Flights-to-Safety

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What is Flight-to-Safety?

Popular Press

- No less than 805 references to Flight-to-Quality in Financial Times between August 2004 and July 2012, and 533 to Flight-to-Safety.
What is Flight-to-Safety?

Definition

- **Flight-to-Safety**: Sudden increase in *appetite* for safe assets relative to risky assets. Typically, it is a combination of a preference for *Safe* assets (low volatility, downside risk), high *Quality* assets (low default) and highly *Liquid* assets.

Aim of the Paper

- Identify Flight-to-Safety (FTS) over time and across many countries. We look at the flight from *equities* to government *bonds* (e.g. from US equities to US Treasury bonds).
- Distinguish between *global* and *local* FTS spells.
- Investigate behavior of large number of *financial & economic variables* during FTS episodes.
FTS Diagnostics

- Existing (theoretical) work (e.g. Vayanos (2004), Kodres and Pritsker (2002), Caballero and Krishnamurthy (2008), Brunnermeier and Pedersen (2009), Adrian and Shin (2010) not very clear on what exactly is a FTS

- Diagnostics of a FTS
  1. Market stress (high equity market volatility)
  2. Large and negative equity return
  3. Large and positive bond return
  4. Negative high-frequency stock-bond return correlation
Four approaches to transform diagnostics into four different FTS Indicators:

1. FTS Dummy Threshold Model
2. Ordinal Approach: Composite FTS Index
3. Univariate Regime-Switching Model
4. Bivariate Regime-Switching Model

Aggregation of the 4 individual FTS measures into a single FTS indicator
Stock & Bond return data

- Daily frequency, from 1980 till early 2012, local currency (national currencies before euro introduction)
- 23 Countries: US, Canada, Austria, Belgium, Denmark, France, Finland, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, Czech Republic, Poland, Australia, Japan, New-Zealand.
- Equity: Datastream Total Market Indices
- Bonds: Datastream 10-year Benchmark bond indices

Are Treasury bonds safe and liquid?

- Liquidity at least as important as credit quality
- For euro area countries, German 10-year government bonds are the safe asset (rather than Greek, Irish, or Spanish bonds)
Our simplest flight-to-safety indicator $FTS_{i,t}$ for country $i$ at time $t$ is calculated as:

$$FTS_{i,t} = I \{ r_{i,t}^b > z_{i,b} \} \times I \{ r_{i,t}^s < z_{i,s} \}$$

Threshold levels are calculated as:

$$z_{i,b} = \kappa \times \sigma_{i,b} \quad z_{i,s} = -\kappa \times \sigma_{i,s}$$

$$\kappa = 0, 0.5, 1, \ldots$$
FTS Dummy Threshold Model

% FTS and Return Impact for k=1,...,4

- Red: % FTS Normal Distr
- Blue: Observed % FTS
- Orange: Return Impact (right axis)

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Flights-to-Safety
Ordinal Approach: Composite FTS Index (see Holo, Kremer, Lo Duca (2012))

- Consider **6 indicators** that increase with the likelihood of FTS:
  - $r_{b,t} - r_{s,t}$ and $[r_{b,t} - MA(r_{b,t})] - [r_{s,t} - MA(r_{s,t})]$
  - short-term $\sigma_{s,t}$ and (short-term $\sigma_{s,t}$ − long-term $\sigma_{s,t}$)
  - minus short-term $\rho_{s,b,t}$ and (long-term $\rho_{s,b,t}$ − short-term $\rho_{s,b,t}$)

- For each indicator, **rank** from low to high, and **replace** each observation by its **rank** divided by total number of observations (i.e. $s_i(t) = r_i(t) / T$)
  - 0.95 means that only 5 percent of observations have higher link with FTS

- **Aggregate** the individual measures $s_{i,t}$ into a **composite FTS indicator** $CFTSI_t$ (simple average)
Ordinal Approach: Composite FTS Index

- **Caveat:** Index cannot be interpreted as a probability
- **Solution:**

1. Select observations matching minimal FTS criteria (i.e. $r_{b,t} - r_{s,t} > 0$, short-term $\sigma_{s,t} < \sigma_s$, short-term $\rho_{s,b,t} < 0$, ...)

2. Collect value of composite FTS index for those observations and take minimum as threshold

3. FTS probability

\[
\begin{align*}
&= 0 \quad \text{if index < threshold} \\
&= 1 - \text{proportion false positives} \quad \text{if index > threshold}
\end{align*}
\]

Proportion of False Positives: % of observations with ordinal number > threshold not matching minimal FTS criteria
Ordinal Approach: Composite FTS Index
Univariate Regime-Switching FTS Model

- **Three-state regime-switching mean and volatility model** for $r_{i,b} - r_{i,s}$ (regime index $\nu = 1, 2, 3$):
  \[
  r_{i,b} - r_{i,s} = \mu_{i,\nu} + \sigma_{i,\nu} \epsilon_{i,t}
  \]

- **To identify FTS**, impose $\mu_{i,3} > 0, \mu_{i,3} > \mu_{i,1}, \mu_{i,3} > \mu_{i,2}$.

