

Unconventional Monetary Policy and Risk-Taking: Evidence from Agency Mortgage REITs

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October 13, 2017

***The views expressed are those of the author and not necessarily
those of the Atlanta Fed or the Federal Reserve System.**



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Introduction

Following the global financial crisis and into the Great Recession, the Federal Reserve reduced its overnight interest rate to the zero lower bound and engaged in large-scale asset purchases (“quantitative easing”) in an effort to lower long-term interest rates.

Empirical evidence of success in both Treasury and Agency MBS markets: Gagnon, Raskin, Remache, and Sack (2011); Krishnamurthy and Vissing-Jorgensen (2011); Hancock and Passmore (2011); among others).

Principal theoretical channels:

- 1.) **Portfolio balance channel:** Asset purchases reduce “term premiums” by taking long-term assets out of the market (e.g., Bernanke 2010).
- 2.) **Signaling channel:** Asset purchases lower expected level of future short-term interest rates. (e.g., Bauer and Rudebusch, 2014).

Central bank communication that interest rates would remain low for a considerable period of time likely amplified these effects.

Introduction

Over time, unconventional monetary policy accommodation led to concerns about financial stability risks.

Bernanke (2013): Maintaining low interest rates for too long may create incentives for market participants to take on greater duration or credit risks, or to employ additional financial leverage, in an effort to “reach for yield.”

Such risk-taking behavior is seemingly an intended consequence of unconventional monetary policy. But theoretical research points to potential distortions owing to agency problems with delegated asset management that is exacerbated in very low interest rate environments (e.g., Rajan 2005; Morris & Shin 2014; among others).

New empirical evidence of “reaching for yield” provided by: Chodorow-Reich (2014), DiMaggio and Kacperczyk (2014), and Choi and Kronlund (2015).

- Related to a new and broader literature describing the existence of a “risk taking channel” of monetary policy (e.g., Adrian and Shin, 2010; Borio and Zhu, 2012).

This Paper

We study Agency mortgage REITs, a type of shadow bank that holds Agency MBS and finances them with a combination of short-term repurchase agreements and equity.

- Significant maturity transformation and $\sim 10x$ leverage.
- Material interest rate and liquidity risk without access to government backstops.

Agency MREITs grew markedly during the Federal Reserve's balance sheet expansion: During QE1 and QE2, total assets rose from \$79.2 billion to \$363.5 billion (356 percent).

Financial Stability Oversight Council (2013) raised concerns about Agency MREITs.

- Vulnerable to sharp increases in interest rates that would erode asset values and lead to margin calls, increased repo haircuts, and deleveraging.
- At worst, dealer funding could be markedly reduced, thus forcing significant asset sales and placing downward pressure on Agency MBS prices.
- Assumes that these shadow banks would act in unison.

This Paper

We study the emergence of Agency MREITs after the recent financial crisis; and in the context of the Federal Reserve's unconventional monetary policies.

First, we explore the rapid growth of these shadow banks in terms of total assets, equity issuance, and equity returns.

- Find significant expansion during QE2 when the Federal Reserve exited the Agency MBS market. Subsequent slowdown once the central bank re-entered.
- Illustrates how shadow banks can attract capital to finance the mortgage market; and crowding-out by the central bank (i.e., portfolio balance effects).

Second, we look at Agency MREIT risk-taking during this period.

- Find reduced interest rate hedging during the initial stages of quantitative easing. This behavior reversed course during QE3 and through Tapering and was related to Federal Reserve share of newly issued securities.
- Consistent with Federal Reserve signaling and communication; and “reaching for yield” behavior.

Contributions

1.) First study of Agency MREITs in the academic literature (to our knowledge). But see nice descriptive overview by Pellerin, Sabol, and Walter (2013).

- These shadow banks could play a very prominent role in the Agency MBS market going forward given the required exit of Fannie Mae and Freddie Mac.

2.) First study in the new QE-induced “reaching for yield” literature to examine leverage, liquidity risk, and interest rate risk.

- Agency MREITs do not take-on much credit risk, although this is the exclusive focus of existing studies.

Some Background on REITs

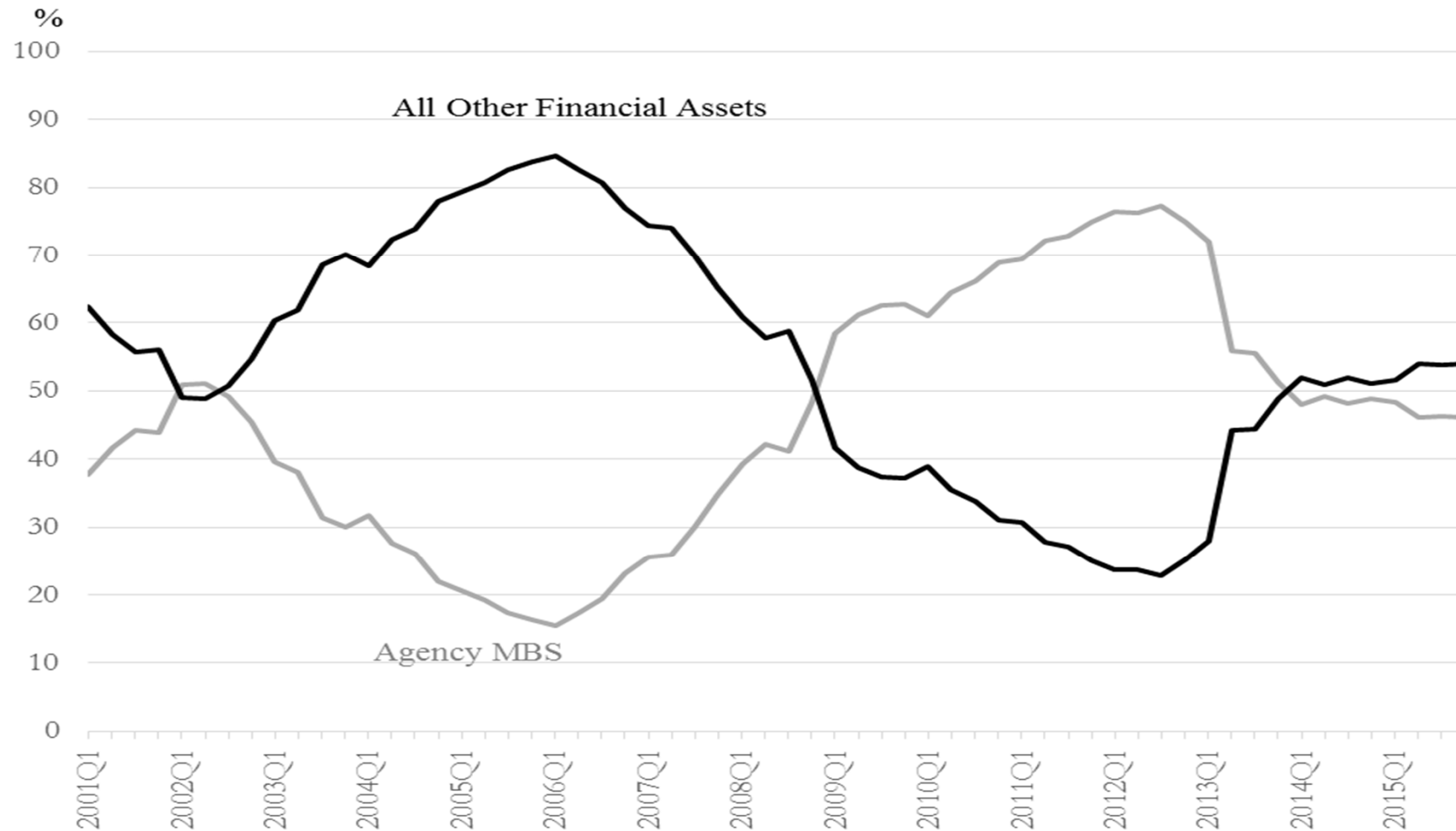
Real estate investment trusts (REITs) are specialized investment vehicles that primarily invest in real estate-related assets. They generally specialize in either owning real estate assets or providing debt financing for them.

