The U.S. Dollar Safety Premium

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International Monetary System characterized by the existence of a Reference Country and a Reference Currency:

- Pre WW I: UK, British Pound Sterling, Gold
- Post WW II: US, US Dollar

**Key Characteristic:** Safe Haven during periods of crisis. Global Flight to Quality toward the Reference Currency

First emphasized by Bagehot (1873) for Sterling. 2008 Lehman Crisis was a painful reminder of the mechanism
Convert conventional wisdom into finance terminology:

- The USD is a global safe asset since it pays high in bad states of the world ⇒ Unconditional Safety Premium > 0
- There is a GFtQ to the USD during bad times ⇒ Conditional Safety Premium increases during bad times

*Def.* The USD Safety Premium is the excess return of investing in foreign currency while shorting the USD

Previous literature focused on the first point: contentious


UIP and carry trade literature: Lustig, Rousannov, Verdhelan (2010, 11)
My Contribution

- New Dataset: high quality estimates of global currencies returns
- Measure the Unconditional and Conditional USD Safety Premium
  - 1% on average for the modern floating period (1973-2010)
  - Near 10% during crises, and as large as 50% during the Oct 2008 collapse
- Confirm the role of the USD as a Safe Haven during crises
- Interpret these findings in terms of risk: no free lunch for the US
Results Preview: Dollar Safety Premium
Simple law of one price asset pricing:

\[ 1 = E_t[\Lambda_{t+1} R_{t+1}] \quad \quad 1 = E_t[\Lambda_{t+1}^* R_{t+1}^*] \]

* are Foreign variables

**Proposition 1** There exist two stochastic discount factors, one for each country, such that:

\[ \Lambda_{t+1} = \Lambda_{t+1}^* \frac{E_t}{E_{t+1}} \]

\( E_t \downarrow : \) USD appreciates

The stochastic discount factors:

\[ M_{t+1} \equiv \text{proj}(\Lambda_{t+1} | A) \quad M_{t+1}^* \equiv \text{proj}(\Lambda_{t+1}^* | A^*) \]

where \( A = A^* E_{t+1} \) is the space of internationally traded assets, always satisfy the above relationship
Return Decomposition

**Proposition 2** Assume that asset returns, SDFs and the exchange rate are jointly log-normally distributed. Then the expected excess return in Home currency of the Foreign asset over the Home asset is:

\[
E_t[r_{t+1}^* + \Delta e_{t+1} - r_{t+1}] + \frac{1}{2} \text{Var}_t(r_{t+1}^* + \Delta e_{t+1}) - \frac{1}{2} \text{Var}_t(r_{t+1}) =
\]

\[
- \text{Cov}_t(m_{t+1}^*, r_{t+1}^*) + \text{Cov}_t(m_{t+1}, r_{t+1}) + \text{Cov}_t(r_{t+1}^*, \Delta e_{t+1}) - \text{Cov}_t(m_{t+1}, \Delta e_{t+1})
\]

- **domestic risk**
- **exchange rate risk**

- \( - \text{Cov}_t(m_{t+1}^*, r_{t+1}^*) \): Foreign asset risk premium in Foreign currency

- \( - \text{Cov}_t(m_{t+1}, r_{t+1}) \): Home asset risk premium in Home currency

- \( \text{Cov}_t(r_{t+1}^*, \Delta e_{t+1}) \): Foreign asset is riskier for Home investors if it pays high when the Home currency depreciates

- \( - \text{Cov}_t(m_{t+1}, \Delta e_{t+1}) \): currency risk premium
Safe currency

If assets are the risk free rate for each country, then the currency risk premium:

\[ E_t[r^{*,t+1}_f + \Delta e_{t+1} - r_{f,t+1}] + \frac{1}{2} \text{Var}_t(\Delta e_{t+1}) = -\text{Cov}_t(m_{t+1}, \Delta e_{t+1}) \]

A currency is safe if the covariance is positive: i.e. the currency appreciates in bad times

