

DO INTERMEDIARIES MATTER FOR AGGREGATE ASSET PRICES?

Valentin Haddad

UCLA & NBER

Tyler Muir

UCLA & NBER

January 2019

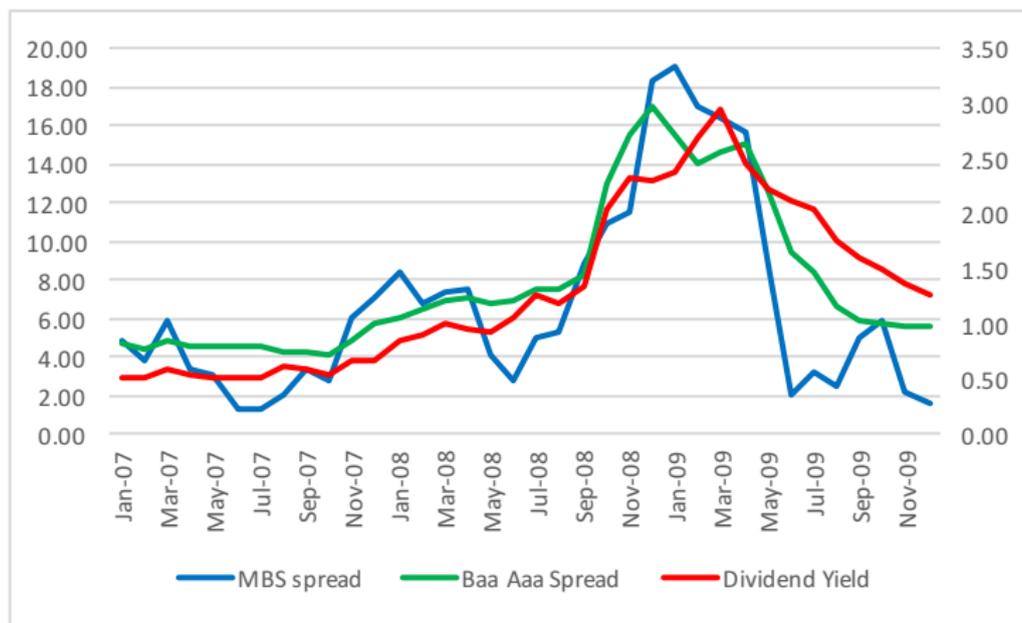
RESEARCH QUESTION

How much variation in aggregate risk premia can we ascribe to intermediaries rather than to households?

RESEARCH QUESTION

How much variation in **aggregate** risk premia can we ascribe to intermediaries **rather than** to households?

EXAMPLE: 2008-09 FINANCIAL CRISIS



- Intermediary risk-bearing capacity was impaired
- But aggregate risk aversion also likely moved
 - ▶ habits, sentiment, etc

WHAT WE DO

Intermediary risk appetite matters more for assets that are difficult to directly invest in, household risk appetite matters less

WHAT WE DO

Intermediary risk appetite matters more for assets that are difficult to directly invest in, household risk appetite matters less

- 1 Overcomes identification issue of positive correlation of intermediary and household risk aversion
- 2 Theoretically justified
 - ▶ A model that nests the simple version of two main views
 - ▶ Existing “intermediary tests” do not get at the question
- 3 Across asset classes, we find:
 - ▶ Measures of financial sector health predict returns more strongly in asset classes that are difficult to invest in
 - ▶ Household measures have opposite pattern
 - ▶ Unrelated to *observable* variation in risk (vol, skewness, or beta)

WHAT WE DO

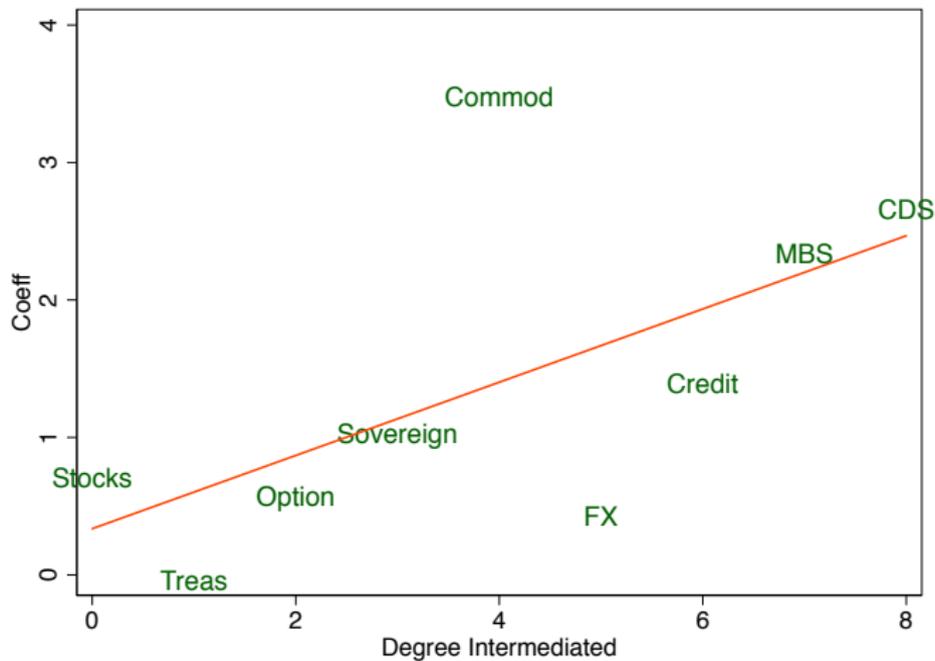
Intermediary risk appetite matters more for assets that are difficult to directly invest in, household risk appetite matters less

- 1 Overcomes identification issue of positive correlation of intermediary and household risk aversion
- 2 Theoretically justified
 - ▶ A model that nests the simple version of two main views
 - ▶ Existing “intermediary tests” do not get at the question
- 3 Across asset classes, we find:
 - ▶ Measures of financial sector health predict returns more strongly in asset classes that are difficult to invest in
 - ▶ Household measures have opposite pattern
 - ▶ Unrelated to *observable* variation in risk (vol, skewness, or beta)