- Equity REITs own properties and typically focus on specific geographies and/or sectors (e.g., apartment, retail, or office).
- Mortgage REITs invest in whole mortgage loans and/or mortgage-backed securities that are secured by residential and commercial properties.

REITs:

- May be a public company (SEC registrant; listed or unlisted) or privately held.
- Exempt from specific provisions of the Investment Company Act and not subject to prudential regulation, including leverage limits.
- Distribute at least 90 percent of their taxable net income annually to be exempt from federal corporate income tax.
- Dividend distributions taxed at the shareholder's ordinary income tax rate (avoids double-taxation).
- The high level of mandatory dividend distributions implies that REITs must fund growth by raising new equity, rather than through retained earnings.
- REITs face several other restrictions on assets and income -- noted in the paper.

Mortgage REIT Investment Share in Agency MBS versus Other Financial Assets (% Total Financial Assets)



Source: Flow of Funds

Agency MREITs

To distinguish Agency MREITs (from other mortgage REITs), we first calculate the ratio of Agency MBS to total assets for each firm-quarter 2000:Q1 through 2015:Q4 and flag those institutions for which this ratio exceeds 50 percent. [Actual ~90%.]

Three categories: ‘Always Agency MREITs’, ‘Conversion Agency MREITs’, and ‘Creation Agency MREITs’. Categories are stable throughout the sample period.

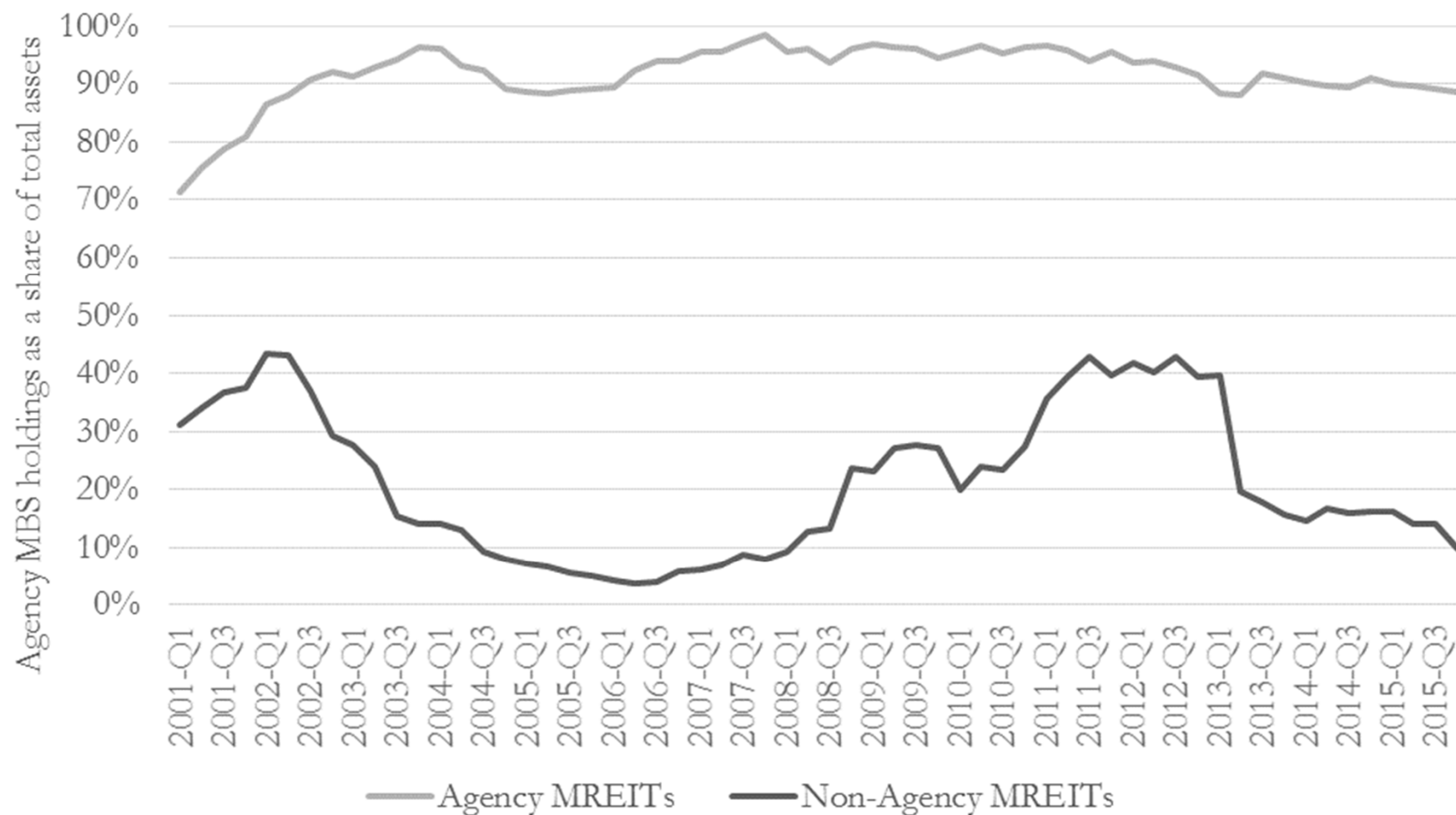
Primary data from SNL Financial. Comprehensive quarterly information about REIT balance sheets, income statements, and capital market activities.

- Balance sheet: Total assets, Agency MBS, repo debt (with sub-categories), and equity.
- Performance: Equity price returns and dividend yields, equity issuance, and share repurchases.

Hedging: Interest rate derivatives (notional amounts) from SEC filings.

