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

Overview of Approaches

- 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

Data

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)

FTS Dummy Threshold Model

- Our simplest flight-to-safety indicator $FTS_{i,t}$ for country i at time t is calculated as:

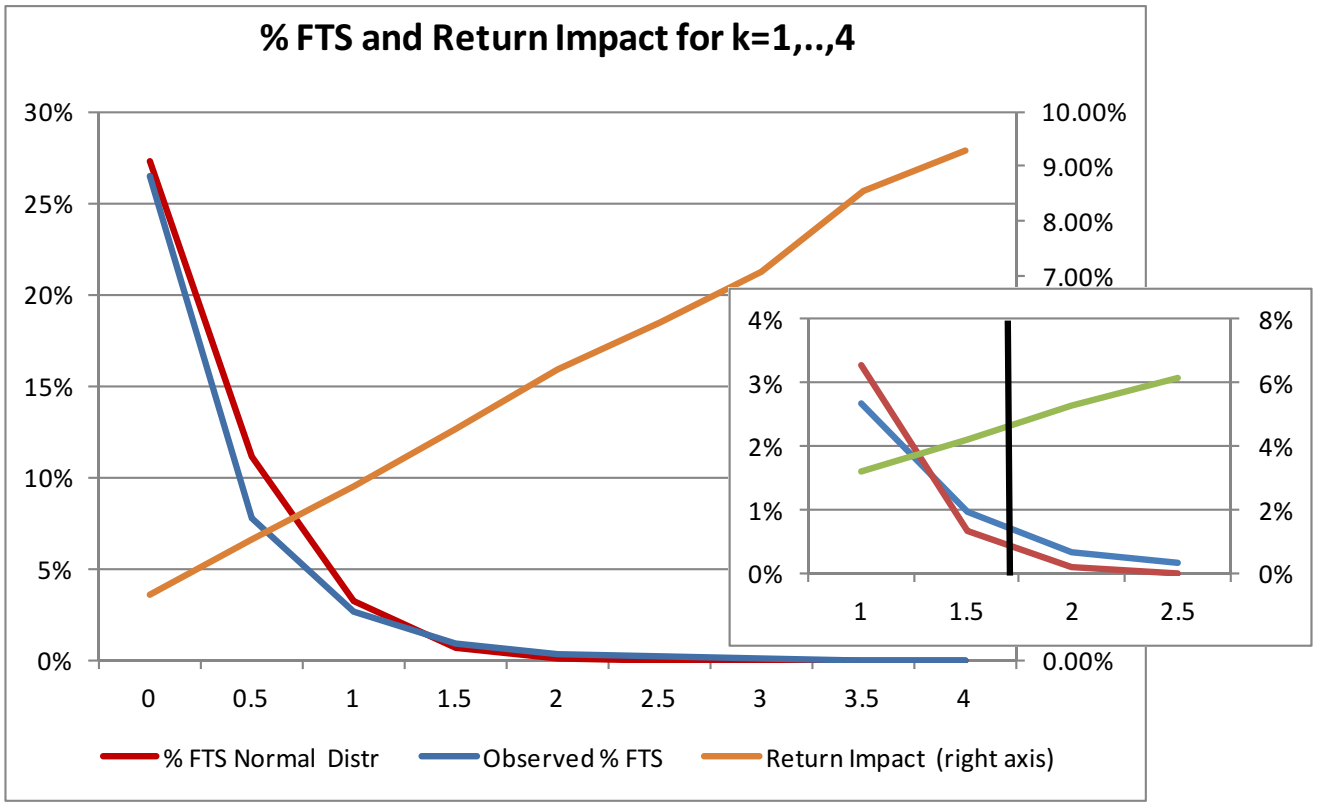
$$FTS_{i,t} = I\left\{r^b_{i,t} > z_{i,b}\right\} \times I\left\{r^s_{i,t} < z_{i,s}\right\}$$

- Threshold levels are are calculated as:

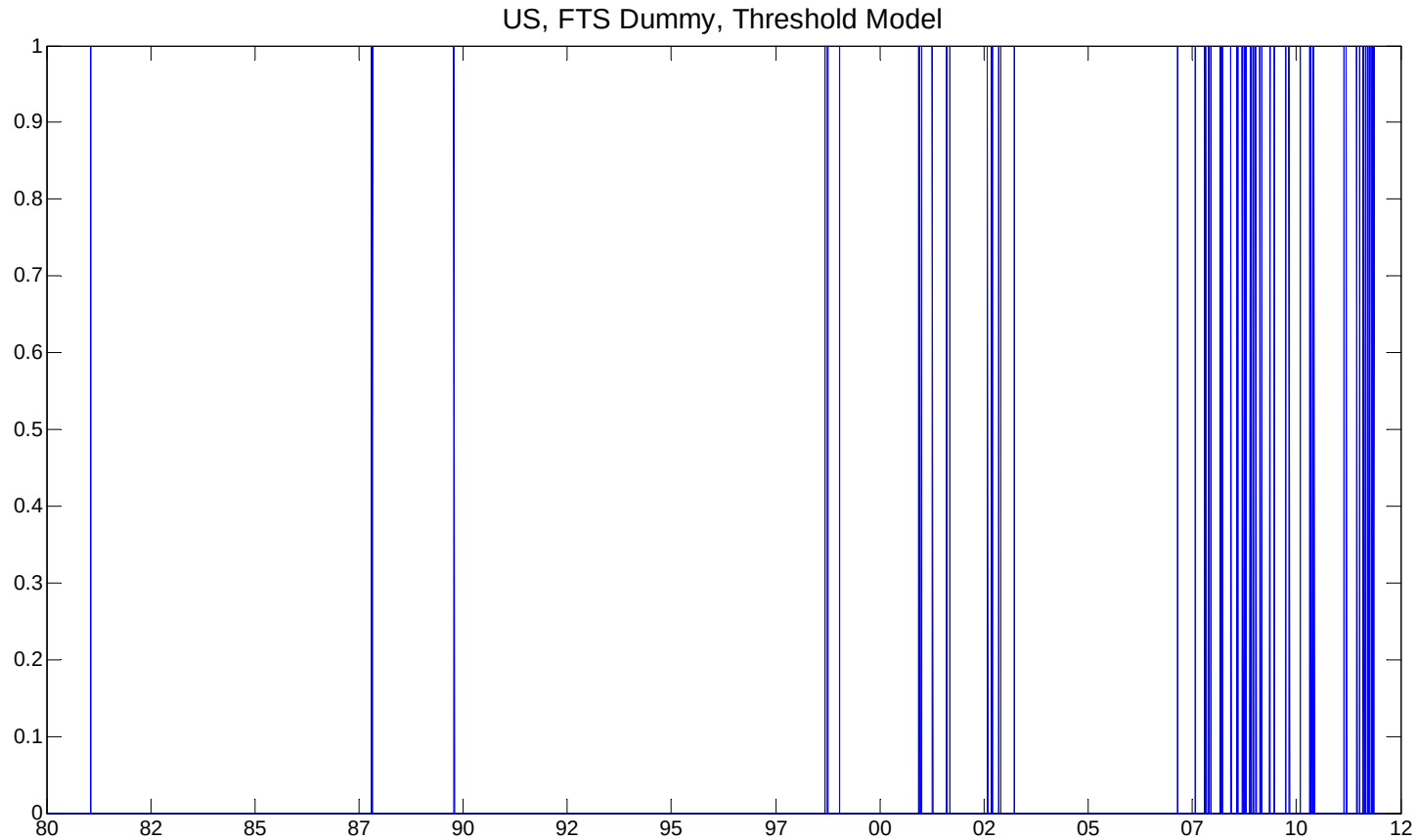
$$z_{i,b} = \kappa \times \sigma_{i,b} \qquad z_{i,s} = -\kappa \times \sigma_{i,s}$$

$$\kappa = 0,\ 0.5,\ 1, ...$$

FTS Dummy Threshold Model



FTS Dummy Threshold Model



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)