- Interesting to analyze: \( \text{Cov}_t(\text{risky return}_{t+1}, \Delta e_{t+1}) \)
  - \( \text{risky return}_{t+1} = r^{*,t+1}_f \): measures 3rd term
  - \( \text{risky return}_{t+1} = r^w_{t+1} \): then under CAPM \( m_{t+1} \equiv a_t - b_t r^w_{t+1} \) it is a direct measure of the currency risk premium

\[ -\text{Cov}_t(m_{t+1}, \Delta e_{t+1}) = b_t \text{Cov}_t(r^w_{t+1}, \Delta e_{t+1}) \]

The challenge: what matters is the conditional covariance. Not observable
Identification Strategy: Intuition

Methodology originally developed by Campbell (1987) and Harvey (1989). I follow Duffee (2005). Intuition:

- I want to measure: \( b_t \text{ Cov}_t(r_{t+1}, \Delta e_{t+1}) \)
- By definition: \( r_{t+1} = E_t[r_{t+1}] + \eta_{t+1} \) \( \Delta e_{t+1} = E_t[\Delta e_{t+1}] + \eta_{t+1}^e \)
- So we have: \( \text{Cov}_t(r_{t+1}, \Delta e_{t+1}) = E_t[\eta_{t+1}^r \eta_{t+1}^e] \)

This leads to a three stage econometric procedure
Identification Strategy: Econometric Technique

- **Zero Order** regressions: Predictive regressions
  
  \[ r_{t+1} = \alpha_r Y_t^r + \epsilon_{t+1}^r \]
  
  \[ \Delta e_{t+1} = \alpha_e Y_t^e + \epsilon_{t+1}^e \]

  \[ \tilde{\text{Cov}}(r_{t+1}, \Delta e_{t+1}) \equiv \hat{\epsilon}_{t+1}^r \hat{\epsilon}_{t+1}^e \] is the estimated ex-post covariance

- **First Order** regression: Time varying covariance

  \[ \tilde{\text{Cov}}(r_{t+1}, \Delta e_{t+1}) = \alpha_z Z_t + \xi_{t+1} \]

- **Second Order** regressions: relation between covariance and returns:
  
  **Constant price of risk:**

  \[ r^*_{f,t+1} + \Delta e_{t+1} - r_{f,t+1} + \frac{1}{2} \tilde{\text{Var}}(\Delta e_{t+1}) = d_0 + d_1 \tilde{\text{Cov}}(r_{t+1}, \Delta e_{t+1}) + \omega_{t+1} \]

  **Time varying price of risk:**

  \[ r^*_{f,t+1} + \Delta e_{t+1} - r_{f,t+1} + \frac{1}{2} \tilde{\text{Var}}(\Delta e_{t+1}) = d_0 + [d_1 + d_2 b_t] \tilde{\text{Cov}}(r_{t+1}, \Delta e_{t+1}) + \omega_{t+1} \]
Instruments: Empirical

\[ Y_t^r = [1, dp_t, r_t] \]
\[ Y_t^e = [1, r_{f,t+1}^* - r_{f,t+1}, \Delta e_t] \]
\[ Z_t = [1, dp_t, r_{f,t+1}^* - r_{f,t+1}, r_t, \Delta e_t, vol_t', vol_t^e, cov_{t-1}'] \]

Definitions:

- \( vol_t'x \equiv \sum_{i=0}^{1} (x_{t-i} - \bar{x})^2 \) for \( x = \{r, e\} \)
- \( cov_t' \equiv \sum_{i=0}^{2} (r_{t-i} - \bar{r})(\Delta e_{t-i} - \bar{\Delta e}) \)

Robustness checks:

- \( cay: \) Lettau and Ludvingson (2001)
- \( nxa: \) Gourinchas and Rey (2001)
- \( \text{volatility index: } \) Bloom (2009)
- \( \text{carry trade risk factors: } \) Lustig, Roussanov, Verdhelan (2009)
World and Developed Markets Indices

- Stock Market indices and capitalization weights from MSCI-Barra

- USD Currency indices: my own estimates based on forward, Libor, and government rates

- I build two market cap. weighted indices: Dec 1969 - March 2010
  - World: 45 Developed (D) and Emerging (EM) countries.
  - Developing: 23 Developed countries.

