

The Tension between Monetary Policy and Financial Stability: Evidence from Agency Mortgage REITs

W. Scott Frame, Federal Reserve Bank of Atlanta*

and

Eva Steiner, Cornell SC Johnson College of Business

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Abstract

The prolonged use of unconventional monetary policies since the financial crisis has resulted in concerns about the potential for such policy accommodation to undermine financial stability. Recent research identifying a “risk-taking channel” of monetary policy suggests that rapidly growing shadow banking organizations are of particular concern. In this paper, we study Agency mortgage REITs (Agency MREITs), which are specialized, tax-exempt financial institutions, whose rapid growth raised systemic risk concerns by the Financial Stability Oversight Council.

After controlling for key variables that drive the Agency MREIT business (level, slope, and expected volatility of the term structure as well as the mortgage yield spread) we find that the growth (and associated equity issuance) of these institutions was concentrated during QE2 and reversed course following the implementation of QE3 and on through asset purchase tapering. We also show that Agency MREIT equity returns rose during QE1 and into QE2 (likely owing to gains on existing holdings), but then declined during the Maturity Extension Program, QE3, and tapering periods. Dividend yields, which are negatively related to the policy rate and positively related to the slope of the term structure, declined during both QE2 and QE3.

In terms of risk-taking, Agency MREITs decreased their leverage during QE1. While these institutions increased their use of repo financing during the MEP, QE3, and Tapering periods, this was not concentrated in the shortest tenors.

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1 Introduction

Following the recent global financial crisis and into the Great Recession, the Federal Reserve reduced its overnight interest rate (effectively) to the zero lower bound and engaged in large-scale purchases of long-term U.S. Treasury and Federal Agency securities. From the start of 2008 through the end of 2015, the U.S. central banks' balance sheet grew from \$0.9 trillion to \$4.4 trillion; and is now principally comprised of longer-term U.S. Treasury notes and bonds (\$2.5 trillion) and Federal Agency mortgage-backed securities (\$1.8 trillion).¹

A number of empirical studies have demonstrated that the Federal Reserve's large-scale asset purchases lowered long-term interest rates as intended – both for the U.S. Treasury and Federal Agency mortgage-backed securities.² These effects are believed to principally result from reduced term premiums and by lowering the expected level of future short-term interest rates. The term premium may fall as central bank large-scale asset purchases reduce the amount of longer term bonds in private-sector portfolios – a mechanism generally referred to as the “portfolio balance channel” (e.g., Bernanke, 2010). These purchases may also cause market participants to revise down their expectations about the future path of short-term interest rates – known as the “signaling channel” (e.g., Bauer and Rudebusch, 2014). Central bank communication that interest rates would remain low for a considerable period of time likely amplify these effects.

As U.S. monetary policy accommodation lingered, there was growing concern about the heightened potential for financial stability risks. Such an environment 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” (e.g., Bernanke 2013; Stein 2013). While such risk-taking behavior is seemingly an intended consequence of unconventional monetary policy, recent theoretical research points to it being potentially exacerbated by agency problems associated with delegated asset management (e.g., Rajan 2005; Morris and Shin 2014; Feroli, Kashyap, Schoenholtz, and Shin 2014; Acharya and Naqvi 2015). Related empirical evidence is provided by Chodorow-

¹ Data as of December 31, 2015. Federal Reserve balance sheet information is available weekly from Federal Reserve Statistical release (H.4.1. Factors Affecting Reserve Balances) available at: <https://www.federalreserve.gov/releases/h41/>

² See Gagnon, Raskin, Remache, and Sack (2011); Krishnamurthy and Vissing-Jorgensen (2011); Hancock and Passmore (2011); Hamilton and Wu (2012); Neely (2012); D'Amico and King (2013); and Bauer and Rudebusch (2014).

Reich (2014), DiMaggio and Kacperczyk (2014), and Choi and Krundland (2015); each of whom finds evidence of heightened risk-taking for different types of financial institutions since the Federal Reserve set its policy rate equal to the effective lower bound. This research linking unconventional monetary policy to risk-taking is part of a new literature describing the existence of a “risk taking channel of monetary policy” that results in lower risk premia and thus amplifies policy stimulus (e.g., Adrian and Shin, 2010; Borio and Zhu, 2012; Jimenez, Ongena, Peydro, and Saurina, 2014; Ioannidou, Ongena, and Peydro, 2015; Aramonte, Lee, and Stebunovs, 2015; Dell’Ariccia, Leaven, and Suarez, 2016; Paligorova and Santos, 2017; Delis, Hasan, and Mylolonidis, 2017).

