The Dollar Variance Risk Premium: A Tale of Two Investors

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The risk premium on dollar uncertainty

How does the risk premium on dollar uncertainty affect the risk premium of currency investments?

- A standard view
  - Since USD is a safe haven, dollar appreciation is unfavorable.
  - US investors may require a higher risk premium for foreign investments.
- An alternative: The non-US investor also may require a risk premium for investing in USD assets
  - Despite investing in a safe currency, international investments are riskier than local investments
  - Londono and Zhou (2017) find that the dollar variance risk premium predicts dollar appreciation

A tale of two investors

We show that signed variance matters: investors care about currency appreciation risk

- Foreign investors
  - Local currency appreciation risk is important (Up states)
  - Upside DVP (DVP^U) matters
  - Should predict future dollar appreciation
- US investors
  - Dollar appreciation risk (Down states)
  - Downside DVP (DVP^D) matters
  - Should predict foreign currency appreciation
- Skewness Risk Premium (SRP): Their difference should be a strong predictor of dollar returns.

Local currency appreciation risk

Why should investors dislike local currency appreciation?

- *Balance Sheet:* The US holds a net negative position in dollar-denominated asset (Gourinchichas and Rey 2007, Caballero, Frahi, and Gourinchas 2008, Jiang, Krishnamurthy, and Lustig 2021)

  $\rightarrow$ US prefers dollar depreciation and other countries prefers dollar appreciation (=local currency deprecation)

- *Net Export:* Local currency depreciation stimulates economic growth if firms are net exporters (Rodrik 2008)

- *Investors:* Local currency appreciation leads to lower returns on foreign investment(e.g., Jansen, Shin, and von Peter 2024)

$\Rightarrow$ Investors dislike local currency appreciation

A preview of the main findings

- The dollar variance risk premium (DVP) predicts USD appreciation (Londono and Zhou 2017).
  - Foreign investors take dollar investments as "risky" even though a dollar position can hedge global risk.
- A tale of two investors
  - We find that a high risk premium on appreciative-component of the variance leads to currency depreciation (for both USD and non-US currencies)
- The sign is switched for safe (Japan and Switzerland) currencies: the upside of safe and the downside variance risk premium of other currencies contain information on global/US risk.

Model setup

- When the market is complete, currency returns is represented by:

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

  - Higher q^i means appreciation for currency i
  - m^i_{t+1} is the domestic SDF, m_{t+1} is the US SDF

- $m^i_{t+1} - E_t[m^i_{t+1}] = \delta^i \sqrt{\frac{z^i_t}{2}}(v^i_{t+1} - 1) + \lambda^i \sqrt{\frac{z_t}{2}}(v_{t+1} - 1),$
  - v^i_{t+1} and v_{t+1} are i.i.d with Chi-square 1 (shocks to z)
  - US SDF is denoted without superscript i
  - We assume $\delta^i > \delta$ and $\lambda^i < \lambda$

Model setup

$$\Delta q^i_{t+1} - E_t[\Delta q^i_{t+1}] = \underbrace{(\delta^i - \delta)}_{\text{Positive}} \sqrt{\frac{z^i_t}{2}}(v^i_{t+1} - 1) + \underbrace{(\lambda^i - \lambda)}_{\text{Negative}} \sqrt{\frac{z_t}{2}}(v_{t+1} - 1),$$

- ▷ A higher q^i denotes higher currency value for i relative to USD
- ▷ Because shocks to v^i and v_t are positively skewed:
  - A positive US SDF/variance shock will increase USD and is likely to be more important for US investors
  - A positive foreign SDF/variance shock will lower USD and is important for non-US investors
- ▷ The up/down variance risk premium will capture the risk premium attached to each of the two components.

Data sources

- ▷ Data on currency options from Bloomberg
- ▷ Intraday data from histdata.com
- ▷ Daily currency returns from Bloomberg
- ▷ nine major developed-market currencies against the US dollar:
  - AUD, CAD, CHF, EUR, GBP, JPY, and NZD (Jan 2008 – Dec 2022)
  - NOK and SEK (Oct 2008 – Dec 2022)

Estimation

- The currency variance risk premium ($CVRP_i$) of the currency pair between country i and USD