- **Main results**:
  - FTS regimes are always identified as **high volatility** states (except for Greece)
  - **FTS duration** ranges from 8 days (Japan) to 51 days (Finland)
Univariate Regime-Switching FTS Model

US, Ex-Post Prob of FTS Regime, Univariate RS model
Bivariate Regime-Switching FTS Model

- $r_{i,s} - r_{i,b}$ may be positive even when $r_{i,b}$ is not positive or when $r_{i,s}$ is not negative
- We estimate the following bivariate two-state Regime-Switching FTS model

\[
\begin{align*}
    r_{s,t} &= \alpha_0 + \alpha_1 J_{s,t}^{lh} + \alpha_2 J_{s,t}^{hl} + \alpha_3 \left( J_t^{FTS} + \nu S_t^{FTS} \right) + \varepsilon_{s,t} \\
    r_{b,t} &= \beta_0 + \beta_1 J_{b,t}^{lh} + \beta_2 J_{b,t}^{hl} + \beta_3 \left( J_t^{FTS} + \nu S_t^{FTS} \right) + \left( \beta_4 + \beta_5 S_t^{FTS} \right) r_{s,t} + \varepsilon_{b,t}
\end{align*}
\]

$\varepsilon_{s,t} \sim N(0, h_s(S^s_t)) \quad \varepsilon_{b,t} \sim N(0, \text{yield}_{t-1} h_b(S^b_t))$

- We identify FTS by imposing $\alpha_3 < 0, \beta_3 > 0, \beta_5 < 0, \nu \geq 0,$ and $Pr\left( S^s_t = 1 | S^s_{t-1}, S^{FTS}_t = 1 \right) = 1$
Main results:

- $\alpha_3$ negative and large (on average -5 percent daily return!)
- $\nu$ mostly between 1.5 and 4 percent: Biggest FTS effect on switch date
- $\beta_3$ smaller in magnitude and often not statistically significant (often hits zero lower bound)
- $\beta_5$ negative and large, so that $\beta_4 + \beta_5 < 0$
- Non-FTS jump terms ($\alpha_1 < 0$, $\alpha_2 > 0$, $\beta_1 < 0$, $\beta_2 > 0$) often significant, both in statistical and economic terms
Bivariate Regime-Switching FTS Model

US, Ex-post Probability, Bivariate RS Model
We aggregate our 4 individual “noisy” FTS measures into one FTS measure.

Let $F_{i,t}^j$ be probability that country $i$ is experiencing FTS at time $t$ according approach $j$ ($= 1, ..., 4$).

Two aggregation methods:

1. **Average indicator**: $FTS_{i,t}^A = \frac{1}{4} \sum_{j=1}^{4} F_{i,t}^j$

2. **Joint probability**: $FTS_{i,t}^J = 1$ if at least three individual indicators signal FTS ($F_{i,t}^j > 0.5$), and zero otherwise.

We also record joint FTS probability as a measure of strength of our confidence.
## Aggregate FTS Measures

### Percentage Number of FTS Instances (selection of countries)

<table>
<thead>
<tr>
<th>Country</th>
<th>Aggregate Measures</th>
<th>Individual Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Joint Prob.</td>
</tr>
<tr>
<td>US</td>
<td>3.91</td>
<td>2.84</td>
</tr>
<tr>
<td>Germany</td>
<td>4.95</td>
<td>3.92</td>
</tr>
<tr>
<td>UK</td>
<td>5.22</td>
<td>3.51</td>
</tr>
<tr>
<td>Average</td>
<td>4.70</td>
<td>2.36</td>
</tr>
<tr>
<td>Min</td>
<td>0.58</td>
<td>0.08</td>
</tr>
<tr>
<td>Max</td>
<td>9.60</td>
<td>4.40</td>
</tr>
<tr>
<td>Interquartile</td>
<td>3.21</td>
<td>1.80</td>
</tr>
<tr>
<td>Range</td>
<td>6.38</td>
<td>3.02</td>
</tr>
</tbody>
</table>
Aggregate FTS Measures

Average Impact on FTS days and non-FTS days

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Global versus Local FTS

Percentage of Countries in FTS, "Average" method

Percentage of Countries in FTS, Joint Probability Measure

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Flights-to-Safety
Examine comovement of FTS and financial/economic environment:

1. Alternative stress indicators
   - Stock volatility (VIX)
   - Sentiment indicators (Baker-Wurgler, Michigan, Ifo, OECD)
   - Safe haven currencies (yen, Swiss franc)

2. Financial returns
   - Stock portfolios (industry, style)
   - Bond portfolios (cash, government, corporate)
   - Commodity prices (precious metals, oil, agricultural, etc)

3. Real economy
   - Contemporaneous and future economic variables (output growth, inflation, unemployment, etc)
   - Expectations about economic variables (from Survey of Professional Forecasters)
Approach

Simple regression method:

\[ \Delta y_t = \alpha + \beta_{FTS} FTS_t + \gamma z_t + \varepsilon_t \]

where

\[ \Delta y_t \] = return or price change

\[ FTS_t \] = FTS dummy (if \( y_t \) is daily data) OR
fraction of days of FTS instances within month
(if \( y_t \) is monthly data)

\[ \beta_{FTS} \] = FTS beta

\[ z_t \] = other explanatory variables
FTS and Alternative Stress Indicators

- **VIX** increases significantly during FTS episodes for all countries.
- Significant *decline* in consumer-business *sentiment* during FTS:
  - *Ifo business climate* declines significantly in times of FTS for all but one country (German-specific measure).
  - FTS negatively affects *OECD consumer confidence* in 19 countries (country-specific measure).

- **Safe have currencies** in times of FTS:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Ger</th>
<th>UK</th>
<th>Mean</th>
<th>Interquartile</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swiss Franc</td>
<td>0.04</td>
<td>0.17</td>
<td>0.21</td>
<td>0.22</td>
<td>0.04</td>
<td>0.29</td>
</tr>
<tr>
<td>Japanese Yen</td>
<td>0.17</td>
<td>0.30</td>
<td>0.39</td>
<td>0.43</td>
<td>0.16</td>
<td>0.44</td>
</tr>
</tbody>
</table>
FTS and Stock Portfolios

**FTS beta of industry and style portfolios, controlling for normal beta risk (world and local market return):**

![Graph showing FTS beta for various industries and styles.](image-url)

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FTS and Bond Portfolios

- **FTS beta** of money market instruments and government bonds, controlling for long-term benchmark bond:
  - For US and UK, very pronounced term structure shift in FTS (short-term underperforming; long-term outperforming)
  - Across countries, underperformance of money market instruments relative to benchmark bond by average of 5-6 bp

- **FTS beta** of corporate bonds, controlling for long-term benchmark bond and local stock market:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Ger</th>
<th>UK</th>
<th>$\beta_{FTS}$</th>
<th>Interquartile</th>
<th>$\beta_b$</th>
<th>$\beta_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>-0.016</td>
<td>-0.001</td>
<td>-0.013</td>
<td>0.004</td>
<td>[-0.028 ; -0.009]</td>
<td>0.413</td>
<td>-0.003</td>
</tr>
<tr>
<td>BBB</td>
<td>-0.060</td>
<td>-0.077</td>
<td>-0.075</td>
<td>-0.062</td>
<td>[-0.092 ; -0.054]</td>
<td>0.354</td>
<td>0.008</td>
</tr>
<tr>
<td>BBB-AAA</td>
<td>-0.040</td>
<td>-0.075</td>
<td>-0.062</td>
<td>-0.066</td>
<td>[-0.075 ; -0.041]</td>
<td>-0.041</td>
<td>0.011</td>
</tr>
</tbody>
</table>
### FTS and Commodities

**FTS beta** for returns on commodity future contracts worldwide (no natural risk correction for normal times):

<table>
<thead>
<tr>
<th>Commodity</th>
<th>US</th>
<th>Ger</th>
<th>UK</th>
<th>Mean</th>
<th>Interquartile</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodity Total</td>
<td>-0.74</td>
<td>-0.65</td>
<td>-0.68</td>
<td>-0.65</td>
<td>-0.74</td>
<td>-0.37</td>
</tr>
<tr>
<td>Energy</td>
<td>-0.87</td>
<td>-0.75</td>
<td>-0.78</td>
<td>-0.74</td>
<td>-0.82</td>
<td>-0.43</td>
</tr>
<tr>
<td>Industrial Metals</td>
<td>-0.81</td>
<td>-0.93</td>
<td>-0.88</td>
<td>-0.77</td>
<td>-0.93</td>
<td>-0.43</td>
</tr>
<tr>
<td>Precious Metals</td>
<td>0.07</td>
<td>-0.03</td>
<td>-0.07</td>
<td>-0.02</td>
<td>-0.07</td>
<td>0.02</td>
</tr>
<tr>
<td>Agriculture</td>
<td>-0.43</td>
<td>-0.44</td>
<td>-0.40</td>
<td>-0.42</td>
<td>-0.44</td>
<td>-0.21</td>
</tr>
<tr>
<td>Livestock</td>
<td>-0.23</td>
<td>-0.26</td>
<td>-0.24</td>
<td>-0.20</td>
<td>-0.26</td>
<td>-0.13</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>-1.04</td>
<td>-0.85</td>
<td>-0.90</td>
<td>-0.81</td>
<td>-0.91</td>
<td>-0.47</td>
</tr>
<tr>
<td>Brent Crude Oil</td>
<td>-1.20</td>
<td>-0.96</td>
<td>-0.99</td>
<td>-0.97</td>
<td>-1.20</td>
<td>-0.59</td>
</tr>
<tr>
<td>Gold</td>
<td>0.12</td>
<td>0.04</td>
<td>0.00</td>
<td>0.04</td>
<td>-0.02</td>
<td>0.08</td>
</tr>
</tbody>
</table>
FTS and the Real Economy