We study a set of financial institutions that grew markedly during the Federal Reserve’s balance sheet expansion: Agency Mortgage REITs (Agency MREITs). During the first two rounds of the central banks’ large-scale asset purchase programs (so-called QE1 and QE2), Agency MREIT total assets grew from \$79.2 billion to \$363.5 billion (356 percent). Generally speaking, these shadow banks hold mortgage-backed securities (MBS) guaranteed by U.S. government agencies (Fannie Mae, Freddie Mac, and Ginnie Mae) and finance them with a combination of equity and short-term repurchase agreements. Hence, Agency MREITs are engaged in significant maturity transformation (i.e., a “carry trade”) that involves material interest rate and liquidity risks without access to government backstops. In fact, the U.S. Financial Stability Oversight Council (2013) raises the specter of financial stability concerns emanating from Agency MREITs. Their thesis is that these shadow banks are vulnerable to a sharp increase in interest rates that would erode the value of their assets. Given Agency MREITs’ reliance on short-term collateralized borrowing, this could lead to dealer margin calls, increases in repo haircuts, and deleveraging.³ At worst, dealer funding could be markedly reduced, thus forcing significant asset sales and placing downward pressure on Agency MBS prices (or equivalently upward pressure on yields). The assumption is that Agency MREITs are expected to act in unison in response to a shock given their homogenous business model.

³ An important part of the financial crisis narrative concerns the liquidity risks posed by shadow banks that principally finance themselves using repurchase agreements (e.g., Gorton and Metrick, 2012).

We conduct two sets of analyses to better understand the emergence of Agency MREITs after the recent financial crisis. In the first, we study the rapid growth of these institutions in terms of total assets and equity issuance. After controlling for the key drivers of the Agency MREIT business model (interest rate level, term structure slope, mortgage yield spread, and expected interest rate volatility) we find that their expansion was concentrated during QE2 and then began to reverse once the Federal Reserve introduced QE3 and subsequently began tapering asset purchases. We also show that Agency MREIT equity returns rose during QE1 (likely owing to gains on existing holdings) and QE2; and then reversed during QE3 and Tapering. We find that dividend yields decreased during the central banks' QE3 program. Our second analysis focuses on the relationship between unconventional monetary policy and Agency MREIT risk-taking, as the "risk-taking channel of monetary policy" has recently been garnering significant academic and policy attention. Our preliminary evidence suggests that Agency MREITs actually decreased leverage during QE1; but expanded repo borrowings during the Maturity Extension Program, QE3, and Tapering periods.

The first part of our analysis relating unconventional monetary policy to the growth and profitability of Agency MREITs is most closely related to Chodorow-Reich (2014) who conducts high-frequency event studies to analyze equity returns for U.S. commercial banking organizations, life insurance companies, money market funds, and private define-benefit pension funds. He finds significant benefits of QE1 for banking organizations and life insurance companies through increased values for legacy assets. The second part of our study examines the empirical relationship between unconventional monetary policy and Agency MREIT risk-taking. This analysis is in-line with that in DiMaggio and Kacperczyk (2014), which finds that unconventional monetary policy induces money market funds to invest in riskier assets and hold less diversified portfolios. It is also in-line with Choi and Krundland (2015), who find that corporate bond funds reach for yield when the level and slope of the term structure are low and credit spreads are narrow. Chodorow-Reich (2014) also provides some evidence of money funds and pension funds increasing their risk-taking during 2009-2011.

This research contributes to this emerging literature along at least two dimensions. First, to our knowledge this is the first empirical analysis of Agency MREITs in the academic literature, although Pellerin, Sabol, and Walter (2013) provide a descriptive overview of these institutions and related issues. Second, we examine

whether Agency MREITs alter their leverage, interest rate risk, and liquidity risk profiles, while the extant literature has focused exclusively on changes in credit risk at money funds, pension funds, and corporate bond funds.

The remainder of the paper is structured as follows. Section 2 provides background information about REITs in general and Agency MREITs in particular. Section 3 describes the data used in our analysis. Section 4 examines the relationship between the Federal Reserve's unconventional monetary policy and Agency MREIT growth and profitability, while Section 5 tests for a link between such policies and measures of institutional risk-taking. In Section 6 we offer concluding remarks.

2 Agency Mortgage REITs

Real estate investment trusts (REITs) are specialized investment vehicles that primarily invest in real estate-related assets. REITs are exempt from specific provisions of the Investment Company Act, which implies that they are not subject to prudential regulation, including leverage limits. A REIT may be a public company registered with the U.S. Securities and Exchange Commission or privately held. A public REIT may have its shares listed on an exchange, or be unlisted and have shares sold directly to investors by broker-dealers. As long as REITs distribute at least 90 percent of their taxable net income annually, they are exempt from federal corporate income tax.⁴ To the extent that such distributions are in the form of dividends, these profits are taxed at the shareholder's ordinary income tax rate and hence avoid double-taxation. The high level of mandatory dividend distributions implies that REITs must fund growth by raising new equity, rather than through retained earnings.