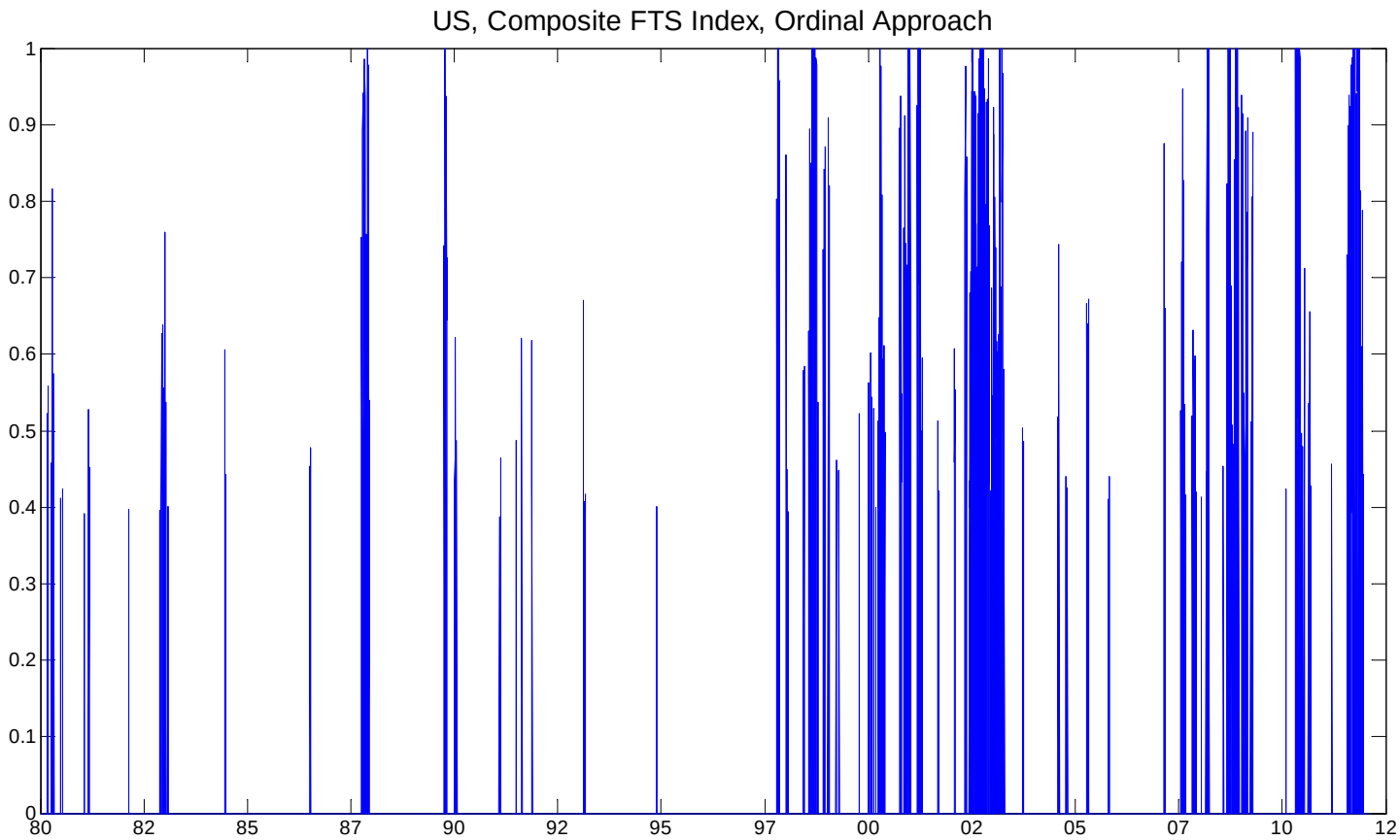
Ordinal Approach: Composite FTS Index

- 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 mininum as threshold
  3. FTS probability

$$\begin{cases} = & 0 & \text{if} \quad \textit{index} < \textit{threshold} \\ = & 1 - \textit{proportion false positives} & \text{if} \quad \textit{index} > \textit{threshold} \end{cases}$$

Proportion of False Positives: % of observations with ordinal number > threshold not matching minimal FTS criteria