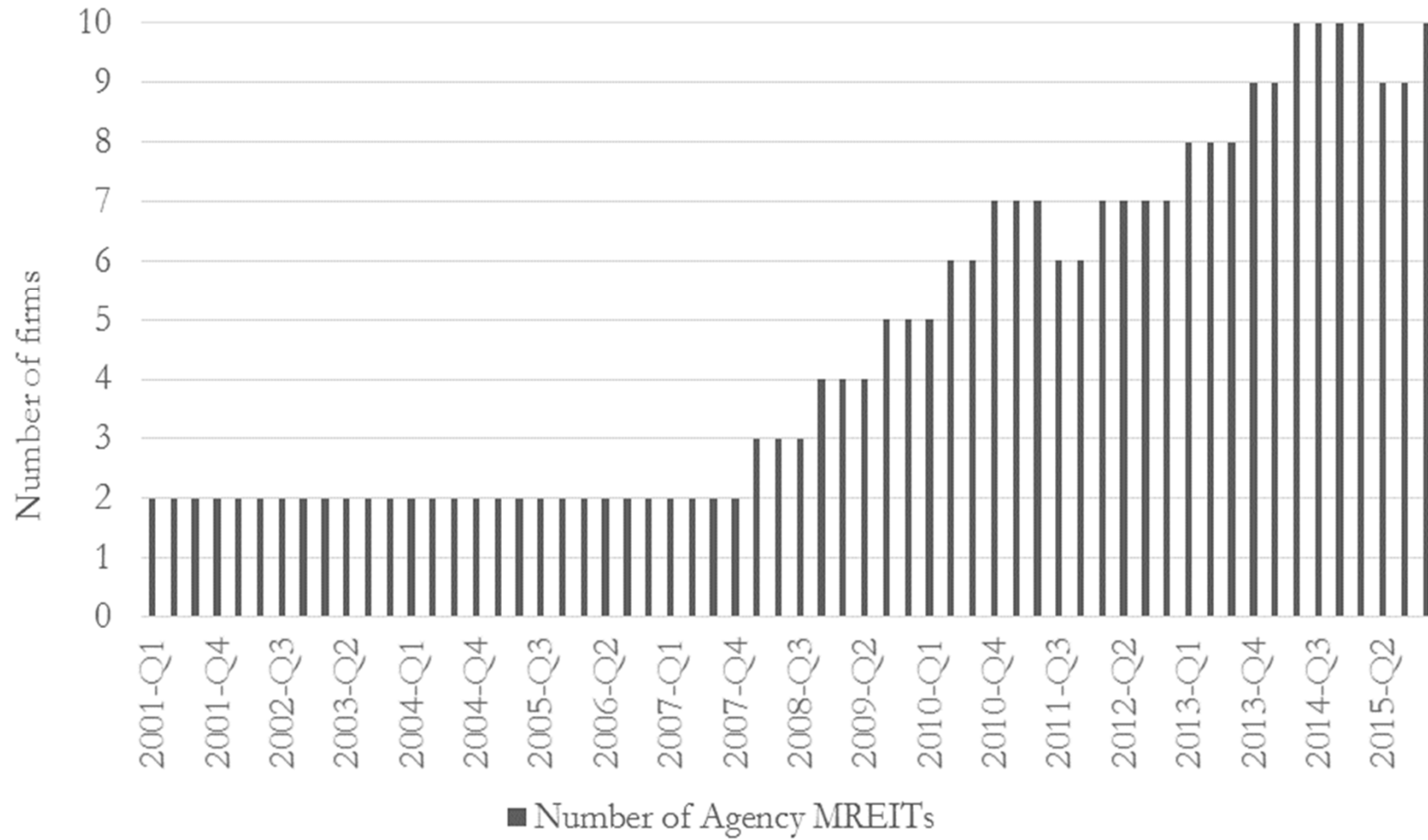
Interest rate data from FRED and Agency MBS data from Bloomberg.

Mortgage REIT Holdings of Agency MBS (% of MREIT Total Assets)



Source: SNL

Number of Agency MREITs



Source: SNL

Agency MREIT Capital Structure (% of Total Assets)