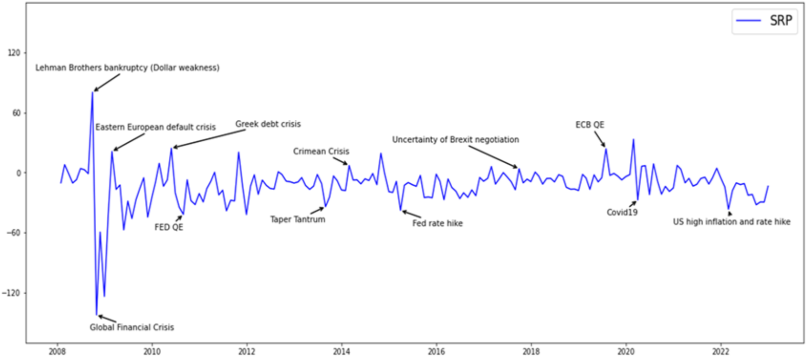
$$CVRP_{i,t} = E_t^Q[QV_{i,t}] - E^P[QV_{i,t}], \tag{1}$$

  - Q component from option prices, P component using HAR-RV
- The dollar variance risk premium (DVP) is the cross-currency average of CVRP
- We also measure DVP^U (related to foreign currency appreciation) and DVP^D (related to dollar appreciation) from the semi-variance and define the skewness risk premium as

$$SRP = DVP^U - DVP^D$$

- The equity variance risk premium (EVRP) is the variance premium of the S&P 500 Index

SRP = DVPU (USD depreciation) – DVPD (USD appreciation)



Empirical Results (DVP)

$$\Delta q_{i,t+1} = b_0 + b_F DVP_t + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t}\right) + FE_i + e_{i,t+1} \quad (\textit{Londono \& Zhou}, 2017)$$

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

- Our interpretation: Controlling for the global/US variance premium, the DVP represents the risk premium of investing in dollar for the non-US investor.

Empirical Results (DVP^U,DVP^D)

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

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

▷ If we decompose DVP into up (dollar depreciation) and downside components,

- A high DVP^U should lead to future dollar appreciation.
- A high DVP^D should lead to future dollar depreciation.

Empirical Results (SRP)

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

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

Shows that we can replace the DVP^U and DVP^D by the difference (SRP)

Empirical Results (Dollar Index)

- We show that identical pattern appears for dollar index:

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

  Also, with time-series regressions, we can avoid the possibility of cross-currency correlation driving the result.

- We also show that individual currency indices can be used (panel regression)

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

  CVRP and CSRP are measures agaist the USD, defined at the currency level.

Empirical Results (Safe: JPY, CHF)

We observe the opposite pattern if only safe currencies are used:

$$\Delta q_{i,t+1} = b_0 + b_U DVP^U_{t,Safe} + b_D DVP^D_{t,Safe} + b_E EVRP_t + b_I \left(y_{US,t} - y_{i,t} \right) + e_{i,t+1},$$

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

- ▷ A high premium on safe currency appreciation risk predicts lower dollar returns.

Drivers of SRP (Downside: US or global shock)

$$SRP_t = \alpha + \beta_g \text{Global UNC}_t + \beta_1 SRP_{t-1} + \beta_u DVP^U_{t-1} + \beta_d DVP^D_{t-1} + \epsilon_t$$

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

- SRP negatively related to global uncertainty from Bekaert, Engstrom, and Xu (2022) and US sovereign CDS spread
- Positively related to the global financial cycle factor (Miranda-Agrippino and Rey 2020).

Drivers of SRP (Downside: US or global shock)

$$DVP_t^{U/D} = \alpha + \beta_g \text{Global UNC}_t + \beta_U DVP_t^U + \beta_D DVP_t^D + \beta_u DVP_{t-1}^U + \beta_d DVP_{t-1}^D + \epsilon_t$$

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

- Upside DVP is negatively related to global uncertainty and US sovereign CDS spread and positively related to the global financial cycle factor.
- Opposite sign for downside DVP.

Drivers of SRP (Upside spike: Non-US shock)

Does more country-specific risk lead to higher CSRP (cross-currency)

$$CSRP_{c,t} = \alpha_1 + \beta_c \Delta CDS_{c,t} + \beta_1 CSRP_{t-1} + \beta_2 CVRP_{t-1} + \epsilon_t$$

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

Drivers of SRP (Upside spike: Non-US shock)

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

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

Conclusion

- We provide an alternative explanation why a high DVP could lead to a dollar appreciation.
- The DVP contains information on the currency risk premium required by both US and non-US investors
- Decomposing the DVP into upside and downside components, the downside DVP contains information on the risk premium of the US investor, and the upside contains non-US investor's risk premium
- For safe currencies, the information contained in upside and downside variance risk premiums are switched.