Ordinal Approach: Composite FTS Index



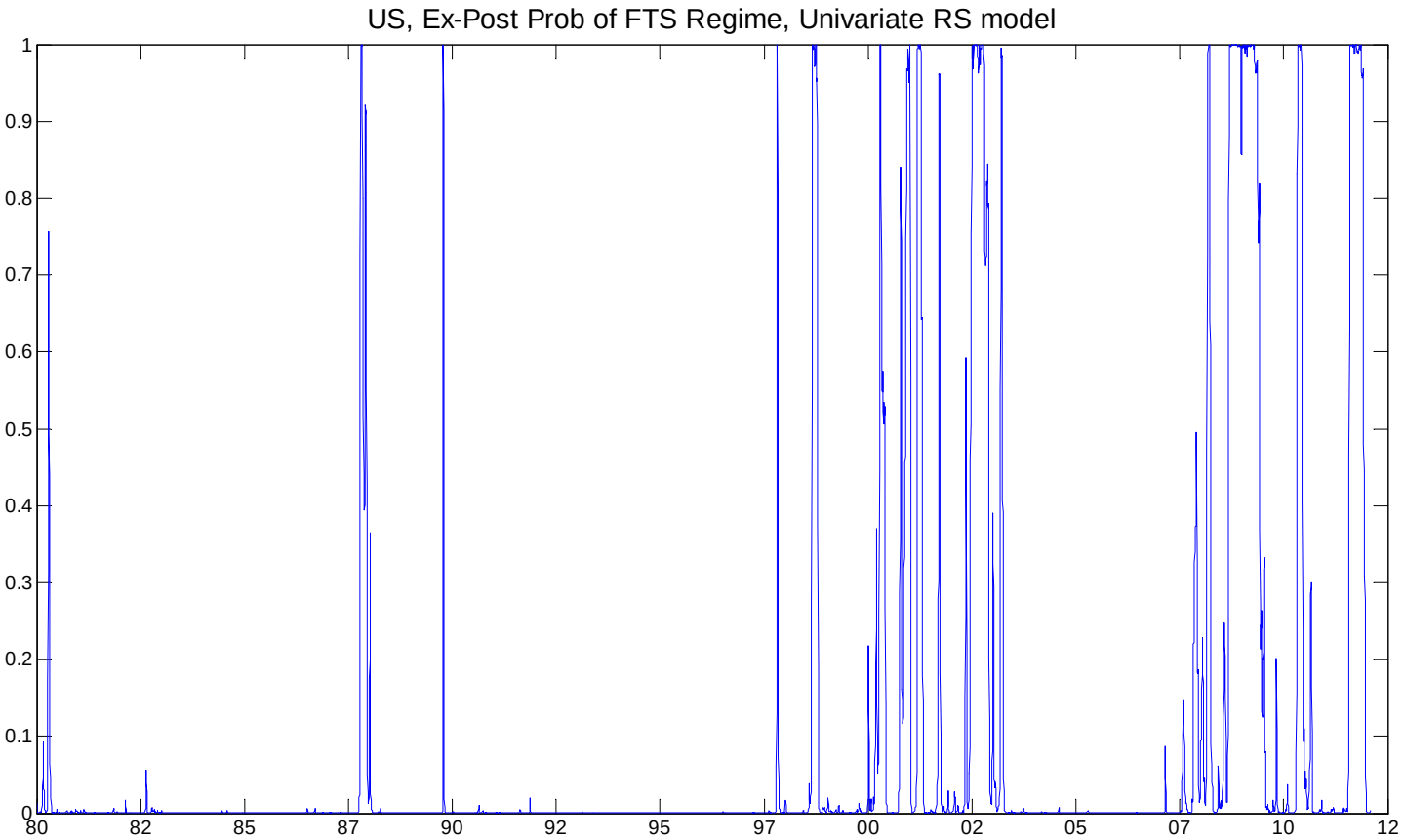
Univariate Regime-Switching FTS Model

- Three-state regime-switching mean and volatility model for $r_{i,b} - r_{i,s}$ (regime index $v = 1, 2, 3$):

$$r_{i,b} - r_{i,s} = \mu_{i,v} + \sigma_{i,v}\epsilon_{i,t}$$

- 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



Bivariate Regime-Switching FTS Model

- $r_{i,b} - r_{i,s}$ 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

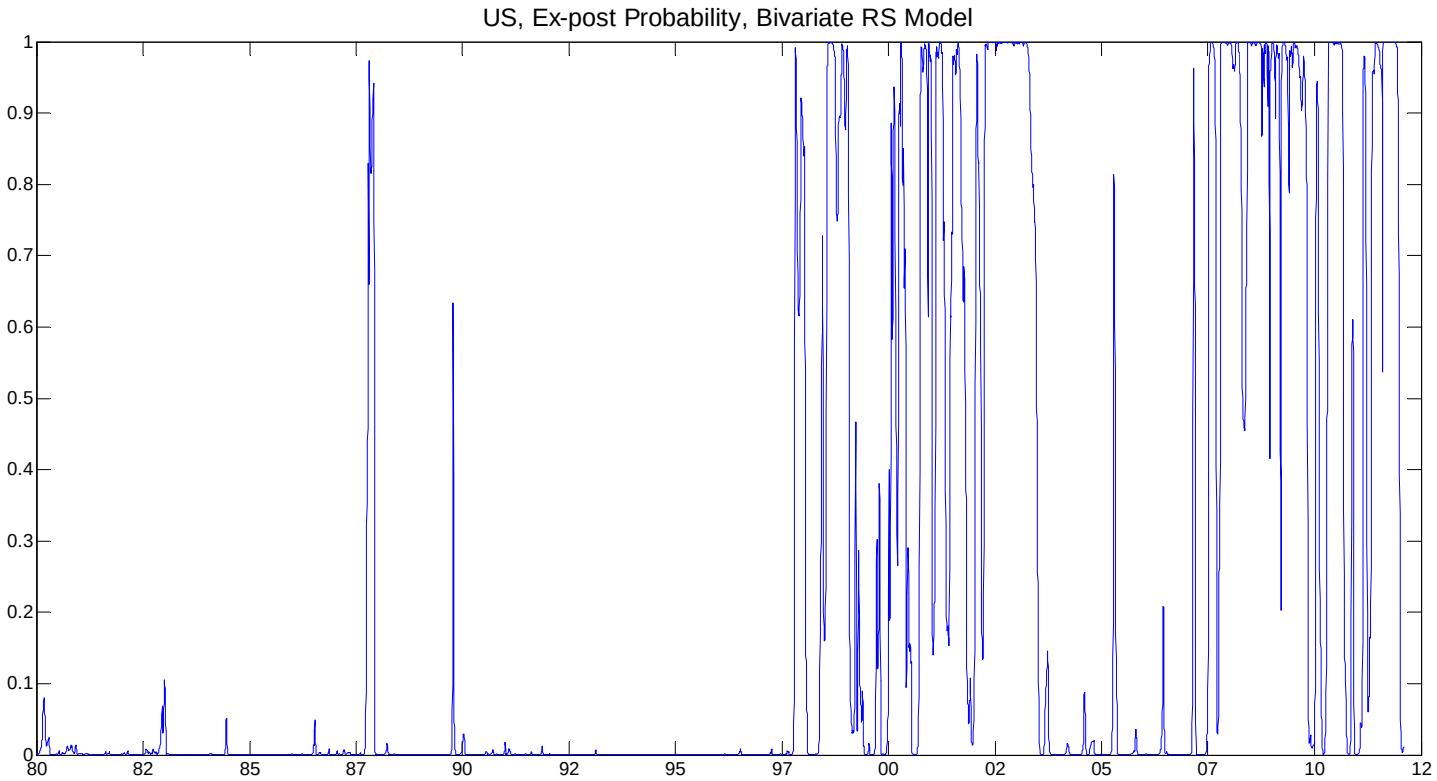
$$
\begin{aligned}
r_{s,t} &= \alpha_0 + \alpha_1 J^{lh}_{s,t} + \alpha_2 J^{hl}_{s,t} + \alpha_3 \left(J^{FTS}_t + v S^{FTS}_t \right) + \varepsilon_{s,t} \\
r_{b,t} &= \beta_0 + \beta_1 J^{lh}_{b,t} + \beta_2 J^{hl}_{b,t} + \beta_3 \left(J^{FTS}_t + v S^{FTS}_t \right) \\
&\quad + \left(\beta_4 + \beta_5 S^{FTS}_t \right) r_{s,t} + \varepsilon_{b,t} \\
\varepsilon_{s,t} &\sim N\left(0, h_s\left(S^s_t\right)\right) \qquad \varepsilon_{b,t} \sim N\left(0, yield_{t-1} h_b\left(S^b_t\right)\right)
\end{aligned}
$$

