The Impact of Unconventional Monetary Policy on Real Estate Markets

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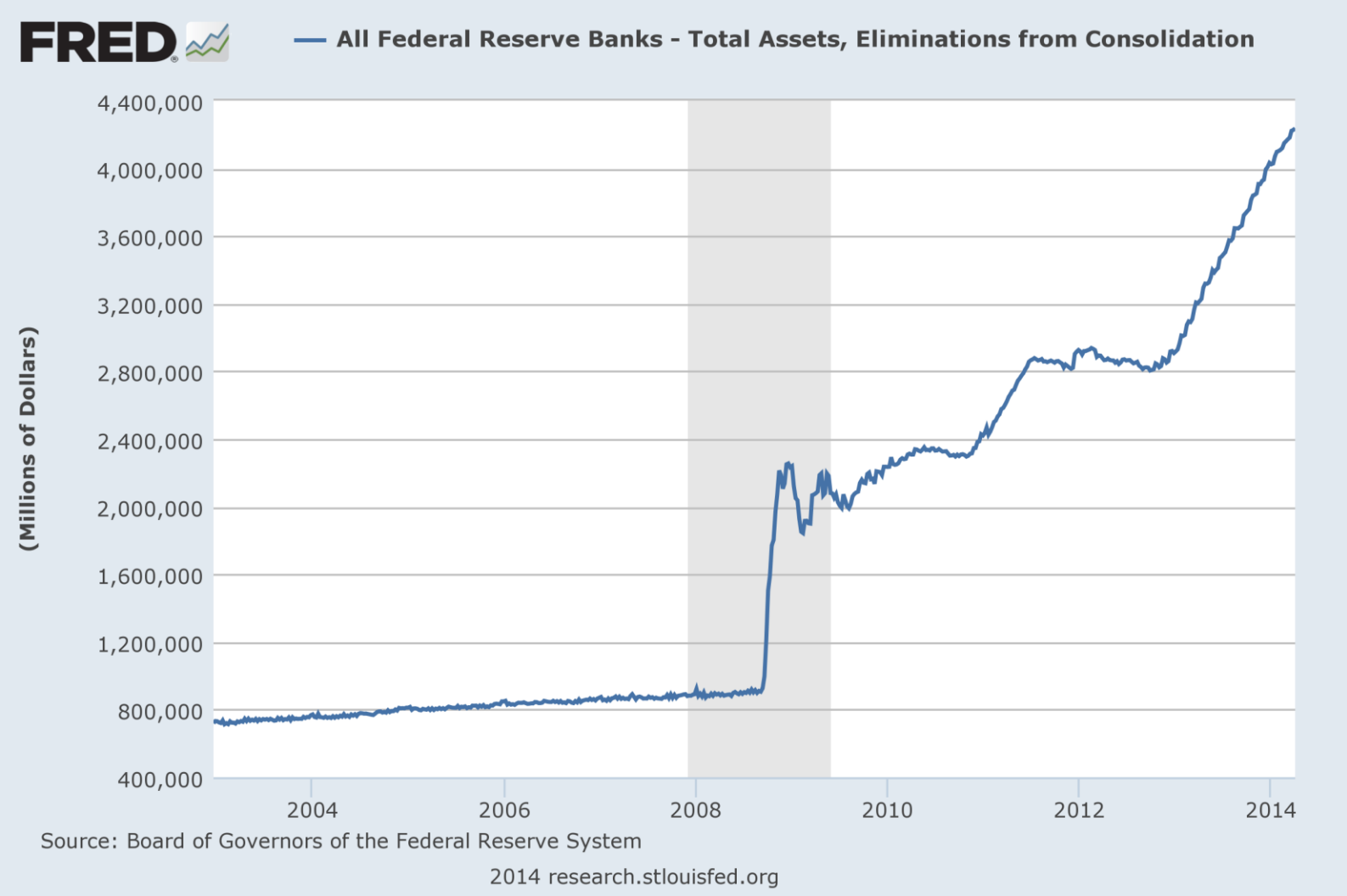
Fed Balance Sheet



Introduction

- Fed balance sheet exploded from $880 billion in January of 2008 to over $4 trillion in December 2013
- Fed unconventional tools: Long-term government bond and MBS purchase (QE) and new guidance regarding the future direction of monetary policy
  - Substantial bond purchases directed at ailing housing sector; purchase of mortgage-backed securities
- Despite massive monetary accommodation, the Fed faced substantial uncertainty as to the benefits of the policy innovation.
- Goal: Measure the impact of unconventional monetary policy on residential and non-residential real estate and related markets

Introduction

- Use a structural factor-augmented vector autoregression (FAVAR) model
  - Study the impact of unconventional monetary policy on real estate markets
  - Allows for numerous equity, bond market, and real estate time series
  - Over 30 daily time series included in the dataset
  - Identification of the structural shocks by assuming heteroskedasticity across event and non-event days
    - Information regarding monetary policy shocks surfaces in a “lumpy” manner