Currency Return Dataset: more extensive in both coverage and time span, and higher quality than datasets currently used in the literature
Average USD Safety Premium: 1970-2010

\[ SP = r_{f,t+1} + \Delta e_{t+1} - r_{f,t+1} + \frac{1}{2} \hat{\text{Var}}(\Delta e_{t+1}) \]

<table>
<thead>
<tr>
<th></th>
<th>World</th>
<th>Developed</th>
<th>Equally Wght</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.98%</td>
<td>0.99%</td>
<td>1.18%</td>
</tr>
<tr>
<td>Stand. Dev</td>
<td>8.06%</td>
<td>8.26%</td>
<td>7.16%</td>
</tr>
<tr>
<td><strong>Subcomponents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\Delta e)</td>
<td>0.72%</td>
<td>1.12%</td>
<td>-2.20%</td>
</tr>
<tr>
<td>(r_{f}^* - r_f)</td>
<td>-0.05%</td>
<td>-0.45%</td>
<td>3.13%</td>
</tr>
</tbody>
</table>

- Safety Premium is positive, but not statistically significant
- This is a symptom of low Sharpe Ratios and short samples. Even if true, it would take at least 64 years of data to have statistical significance!
- Simple, pervasive, but surprisingly under-appreciated problem in the literature
Figure: USD Safety Premium: Roll start date - 2010

Figure: USD Safety Premium: 1970 - Roll end date
Zero Order Regressions: Predictive Regressions

\[ r_{t+1} = \alpha_r Y_r^r + \epsilon_{t+1}^r \]
\[ \Delta e_{t+1} = \alpha_e Y_e^e + \epsilon_{t+1}^e \]

<table>
<thead>
<tr>
<th></th>
<th>World</th>
<th>Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity Returns</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( r_{t+1} )</td>
<td>0.0463</td>
<td>0.0448</td>
</tr>
<tr>
<td>const.</td>
<td>[2.41]</td>
<td>[2.34]</td>
</tr>
<tr>
<td>( dp_t )</td>
<td>0.0106</td>
<td>0.0102</td>
</tr>
<tr>
<td></td>
<td>[2.03]</td>
<td>[1.95]</td>
</tr>
<tr>
<td>( r_t )</td>
<td>0.1259</td>
<td>0.1227</td>
</tr>
<tr>
<td></td>
<td>[1.68]</td>
<td>[1.67]</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.0238</td>
<td>0.0228</td>
</tr>
<tr>
<td><strong>Exchange Rate Changes</strong></td>
<td>( \Delta e_{t+1} )</td>
<td>( \Delta e_{t+1} )</td>
</tr>
<tr>
<td>( \Delta e_{t+1} )</td>
<td>0.0004</td>
<td>0.0013</td>
</tr>
<tr>
<td>const.</td>
<td>[0.29]</td>
<td>[1.01]</td>
</tr>
<tr>
<td>( r_{r,t+1}^* - r_{r,t+1} )</td>
<td>0.1072</td>
<td>0.1330</td>
</tr>
<tr>
<td></td>
<td>[1.96]</td>
<td>[2.22]</td>
</tr>
<tr>
<td>( \Delta e_t )</td>
<td>0.0526</td>
<td>0.0415</td>
</tr>
<tr>
<td></td>
<td>[0.99]</td>
<td>[0.81]</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.0133</td>
<td>0.0169</td>
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First Order Regressions: Covariance Predictability

\[ \widetilde{\text{Cov}}(r_{t+1}, \Delta e_{t+1}) = \alpha Z_t + \xi_{t+1} \]