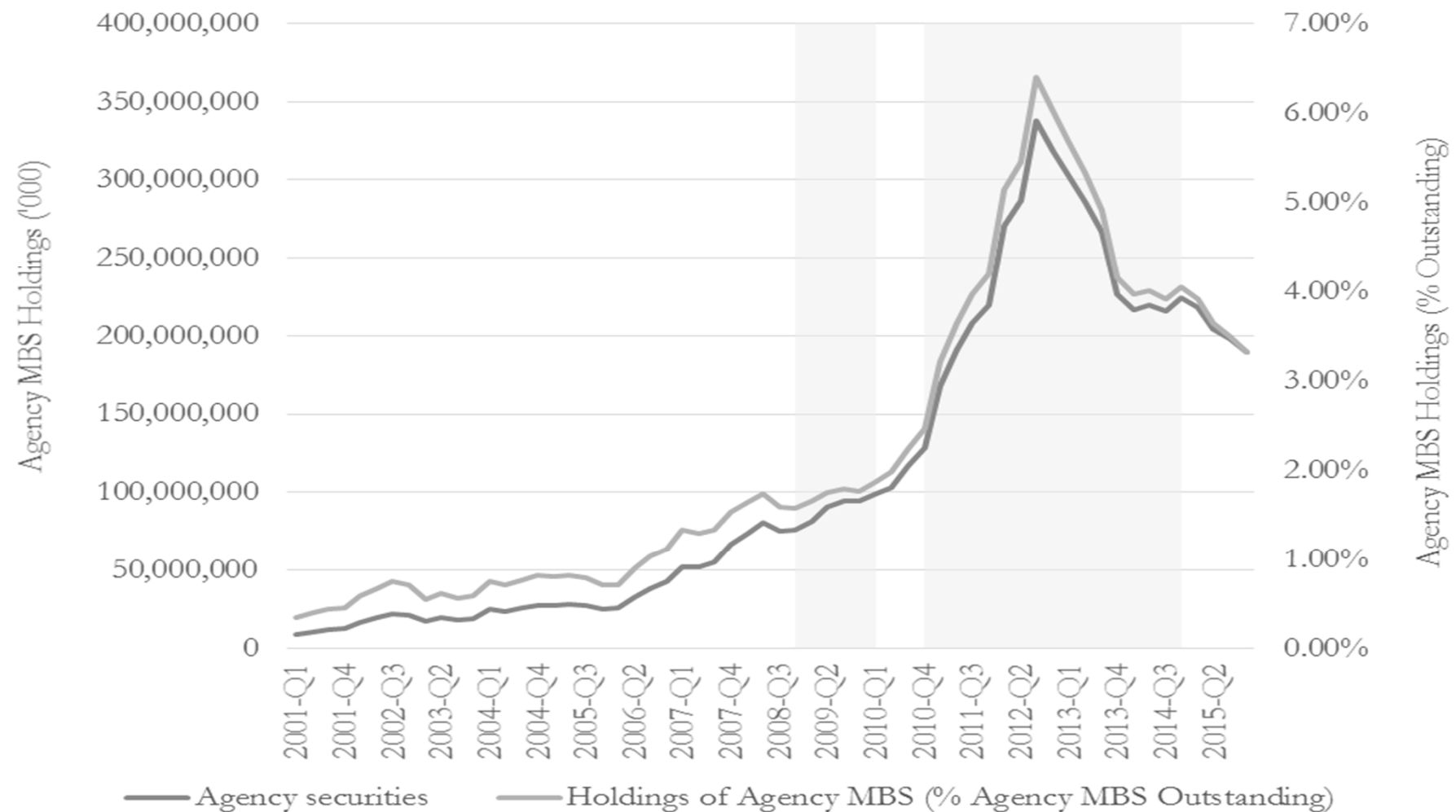
Source: SNL

Agency MREIT Dividend Yields and the Slope of the U.S. Treasury Term Structure



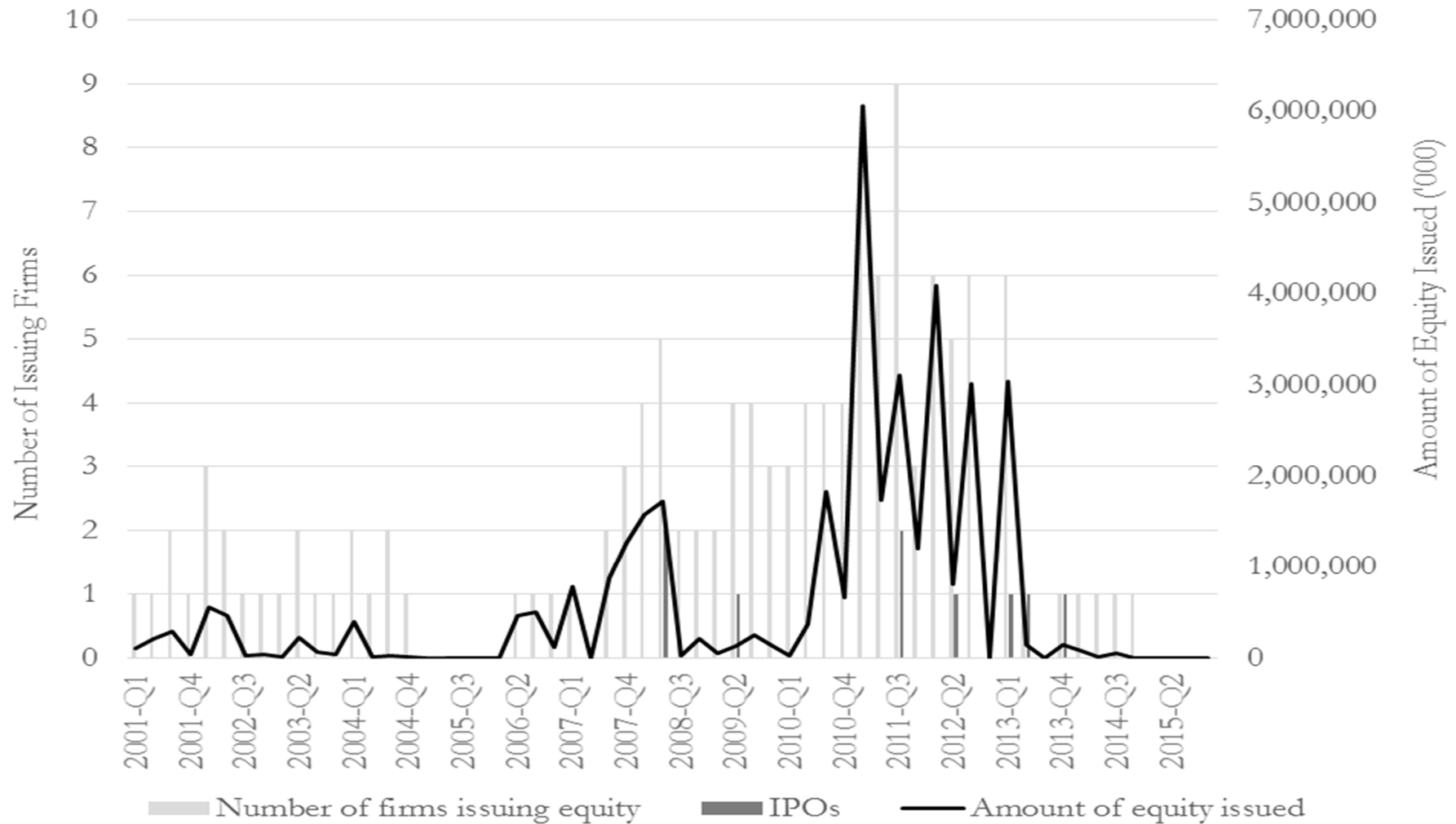
Sources: SNL & Federal Reserve Bank of St. Louis

Agency MREITs: Agency MBS Holdings and Market Share



Sources: SNL & Inside Mortgage Finance

Agency MREIT Equity Issuance



Source: SNL

Empirical Analysis

Conduct two sets of analyses using quarterly panel data from 2005-2015:

- Growth in terms of total assets and equity issuance. Also look at equity performance.
- Risk-taking in terms of leverage, short-term debt financing, and interest rate hedging.