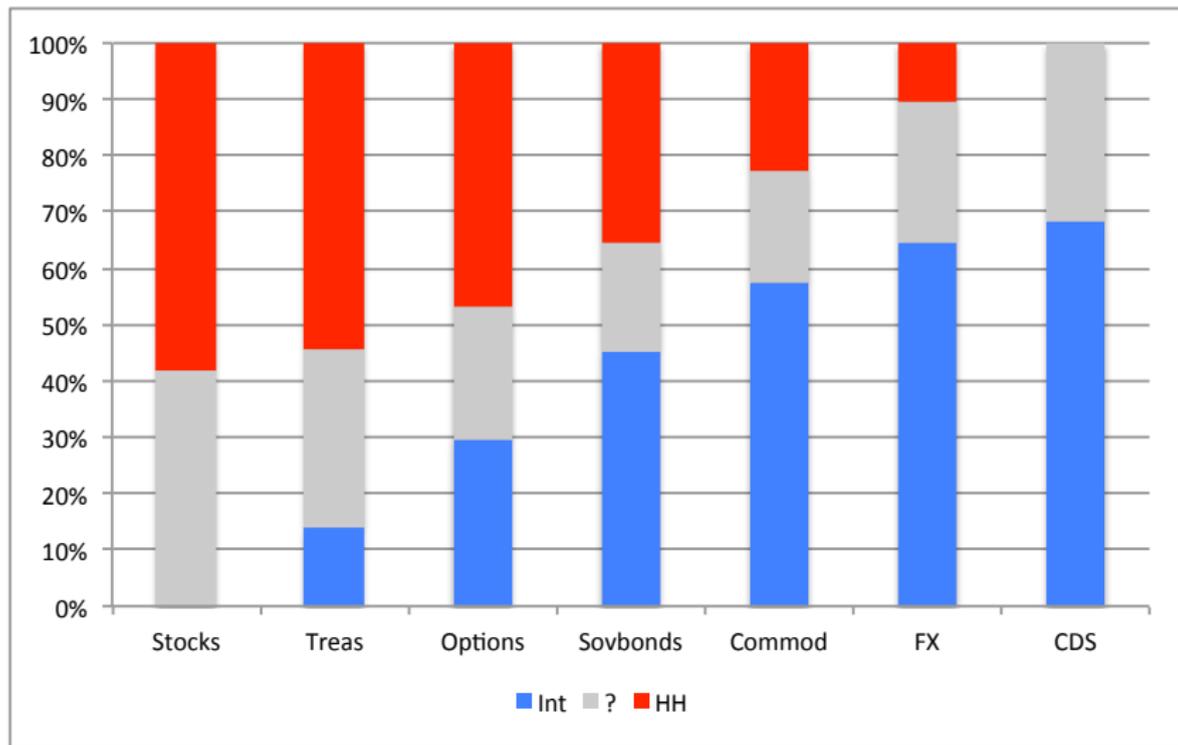
→ *Intermediaries and households have distinct, sizable effect on risk premia*

RESULTS

$$\tilde{r}_{i,t+1} = a_i + b_i \hat{\gamma}_{I,t} + \varepsilon_{i,t+1}$$



BOUNDS OF RISK PREMIA VOLATILITY



Use panel to provide lower bound of volatility due to each

LITERATURE

- **Aggregate** prices **consistent** with role of intermediaries: optimal decisions
 - ▶ Exposure to intermediary factor explains the cross-section of returns, e.g. Adrian Etula Muir (2014), He Kelly Manela (2017), intermediary balance sheet predicts returns, e.g. Haddad Sraer (2016)
- **Local** evidence that intermediaries **cause** changes in prices
 - ▶ Arbitrage opportunities directly related to intermediation regulatory constraints, e.g. Du Tepper Verdelhan (2017), Lewis, Longstaff, Petrasek (2017).
 - ▶ Price dislocations tied to risk bearing capacity (e.g., Duffie 2010)

BASIC IDEAS

- Time-varying risk appetite of intermediaries $\gamma_{I,t}$ and of household risk aversion $\gamma_{H,t}$
- Question: does $\gamma_{I,t}$ play a role for risk premium?

$$\frac{r_{i,t+1}}{E[r_i]} = a_i + \beta_{i,H}\gamma_{H,t} + \underbrace{\beta_{i,I}}_{>0?} \gamma_{I,t} + \varepsilon_{i,t+1}$$

BASIC IDEAS

- Time-varying risk appetite of intermediaries $\gamma_{I,t}$ and of household risk aversion $\gamma_{H,t}$
- Question: does $\gamma_{I,t}$ play a role for risk premium?

$$\frac{r_{i,t+1}}{E[r_i]} = a_i + \beta_{i,H}\gamma_{H,t} + \underbrace{\beta_{i,I}}_{>0?} \gamma_{I,t} + \varepsilon_{i,t+1}$$

- Problem: observe proxy $\hat{\gamma}_{I,t}$
 - ▶ Positively correlated with $\gamma_{I,t}$
 - ▶ Possibly positively correlated with $\gamma_{H,t}$