Panel A: Exploring covariance predictability

<table>
<thead>
<tr>
<th>Instruments</th>
<th>World F - Stat</th>
<th>(\chi^2) p - val</th>
<th>Developed F - Stat</th>
<th>(\chi^2) p - val</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>14.12</td>
<td>(0.0000)</td>
<td>13.49</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>ex int. diff</td>
<td>15.76</td>
<td>(0.0000)</td>
<td>15.38</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>ex dp ratio</td>
<td>14.03</td>
<td>(0.0000)</td>
<td>13.18</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>ex covariance</td>
<td>17.10</td>
<td>(0.0000)</td>
<td>15.65</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>ex volatilities</td>
<td>5.12</td>
<td>(0.0004)</td>
<td>4.11</td>
<td>(0.0025)</td>
</tr>
<tr>
<td>ex return &amp; exch. rate chg.</td>
<td>19.70</td>
<td>(0.0000)</td>
<td>19.15</td>
<td>(0.0000)</td>
</tr>
</tbody>
</table>

Panel B: Details

<table>
<thead>
<tr>
<th>Instruments</th>
<th>World Coeff. (\times 10^4)</th>
<th>(\chi^2) p - value</th>
<th>Developed Coeff. (\times 10^4)</th>
<th>(\chi^2) p - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>int. diff.</td>
<td>-0.600332</td>
<td>(0.2725)</td>
<td>-0.435235</td>
<td>(0.5021)</td>
</tr>
<tr>
<td></td>
<td>-[1.10]</td>
<td></td>
<td>-[0.67]</td>
<td></td>
</tr>
</tbody>
</table>
Second Order Regressions: USD Safety Premium

\[ r_{f,t+1}^* + \Delta e_{t+1} - r_{f,t+1} + \frac{1}{2} \text{Var}(\Delta e_{t+1}) = d_0 + d_1 \text{Cov}(r_{t+1}, \Delta e_{t+1}) + \omega_{t+1} \]

<table>
<thead>
<tr>
<th></th>
<th>World</th>
<th>Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( d_0 )</td>
<td>( d_1 )</td>
</tr>
<tr>
<td>All</td>
<td>0.0001</td>
<td>10.2047</td>
</tr>
<tr>
<td></td>
<td>[0.03]</td>
<td>[2.54]</td>
</tr>
<tr>
<td>ex int. diff.</td>
<td>-0.0028</td>
<td>12.0672</td>
</tr>
<tr>
<td></td>
<td>[-1.45]</td>
<td>[3.19]</td>
</tr>
<tr>
<td>ex dp ratio</td>
<td>-0.0042</td>
<td>16.3391</td>
</tr>
<tr>
<td></td>
<td>[-1.59]</td>
<td>[2.55]</td>
</tr>
<tr>
<td>ex covariance</td>
<td>-0.0031</td>
<td>13.1771</td>
</tr>
<tr>
<td></td>
<td>[-1.56]</td>
<td>[3.16]</td>
</tr>
<tr>
<td>ex volatilities</td>
<td>-0.0005</td>
<td>3.6559</td>
</tr>
<tr>
<td></td>
<td>[-0.22]</td>
<td>[0.82]</td>
</tr>
<tr>
<td>ex return &amp; exch. rate chg.</td>
<td>-0.0009</td>
<td>4.6295</td>
</tr>
<tr>
<td></td>
<td>[-0.44]</td>
<td>[1.07]</td>
</tr>
</tbody>
</table>
Dollar Safety Premium Developed Index

\[ \hat{d}_0 + \hat{d}_1 \text{Cov}(r_{t+1}, \Delta e_{t+1}) \]
Dollar Safety Premium World Index

\[ \hat{d}_0 + \hat{d}_1 \widehat{Cov}(r_{t+1}, \Delta e_{t+1}) \]
Conclusion

Main points:

- There is a positive USD safety premium
- There is substantial time variation in the safety premium
- The dollar acts as a Safe Haven during crisis

Evidence supports the role of the USD as a global reserve currency.