FTS effect on real activity (GDP, IP, UE) is negative:

<table>
<thead>
<tr>
<th>GDP growth</th>
<th>US</th>
<th>Ger</th>
<th>UK</th>
<th>Mean</th>
<th>Interquartile</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemporaneous</td>
<td>-2.04</td>
<td>-2.78</td>
<td>-1.36</td>
<td>-3.35</td>
<td>-3.64</td>
<td>-1.36</td>
</tr>
<tr>
<td>Survey Forecast Mean</td>
<td>-1.80</td>
<td>-1.52</td>
<td>-0.95</td>
<td>-1.59</td>
<td>-1.52</td>
<td>-0.86</td>
</tr>
<tr>
<td>Survey Forecast St. Dev.</td>
<td>0.10</td>
<td>0.09</td>
<td>-0.00</td>
<td>0.12</td>
<td>0.03</td>
<td>0.09</td>
</tr>
<tr>
<td>One Year Predictive</td>
<td>-4.22</td>
<td>-6.69</td>
<td>-4.53</td>
<td>-8.87</td>
<td>-8.96</td>
<td>-3.13</td>
</tr>
</tbody>
</table>

- Average GDP growth and interquartile range across countries are strictly negative (idem for IP growth)
- In the US, GDP growth is predicted to be 4.2% lower if all days within month are FTS days
- Unemployment increases significantly for 16 out of 23 countries
- On average, unemployment is predicted to be 2% higher if all days within month are FTS days
FTS and the Real Economy

- **FTS effect** on OECD leading indicator:
  - Contemporaneous response of OECD indicator to a FTS spell is negative
  - High FTS incidence predicts an increase in the OECD indicator one year from now
  - Suggests economy is expected to rebound within two years

- **FTS effect** on inflation is negative (contemporaneous, survey forecasts, one year predictive):

<table>
<thead>
<tr>
<th>Inflation</th>
<th>US</th>
<th>Ger</th>
<th>UK</th>
<th>Mean</th>
<th>Interquartile</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemporaneous</td>
<td>-1.27</td>
<td>-0.91</td>
<td>-0.80</td>
<td>-0.85</td>
<td>-1.11</td>
<td>19</td>
</tr>
<tr>
<td>Survey Forecast Mean</td>
<td>-1.34</td>
<td>-0.49</td>
<td>-0.94</td>
<td>-0.84</td>
<td>-0.94</td>
<td>17</td>
</tr>
<tr>
<td>One Year Predictive</td>
<td>-3.57</td>
<td>-3.11</td>
<td>-2.88</td>
<td>-2.58</td>
<td>-3.57</td>
<td>18</td>
</tr>
</tbody>
</table>
Conclusions

- We have identified FTS in 23 countries using only data on equity and bond returns.
- FTS characteristics: positive (negative) bond (stock) returns, negative stock-bond correlation and large stock volatility.
- We show that:
  - FTS episodes comprise less than 5% of the sample and include major market crashes.
  - FTS events are mostly country-specific and less than 30% can be characterized as global.
  - FTS episodes coincide with increases in the VIX, decreases in sentiment and appreciations of yen and Swiss franc.
  - Most financial returns (stocks, money market, corporate bonds, commodities) have a negative FTS beta.
  - Both real activity and inflation decrease immediately (and year after) following a FTS spell.
Further Research

- Relax independence assumption in aggregation method
- Understand better the persistence in FTS identified by the regime-switching models
- Identification of FTS: Alternative regime-switching model on diagnostic measures (i.e. bond minus stock return, stock-bond return correlation, stock return volatility) directly
- Additional financial and economic indicators: stock and bond illiquidity; term structure (level, slope, curvature); monetary policy stance
- Is there anything predicting a FTS incidence?
- ...