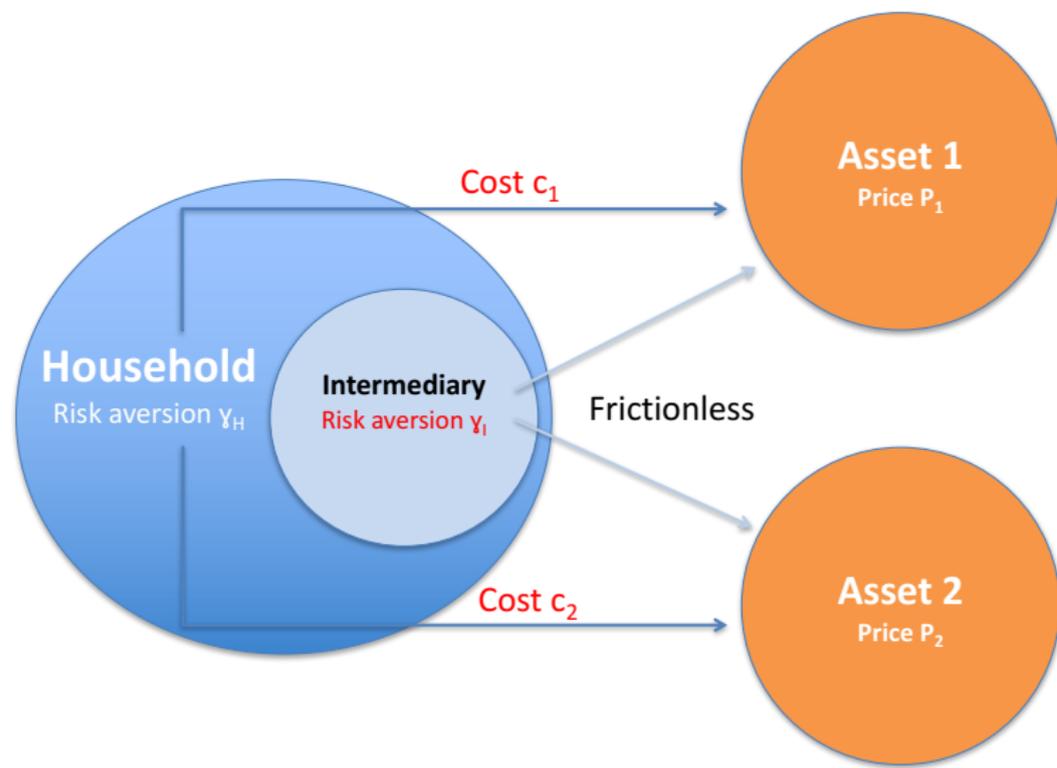
BASIC IDEAS

- Time-varying risk appetite of intermediaries $\gamma_{I,t}$ and of household risk aversion $\gamma_{H,t}$
- Question: does $\gamma_{I,t}$ play a role for risk premium?

$$\frac{r_{i,t+1}}{E[r_i]} = a_i + \beta_{i,H}\gamma_{H,t} + \underbrace{\beta_{i,I}}_{>0?} \gamma_{I,t} + \varepsilon_{i,t+1}$$

- Problem: observe proxy $\hat{\gamma}_{I,t}$
 - ▶ Positively correlated with $\gamma_{I,t}$
 - ▶ Possibly positively correlated with $\gamma_{H,t}$
- Solution: Households face different frictions to invest in each asset class $\rightarrow \beta_{i,H}$ is (weakly) lower for more intermediated asset class

MODEL



- Two periods, N assets with payoffs $\mathcal{N}(\mu, \Sigma)$

SETUP

- **Household:** invest directly or through intermediary
 - ▶ CARA, risk aversion γ_H
 - ▶ Takes intermediary decisions as given
 - ▶ *Friction 1: Assets differ in their ease of access for direct investment (C)*

$$\max_{D_H} (D_H + D_I)' (\mu - p) - \frac{\gamma_H}{2} (D_H + D_I)' \Sigma (D_H + D_I) - \frac{1}{2} D_H' C D_H.$$

SETUP

■ Household: invest directly or through intermediary

- ▶ CARA, risk aversion γ_H
- ▶ Takes intermediary decisions as given
- ▶ *Friction 1: Assets differ in their ease of access for direct investment (C)*

$$\max_{D_H} (D_H + D_I)' (\mu - p) - \frac{\gamma_H}{2} (D_H + D_I)' \Sigma (D_H + D_I) - \frac{1}{2} D_H' C D_H.$$

■ Intermediary

- ▶ *Friction 2: Intermediaries invest on behalf of household, but with different investment policies*
- ▶ CARA, risk aversion γ_I

$$\max_{D_I} D_I' (\mu - p) - \frac{\gamma_I}{2} D_I' \Sigma D_I.$$

RELATIVE PREDICTABILITY

$$\beta_{i,I} = \frac{1}{\mu_i - p_i} \frac{\partial(\mu_i - p_i)}{\partial \log(\gamma_I)} = \frac{c_i}{\gamma_I \sigma_i^2 + c_i} \geq 0$$

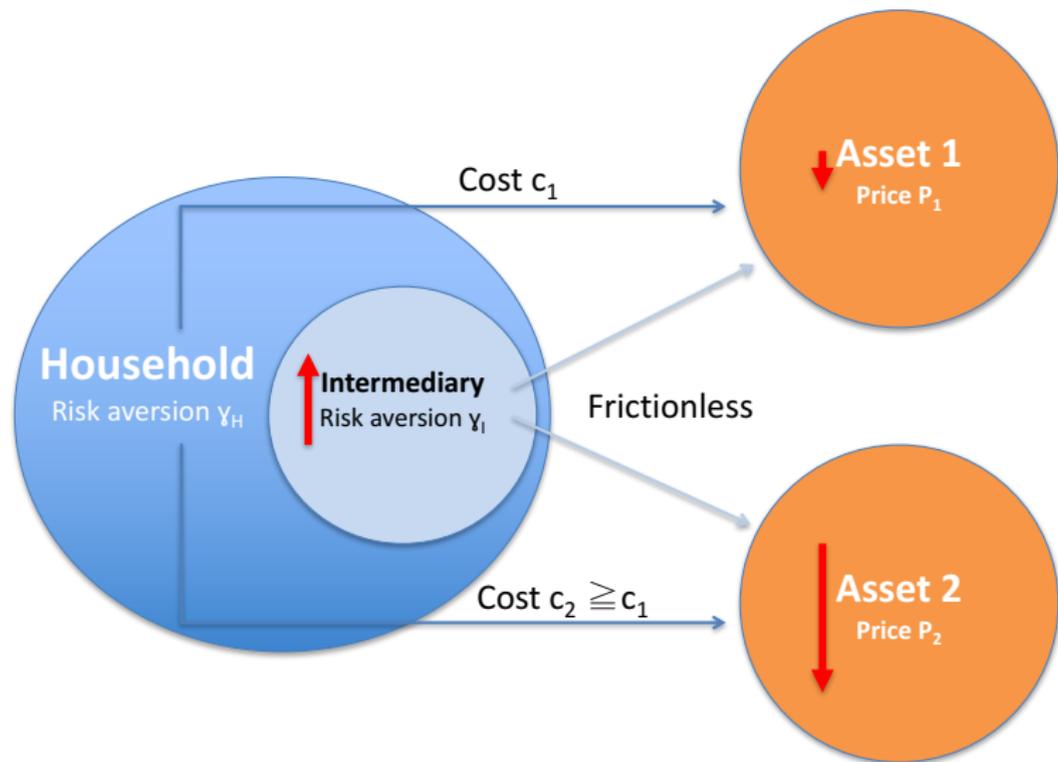
$$\beta_{i,H} = \frac{1}{\mu_i - p_i} \frac{\partial(\mu_i - p_i)}{\partial \log(\gamma_H)} = \frac{\gamma_H \sigma_i^2}{\gamma_H \sigma_i^2 + c_i} > 0$$