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

Bivariate Regime-Switching FTS Model

- Main results:
  - α_3 negative and large (on average -5 percent daily return!)
  - ν mostly between 1.5 and 4 percent: Biggest FTS effect on switch date
  - β_3 smaller in magnitude and often not statistically significant (often hits zero lower bound)
  - β_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



Aggregation Methods

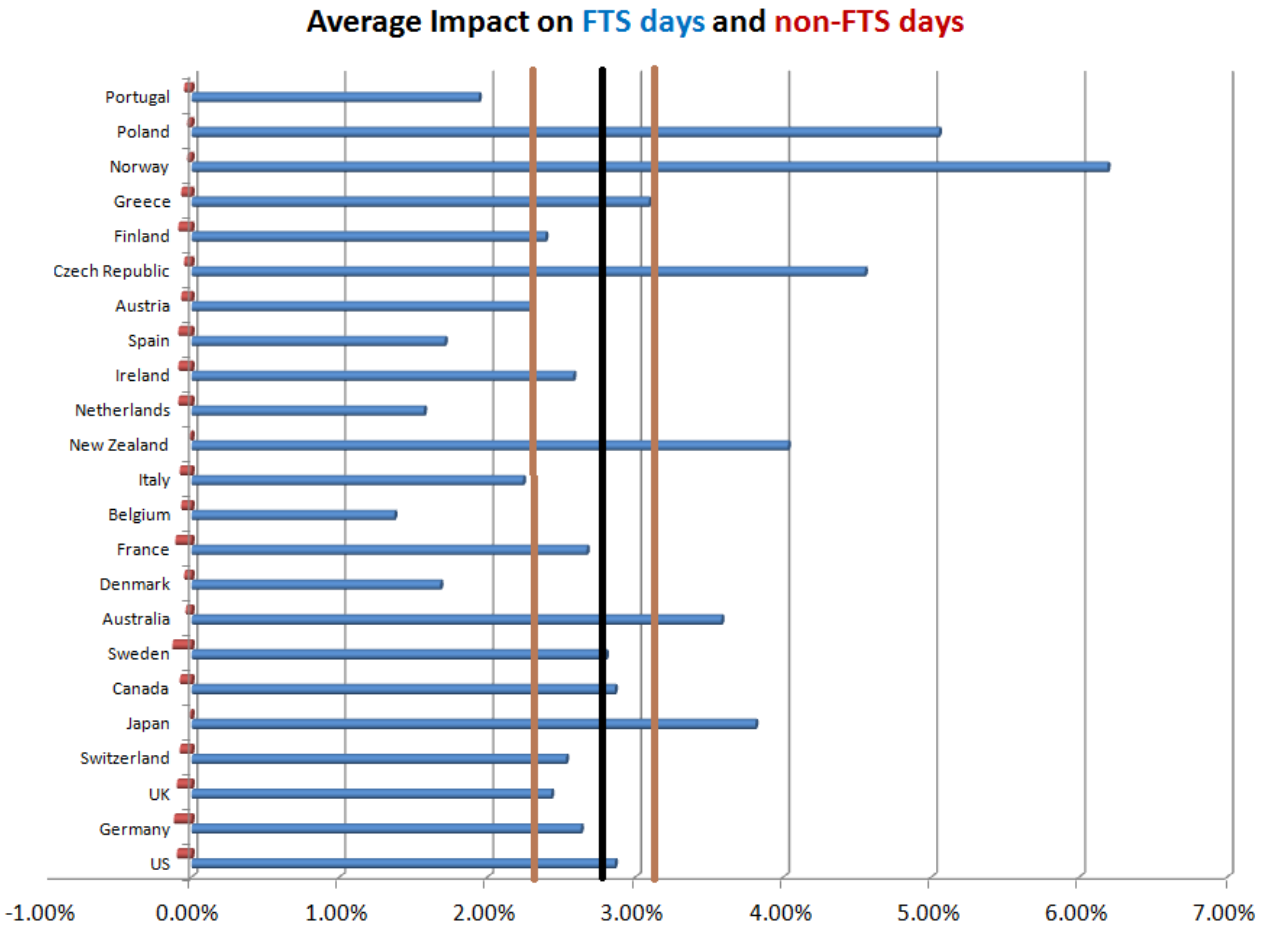
- We aggregate our 4 individual "noisy" FTS measures into one FTS measure
- Let $F^j_{i,t}$ be probability that country i is experiencing FTS at time t according approach j $(= 1, ..., 4)$
- Two aggregation methods:
  1. Average indicator: $FTS^A_{i,t} = \frac{1}{4} \sum_{j=1}^{4} F^j_{i,t}$
  2. Joint probability: $FTS^J_{i,t} = 1$ if at least three individual indicators signal FTS $(F^j_{i,t} > 0.5)$, and zero otherwise
     - We also record joint FTS probability as a measure of strength of our confidence