⁴ Other important limits placed on REITs include: [1] maintaining at least 75 percent of total assets in qualifying real estate assets and cash; [2] receiving at least 75 percent of income from some combination of rent from real property, interest from mortgages securing real property, gains from the sale of real property, and distributions from other REITs; [3] receiving at least 95 percent of its income from the aforementioned qualified real estate sources or from certain other passive sources; [4] deriving less than 30 percent of gross income from the sale or other disposition of stock or securities held for less than six months, and real property held for less than four years; and [5] issue transferrable shares held by at least 100 individuals with no five or fewer owning more than 50 percent during the last half of the taxable year.

REITs 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). By contrast, mortgage REITs invest in whole mortgage loans and/or mortgage-related securities that are secured by residential and commercial properties.⁵ As shown in Figure 1, based on Flow of Funds data, a large share of MREIT investment is in the form of Agency mortgage-backed securities (Agency MBS) guaranteed by either Fannie Mae, Freddie Mac, or Ginnie Mae.⁶ While Agency MBS are viewed as having virtually no credit risk, these instruments are very long-term and subject to significant prepayment risk arising from borrower refinancing due to changes in interest rates, as well as routine housing turnover.

[Figure 1 about here.]

Using institution-level data from SNL Financial, Figure 2 (Panel A) shows that MREIT investment in Agency MBS has been persistently concentrated in a subset of these institutions that specialize in managing such portfolios. These so-called Agency MREITs are typically identified as holding more than one-half of their total assets in Agency MBS; with an actual portfolio share of about 90 percent. In the years preceding the financial crisis, there were only two Agency MREITs of note (Annaly Capital Management and Anworth Mortgage Asset Corporation). However, following the onset of the financial crisis and through the Great Recession, as many as 10 were in operation at a given point in time. Figure 2 (Panel B) presents the quarterly number of Agency MREITs based on the standard definition and using the SNL Financial data.

[Figure 2 about here.]

Agency MREITs principally finance their Agency MBS holdings using a mix of equity and short-term collateralized debt in the form of bilateral repurchase agreements, or repo, entered into with broker-dealers.⁷

⁵ See Pellerin, Sabol, and Walter (2013) for a historical evolution of mortgage REITs.

⁶ Fannie Mae and Freddie Mac are U.S. government-sponsored enterprises (GSEs) that securitize “conforming” residential mortgages; and since the financial crisis the two institution have enjoyed “effective” federal backing of all obligations (e.g., Frame, Fuster, Tracy, and Vickery, 2015). Ginnie Mae is a government agency within the U.S. Department of Housing and Urban Development (HUD) created exclusively to securitize government-insured mortgages. All three institutions provide blanket guarantees on the MBS that they issue to investors in exchange for guarantee fees (insurance premiums) from mortgage originators.

⁷ Repurchase agreements are effectively collateralized loans whereby a borrower sells an asset to a lender with a promise to repurchase the asset back at a later date for a pre-specified price. Since 2005, repurchase agreements

While MREITs face no regulatory leverage limits, repo haircuts place an effective limit. Further, this margin must be maintained throughout the life of the loan; and a margin call will occur if the collateral value falls beyond some pre-specified amount. This explains Agency MREIT holdings of some unencumbered assets (cash and securities) as a liquidity buffer to cover any margin calls.

Figure 3 illustrates the aggregate capital structure of Agency MREITs using the SNL Financial data. These institutions tended to hold about eight percent equity in the years prior to the onset of the financial crisis (2007:Q3), although this is only based on two institutions. Shortly thereafter, total equity among Agency MREITs increased substantially and averaged around 12-14 percent since 2008. The figure also demonstrates that repurchase agreements are the dominant form of debt financing – accounting for about 80-90 percent of total assets since the early 2000s. Interestingly, while very short-term repo funding (< 30 days) dominates Agency MREITs' capital structure, there was a significant substitution toward term repo following the onset of the financial crisis.

[Figure 3 about here.]

In terms of income, Agency MREITs earn the difference between the coupon interest on long-term assets (Agency MBS) and the interest costs of their short-term repo debt, hedging costs, and operating expenses. Hence, the slope of the yield curve is a principal driver of profitability. Figure 4 demonstrates this by plotting the time series of Agency MREIT dividend yields from SNL Financial and the spread between 10-year and 3-month U.S. Treasury constant maturity rates available from the Federal Reserve Bank of St. Louis.

[Figure 4 about here.]