RELATIVE PREDICTABILITY

$$\beta_{i,I} = \frac{1}{\mu_i - p_i} \frac{\partial(\mu_i - p_i)}{\partial \log(\gamma_I)} = \frac{c_i}{\gamma_I \sigma_i^2 + c_i} \geq 0, \uparrow c_i$$
$$\beta_{i,H} = \frac{1}{\mu_i - p_i} \frac{\partial(\mu_i - p_i)}{\partial \log(\gamma_H)} = \frac{\gamma_H \sigma_i^2}{\gamma_H \sigma_i^2 + c_i} > 0, \downarrow c_i$$

- 1 Elasticity of risk premium to γ_I increasing in c_i
- 2 Elasticity to household risk aversion γ_H is decreasing in c_i

INTERMEDIARY RISK AVERSION



RISK APPETITE PROXIES

- Measures of intermediary risk aversion $\hat{\gamma}_{I,t}$:
 - ▶ Adrian Etula Muir (2014), He Kelly Manela (2016) factors
 - ★ Shown to proxy for health of financial sector
 - ▶ Take log annual change in variables as return predictors, standardize and average them together

- Measures of household risk aversion $\hat{\gamma}_{H,t}$
 - ▶ Habit: surplus consumption ratio from Cochrane (2017)
 - ▶ *cay* from Lettau Ludvigson (2001)
 - ▶ Consumer sentiment from Michigan Survey

RETURNS

Returns $r_{i,t+1}$:

- Stocks, Treasury bonds, Sovereign bonds, Options on stocks (straddle), Commodities, FX (carry trade), CDS
- **New:** Credit (high minus low yield corp return), MBS (Barclays hedged MBS index)
- Also look at returns to convertible bond arb, fixed income arb, other hedge fund strategies

RETURNS

Returns $r_{i,t+1}$:

- Stocks, Treasury bonds, Sovereign bonds, Options on stocks (straddle), Commodities, FX (carry trade), CDS
- **New:** Credit (high minus low yield corp return), MBS (Barclays hedged MBS index)
- Also look at returns to convertible bond arb, fixed income arb, other hedge fund strategies

Normalization: different assets have different level of risk

- $r_{i,t+1}/E[r_i]$
- $r_{i,t+1}/\sigma[r_i]$

COST RANKINGS

- Create a ranking of direct investment costs c_i (low to high):

Stocks Bonds Options Sov. Com. FX CDS

COST RANKINGS

- Create a ranking of direct investment costs c_i (low to high):

| | Stocks | Bonds | Options | Sov. | Com. | FX | CDS |
|------------|---------------|--------------|----------------|-------------|-------------|-----------|------------|
| <i>FoF</i> | Stocks | Bonds | | Sov Bonds | | | |
| <i>VaR</i> | Stocks | Bonds | | | Comm | FX | |
| <i>BIS</i> | | Bonds | Options | | Comm | FX | CDS |

- Confirm using multiple sources

- ▶ *Flow of funds*: HH holdings / Total assets compared to broker dealers and other fin institutions
- ▶ *Value-at-Risk*: Take VaR for primary dealers (10K), normalize by asset class std dev, compare to size of each market
- ▶ *BIS* data on derivatives: Gross value, totals as well as accounted by fin institutions