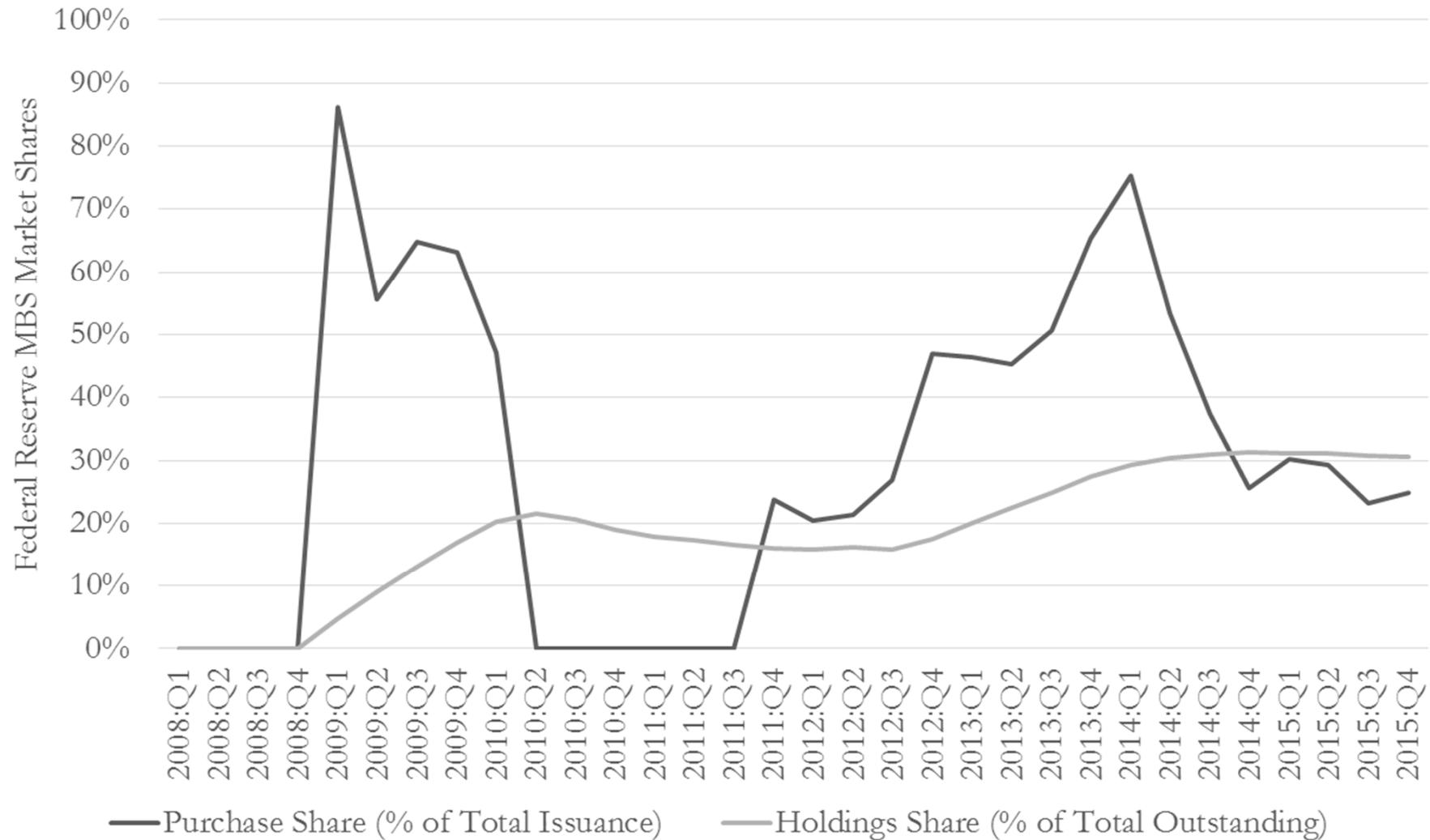
Agency MREIT business model should be tied to the level and slope of the term structure and the relative attractiveness of Agency MBS versus Treasury bonds.

- Term Structure Level: 3-Month CMT.
- Term Structure Slope: 10-year CMT *less* 3-month CMT.
- Option-Adjusted Mortgage Spread (OAS): Bloomberg Barclays US MBS Fixed Rate Average OAS.

Unconventional monetary policy periods (quarterly indicators): QE1, QE2, MEP, QE3, Tapering, and Reinvestment. Also collect data on Federal Reserve quarterly purchases and holdings of Agency MBS.

Empirical models include firm fixed effects and clustered standard errors (firm); and some firm-specific control variables (typically lagged).

Federal Reserve Purchases and Holdings of Agency MBS (% New Issuance and Outstanding)



Source: Federal Reserve Bank of New York

Descriptive Statistics

Variable	N	Mean	SD	P25	Median	P75	Min	Max
Total Assets	238	24.20	32.80	4.32	8.48	23.50	0.36	142.00
Growth in Assets	238	0.09	0.25	-0.02	0.02	0.10	-0.27	1.65
Issued Equity	238	0.29	0.46	0.00	0.00	1.00	0.00	1.00
Amount of Equity Issued	238	0.01	0.03	0.00	0.00	0.00	0.00	0.20
Repurchased Shares	238	0.24	0.43	0.00	0.00	0.00	0.00	1.00
Number of Shares Repurchased	238	0.01	0.02	0.00	0.00	0.00	0.00	0.13
Price Return	238	-0.01	0.11	-0.08	-0.01	0.06	-0.30	0.34
Dividend Yield	238	0.13	0.05	0.11	0.13	0.16	0.00	0.26
Equity to Total Assets	238	0.12	0.04	0.10	0.11	0.14	0.06	0.35
Repo Debt to Total Assets	238	0.81	0.07	0.78	0.83	0.87	0.54	0.91
Repo Debt (0-30 days) to Total Repo Debt	238	0.51	0.25	0.33	0.48	0.72	0.03	1.00
Repo Debt (>30 days) to Total Repo Debt	238	0.49	0.25	0.28	0.52	0.67	0.00	0.97
Cash to Total Assets	238	0.02	0.01	0.01	0.02	0.03	0.00	0.06
Swaps to Repo Debt	238	0.47	0.24	0.38	0.47	0.62	0.00	1.31
Swaps and Swaptions to Repo Debt	238	0.52	0.28	0.38	0.48	0.70	0.00	1.31
QE1	238	0.10	0.30	0.00	0.00	0.00	0.00	1.00
QE2	238	0.09	0.28	0.00	0.00	0.00	0.00	1.00
MEP	238	0.11	0.31	0.00	0.00	0.00	0.00	1.00
QE3	238	0.20	0.40	0.00	0.00	0.00	0.00	1.00
Tapering	238	0.16	0.37	0.00	0.00	0.00	0.00	1.00
Fed Purchase Share	238	0.29	0.24	0.00	0.26	0.47	0.00	0.86
3-Month CMT	238	0.50	1.25	0.03	0.07	0.14	0.01	5.08
CMT Term Structure	238	2.25	0.83	1.97	2.25	2.79	-0.52	3.58
Option-Adjusted Spread	238	0.46	0.28	0.26	0.37	0.58	0.11	1.45

Agency MREIT Asset Growth

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3-Month CMT	0.026 (0.02)	0.009 (0.01)	0.024 (0.02)	-0.010 (0.01)	0.024 (0.02)	-0.015* (0.01)	0.064* (0.03)	0.020 (0.02)
CMT Term Structure	0.020 (0.04)	0.002 (0.01)	0.014 (0.03)	-0.043** (0.01)	0.014 (0.03)	-0.043*** (0.01)	0.088 (0.06)	0.016 (0.03)
Option-Adjusted Spread	-0.100 (0.07)	-0.022 (0.02)	-0.098 (0.07)	-0.021 (0.01)	-0.098 (0.08)	-0.027* (0.01)	-0.122 (0.08)	-0.031* (0.02)
Issued Equity	0.255** (0.09)		0.222** (0.08)		0.222** (0.08)		0.207** (0.08)	
Repurchased Shares	-0.099** (0.04)		-0.080* (0.04)		-0.080* (0.04)		-0.061 (0.04)	
Amount of Equity Issued		8.017*** (1.08)		7.739*** (1.08)		7.724*** (1.03)		7.592*** (1.01)
Number of Shares Repurchased		-1.617*** (0.47)		-1.211** (0.47)		-1.050** (0.47)		-0.899* (0.46)
QE1			-0.051 (0.10)	0.085** (0.03)	-0.052 (0.11)	0.145** (0.05)	-0.491 (0.30)	-0.144 (0.11)
QE2			0.189** (0.06)	0.118*** (0.03)	0.189*** (0.06)	0.099*** (0.02)	0.147** (0.05)	0.081*** (0.02)
MEP			0.048 (0.05)	0.015 (0.02)	0.048 (0.05)	0.019 (0.02)	0.106* (0.05)	0.053* (0.03)
QE3			-0.044 (0.03)	-0.034** (0.01)	-0.044 (0.04)	0.004 (0.02)	0.323** (0.12)	0.242*** (0.08)
Tapering			-0.028 (0.04)	-0.012 (0.01)	-0.029 (0.03)	0.024 (0.02)	-0.120 (0.09)	0.030 (0.05)
Fed Purchase Share					0.001 (0.11)	-0.126* (0.06)		
Fed Purchase Share QE1							0.607 (0.35)	0.280 (0.17)
Fed Purchase Share QE3							-0.744** (0.28)	-0.558*** (0.16)
Fed Purchase Share Taper							0.170 (0.21)	-0.106 (0.11)
Observations	238	238	238	238	238	238	238	238
R-squared	0.313	0.81	0.373	0.828	0.373	0.832	0.399	0.839
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12