Figure 5 shows that Agency MREITs expanded dramatically after the onset of the financial crisis and increasingly became important Agency MBS investors. Between 2008:Q4 and 2012:Q3, Agency MREITs increased their holdings of Agency MBS from \$76.2 to \$337.6 billion; and thereby increased their share of this market by more than a factor of four, from 1.5% to 6.4%. Much of this increase in market share was concurrent

collateralized by Agency MBS have been treated as “qualified financial contracts” for purposes of the Bankruptcy Code meaning that they are exempt from automatic stay provision.

with the shrinkage of Agency MBS holdings by Fannie Mae and Freddie Mac which themselves had long been the largest investors. The Federal Reserve’s unconventional monetary policy programs, which started in 2009, interjected the central bank into the Agency MBS market where it quickly became the largest investor. The various post-crisis Federal Reserve monetary policy regimes (discussed in greater detail below) are indicated by shading.

[Figure 5 about here.]

Given that REITs must distribute at least 90 percent of their taxable net income annually to remain exempt from federal corporate income tax, any significant growth requires new equity issuance. Figure 6 illustrates this using issuance data from SNL Financial. Clearly, much of the issuance is clustered in the 2010-2012 period which coincides with the asset growth presented above.

[Figure 6 about here.]

The remarkable growth of Agency MREITs after the financial crisis, coupled with their potentially fragile business model, caught the attention of the newly created Financial Stability Oversight Council in 2013. Policymaker concerns centered on the vulnerability of these shadow banks to sharp increases in interest rates that would erode the value of their assets -- potentially resulting in a run on their very short-term liabilities and a resulting large-scale sell-off in the Agency MBS market.

3 Data and Sample Selection

The primary data used in our analysis comes from SNL Financial and includes comprehensive quarterly information about REIT balance sheets, income statements, and capital market activities. To identify Agency MREITs, 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. This criterion produces three types of institutions: (i) “Always Agency MREITs” that existed at the start of the sample period (2001:Q1) and remained classified as Agency MREITs for all remaining sample periods; (ii) “Conversion Agency MREITs” that were also alive at the start of the sample period, but whose portfolio share of Agency MBS was initially

below 50 percent before conforming to the Agency MREIT criterion for the remainder of their life in the sample; and (iii) “Creation Agency MREITs” that were born after the beginning of our study period but that were classified as agency MREITs for the duration of their life in the sample. Firms leave the sample when they become inactive/defunct.

For each Agency MREIT, we collect the following quarterly balance sheet information reflecting the simplicity of the MREIT business model: Total Assets, Total Agency MBS, Total Repo Debt (with sub-categories reflecting different maturities), and Total Equity. We also obtain quarterly performance information as measured by equity price returns and dividend yields, as well as information about whether an Agency MREIT issued equity in a particular quarter and the amount.

We also make use of interest rate data to construct measures of: the slope of the U.S. Treasury yield curve (10-year CMT less 3-month CMT), the mortgage spread (current coupon Agency MBS rate less the 10-year Treasury CMT), and the expected volatility of the 10-year bond. The U.S. Treasury interest rate data is obtained from the Federal Reserve Bank of St. Louis’s website; the current coupon Agency MBS rate data is from Bloomberg; and the expected volatility information from the Chicago Board Options Exchange (CBOE). The current coupon Agency MBS is a synthetic 30-year fixed-rate par value security for one month delivery in the ‘too-be-announced’ forward market obtained by interpolating the highest coupon below par and the lowest coupon above par. The CBOE’s 10-year U.S. Treasury Note Volatility Index (TYVIX) uses the VIX methodology to measure a constant 30-day expected volatility of 10-year Treasury note futures prices based on actively traded options on the futures. As shown above, the slope of the term structure is closely related to Agency MREIT profitability. The mortgage spread, which includes compensation for prepayment risk, could also influence profitability. Finally, interest rate volatility can affect prepayment risk, hedging costs, and expectations about future profitability.

We are principally interested in learning why the behavior of Agency MREITs changed so dramatically in the late-2000s. As previously noted, this change may be closely linked to changes in the monetary policy environment. Table 1 provides a comprehensive timeline of the Federal Reserve’s unconventional monetary

policy actions starting after the failure of Lehman Brothers in the fall of 2008 based on the published minutes from the Federal Open Market Committee meetings. The first round of quantitative easing (QE1) was announced in 2008:Q4 and ran through 2010:Q1 and included the purchase of \$1.25 trillion in Agency MBS, \$300 billion of U.S. Treasury securities, and \$200 billion of Agency debt. QE2 was a short-lived program (2010:Q4 – 2011:Q2) that involved the central bank purchasing an additional \$600 billion in U.S. Treasury securities but no more Agency MBS. This was followed by the Maturity Extension Program (2011:Q3 – 2012:Q4) that included the purchase of another \$400 billion in very long-term U.S. Treasury securities (6-30 years) and the sale of similar short-term securities in an effort to “twist” the yield curve. During the same period the Federal Reserve began ratcheting-up its use of “forward guidance” to anchor expectations of the very short-term policy rate at the effective zero lower bound for up to two years out. QE3 (2012:Q3-2013:Q4) saw a renewal of Federal Reserve purchases of Agency MBS and the continuation of long-term U.S. Treasury purchases. During the Tapering regime (2014-2015), the Federal Reserve methodically slowed the pace of long-term assets purchases.