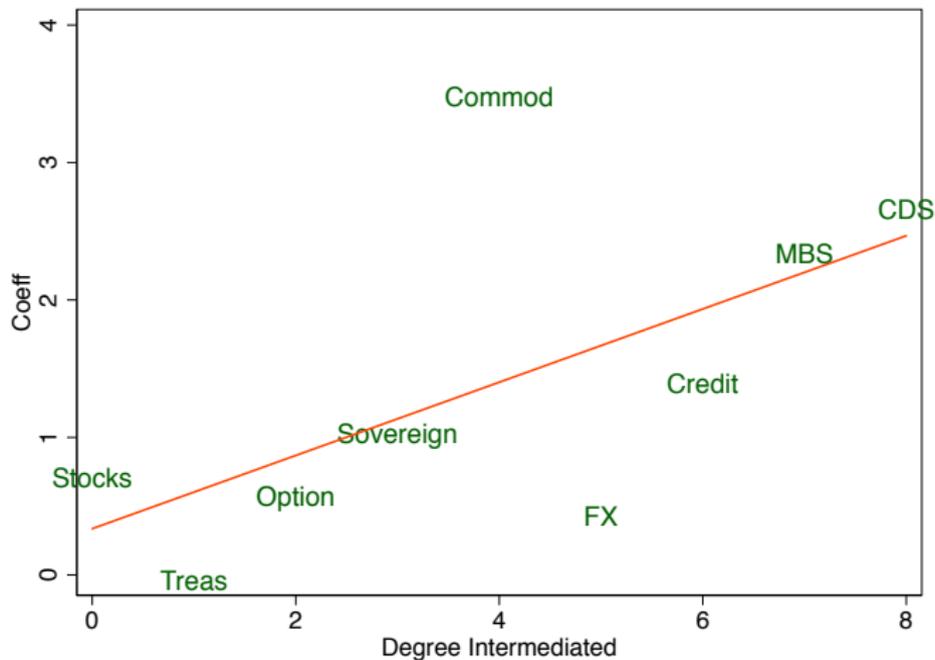
INTERMEDIARIES AND RISK PREMIUM

$$r_{i,t+1}/E[r_i] = a_i + b_i \hat{\gamma}_{I,t} + \varepsilon_{i,t+1}$$

| | (1) Stock | (2) Treas | (3) Opt | (4) Sov | (5) Comm | (6) FX | (7) CDS | (8) Cred | (9) MBS |
|------------|----------------|----------------|-----------------|-------------------|-------------------|-----------------|------------------|------------------|------------------|
| γ_I | 0.31 (0.26) | 0.07 (0.15) | 0.57* (0.10) | 0.65*** (0.33) | 2.07*** (0.79) | 0.19* (0.11) | 1.12** (0.45) | 0.73** (0.33) | 1.03** (0.46) |
| N | 164 | 154 | 100 | 62 | 102 | 113 | 44 | 145 | 94 |
| R^2 | 0.012 | 0.001 | 0.026 | 0.257 | 0.047 | 0.027 | 0.233 | 0.088 | 0.086 |

RESULTS

$$r_{i,t+1}/E[r_i] = a_i + b_i \hat{\gamma}_{I,t} + \varepsilon_{i,t+1}$$



PANEL REGRESSIONS

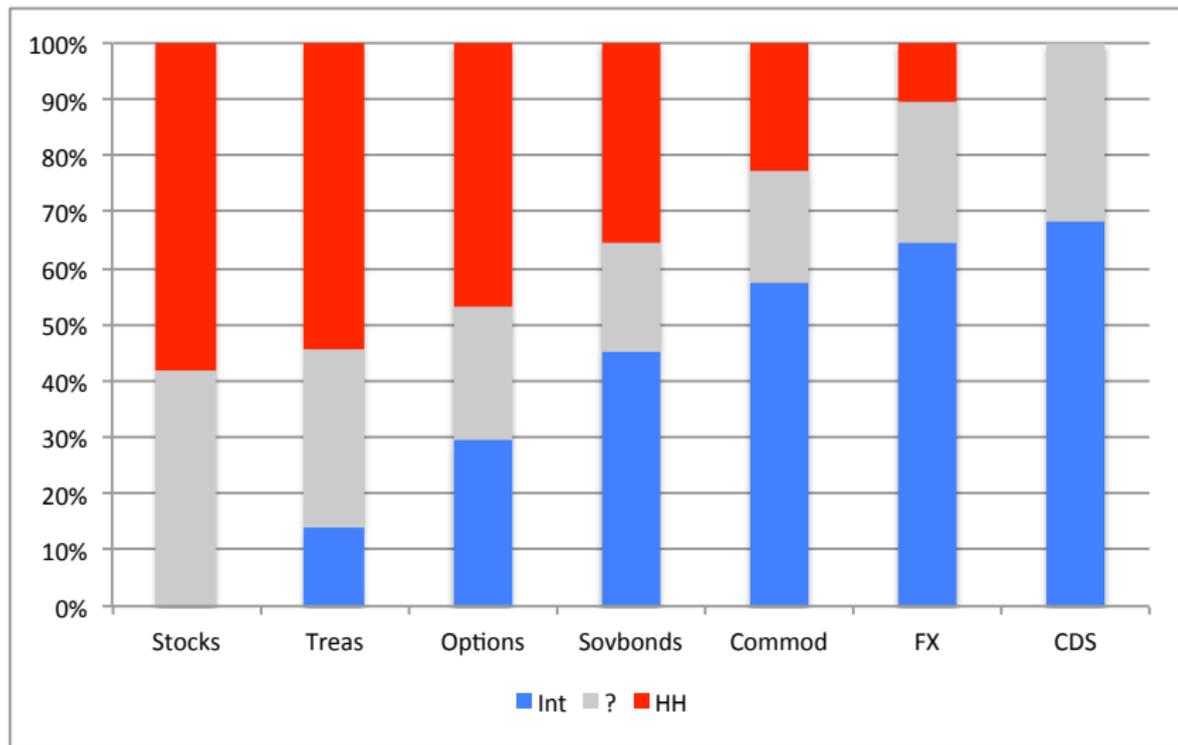
$$\tilde{r}_{i,t+1} = a_i + b_1^I \gamma_{I,t} + 1_{INT} b_2^I \gamma_{I,t} + b_1^H \gamma_{H,t} + 1_{INT} b_2^H \gamma_{H,t} + \varepsilon_{i,t}$$

- Panel regression with INT dummies for more intermediated assets (test if coeffs different)
- Add Campbell Cochrane habit (similar for *cay*)

TWO RISK PREMIUM CYCLES

| $INT =$ | $1_{\neq Stock/Bond}$ | $1_{\neq Stock/Bond/Opt}$ | Rank $\in [0,1]$ | | | |
|-----------------------|-----------------------|---------------------------|------------------|------------------|------------------|------------------|
| γ_I | 0.33* (0.18) | 0.20 (0.18) | 0.39** (0.20) | 0.31 (0.19) | 0.36* (0.21) | 0.23 (0.21) |
| $INT \times \gamma_I$ | 0.56** (0.27) | 0.76*** (0.28) | 0.61** (0.30) | 0.77** (0.34) | 0.75** (0.37) | 1.04** (0.41) |
| γ_H | | 0.41** (0.19) | | 0.29 (0.21) | | 0.40* (0.22) |
| $INT \times \gamma_H$ | | -0.61* (0.36) | | -0.53 (0.37) | | -0.85* (0.45) |
| N | 730 | 730 | 730 | 730 | 730 | 730 |
| R^2 | 0.0288 | 0.0335 | 0.0296 | 0.0330 | 0.0280 | 0.0320 |