Preview of Main Results

- Find that an expansionary unconventional monetary shock
  1. Reduces key housing market interest rates
  2. Leads to increased returns for homebuilder and REIT stocks
  3. Lowers the cost to insure subprime mortgage and commercial real estate debt
  4. Damps housing distress at the state-level and for the United States overall.
  5. The size of the estimated effects in real estate markets are similar to those found in equity markets.
  - The effects differ in magnitude across US states and MBS traunched by level of credit exposure
    - Large reduction in the cost to insure AAA rated subprime mortgage-backed debt, but little effect on lower rated debt
    - Larger reductions in housing distress for the bubble housing markets in California and Florida relative to those in Texas and New York
  - The effects attenuate relatively quickly with an estimated half-life that is generally less than three months

Econometric Methodology

- Factor-augmented vector autoregression (FAVAR) model (Bernanke, Boivin, and Eliasz (2005; BBE)
  - Accommodates multiple time series
  - Use a dataset that is likely to span the information sets used by policy makers and private sector practitioners
  - Avoids the potential omitted variable bias frequently found in standard VARs
  - Allows for a more accurate measurement of monetary policy shocks compared to standard techniques
- Identification by assuming the structural monetary shock is heteroskedastic across event and non-event days
  - Monetary events are exogenous and news regarding monetary policy surfaces in a “lumpy manner.”

Econometric Methodology

- FAVAR model
  - Assume financial markets are affected by basket of key interest rates (observed factors) and a set of latent factors
  - Key Interest Rates, Observed Factors (Wright (2012)):
    - 2-Year Treasury and 10-Year Treasury
    - Five-year and forward-five-to-ten-year TIPS breakeven
    - Moody's AAA and BAA corporate bond yields
  - All other time series are part of the set of "informational time series"
  - Mirrors the approach used by BBE during conventional times.

Estimation, Identification, and IRFs

- Estimation, Identification, and computation of the structural impulse response functions (IRFs) requires the following steps:
  1. Extract a set of latent factors from the set of informational time series using principal component analysis
  2. Estimate a reduced-form VAR using the observed factors and latent factors from step (1)
  3. Identify structural monetary shocks by assuming that the reduced-form VAR residuals are heteroskedastic across event and non-event days
  4. Calculate IRFs for the latent and observed factors using the structural identification from step (3)
  5. Calculate the IRFs for all variables in the set of informational time series by multiplying the IRFs from step (4) by the factor loadings from step (1)

The FAVAR Model

$$C_t = [F_t \, S_t]'$$

- F_t is a $K \times 1$ vector representing the latent factors and S_t is a 6×1 vector of observed factors.
- Observation Equation:

$$X_t = \Lambda \, C_t + e_t$$

- Λ is an $N \times (K + 6)$ matrix of factor loadings and e_t is an $N \times 1$ vector representing the idiosyncratic component

The FAVAR Model

$$C_t = \Phi(L)C_{t-1} + v_t$$

- v_t is a $K \times 1$ vector of reduced-form errors
- let $\eta_{i,t}$ be the ith structural shock at time t and assume that the structural shocks are independent over both i and t.

$$v_t = \sum_{i=1}^{p} R_i \eta_{i,t}$$

- R_i is an unknown $K \times 1$ vector.

Identification

- Assume that the variance of the structural monetary shock is heteroskedastic across announcement and non-announcement days.
- Relies upon assumption that monetary announcements are exogenous, so that news about monetary policy events surfaces in a “lumpy manner” (Wright (2012)).
- Let the structural monetary policy shock be ordered first (for convenience) and have mean zero with variance σ_1^2 on event days and variance σ_0^2 on non-event days.
- The key assumption for identification is that $\sigma_0^2 \neq \sigma_1^2$; that the variance of the structural monetary shock is heteroskedastic across event and non-event days.

Identification

- In order to identify the structural shocks, we need to determine, R_1, the parameter relating the reduced-form errors to the structural monetary policy shock
- From the formulation of the reduced-form errors, solve the following minimum distance problem for R_1

$$\Sigma_1 - \Sigma_0 = R_1 R_1' \sigma_1^2 - R_1 R_1' \sigma_0^2$$

- where Σ_0 and Σ_1 are the reduced-form variance-covariance matrices of the forecast errors on event and non-event days, respectively
- Can then trace out IRFs for all variables in the dataset
- Can implement statistical tests to ensure that the variance is heteroskedastic across event and non-event days and that there is a single monetary shock.

Advantages/Disadvantages of Econometric Framework

- Advantages
  - Calculates initial response and persistence to an identified monetary shock
  - Measures total effect of FOMC-related news on real-estate markets
  - Allows for multiple variables and multiple controls
  - Doesn't require measurement of market expectations, only dates when FOMC news surfaces
  - Minimizes endogeneity concerns as only event dates are required to identify monetary policy shocks (allows for other shocks to occur on event days)
- Disadvantages
  - Cannot disentangle the effects of the different policy actions

Table 1: Major QE Events

Event Date	Time (EST)	QE Round	Event	Event Description
11/25/2008	8:15 AM	1	QE1 Announcement	FOMC announces planned purchases of $100 billion of GSE debt and up to $500 billion in MBS
12/1/2008	1:40 PM	1	Bernanke Speech In Texas	Bernanke announces that the Fed may purchase long-term US Treasuries
12/16/2008	2:15 PM	1	FOMC Statement	FOMC first suggests that long-term US Treasuries may be purchased
1/28/2009	2:15 PM	1	FOMC Statement	FOMC indicates that it will incrase its purchases of agency debt and long-term US Treasuries
3/18/2009	2:15 PM	1	FOMC Statement	FOMC announces that will purchase an additional $750 billion in agency MBS, up to an additional $100 billion of agency debt, and up to $300 billion of long-term US Treasuries
8/10/2010	2:15 PM	2	FOMC Statement	FOMC announces that it will roll over the Fed's holdings of US Treasuries
8/27/2010	10:00 AM	2	Bernanke Speech In Jackson Hole	Bernanke signals that monetary easing will be continued
9/21/2010	2:15 PM	2	FOMC Statement	FOMC announces that it will roll over the Fed's holdings of US Treasuries
10/15/2010	8:15 AM	2	Bernanke Speech at Boston Fed	Bernanke signals that monetary easing will be continued