[Table 1 about here.]

To supplement the information about the QE regimes, we also acquired quarterly data from the Federal Reserve Bank of New York about the central banks’ purchases and holdings of Agency MBS, as well as the total amount of these securities issued and outstanding per quarter. We further collected similar purchases and holdings information for Fannie Mae and Freddie Mac from the Federal Housing Finance Agency. This data became available starting in 2004. We incorporate information about the GSEs’ because they had long been large-scale investors in Agency MBS. To provide context, at the end of 2003, Fannie Mae and Freddie Mac collectively held just over \$1.0 trillion of Agency MBS, while all U.S. commercial banks combined held just \$668 billion.

Figure 7 (Panel A) presents data on quarterly holdings of Agency MBS by the Federal Reserve, as well as collectively by Fannie Mae and Freddie Mac, over the 2004-2015 period. The Federal Reserve’s holdings began to accumulate with the start of QE1 in 2009:Q1 and reached over 22 percent of securities outstanding by

2010:Q2. The central banks' market share leveled-off during QE2 and the MEP before ramping up and remaining steady at about 30 percent in 2015. The GSEs' share of the Agency MBS market steadily declined between 2004 and 2015 from 30 percent to five percent. Before the crisis, this was likely a result of increased regulatory capital charges following accounting scandals at both institutions, coupled with the general macro-financial environment which featured extremely compressed credit spreads. Later, a stipulation of the U.S. Treasury funding of the GSE conservatorships in September 2008 was that Fannie Mae and Freddie Mac begin to shrink their balance sheets by 10 percent per year.

Panel B of Figure 7 presents data on quarterly purchases of Agency MBS by the Federal Reserve and collectively by Fannie Mae and Freddie Mac, over the 2004-2015 period. The GSEs' purchases averaged about 20 percent of quarterly issuance volumes between 2004 and 2007. These purchases then peaked at over 60 percent of quarterly issuance during 2008:Q4 before rapidly declining to under two percent in 2010:Q2. From that point onwards, Agency MBS purchases by Fannie Mae and Freddie Mac accounted for approximately 10 percent of quarterly issuance. The Federal Reserve had not purchased Agency MBS in many years, but absorbed 36 percent of new issuance during the first quarter of QE1 (2009:Q1). The central bank did not purchase any additional Agency MBS during QE2, but renewed its activities during QE3 and maintained an average purchase share above 20 percent during that time. Once the Federal Reserve opted only for reinvestment to maintain constant dollar holdings of Agency MBS, its quarterly purchase share fell to about 10 percent.

[Figure 7 about here.]

Table 2 presents descriptive statistics for our Agency MREIT sample which includes 246 firm-quarter observations from 12 Agency MREITs over the 2004-2015 timeframe. Total assets for these firms averaged \$23.7 billion during this time. Consistent with the tremendous growth documented above, 30 percent of firm-quarters include equity issues, with the average amount issued per quarter being one percent of the total book value of assets at the beginning of the quarter. The average quarterly price return is -1 percent, although there is very large dispersion around the mean (minimum of -30 percent and maximum of 34 percent). Our Agency MREITs pay average dividends of 13 percent of the firm's quarter-end stock price. The average book equity

ratio is 12 percent over the study period. On average, the ratio of total repo debt to total assets is 81 percent; with the average share of short-term repo debt (due within 30 days) being 52 percent. The average effective Federal Funds rate was 0.60 percent, but ranged from 0.04 to 5.34 percent. In terms of other variables capturing the interest rate environment, the slope of the term structure averaged 2.26 percent, the mortgage yield spread 0.79 percent, and the 10-year expected interest rate volatility index 6.26. Quarterly Agency MBS purchases shares for the Federal Reserve and GSEs averaged 9.5 percent and 11.2 percent, respectively.

[Table 2 about here.]

Table 3 presents the unconditional pairwise Pearson correlation coefficients for the variables of interest and the Federal Reserve's unconventional monetary policy regimes. Not surprisingly, we find that Agency MREIT asset growth is positively correlated with QE2 and negatively correlated with the QE3 and Tapering periods. Asset growth is also negatively associated with Fed purchases of MBS. Equity issuance is positively correlated with QE1 and QE2 and negatively correlated with the QE3 and Tapering regimes, as well as Fed purchases of MBS. Agency MREIT equity price appreciation is positively correlated with the QE1 regime -- consistent with the associated large decline in interest rates significantly increasing the value of financial institution legacy assets -- and negatively correlated with QE3. Dividend yields are positively related to QE1 and QE2, as well as Fed purchases of MBS. In terms of financing, the equity to total assets ratio increases during the Tapering regime and with Fed purchases. The use of repurchase agreements -- especially very short-term ones -- is negatively correlated with QE3, Tapering and Fed purchases, and positively related to GSE purchases.