BOUNDS OF RISK PREMIA VOLATILITY



Use panel to provide lower bound of volatility due to each

ROBUSTNESS

- Different samples: Table 8
 - ▶ Exclude crisis
 - ▶ More balanced panel: start post 1990
- Alternative measures of intermediary risk aversion: Tables 5-6
 - ▶ Use two measures separately
 - ▶ Use long-term changes in AEM/HKM or levels
 - ▶ Use Gilchrist Zachrajsek (2010) spread, health of intermediaries

ROBUSTNESS

- Different samples: Table 8
 - ▶ Exclude crisis
 - ▶ More balanced panel: start post 1990
- Alternative measures of intermediary risk aversion: Tables 5-6
 - ▶ Use two measures separately
 - ▶ Use long-term changes in AEM/HKM or levels
 - ▶ Use Gilchrist Zachrajsek (2010) spread, health of intermediaries

Next:

- Time-varying risk

TIME-VARYING RISK

- **Concern:** More intermediated assets become more risky exactly when intermediary health is poor... but nothing to do with intermediaries
- Measure and control for *observable* variation in risk

$$\ln(\sigma_{i,t+1}^2) = a_i + b_i \gamma_{I,t} + \varepsilon_{i,t+1}$$

| | Mkt | Treas | Options | Sovereigns | Commodities | FX | CDS |
|------------|-------------------|-------------------|-------------------|----------------|-------------------|-----------------|-------------------|
| γ_I | 0.30*** (0.09) | -0.05 (0.10) | 0.23*** (0.09) | 0.20 (0.14) | 0.35*** (0.10) | 0.06 (0.11) | 0.13 (0.21) |
| γ_H | 0.12 (0.07) | 0.28*** (0.10) | -0.02 (0.11) | 0.27 (0.16) | 0.20 (0.13) | -0.05 (0.07) | 1.02*** (0.23) |
| N | 164 | 154 | 100 | 62 | 102 | 113 | 44 |
| R^2 | 0.139 | 0.055 | 0.0441 | 0.123 | 0.141 | 0.00818 | 0.431 |

TIME-VARYING RISK

- **Concern:** More intermediated assets become more risky exactly when intermediary health is poor... but nothing to do with intermediaries
- Measure and control for *observable* variation in risk

$$\ln(\sigma_{i,t+1}^2) = a_i + b_i \gamma_{I,t} + \varepsilon_{i,t+1}$$

| | Mkt | Treas | Options | Sovereigns | Commodities | FX | CDS |
|------------|-------------------|-------------------|-------------------|----------------|-------------------|-----------------|-------------------|
| γ_I | 0.30*** (0.09) | -0.05 (0.10) | 0.23*** (0.09) | 0.20 (0.14) | 0.35*** (0.10) | 0.06 (0.11) | 0.13 (0.21) |
| γ_H | 0.12 (0.07) | 0.28*** (0.10) | -0.02 (0.11) | 0.27 (0.16) | 0.20 (0.13) | -0.05 (0.07) | 1.02*** (0.23) |
| N | 164 | 154 | 100 | 62 | 102 | 113 | 44 |
| R^2 | 0.139 | 0.055 | 0.0441 | 0.123 | 0.141 | 0.00818 | 0.431 |

- In addition: no differential effect for skewness, no difference when we control for time-varying betas, rolling vol, VIX, or other risk measures

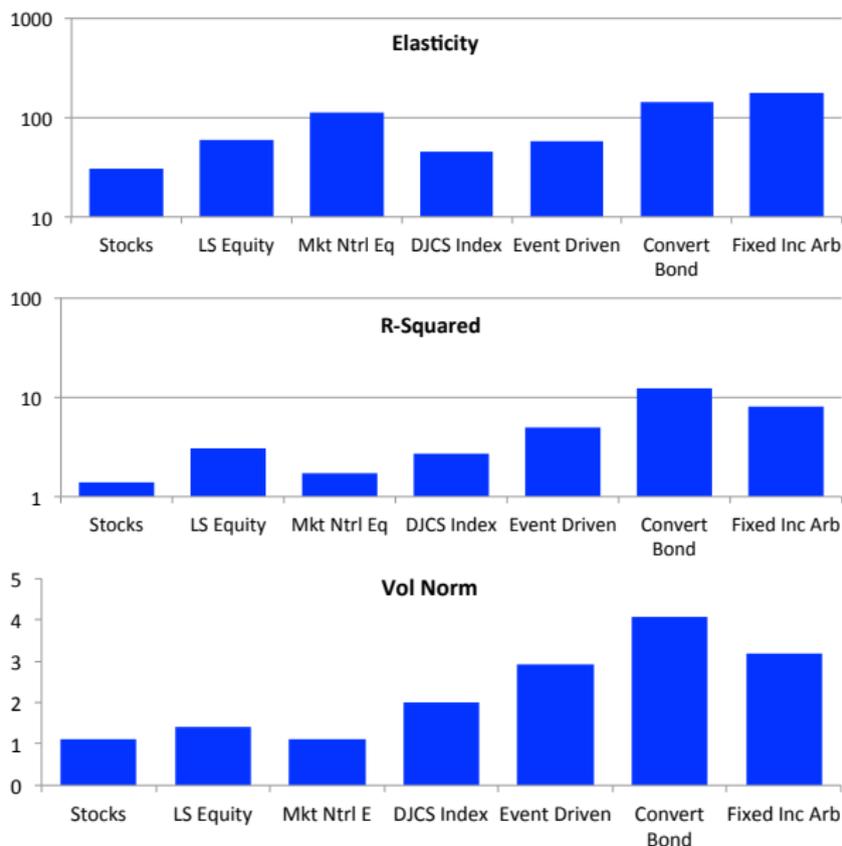
ADDITIONAL EVIDENCE: HEDGE FUND RETURNS

- Convert bond arb and Merger arb (Mitchell and Pulvino (2001, 2012)): disruptions linked to capital scarcity, HF own 40+% of convertible bonds

