		-85.911***		-56.110***	
		(1.107)		(2.841)		(4.028)		(4.710)	
	DVP^D	41.885**		21.200***		29.395***		18.339***	
		(1.993)		(3.115)		(3.483)		(3.172)	
	SRP		-45.443		-41.427***		-46.799***		-29.992***
AUD			(1.608)		(3.630)		(4.625)		(5.340)
	DVP		-3.690		-20.245**		-17.483***		-11.709***
			(0.296)		(2.437)		(3.472)		(3.813)
	$y_{US} - y_i$	1.087	1.133	0.717	0.865	1.032	1.167	0.126	0.214
		(0.630)	(0.673)	(0.407)	(0.487)	(0.544)	(0.610)	(0.103)	(0.172)
	Adj R^2	0.018	0.018	0.057	0.054	0.151	0.141	0.156	0.144
	DVP^U	-5.468		-21.000		-32.418***		-31.634***	
		(0.207)		(1.310)		(2.792)		(3.952)	
	DVP^D	22.986**		11.229**		16.159***		10.526***	
		(2.420)		(2.288)		(4.001)		(3.848)	
	SRP		-17.313		-15.368**		-21.106***		-17.016***
CAD			(1.433)		(2.354)		(3.973)		(5.444)
	DVP		5.699		-4.076		-4.998*		-6.555***
			(0.785)		(0.871)		(1.769)		(3.221)
	$y_{US} - y_i$	11.536**	11.446**	8.620**	8.652**	6.896**	6.992**	4.813**	4.947**
		(2.366)	(2.359)	(2.292)	(2.300)	(2.476)	(2.483)	(2.220)	(2.236)
	Adj R^2	0.038	0.038	0.069	0.071	0.154	0.152	0.239	0.230
	DVP^U	6.174		-14.472		-21.581**		-11.778	
		(0.219)		(0.719)		(2.030)		(1.646)	
	DVP^D	-6.430		-3.156		5.143		3.608	
		(0.484)		(0.752)		(1.331)		(1.381)	
	SRP		6.602		-1.541		-9.547*		-6.330*
CHF			(0.359)		(0.186)		(1.876)		(1.777)
	DVP		0.150		-4.802		-4.503		-2.726
			(0.018)		(0.839)		(1.427)		(1.267)
	$y_{US} - y_i$	0.228	0.228	0.414	0.441	0.832	0.857	0.869	0.886
		(0.146)	(0.145)	(0.334)	(0.347)	(0.709)	(0.717)	(0.870)	(0.886)
	Adj R^2	-0.016	-0.016	-0.004	-0.007	0.013	0.007	0.020	0.020
	DVP^U	-29.153		-44.886***		-40.733***		-19.334**	
		(0.784)		(2.882)		(3.358)		(1.978)	
	DVP^D	16.429		10.819		12.581		6.126	
		(1.479)		(1.842)		(2.572)		(1.604)	
	SRP		-21.427		-21.481***		-20.852***		-10.640**
EUR			(1.154)		(2.934)		(3.401)		(2.172)
	DVP		-4.938		-10.741**		-8.383**		-4.509
			(0.437)		(2.430)		(2.449)		(1.577)
	$y_{US} - y_i$	2.415*	2.435*	2.550**	2.592**	2.703**	2.734**	1.846**	1.866**
		(1.667)	(1.705)	(2.004)	(2.031)	(2.373)	(2.361)	(2.380)	(2.370)
	Adj R^2	0.000	0.000	0.051	0.048	0.107	0.099	0.090	0.091

Table A3: Regression of individual currency pairs (continued)

		Dependent variable: currency returns							
		1-month		3-month		6-month		12-month	
GBP	DVP^U	-19.265		-33.254**		-44.309***		-22.687***	
		(1.072)		(2.440)		(3.619)		(2.673)	
	DVP^D	14.905		6.858		14.491***		6.148	
		(1.638)		(1.265)		(2.628)		(1.623)	
	SRP		-16.419		-17.466***		-24.927***		-11.710***