[Table 3 about here.]

4 Methodology

We begin our empirical analysis by seeking to understand the drivers of Agency MREIT growth, defined as the quarterly percentage change in the book value of assets. Recall that the Agency MREIT business model is predicated on the spread between Agency MBS and short-term interest rates. To capture this, we break this spread into its component parts. First, we include the Federal Reserve's policy rate (Federal Funds Rate) to

control for movements in funding costs. Second, we include the slope of the term structure of U.S. Treasury rates (Term Structure) defined as the difference between the 10-year and 3-month constant maturity rates. Third, we define the mortgage yield spread (Mortgage Spread) as the difference between the Agency MBS current coupon rate and the 10-year constant maturity Treasury rate. Finally, we also include the expected volatility in the 10-year Treasury bond (Volatility Index). Collectively, these four variables comprise a vector of interest rate variables.

Our empirical specification also includes a vector of indicator variables for the various post-crisis monetary policy regimes established by the Federal Reserve as described above: QE1, QE2, MEP, QE3, and Tapering. In alternative specifications, we consider the effects of Federal Reserve and GSE purchase shares of Agency MBS in lieu of the indicators for the different phases of quantitative easing.

Finally, given that REITs must distribute such a large fraction of their earnings as dividends, asset growth must largely be financed through new equity issuance. We examine this as well in our empirical specification by including either an indicator that the institution issued equity in a given quarter (Issued Equity) or the amount of equity issued as a percentage of total assets at the end of the previous quarter (Amount of Equity Issued).

Equation (1) summarizes these relationships, which are estimated using a panel model and including firm fixed effects α_i to control for unobserved heterogeneity.⁸ Regressions are estimated via OLS with standard errors clustered by firm.

$$(1) \text{ Asset_Growth}_{it} = f(\text{Interest Rate Variables}_{it}, \text{Monetary Policy Regimes}_{it}, \text{Equity Issuance}_{it}) + \alpha_i + \epsilon_{it}$$

We next examine equity issuance further, given its important role in supporting Agency MREIT growth. Equation 2 examines the determinants of equity issuance (Issued Equity and Equity Amount Issued) in the same framework, although some specifications are supplemented with lagged values of the institutions' equity

⁸ In unreported regressions, we also controlled for observed heterogeneity in portfolio structure across Agency MREITs. These results were very consistent with those reported, as it seems that the fixed effects absorb most all of the institution-level heterogeneity.

returns (dividend yield and price return) to account for potential return chasing behavior. L denotes the lag operator. Regressions are estimated via OLS.⁹

$$(2) \text{Equity_Issuance}_{it} = f(\text{Interest Rate Variables}_t, \text{Monetary Policy Regimes}_t, L.\text{Equity Returns}_{it-1}) + \alpha_i + \epsilon_{it}$$

Next, we examine price returns and dividend yields. As before, we use OLS regressions with firm fixed effects to estimate these return outcomes as a function of monetary policy regimes, interest rate controls, lagged financing structure, and lagged equity issuance over the study period. Equation (3) summarizes the regression model, where we employ either price returns or dividend yields as the dependent variable.

$$(3) \text{Return}_{it} = f(\text{Interest Rate Variables}_t, \text{Monetary Policy Regimes}_t, L.\text{Financing Structure}_t, L.\text{Issuance}_{it-1}) + \alpha_i + \epsilon_{it}$$

Finally, we explore risk taking by Agency MREITs in a similar framework by estimating panel OLS models for the ratio of equity to total assets as well as the ratio of repurchase agreements to total assets and the percentage of short-term (0-30 days maturity) repurchase agreements relative to total repurchase agreements. Equation (4) summarizes these relationships, where the dependent variable, denoted Risk, stands for the risk measures outlined above. In addition to interest rate variables and monetary policy regimes, we also control for past equity issuance activity. Firm fixed effects are included as before.

$$(4) \text{Risk} = f(\text{Interest Rate Variables}_t, \text{Monetary Policy Regimes}_t, L.\text{Issuance}_{it-1}) + \alpha_i + \epsilon_{it}$$

5 Empirical Results

5.1 Agency MREITs: Growth, Equity Issuance, and Return Performance

Table 4 presents the results of our asset growth regressions. In columns (1)-(3) with indicators for the unconventional monetary policy regimes, the results consistently suggest that Agency MREITs grew significantly during QE2 and then began to contract their balance sheets during QE3 and the Tapering – findings broadly consistent with Figure 5. Not surprisingly, both measures of equity issuance are strongly

⁹ We also estimated regressions specifying the dependent variable as the indicator Equity Issued via Logit and those using Amount of Equity Issued using Tobit. While the Logit and Tobit procedures are more econometrically appropriate given the nature of the two variables, the non-linear model specification results in our dropping firm fixed effects. Results for these regressions are shown in the Appendix and largely consistent with the main results we report below..

associated with Agency MREIT asset growth – especially the relative amount of equity issued which dramatically improves the in-sample fit of the regressions. Finally, there is some evidence that Agency MREIT growth is negatively related to the quarterly purchase share of Agency MBS by the Federal Reserve and GSEs. This is broadly consistent with a reduction in investment opportunities for Agency MREITs.