- Fixed income arbitrage: Hu Pan Wang (2013)

- HF returns from DJCS: Equity LS, Mkt Neutral, Event Driven, Convert Bond, Fixed Income Arb, Total Index

HEDGE FUND RETURNS: INTERMEDIARY ($\hat{\gamma}_I$)



Note: pattern *not* there for γ_H

CONCLUSION

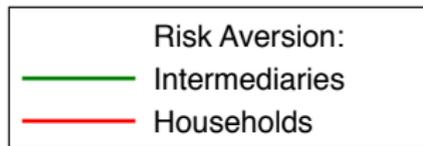
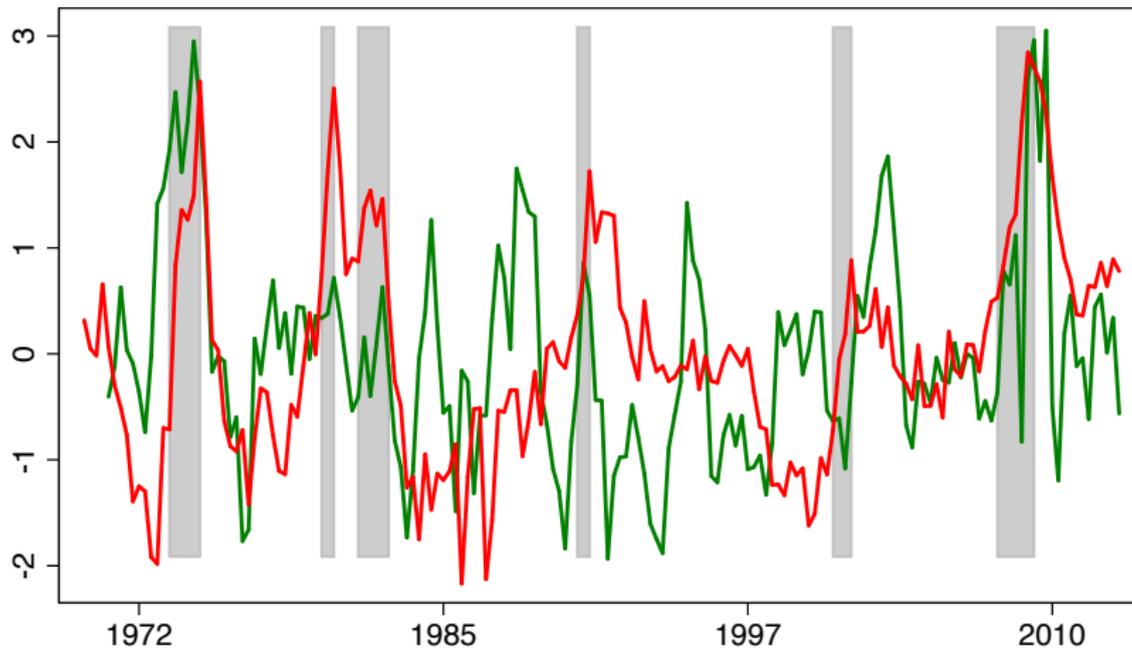
Do intermediaries matter for **aggregate** asset prices?

Yes, a lot. Households too.

- Intermediary risk appetite matters more for assets that are difficult to directly invest in
- Household appetite matters less
- Both results are specific signature of models with financial frictions.

APPENDIX

RISK APPETITE PROXIES



STATISTICAL PROPERTIES

Test if elasticity different?

$$r_{i,t+1}/\overline{(r_{i,t+1})} - r_{stock,t+1}/\overline{(r_{stock,t+1})} = a_i + b_i\gamma_{I,t} + \varepsilon_{i,t+1}$$

| | Elasticity Difference | | | | | |
|------------|-----------------------|-----------------|-----------------|-----------------|----------------|-----------------|
| | Bonds | Options | Sovereign | Commodity | FX | CDS |
| γ_I | 0.26 (0.20) | -0.06 (0.15) | -0.01 (0.36) | -1.40 (0.85) | 0.09 (0.28) | -0.08 (0.36) |
| N | 145 | 100 | 62 | 102 | 113 | 44 |
| R^2 | 0.016 | 0.003 | 0.002 | 0.028 | 0.050 | 0.002 |

- Instability of estimate in smaller sample: $\overline{r_{i,t+1}}$ hard to estimate, blows up std errors
- Elasticity “ideal” from theory, difficult test with smaller samples

VARIANCE NORMALIZATION

Variance norm more stable (easier to estimate than $E[r]$ in small sample)

$$r_{i,t+1}/\hat{\sigma}^2(r_{i,t+1}) - r_{stock,t+1}/\hat{\sigma}^2(r_{stock,t+1}) = a_i + b_i\gamma_{I,t} + \varepsilon_{i,t+1}$$

| | Variance Normalization Difference | | | | | |
|------------|-----------------------------------|---------|-----------|-----------|---------|----------|
| | Bonds | Options | Sovereign | Commodity | FX | CDS |
| γ_I | -2.22* | -0.14 | -3.11*** | -0.87 | -1.79** | -14.88** |
| | (1.21) | (0.20) | (1.13) | (0.68) | (0.76) | (6.66) |
| N | 145 | 100 | 62 | 102 | 113 | 44 |
| R^2 | 0.013 | 0.004 | 0.191 | 0.011 | 0.139 | 0.238 |

- Variance normalization less pure from theory (e.g., need to assume diagonal Σ) but more stable empirically in subsamples