Agency MREIT Equity Issuance

VARIABLES	Issued Equity				Amount Issued			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3-Month CMT	0.119** (0.04)	0.095*** (0.02)	0.078** (0.03)	0.163*** (0.05)	0.006* (0.00)	0.008** (0.00)	0.008** (0.00)	0.011* (0.01)
CMT Term Structure	0.166* (0.08)	0.084** (0.04)	0.085** (0.04)	0.220** (0.09)	0.008 (0.00)	0.010* (0.01)	0.010* (0.01)	0.016 (0.01)
Option-Adjusted Spread	0.271 (0.15)	0.255 (0.18)	0.241 (0.17)	0.291 (0.18)	-0.002 (0.01)	-0.004 (0.01)	-0.004 (0.01)	-0.005 (0.01)
L.Market-to-Book Value of Equity	1.143*** (0.26)	0.840*** (0.22)	0.737*** (0.20)	0.664*** (0.19)	0.049* (0.02)	0.036* (0.02)	0.037* (0.02)	0.029* (0.01)
QE1		0.273 (0.24)	0.506** (0.22)	0.179 (0.57)		-0.010 (0.01)	-0.010 (0.01)	-0.043 (0.04)
QE2		0.367*** (0.09)	0.309*** (0.10)	0.306*** (0.09)		0.019** (0.01)	0.019** (0.01)	0.016** (0.01)
MEP		0.262*** (0.08)	0.280*** (0.08)	0.350** (0.11)		0.013 (0.01)	0.013 (0.01)	0.018* (0.01)
QE3		-0.037 (0.03)	0.114* (0.06)	0.788* (0.36)		-0.004 (0.00)	-0.004 (0.01)	0.032 (0.02)
Tapering		-0.013 (0.11)	0.119 (0.10)	0.074 (0.09)		-0.002 (0.01)	-0.002 (0.00)	-0.015 (0.01)
Fed Purchase Share			-0.474** (0.16)				0.000 (0.02)	
Fed Purchase Share QE1				-0.015 (0.68)				0.045 (0.04)
Fed Purchase Share QE3				-1.653** (0.70)				-0.071 (0.04)
Fed Purchase Share Taper				-0.215** (0.08)				0.026 (0.04)
Observations	238	238	238	238	238	238	238	238
R-squared	0.249	0.318	0.333	0.342	0.114	0.192	0.192	0.214
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12

Agency MREIT Price Returns

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3-Month CMT	0.013 (0.01)	0.012 (0.01)	0.004 (0.01)	0.003 (0.01)	0.003 (0.01)	0.004 (0.01)	-0.005 (0.01)	-0.009 (0.01)
CMT Term Structure	0.012 (0.01)	0.010 (0.01)	-0.017 (0.01)	-0.016 (0.01)	-0.016 (0.01)	-0.016 (0.01)	-0.034* (0.02)	-0.040** (0.02)
Option-Adjusted Spread	0.028* (0.02)	0.021 (0.02)	0.041*** (0.01)	0.030** (0.01)	0.041*** (0.01)	0.031* (0.01)	0.077*** (0.02)	0.059*** (0.01)
L.Repo Debt (0-30 days) to Total Repo Debt	0.041 (0.04)	0.035 (0.04)	0.039 (0.04)	0.035 (0.04)	0.038 (0.04)	0.035 (0.04)	0.027 (0.03)	0.025 (0.03)
L.Equity to Total Assets	0.252 (0.58)	0.305 (0.55)	0.076 (0.55)	0.063 (0.55)	0.064 (0.57)	0.068 (0.57)	0.147 (0.53)	0.145 (0.52)
L.Cash to Total Assets	0.110 (0.86)	0.012 (0.88)	-0.109 (0.74)	-0.167 (0.78)	-0.124 (0.76)	-0.158 (0.81)	-0.367 (0.87)	-0.399 (0.90)
L.Swaps and Swaptions to Total Repo Debt	-0.070 (0.05)	-0.065 (0.05)	-0.070 (0.05)	-0.068 (0.05)	-0.066 (0.04)	-0.069 (0.04)	-0.063 (0.04)	-0.067 (0.04)
L.Issued Equity	-0.011 (0.02)		-0.023 (0.02)		-0.025 (0.02)		-0.032 (0.02)	
L.Repurchased Shares	0.035*** (0.01)		0.052*** (0.01)		0.054*** (0.01)		0.051*** (0.01)	
L.Amount of Equity Issued		0.089 (0.22)		-0.131 (0.25)		-0.125 (0.26)		-0.194 (0.29)
L.Number of Shares Repurchased		1.056** (0.36)		1.187** (0.54)		1.166** (0.50)		1.132** (0.42)
QE1			0.094*** (0.02)	0.077*** (0.02)	0.107*** (0.03)	0.071** (0.03)	0.468*** (0.13)	0.422*** (0.12)
QE2			0.087*** (0.03)	0.075** (0.03)	0.084** (0.03)	0.076** (0.03)	0.109*** (0.03)	0.099*** (0.03)
MEP			0.060** (0.02)	0.047** (0.02)	0.061** (0.02)	0.047** (0.02)	0.049* (0.03)	0.031 (0.02)
QE3			-0.013 (0.02)	-0.011 (0.02)	-0.006 (0.01)	-0.014 (0.01)	0.045 (0.07)	0.012 (0.05)
Tapering			0.069*** (0.01)	0.069*** (0.01)	0.075*** (0.02)	0.066*** (0.02)	-0.007 (0.04)	-0.021 (0.03)
Fed Purchase Share					-0.024 (0.06)	0.011 (0.05)		
Fed Purchase Share QE1							-0.552** (0.21)	-0.505** (0.18)
Fed Purchase Share QE3							-0.123 (0.16)	-0.051 (0.14)
Fed Purchase Share Taper							0.170** (0.06)	0.204*** (0.06)
Observations	238	238	238	238	238	238	238	238
R-squared	0.052	0.047	0.150	0.128	0.150	0.128	0.200	0.175
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12