[Table 4 about here.]

Table 5 presents the results for the equity issuance regressions. Columns (1), (3) and (5) explore variation in the issuance decision. Consistent with Table 4, the results suggest that issuance is positively related to the QE2 period and negatively related to QE3 and the Tapering periods. Issuance is also consistently positively related to the mortgage spread, the prior quarter's equity price return and dividend yield, and negatively related to expected volatility in the 10-year Treasury rate.

Regression results for the amount of equity issued (as a share of last quarter's total assets) are shown in Columns (2), (4) and (6) of Table 5. The volume of Agency MREIT equity issuance was negatively related to QE1 and positively related to QE2. The effects of the interest rate control variables are diminished in these specifications, although there remains a strong positive association between the amount of equity issued and the prior quarter's equity price return and dividend yield. As with the asset growth regressions, we find evidence that Agency MREIT equity issuance is negatively related to the Federal Reserve's and GSEs' share of new Agency MBS.

[Table 5 about here.]

Table 6 presents results from regressions of Agency MREIT equity returns. These returns are positively related to QE1, a time when the value of their legacy assets would have increased significantly. We also find some evidence of a positive effect during QE2. Similar to the growth and equity issuance regressions, Agency MREIT equity returns are found to be negative during QE3 and the Tapering period. Price returns are negatively related to the level and slope of the term structure and unrelated to equity issuance. The regressions studying the relationship between price returns and the Agency MBS quarterly purchase shares of Federal Reserve and GSEs indicate no statistical relationship.

[Table 6 about here.]

Table 7 looks at variation in Agency MREIT dividend yields over the sample and indicates that yields declined significantly during QE2 and QE3. These yields are also positively related to the term structure and recent equity issuance, and negatively related to the level of the policy rate and the equity-to-asset ratio. The share of newly issued Agency MBS purchased by the Federal Reserve and GSEs are unrelated to Agency MREIT dividend yields.

[Table 7 about here.]

5.2 *Agency MREITs: Risk Profiles*

To this point, we have found that Agency MREIT growth and performance were strongly influenced by the Federal Reserve's unconventional monetary policy -- beyond what one would expect solely based on the interest rate environment. Next, we examine why this may have occurred and focus particularly on various risk measures. These results are very preliminary insofar as we currently have only studied variation in leverage (capital-to-assets ratio) and use of repo financing (repo-to-total assets ratio and short-term repo-to-total repo). We intend to extend this analysis soon to study interest rate hedging behavior (particularly the use of interest rate swaps) and use of long-term funding through the Federal Home Loan Bank System as a mechanism to reduce interest rate and liquidity risks.

[Table 8 about here.]

Panel A of Table 8 suggests that Agency MREIT equity ratios increased during QE1 and declined some during QE3. Moreover, equity ratios are found to be negatively associated with the Federal Funds rate, the mortgage yield spread, and expected interest rate volatility. These relations suggest that Agency MREITs are prone to increase their leverage during less favorable interest rate environments. We also find some evidence that the share of newly issued Agency MBS purchased by the Federal Reserve and GSEs is also positively related to Agency MREIT equity ratios.

The results in Panel B in Table 8 indicate that Agency MREITs increased their reliance on repurchase agreements during the Maturity Extension Program, QE3, and the Tapering period. Repo usage is also found to be positively related to the level of the short-term policy rate -- consistent with heightened risk in more adverse economic environments. There seems to be little statistical relationship between Federal Reserve and GSE Agency MBS quarterly purchase shares and Agency MREITs' use of repurchase agreements.

While the increased use of repurchase agreements might be consistent with greater interest rate risk (other things being equal), the results in Panel C do not suggest that the increased use of repo was concentrated in the very shortest tenors (<30 days). Agency MREITs' reliance on short-term repo is (not surprisingly) positively related to the slope of the term structure and negatively associated with the Federal Reserve's quarterly purchase share of Agency MBS.

6 Preliminary Conclusions

The prolonged use of unconventional monetary policies since the financial crisis has resulted in concerns about the potential for such policy accommodation to undermine financial stability. Recent research identifying a "risk-taking channel" of monetary policy suggests that rapidly growing shadow banking organizations are of particular concern. In this paper, we study Agency mortgage REITs (Agency MREITs), which are specialized, tax-exempt financial institutions, whose rapid growth raised systemic risk concerns by the Financial Stability Oversight Council.