INTERMEDIARY RISK AVERSION: HKM AND AEM

Rather than combine HKM AEM measures, here split separately

| | Stocks | Bonds | Options | Sovereign | Commod | FX | CDS |
|------------------|-----------------|------------------|--------------------|--------------------|--------------------|--------------------|-------------------|
| | Annual Changes | | | | | | |
| γ_I^{AEM} | -0.42 (0.26) | -0.22* (0.12) | -0.90*** (0.26) | -0.50*** (0.15) | -3.44*** (0.58) | -0.26*** (0.08) | -0.79** (0.38) |
| γ_I^{HKM} | -0.04 (0.27) | -0.27 (0.18) | 0.25 (0.37) | -0.39** (0.16) | 1.12 (0.93) | 0.01 (0.10) | -0.71* (0.39) |
| N | 164 | 145 | 100 | 62 | 102 | 113 | 44 |
| R^2 | 0.020 | 0.029 | 0.094 | 0.262 | 0.201 | 0.056 | 0.234 |

INTERMEDIARY RISK AVERSION: HKM AND AEM

Rather than combine HKM AEM measures, here split separately

| | Stocks | Bonds | Options | Sovereign | Commod | FX | CDS |
|------------------|-----------------|-----------------|-------------------|--------------------|-----------------|-------------------|-----------------|
| | Levels | | | | | | |
| γ_I^{AEM} | -0.01 (0.39) | 0.31 (0.20) | -1.00** (0.49) | -0.75* (0.39) | -1.75 (1.49) | -0.22* (0.12) | -0.80 (0.76) |
| γ_I^{HKM} | -0.59 (0.37) | -0.32 (0.22) | -0.45 (0.54) | -0.63*** (0.20) | -0.23 (1.52) | 0.42*** (0.16) | -0.78 (0.49) |
| N | 168 | 145 | 100 | 62 | 102 | 113 | 44 |
| R^2 | 0.041 | 0.020 | 0.117 | 0.214 | 0.035 | 0.095 | 0.137 |

INTERMEDIARY RISK AVERSION: LEVELS

- Replace changes in log AEM / HKM with levels to proxy for γ_I
 - ▶ Most theories: level matters, but there are large trends
 - ▶ Follow Adrian Moench Shin (2010), Schularick Taylor (2012), Baron Xiong (2016) using 1-3 year changes

| | Stocks | Bonds | Options | Sovereign | Commodities | FX | CDS |
|------------|-------------------|-----------------|--------------------|--------------------|------------------|----------------|-------------------|
| γ_I | -0.53** (0.22) | -0.01 (0.18) | -1.29*** (0.34) | -1.16*** (0.28) | -1.72* (0.89) | 0.18 (0.13) | -1.40** (0.58) |
| N | 168 | 145 | 100 | 62 | 102 | 113 | 44 |
| R^2 | 0.033 | 0.000 | 0.110 | 0.212 | 0.027 | 0.020 | 0.137 |

INTERMEDIARY RISK AVERSION: GZ SPREAD

- Replace AEM / HKM with Gilchrist Zakrajsek (2012) excess bond premium spread
 - ▶ GZ argue this captures health of intermediaries

| | Stocks | Bonds | Options | Sovereign | Commodities | FX | CDS |
|-----------------------|-----------------|--------------------|----------------|--------------------|----------------|-----------------|-------------------|
| <i>GZ</i> | -0.01 (0.28) | -6.14*** (1.09) | 0.86 (0.84) | -3.10*** (1.01) | 0.83 (1.05) | -0.38 (0.98) | -12.35* (4.09) |
| N | 156 | 145 | 100 | 62 | 102 | 113 | 44 |
| <i>R</i> ² | 0.000 | 0.129 | 0.024 | 0.204 | 0.016 | 0.002 | 0.253 |

SUBSAMPLE: EXCLUDE CRISIS

Dropping the crisis (Panel A), Post 1990 only (Panel B)

| Dropping 2007-2009 | | | | | | | |
|--------------------|-----------------|-----------------|------------------|--------------------|--------------------|-------------------|--------------------|
| | Stocks | Bonds | Options | Sovereign | Commodities | FX | CDS |
| γ_I | -0.22 (0.30) | -0.26 (0.17) | -0.49* (0.27) | -0.73*** (0.18) | -2.74*** (0.75) | -0.25** (0.11) | -0.90*** (0.15) |
| N | 141 | 126 | 81 | 46 | 79 | 90 | 21 |
| R^2 | 0.007 | 0.010 | 0.037 | 0.354 | 0.170 | 0.057 | 0.628 |

▶ Back

SUBSAMPLE: POST 1990

| | Post 1990 | | | | | | |
|------------|-----------------|--------------------|-----------------|--------------------|-------------------|-------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | Stocks | Bonds | Options | Sovereign | Commodities | FX | CDS |
| γ_I | -0.42 (0.30) | -0.41*** (0.10) | -0.42 (0.50) | -0.64*** (0.17) | -4.25** (1.98) | -0.23** (0.11) | -1.07*** (0.38) |
| N | 84 | 80 | 80 | 62 | 84 | 84 | 44 |
| R^2 | 0.025 | 0.163 | 0.008 | 0.254 | 0.038 | 0.035 | 0.231 |

▶ Back

HOUSEHOLD RISK AVERSION: CONSUMER SENTIMENT

Proxy for $\gamma_{H,t}$ using consumer sentiment from Michigan survey

| | Stocks | Bonds | Options | Sovereign | Commodity | FX | CDS |
|------------|-----------------|------------------|------------------|-------------------|-------------------|-------------------|--------------------|
| γ_I | -0.65 (0.57) | -0.51* (0.29) | -1.32* (0.73) | -1.17** (0.51) | -3.86** (1.92) | -0.55** (0.22) | -3.04*** (0.98) |
| γ_H | 0.16 (0.55) | -0.10 (0.41) | -0.06 (0.84) | -0.26 (0.35) | -1.39 (2.59) | -0.47 (0.29) | -0.89 (1.03) |
| N | 167 | 148 | 103 | 65 | 105 | 116 | 47 |
| R^2 | 0.015 | 0.015 | 0.036 | 0.147 | 0.047 | 0.060 | 0.355 |