Aggregate FTS Measures

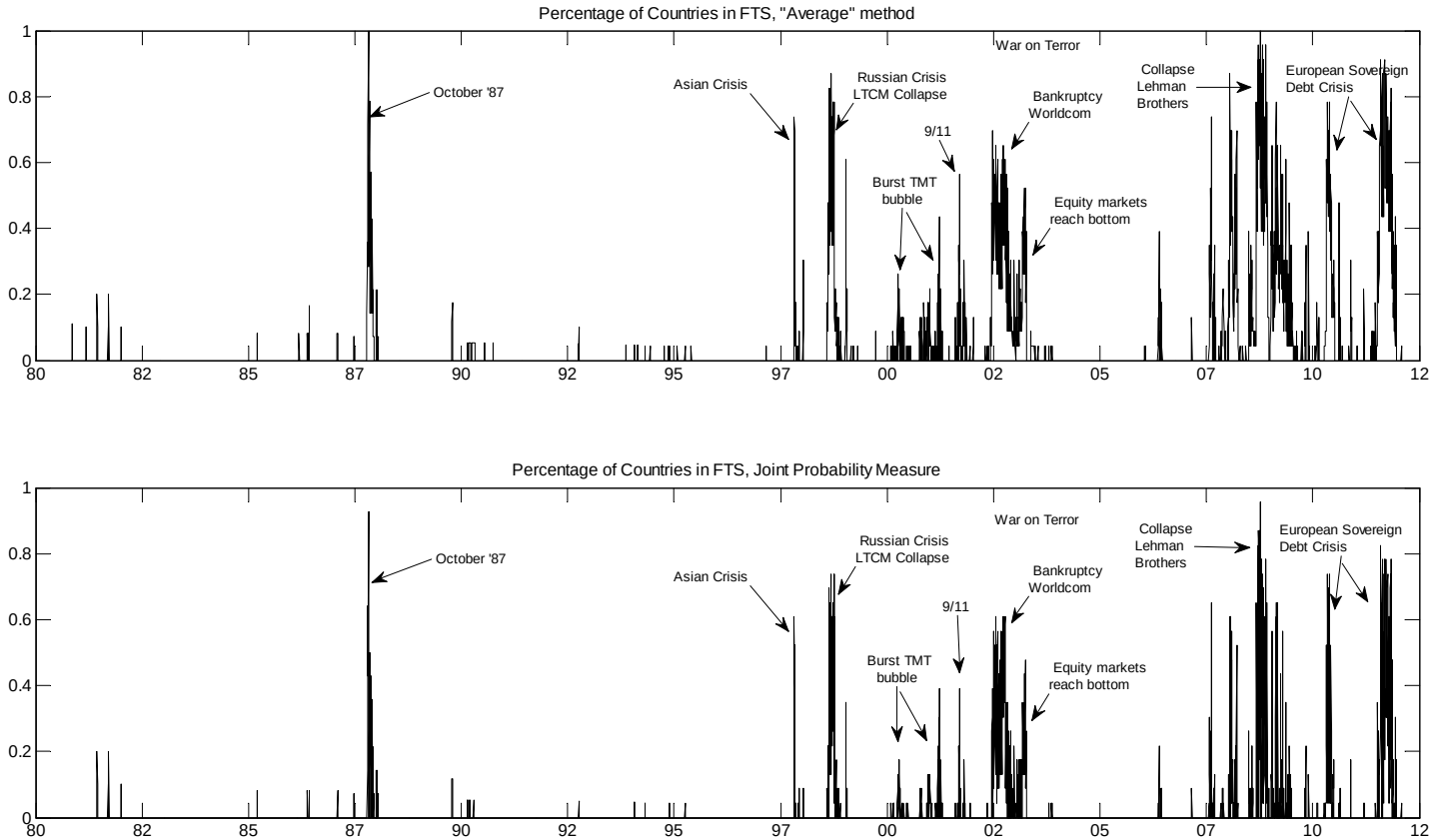
Percentage Number of FTS Instances (selection of countries)