Table 1: Major QE Events

Event Date	Time (EST)	QE Round	Event	Event Description
8/31/2012	10:00 AM	3	Bernanke Speech at Jackson Hole	Bernanke announces intention for further monetay easing
9/13/2012	12:30 PM	3	FOMC Statement	FOMC announces that it will expand its QE policies by purchasing mortgaged-backed securities at a rate of $40 billion per month
12/12/2012	12:30 PM	3	FOMC Statement	FOMC extends monthly purchases to long-term Treasuries and announces numerical threshold targets
5/22/2013	10:00 AM	Taper	Bernanke Congressional Testimony	Bernanke first signals that FOMC may reduce its quantitative stimulus
6/19/2013	2:15 PM	Taper	Bernanke Press Conference & FOMC statement	Bernanke suggests that the FOMC will moderate asset purchases later in 2013
12/12/2013	2:00 PM	Taper	FOMC Statement	FOMC announces that it will reduce its purchases of longer term Treasuries and mortgage-backed securities by $10 billion dollars per month

Notes: Major FOMC announcements or speeches by Chairman Bernanke. Event dates, times, and descriptions updated from Glick and Leduc (2013).

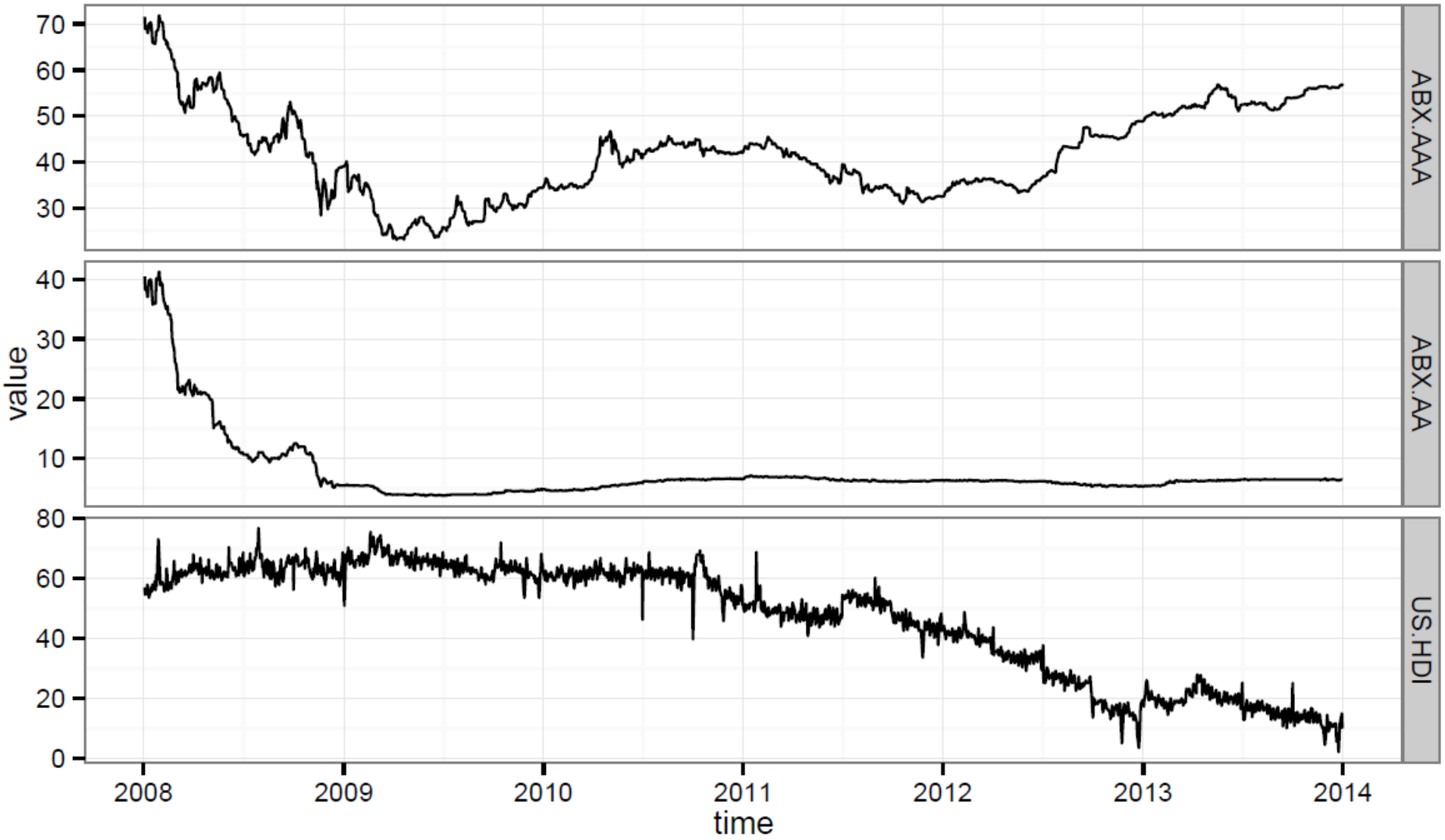
Data

- Interest Rate Series (Observed Factors):
  - 2-Year Treasury and 10-Year Treasury
  - Five-year and forward-five-to-ten-year TIPS breakeven
  - Moody's Aaa and Baa corporate bond yields
- Spreads
  - 10-year yield curve (10-year Treasury minus 2-year Treasury) and 30-year yield curve
  - Corporate default spread
- Equity Market Variable
  - S&P500 and DJIA stock returns
- Exchange Rates
  - US/EURO, US/UK, US/Yen

Housing Data

- Fannie Mae MBS, the Fannie Mae Commitment Rate, Fannie Mae MBS minus 30-year Treasury
- First Trust S&P REIT ETF stock returns (FRI)
- SPDR S&P Homebuilders ETF (XHB)
- ABX AAA, ABX AA, ABX Risk Premium – CDS spreads that track the cost to insure subprime mortgage backed debt
- CMBX AAA – CDS spreads that track the cost to insure commercial mortgage debt
- Housing Distress Index (HDI) for US, California, Florida, Texas, and New York. HDI Risk Premium
  - Relative Internet Search Frequency for terms like "foreclosure help"