			(1.610)		(2.732)		(3.828)		(3.041)
	DVP		-1.515		-10.490***		-10.428***		-5.577**
			(0.342)		(2.714)		(3.961)		(2.222)
	$y_{US} - y_i$	5.622**	5.628**	6.091**	6.121**	6.510**	6.556**	3.832**	3.863**
		(2.107)	(2.119)	(2.153)	(2.194)	(2.452)	(2.469)	(2.431)	(2.426)
	Adj R^2	0.020	0.020	0.095	0.102	0.226	0.230	0.188	0.189
JPY	DVP^U	-49.094***		-11.894		-10.414		-13.408	
		(3.368)		(0.781)		(0.843)		(1.230)	
	DVP^D	4.266		-5.887		-0.832		2.991	
		(0.536)		(1.097)		(0.195)		(0.923)	
	SRP		-18.892**		1.023		-3.040		-6.652
			(2.117)		(0.121)		(0.439)		(1.200)
	DVP		-14.705***		-4.974		-3.874		-3.656
			(3.050)		(1.255)		(1.303)		(1.473)
	$y_{US} - y_i$	3.154*	3.191*	2.674*	2.688*	2.295	2.307	1.895	1.911
		(1.793)	(1.787)	(1.740)	(1.723)	(1.508)	(1.514)	(1.063)	(1.071)
	Adj R^2	0.009	0.009	0.013	0.011	0.015	0.015	0.031	0.032
NOK	DVP^U	-69.213***		-54.111*		-45.490**		-35.430**	
		(2.824)		(1.966)		(2.409)		(2.345)	
	DVP^D	26.290		17.304*		12.063**		11.829*	
		(0.989)		(1.691)		(1.990)		(1.741)	
	SRP		-36.792		-28.508**		-22.287**		-20.032**
			(1.627)		(2.356)		(2.551)		(2.555)
	DVP		-10.218		-10.850		-9.911*		-7.951*
			(1.090)		(1.397)		(1.930)		(1.872)
	$y_{US} - y_i$	1.876	1.938	0.178	0.248	-0.887	-0.823	-0.498	-0.443
		(0.900)	(0.926)	(0.115)	(0.159)	(0.552)	(0.508)	(0.317)	(0.279)
	Adj R^2	0.005	0.000	0.029	0.024	0.065	0.056	0.086	0.088
NZD	DVP^U	-27.756		-59.175		-71.904***		-48.763***	
		(0.645)		(1.622)		(2.956)		(3.459)	
	DVP^D	18.726		12.742*		25.166***		17.004***	
		(0.779)		(1.914)		(3.363)		(3.325)	
	SRP		-21.841		-29.075**		-40.350***		-27.111***
			(0.822)		(2.336)		(3.831)		(4.501)
	DVP		-3.103		-16.249		-15.195***		-10.129***
			(0.290)		(1.613)		(2.888)		(3.328)
	$y_{US} - y_i$	3.752*	3.766*	3.348	3.417	2.919	2.998	1.085	1.145
		(1.849)	(1.884)	(1.568)	(1.601)	(1.392)	(1.420)	(0.762)	(0.795)
	Adj R^2	0.003	0.004	0.061	0.064	0.149	0.147	0.134	0.129
SEK	DVP^U	-52.973*		-47.799**		-45.362***		-30.171**	
		(1.689)		(2.221)		(3.087)		(2.551)	
	DVP^D	-10.850		-1.960		3.512		6.476	
		(0.410)		(0.145)		(0.484)		(1.075)	
	SRP		-8.928		-14.059		-16.888*		-15.102**
			(0.325)		(1.047)		(1.895)		(2.188)
	DVP		-19.240**		-15.572**		-13.012***		-8.372***
			(2.303)		(2.454)		(3.355)		(2.719)
	$y_{US} - y_i$	-0.884	-0.794	-0.457	-0.383	-0.720	-0.658	0.112	0.161
		(0.546)	(0.486)	(0.384)	(0.318)	(0.592)	(0.533)	(0.094)	(0.134)
	Adj R^2	0.011	0.007	0.035	0.030	0.064	0.057	0.042	0.050