Agency MREIT Sharpe Ratios

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3-Month CMT	-0.573*** (0.04)	-0.577*** (0.05)	-0.567*** (0.05)	-0.572*** (0.06)	-0.568*** (0.05)	-0.571*** (0.06)	-0.547*** (0.06)	-0.559*** (0.06)
CMT Term Structure	0.073* (0.04)	0.059 (0.03)	0.082 (0.06)	0.077 (0.05)	0.082 (0.06)	0.076 (0.06)	0.117 (0.08)	0.099 (0.06)
Option-Adjusted Spread	0.268** (0.10)	0.229** (0.08)	0.262** (0.10)	0.223** (0.08)	0.262** (0.10)	0.225** (0.08)	0.304** (0.10)	0.245** (0.09)
L.Repo Debt (0-30 days) to Total Repo Debt	-0.143 (0.11)	-0.159 (0.10)	-0.138 (0.10)	-0.148 (0.10)	-0.139 (0.11)	-0.146 (0.10)	-0.153 (0.11)	-0.160 (0.10)
L.Equity to Total Assets	0.418 (0.70)	0.738 (0.71)	0.159 (0.83)	0.381 (0.91)	0.140 (0.85)	0.408 (0.96)	0.274 (0.78)	0.524 (0.86)
L.Cash to Total Assets	-0.531 (1.21)	-1.121 (1.11)	-0.613 (1.17)	-1.086 (0.96)	-0.637 (1.16)	-1.046 (0.96)	-1.123 (1.36)	-1.498 (1.17)
L.Swaps and Swaptions to Total Repo Debt	-0.245** (0.08)	-0.238** (0.10)	-0.279** (0.10)	-0.288** (0.12)	-0.272** (0.11)	-0.297** (0.13)	-0.244** (0.09)	-0.267** (0.12)
L.Issued Equity	-0.092 (0.06)		-0.096 (0.06)		-0.098 (0.06)		-0.114* (0.06)	
L.Repurchased Shares	0.077*** (0.01)		0.086*** (0.02)		0.089*** (0.02)		0.096*** (0.02)	
L.Amount of Equity Issued		-0.191 (0.66)		-0.261 (0.58)		-0.233 (0.59)		-0.329 (0.61)
L.Number of Shares Repurchased		3.043** (1.02)		2.728* (1.27)		2.630* (1.28)		2.936** (1.27)
QE1			0.015 (0.07)	-0.025 (0.07)	0.036 (0.09)	-0.053 (0.10)	0.280 (0.24)	0.136 (0.23)
QE2			0.008 (0.04)	-0.027 (0.04)	0.004 (0.04)	-0.021 (0.04)	0.001 (0.05)	-0.034 (0.05)
MEP			0.085* (0.04)	0.051 (0.04)	0.087** (0.04)	0.049 (0.04)	0.111* (0.05)	0.065 (0.05)
QE3			-0.018 (0.03)	-0.012 (0.03)	-0.007 (0.03)	-0.028 (0.03)	0.335* (0.16)	0.248* (0.12)
Tapering			0.095*** (0.03)	0.100*** (0.02)	0.105*** (0.03)	0.086*** (0.02)	0.036 (0.04)	0.008 (0.04)
Fed Purchase Share					-0.038 (0.09)	0.054 (0.09)		
Fed Purchase Share QE1							-0.433 (0.32)	-0.270 (0.29)
Fed Purchase Share QE3							-0.721** (0.32)	-0.530** (0.23)
Fed Purchase Share Taper							0.110 (0.09)	0.185* (0.09)
Observations	238	238	238	238	238	238	238	238
R-squared	0.879	0.876	0.882	0.879	0.882	0.879	0.884	0.880
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12

Agency MREITs: Leverage & Liquidity

VARIABLES	Equity/Total Assets				Cash/Total Assets			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3-Month CMT	-0.004 (0.00)	-0.007* (0.00)	-0.007* (0.00)	-0.007 (0.01)	-0.004*** (0.00)	-0.004*** (0.00)	-0.004*** (0.00)	-0.003*** (0.00)
CMT Term Structure	0.007* (0.00)	0.004 (0.00)	0.004 (0.00)	0.003 (0.01)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Option-Adjusted Spread	-0.008 (0.01)	-0.006 (0.01)	-0.006 (0.01)	-0.007 (0.01)	0.002 (0.00)	0.002 (0.00)	0.002 (0.00)	0.002 (0.00)
L.Swaps and Swaptions to Total Repo Debt	0.003 (0.01)	-0.002 (0.01)	-0.002 (0.01)	-0.003 (0.01)	-0.002 (0.00)	-0.002 (0.00)	-0.002 (0.00)	-0.002 (0.00)
L.Equity to Total Assets					0.104*** (0.02)	0.094** (0.03)	0.094** (0.03)	0.096** (0.03)
L.Repo Debt (0-30 days) to Total Repo Debt	0.003 (0.02)	0.003 (0.02)	0.003 (0.02)	0.003 (0.02)	0.006** (0.00)	0.006* (0.00)	0.006* (0.00)	0.006* (0.00)
L.Cash to Total Assets	0.472* (0.22)	0.386* (0.21)	0.381* (0.20)	0.402* (0.20)				
QE1		0.003 (0.01)	0.005 (0.01)	-0.004 (0.01)		0.005*** (0.00)	0.005* (0.00)	0.006 (0.01)
QE2		-0.006* (0.00)	-0.007** (0.00)	-0.006* (0.00)		-0.002 (0.00)	-0.002 (0.00)	-0.002 (0.00)
MEP		-0.006 (0.01)	-0.006 (0.01)	-0.007 (0.01)		0.002 (0.00)	0.002 (0.00)	0.002 (0.00)
QE3		-0.008 (0.01)	-0.007 (0.01)	-0.018 (0.02)		0.002 (0.00)	0.002 (0.00)	0.007 (0.00)
Tapering		0.007 (0.01)	0.008 (0.01)	0.011 (0.01)		0.003 (0.00)	0.003 (0.00)	0.001 (0.00)
Fed Purchase Share			-0.004 (0.02)				0.000 (0.00)	
Fed Purchase Share QE1				0.011 (0.01)				-0.002 (0.01)
Fed Purchase Share QE3				0.021 (0.03)				-0.010 (0.01)
Fed Purchase Share Taper				-0.010 (0.01)				0.004 (0.00)
Observations	238	238	238	238	238	238	238	238
R-squared	0.405	0.456	0.456	0.460	0.377	0.411	0.411	0.414
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12