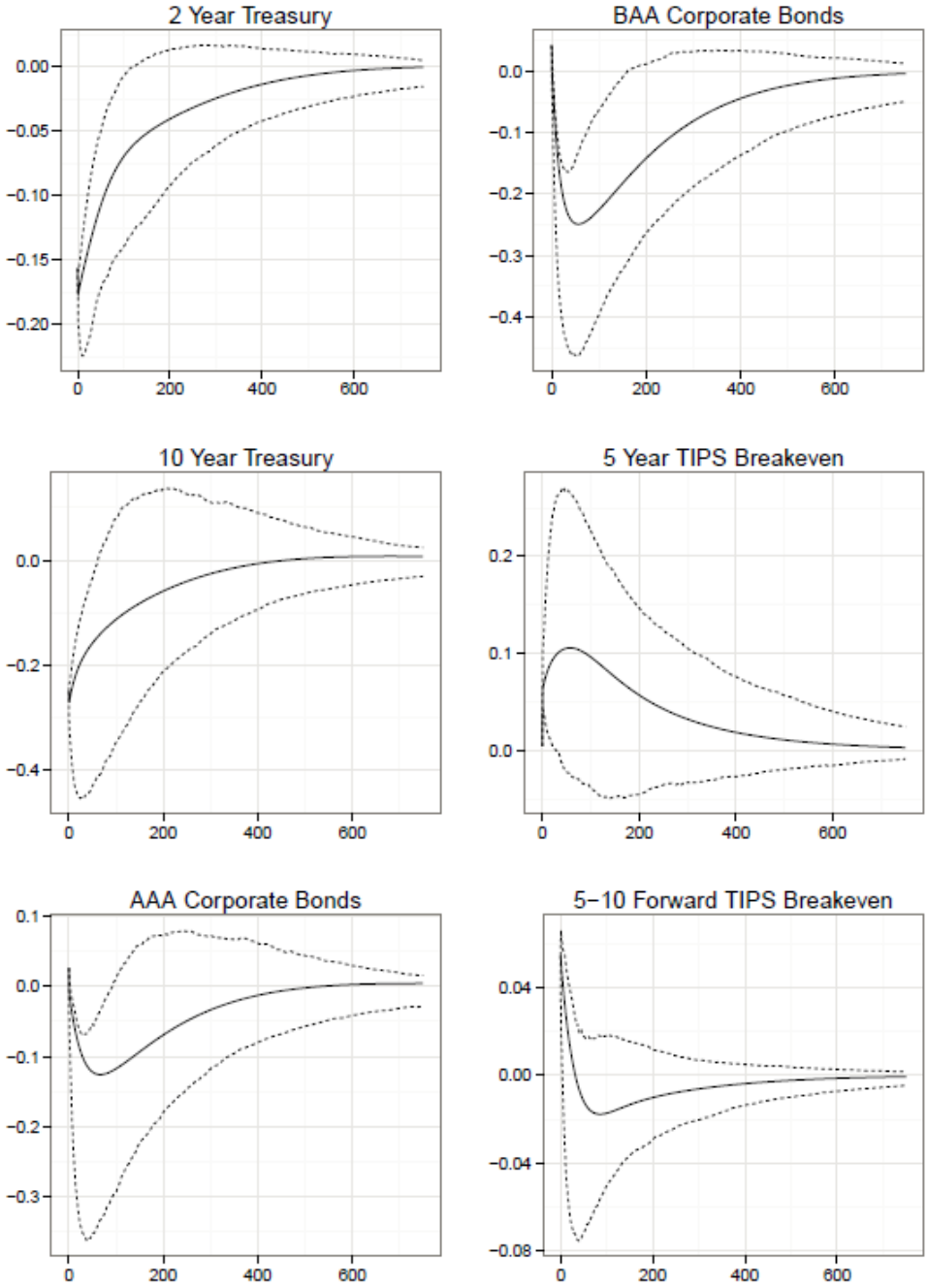
Figure 1: Plots of ABX and HDI Indices



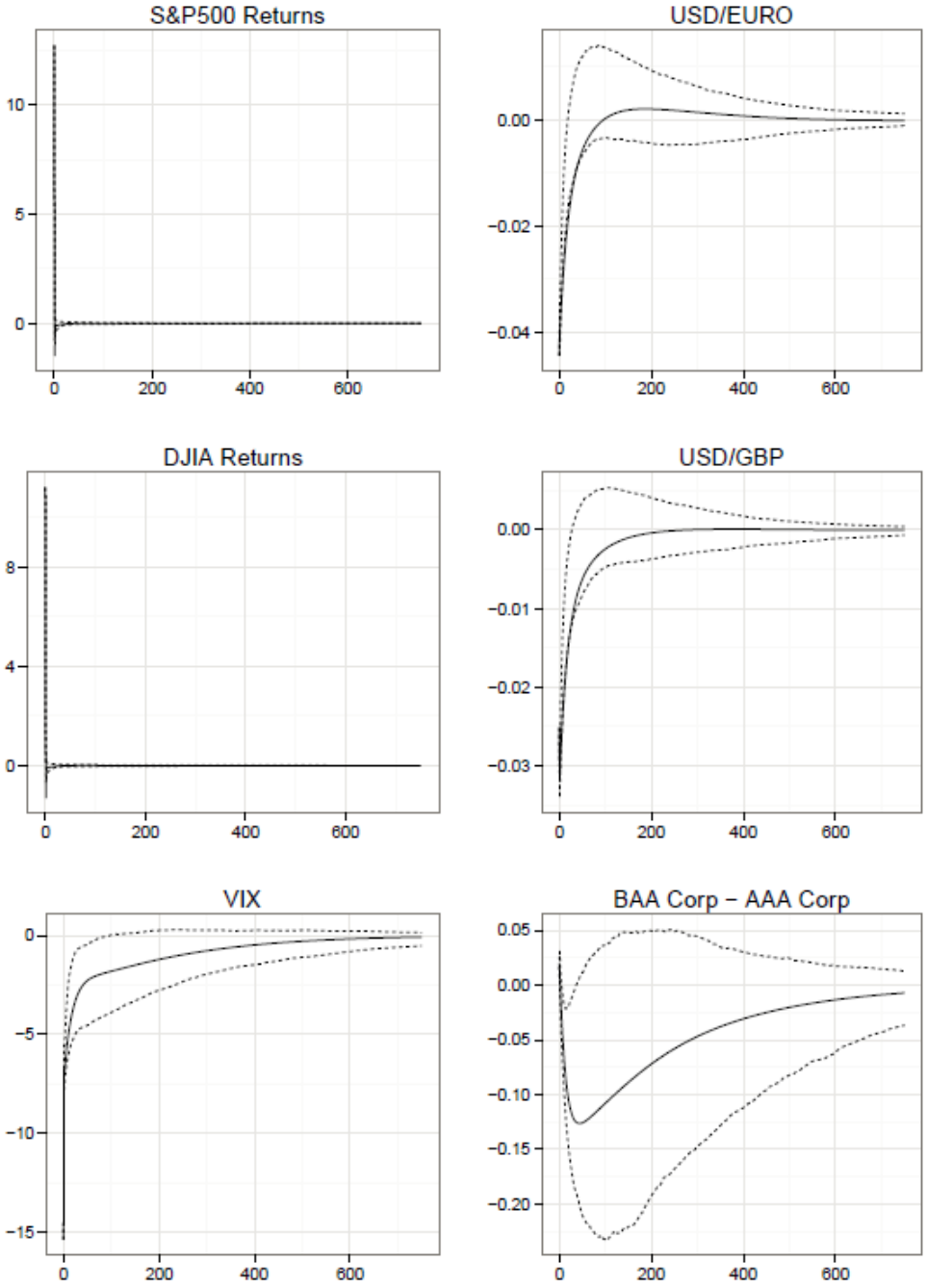
Notes: Plots of the daily ABX and HDI indices. The HDI is normalized so that December 31, 2013 has a value of 10.

	R^2	R^2 Adj
10 Year Yield Curve	1.000	1.000
30 Year Yield Curve	0.948	0.948
BAA Corp - AAA Corp	1.000	1.000
S&P500 Returns	0.941	0.940
DJIA Returns	0.908	0.907
VIX	0.876	0.875
XHB Stock Returns	0.826	0.825
FRI Stock Returns	0.752	0.750
ABX AAA	0.969	0.969
ABX AA	0.571	0.567
ABX Risk Premium	0.965	0.965
CMBX AAA	0.914	0.913
USD/JPY	0.625	0.621
USD/EURO	0.901	0.900
USD/GBP	0.875	0.874
Fannie MBS	0.974	0.974
Fannie MBS - 30 Year Treas	0.820	0.818
Fannie Commitment Rate	0.964	0.964
HDI US	0.766	0.764
HDI CA	0.537	0.533
HDI FL	0.520	0.516
HDI NY	0.519	0.515
HDI TX	0.528	0.523
HDI Risk Premium	0.998	0.998

Notes: R^2 and adjusted R^2 statistics from a regression of a given variable in the set of the informational time series (left column) on the five latent factors and the set of observed factors.