	Aggregate Measures		Individual Measures			
Country	Average	Joint Prob.	Threshold	Ordinal	Univ RS	Bivar RS
US	3.91	2.84	0.90	5.17	7.98	21.74
Germany	4.95	3.92	1.19	6.37	11.31	26.77
UK	5.22	3.51	0.63	5.86	9.40	23.17
Average	4.70	2.36	0.96	4.00	9.76	14.83
Min	0.58	0.08	0.58	0.16	1.99	0.12
Max	9.60	4.40	1.46	6.66	19.75	28.24
Interquartile	3.21	1.80	0.74	2.59	7.98	12.96
Range	6.38	3.02	1.16	5.29	11.91	17.74

Aggregate FTS Measures



Global versus Local FTS



FTS and Financial and Economic Environment

Examine comovement of FTS and financial/economic environment:

1. Alternative stress indicators
   1. Stock volatility (VIX)
   2. Sentiment indicators (Baker-Wurgler, Michigan, Ifo, OECD)
   3. Safe haven currencies (yen, Swiss franc)
2. Financial returns
   1. Stock portfolios (industry, style)
   2. Bond portfolios (cash, goverment, corporate)
   3. Commodity prices (precious metals, oil, agricultural, etc)
3. Real economy
   1. Contemporaneous and future economic variables (output growth, inflation, unemployment, etc)
   2. Expectations about economic variables (from Survey of Professional Forecasters)

Approach

Simple regression method:

$$\triangle y_t = \alpha + \beta_{FTS} FTS_t + \gamma z_t + \varepsilon_t$$

where

$$\begin{aligned}
\triangle y_t &= \text{return or price change} \\
FTS_t &= \text{FTS dummy (if } y_t \text{ is daily data) } \mathbf{OR} \\
&\quad \text{fraction of days of FTS instances within month} \\
&\quad \text{(if } y_t \text{ is monthly data)} \\
\beta_{FTS} &= \text{FTS beta} \\
z_t &= \text{other explanatory variables}
\end{aligned}$$