Agency MREITs: Repurchase Agreements

VARIABLES	Repo/Total Assets				Repo (0-30)/Total Repo			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3-Month CMT	0.009 (0.01)	0.017 (0.01)	0.018* (0.01)	0.015 (0.01)	0.028 (0.07)	0.016 (0.06)	0.015 (0.06)	0.019 (0.06)
CMT Term Structure	-0.007 (0.01)	0.000 (0.02)	0.000 (0.02)	-0.004 (0.02)	0.041 (0.04)	0.025 (0.03)	0.025 (0.03)	0.032 (0.04)
Option-Adjusted Spread	0.025** (0.01)	0.025* (0.01)	0.026* (0.01)	0.022 (0.01)	0.030 (0.06)	0.017 (0.07)	0.016 (0.06)	0.001 (0.07)
L.Swaps and Swaptions to Total Repo Debt	-0.001 (0.03)	-0.009 (0.04)	-0.018 (0.04)	-0.014 (0.04)	-0.093 (0.09)	-0.042 (0.09)	-0.034 (0.10)	-0.047 (0.10)
L.Equity to Total Assets					-0.586 (1.33)	-0.732 (1.41)	-0.760 (1.44)	-0.752 (1.44)
L.Repo Debt (0-30 days) to Total Repo Debt	-0.001 (0.03)	0.006 (0.03)	0.008 (0.03)	0.008 (0.03)				
L.Cash to Total Assets	-0.500 (0.99)	-0.378 (0.87)	-0.321 (0.84)	-0.313 (0.86)	2.293** (0.96)	2.135** (0.82)	2.098** (0.76)	2.299** (0.89)
QE1		0.000 (0.01)	-0.021 (0.01)	-0.022 (0.05)		0.021 (0.06)	0.039 (0.10)	-0.158 (0.12)
QE2		0.021 (0.02)	0.027 (0.02)	0.024 (0.02)		-0.008 (0.05)	-0.013 (0.05)	-0.015 (0.05)
MEP		0.029* (0.02)	0.028* (0.02)	0.027 (0.02)		-0.017 (0.06)	-0.017 (0.06)	-0.012 (0.06)
QE3		0.036** (0.01)	0.023* (0.01)	-0.008 (0.03)		-0.072 (0.05)	-0.061 (0.06)	-0.099 (0.19)
Tapering		0.031* (0.02)	0.020 (0.01)	0.043*** (0.01)		-0.083*** (0.03)	-0.074* (0.04)	-0.073 (0.05)
Fed Purchase Share			0.042 (0.03)				-0.036 (0.11)	
Fed Purchase Share QE1				0.039 (0.06)				0.269 (0.17)
Fed Purchase Share QE3				0.091** (0.04)				0.058 (0.35)
Fed Purchase Share Taper				-0.024 (0.02)				-0.025 (0.11)
Observations	238	238	238	238	238	238	238	238
R-squared	0.148	0.216	0.225	0.225	0.057	0.098	0.098	0.102
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12

Agency MREIT Interest Rate Derivatives

VARIABLES	Swaps/Total Repo				Swaps and Swaptions/Total Repo			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3-Month CMT	-0.127*** (0.04)	-0.125** (0.05)	-0.107** (0.05)	-0.163*** (0.04)	-0.123** (0.04)	-0.103* (0.05)	-0.083 (0.05)	-0.150*** (0.05)
CMT Term Structure	-0.072** (0.03)	-0.041 (0.04)	-0.042 (0.04)	-0.122** (0.05)	-0.071* (0.03)	-0.017 (0.04)	-0.018 (0.04)	-0.117** (0.05)
Option-Adjusted Spread	-0.147*** (0.04)	-0.127*** (0.03)	-0.104*** (0.03)	-0.124*** (0.02)	-0.153*** (0.04)	-0.124*** (0.03)	-0.097** (0.04)	-0.120*** (0.03)
L.Repo Debt (0-30 days) to Total Repo Debt	-0.056 (0.12)	-0.032 (0.10)	-0.009 (0.09)	-0.022 (0.09)	-0.155 (0.14)	-0.110 (0.12)	-0.083 (0.11)	-0.098 (0.11)
L.Equity to Total Assets	-0.830 (0.89)	-1.233* (0.60)	-0.955* (0.47)	-1.174** (0.52)	-0.698 (0.84)	-0.936 (0.54)	-0.607 (0.44)	-0.859* (0.44)
L.Cash to Total Assets	-0.724 (1.46)	-0.164 (1.26)	0.132 (1.10)	0.246 (1.32)	-0.105 (1.46)	0.540 (1.34)	0.890 (1.10)	1.046 (1.39)
QE1		-0.135*** (0.03)	-0.308*** (0.04)	0.038 (0.10)		-0.163*** (0.04)	-0.368*** (0.07)	0.051 (0.11)
QE2		-0.112*** (0.03)	-0.049* (0.03)	-0.050 (0.03)		-0.124*** (0.04)	-0.050* (0.03)	-0.047 (0.04)
MEP		-0.092** (0.04)	-0.094** (0.04)	-0.134*** (0.03)		-0.073* (0.04)	-0.076** (0.03)	-0.125*** (0.03)
QE3		-0.055 (0.05)	-0.160*** (0.04)	-0.473*** (0.10)		0.005 (0.06)	-0.120** (0.05)	-0.510*** (0.12)
Tapering		0.026 (0.06)	-0.074 (0.05)	-0.074 (0.06)		0.074 (0.07)	-0.044 (0.06)	-0.054 (0.07)
Fed Purchase Share			0.361*** (0.08)				0.426*** (0.12)	
Fed Purchase Share QE1				-0.160 (0.14)				-0.196 (0.17)
Fed Purchase Share QE3				0.851*** (0.22)				1.048*** (0.30)
Fed Purchase Share Taper				0.234** (0.10)				0.299** (0.10)
Observations	238	238	238	238	238	238	238	238
R-squared	0.31	0.367	0.417	0.406	0.283	0.359	0.415	0.408
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12

Preliminary Conclusions

The prolonged use of unconventional monetary policy since the financial crisis resulted in concerns about the potential for such accommodation to undermine financial stability.

We contribute to an emerging literature exploring “reaching for yield” behavior by asset managers during this time by studying Agency mortgage REITs. These are specialized, tax-exempt financial institutions that were flagged as a systemic concern by the Financial Stability Oversight Council.

We believe that our analysis is important for (at least) two reasons.

- Study the relationship between unconventional monetary policy and risk-taking with a focus on leverage, liquidity risk, and interest rate risk.
- No prior empirical research about Agency mortgage REITs, which could provide significant capital market funding to the future U.S. housing finance system.

Preliminary Conclusions

We conduct two sets of analyses to better understand the emergence of Agency MREITs after the recent financial crisis and in the context of the Federal Reserve's unconventional monetary policies.

First, we studied the rapid growth of these shadow banks in terms of total assets, equity issuance, and equity returns.

- Found significant expansion during QE2 when the Federal Reserve exited the Agency MBS market. Subsequent slowdown once the central bank re-entered.
- Illustrates how shadow banks can attract capital to finance the mortgage market; and crowding-out by the central bank (i.e., portfolio balance effects).

Second, we looked at Agency MREIT risk-taking during this period.

- Found reduced interest rate hedging during the initial stages of quantitative easing; and this behavior reversed course during QE3 and through Tapering.
- Consistent with Federal Reserve communication and “reaching for yield” (and risk-taking channel).