Notes: Plots of the structural Impulse Response Functions. The IRFs are traced out for 750 periods and normalized so that the initial decrease in the ten-year Treasury is 25 basis points.



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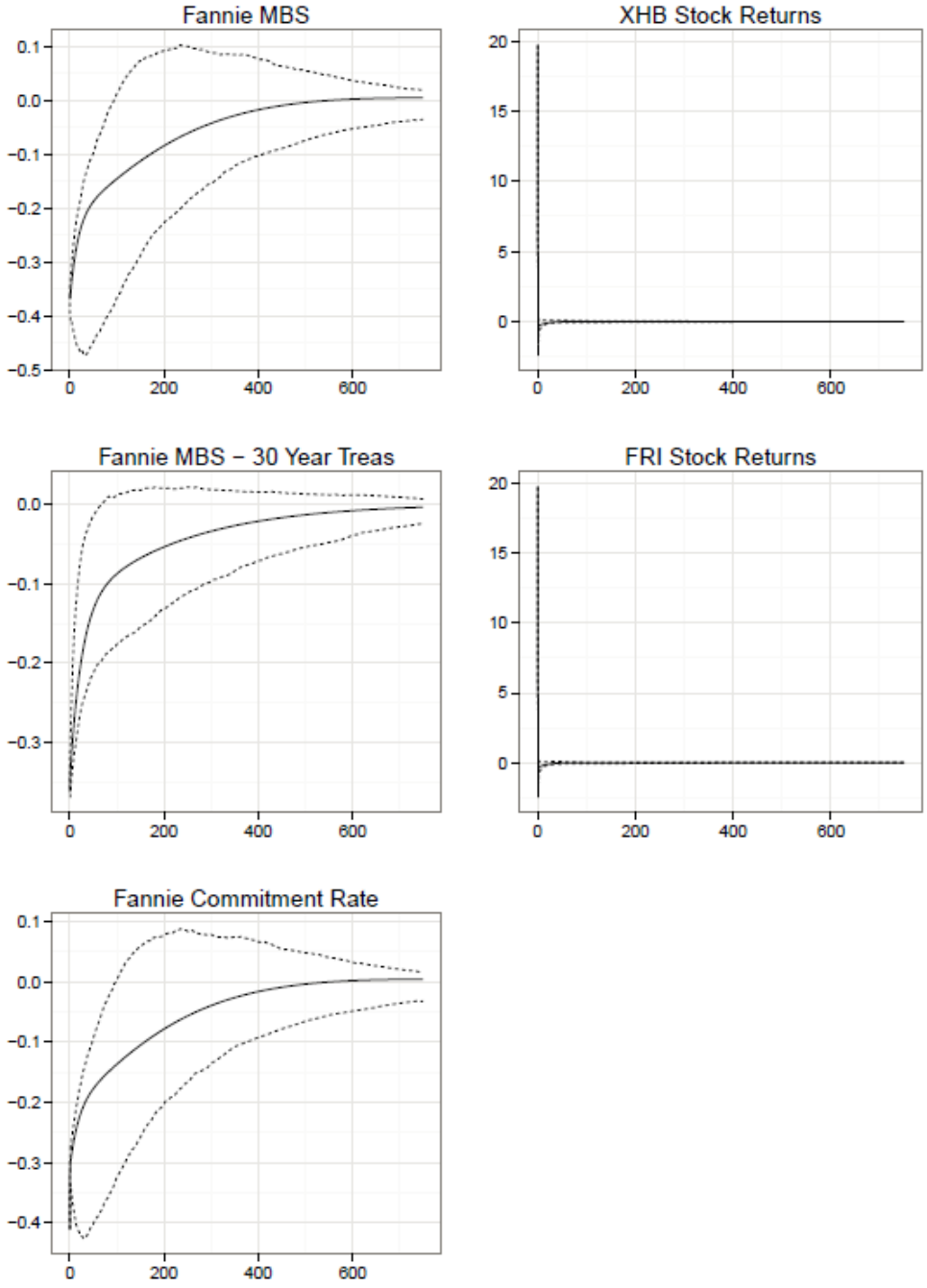