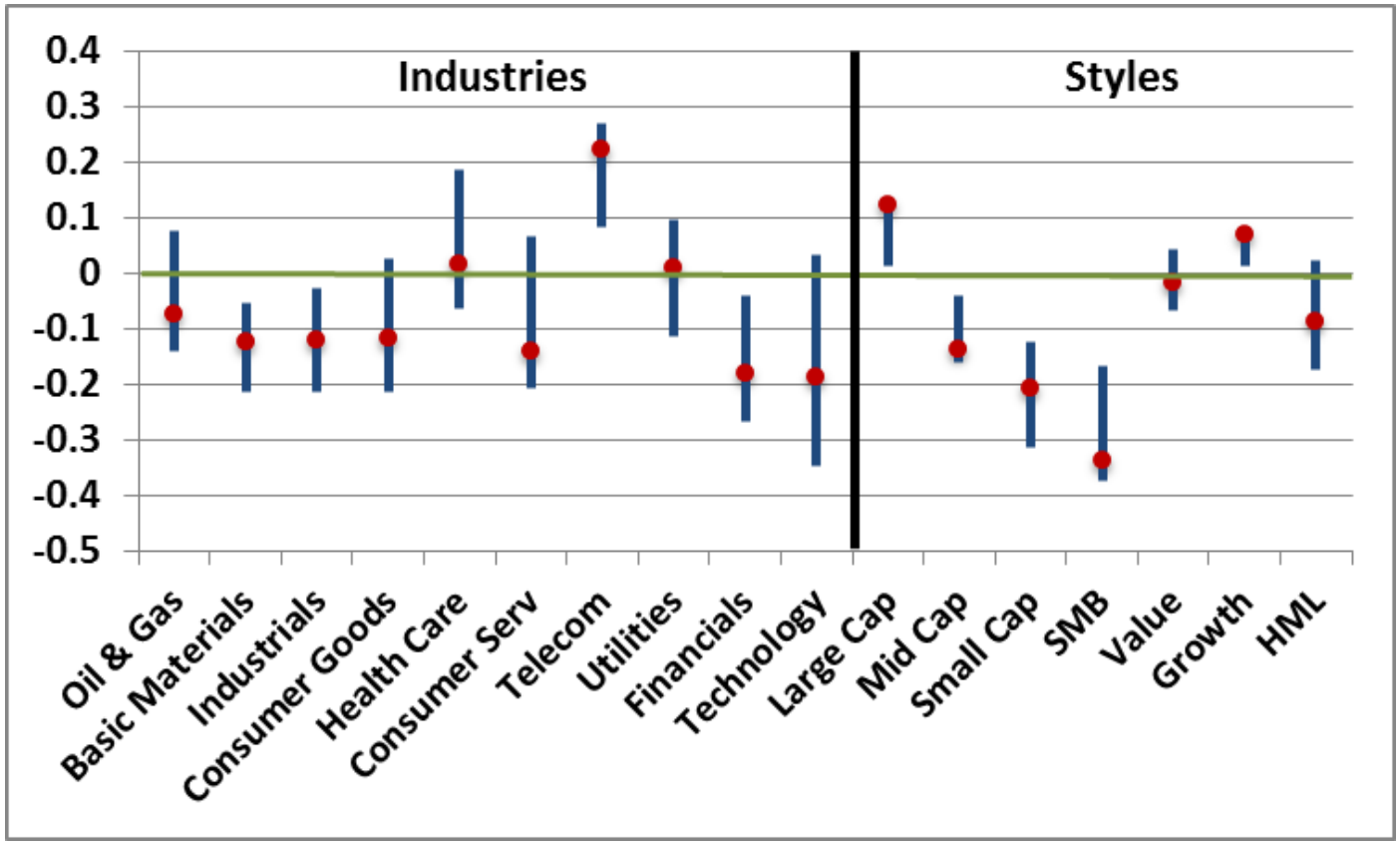
FTS and Alternative Stress Indicators

- VIX increases significantly during FTS episodes for all countries
- Significant decline in consumer-business sentiment during FTS:
  - Baker-Wurgler sentiment and Michigan consumer sentiment: significant decline in the US (US-specific measures)
  - 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:

	US	Ger	UK	Mean	Interquartile		Sign.
Swiss Franc	0.04	**0.17**	**0.21**	0.22	0.04	0.29	19
Japanese Yen	**0.17**	**0.30**	**0.39**	0.43	0.16	0.44	21

FTS and Stock Portfolios

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



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:

	US	**Ger**	**UK**	β_{FTS}	**Interquartile**	β_b	β_s
AAA	-0.016	-0.001	-0.013	0.004	[-0.028 ; -0.009]	0.413	-0.003
BBB	**-0.060**	**-0.077**	**-0.075**	-0.062	[-0.092 ; -0.054]	0.354	0.008
BBB-AAA	**-0.040**	**-0.075**	**-0.062**	-0.066	[-0.075 ; -0.041]	-0.041	0.011

FTS and Commodities

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

	US	Ger	UK	Mean	Interquartile		Sign
Commodity Total	**-0.74**	**-0.65**	**-0.68**	-0.65	-0.74	-0.37	23
Energy	**-0.87**	**-0.75**	**-0.78**	-0.74	-0.82	-0.43	23
Industrial Metals	**-0.81**	**-0.93**	**-0.88**	-0.77	-0.93	-0.43	23
Precious Metals	0.07	-0.03	-0.07	-0.02	-0.07	0.02	3
Agriculture	**-0.43**	**-0.44**	**-0.40**	-0.42	-0.44	-0.21	23
Livestock	**-0.23**	**-0.26**	**-0.24**	-0.20	-0.26	-0.13	21
Crude Oil	**-1.04**	**-0.85**	**-0.90**	-0.81	-0.91	-0.47	23
Brent Crude Oil	**-1.20**	**-0.96**	**-0.99**	-0.97	-1.20	-0.59	23
Gold	**0.12**	0.04	0.00	0.04	-0.02	0.08	4

FTS and the Real Economy

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

GDP growth	US	Ger	UK	Mean	Interquartile		Sign
Contemporaneous	**-2.04**	**-2.78**	**-1.36**	-3.35	-3.64	-1.36	20
Survey Forecast Mean	**-1.80**	**-1.52**	**-0.95**	-1.59	-1.52	-0.86	20
Survey Forecast St. Dev.	0.10	0.09	-0.00	0.12	0.03	0.09	1
One Year Predictive	**-4.22**	**-6.69**	**-4.53**	-8.87	-8.96	-3.13	19

- 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 (contemporeous, survey forecasts, one year predictive):

Inflation	US	Ger	UK	Mean	Interquartile		Sign
Contemporaneous	**-1.27**	**-0.91**	**-0.80**	-0.85	-1.11	-0.43	19
Survey Forecast Mean	**-1.34**	**-0.49**	**-0.94**	-0.84	-0.94	-0.35	17
One Year Predictive	**-3.57**	**-3.11**	**-2.88**	-2.58	-3.57	-1.35	18

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?*
- ...