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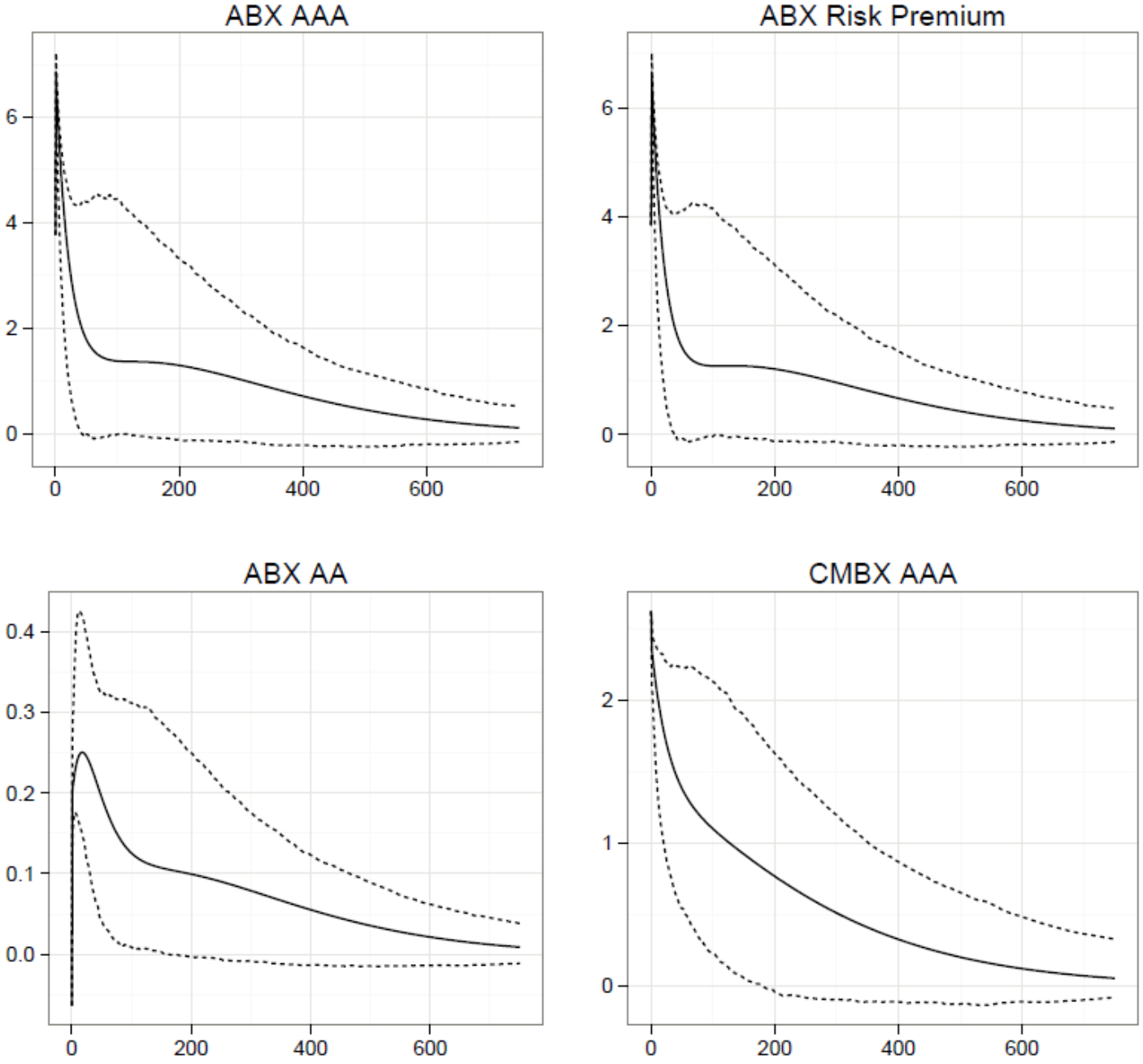

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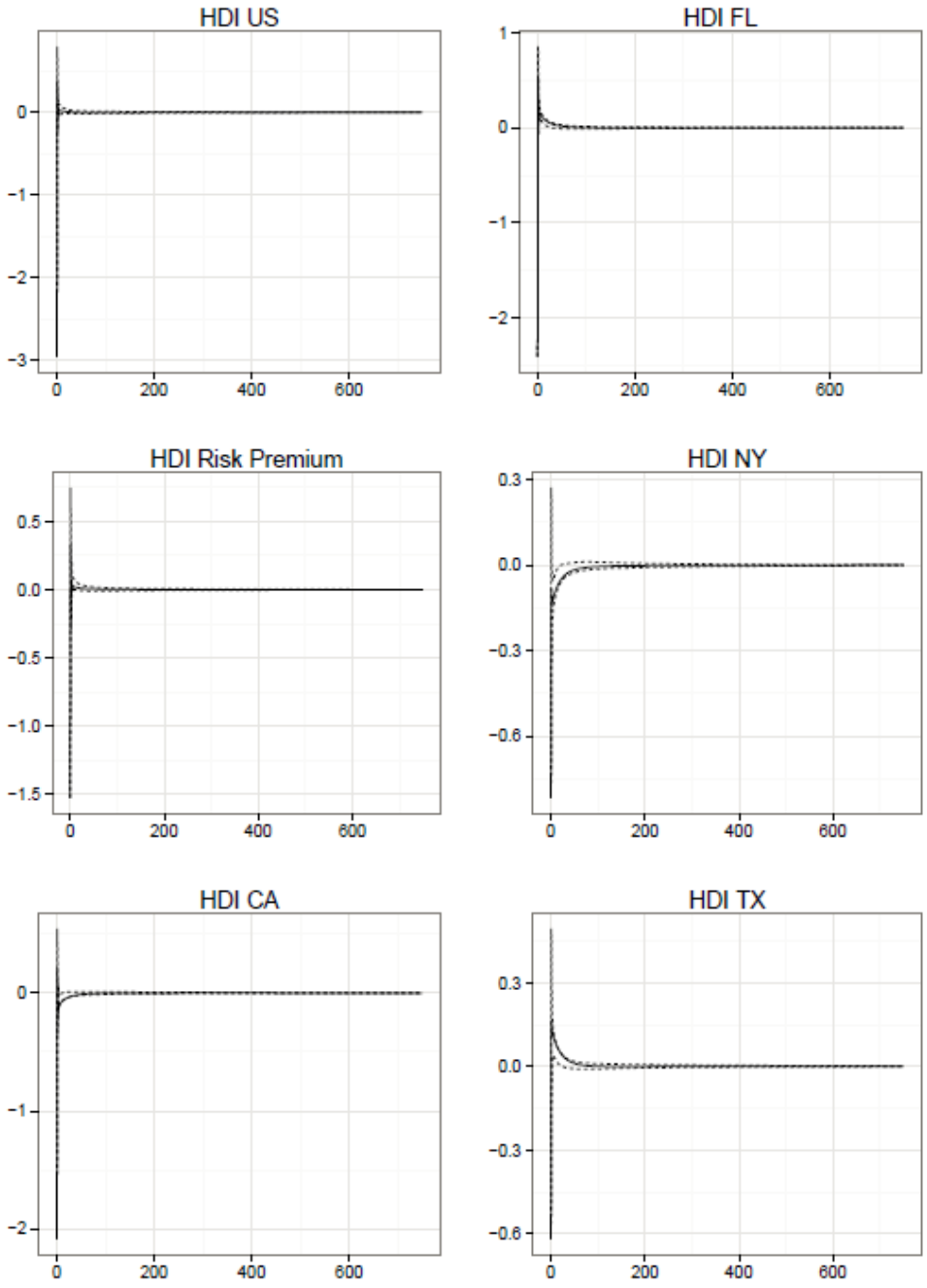

Notes: Plots of the structural Impulse Response Functions. The IRFs are traced out for 750 periods and normalized so that the initial decrease in the ten-year Treasury is 25 basis points.

Table 3: Forecast Error Variance Decomposition

	Forecast Horizon (In Days)					
	1 Day	50 Days	100 Days	250 Days	500 Days	750 Days
2 Year Treasury	0.089	0.184	0.201	0.195	0.186	0.184
10 Year Treasury	0.100	0.079	0.068	0.053	0.048	0.047
Aaa Corporate Yields	0.012	0.044	0.053	0.050	0.046	0.046
Baa Corporate Yields	0.011	0.070	0.107	0.126	0.126	0.125
5 Year Breakeven	0.003	0.012	0.018	0.026	0.028	0.028
5-10 Forward Breakeven	0.014	0.007	0.009	0.014	0.015	0.016

Table 3: Forecast Error Variance Decomposition

	Forecast Horizon (In Days)					
	1 Day	50 Days	100 Days	250 Days	500 Days	750 Days
	Informational Time Series					
S&P500 Returns	0.519	0.000	0.000	0.000	0.000	0.000
DJIA Returns	0.516	0.000	0.000	0.000	0.000	0.000
VIX	0.467	0.009	0.005	0.001	0.000	0.000
XHB Stock Returns	0.524	0.000	0.000	0.000	0.000	0.000
FRI Stock Returns	0.513	0.000	0.000	0.000	0.000	0.000
ABX AAA	0.483	0.187	0.104	0.030	0.002	0.000
ABX AA	0.007	0.035	0.021	0.006	0.000	0.000
ABX Risk Premium	0.476	0.151	0.084	0.024	0.002	0.000
CMBX AAA	0.418	0.123	0.074	0.019	0.001	0.000
USD/JPY	0.149	0.003	0.001	0.001	0.000	0.000
USD/EURO	0.115	0.002	0.004	0.001	0.000	0.000
USD/GBP	0.139	0.000	0.000	0.000	0.000	0.000
Fannie MBS	0.404	0.081	0.039	0.004	0.000	0.000
Fannie MBS - 30 Year Treas	0.182	0.023	0.010	0.003	0.000	0.000
Fannie Commitment Rate	0.547	0.089	0.044	0.004	0.000	0.000
HDI US	0.063	0.000	0.000	0.000	0.000	0.000
HDI CA	0.047	0.000	0.000	0.000	0.000	0.000
HDI FL	0.064	0.000	0.000	0.000	0.000	0.000
HDI NY	0.009	0.000	0.000	0.000	0.000	0.000
HDI TX	0.005	0.000	0.000	0.000	0.000	0.000
HDI Risk Premium	0.016	0.000	0.000	0.000	0.000	0.000

Notes: This table shows the forecast error variance decomposition (FEVD) for the observed factors and the informational time series. The FEVD is the portion of the forecast error variance explained by the monetary policy shock. The size of the monetary shock is normalized so that the FEVD for the 10-year Treasury is 10 percent (0.100). The FEVD for the informational time series is calculated as in BBE.

Extensions and Robustness Checks

- Consider a number of extensions and robustness checks: The results are similar to those obtained above
  - Fannie Mae MBS Yields as an Observed Factor
  - Fannie Mae MBS and the Fannie Mae Commitment Rate as Observed Factors
  - Only Government Securities as Observed Factors
  - 7 Latent Factors
  - Major Monetary Policy Events
  - Log Detrended HDIs

Conclusion

- Estimate a structural FAVAR model to study the impact of unconventional monetary policy on real estate and related markets
- Find that an expansionary monetary policy shock lowers key housing interest rates; increases equity returns for homebuilders and REITs; lowers the cost to insure subprime mortgage and commercial real estate debt; and lowers housing distress
  - Effects similar in magnitude to those found in equity markets
  - Effects differ in magnitude across geographies and risk levels
  - Effects attenuate rather quickly with an estimated half-life that is generally less than three months.