After controlling for key variables that drive the Agency MREIT business (level, slope, and expected volatility of the term structure as well as the mortgage yield spread) we find that the growth (and associated equity issuance) of these institutions was concentrated during QE2 and reversed course following the implementation of QE3 and on through asset purchase tapering. We also show that Agency MREIT equity returns rose during QE1 and into QE2 (likely owing to gains on existing holdings), but then declined during the Maturity Extension Program, QE3, and tapering periods. Dividend yields, which are negatively related to the policy rate and positively related to the slope of the term structure, declined during both QE2 and QE3.

In terms of risk-taking, Agency MREITs decreased their leverage during QE1. While these institutions increased their use of repo financing during the MEP, QE3, and Tapering periods, this was not concentrated in the shortest tenors.

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8 Figures and Tables

Figure 1: Mortgage REIT Share of Investment in Agency MBS and All Other Financial Assets: 2001-2015 (Percent of Total Financial Assets)

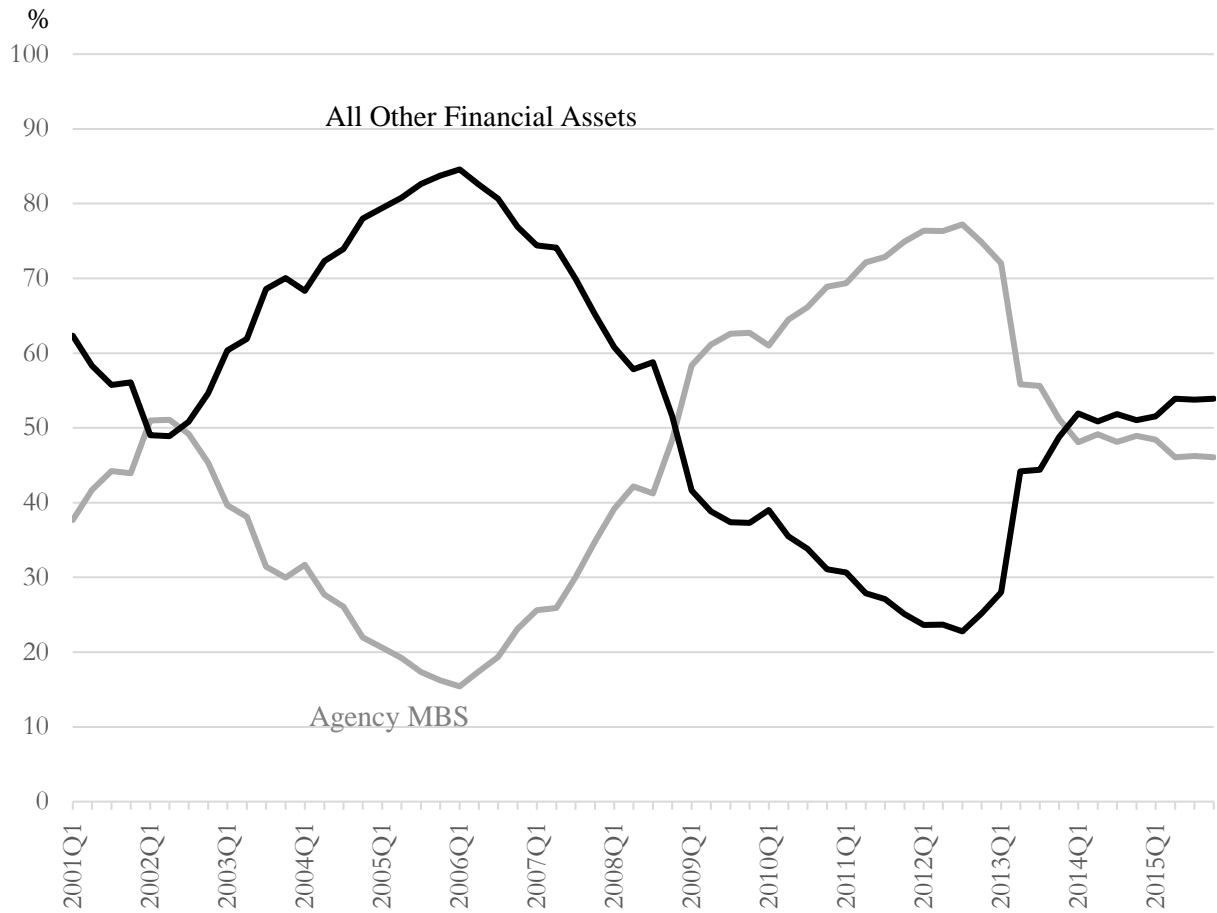
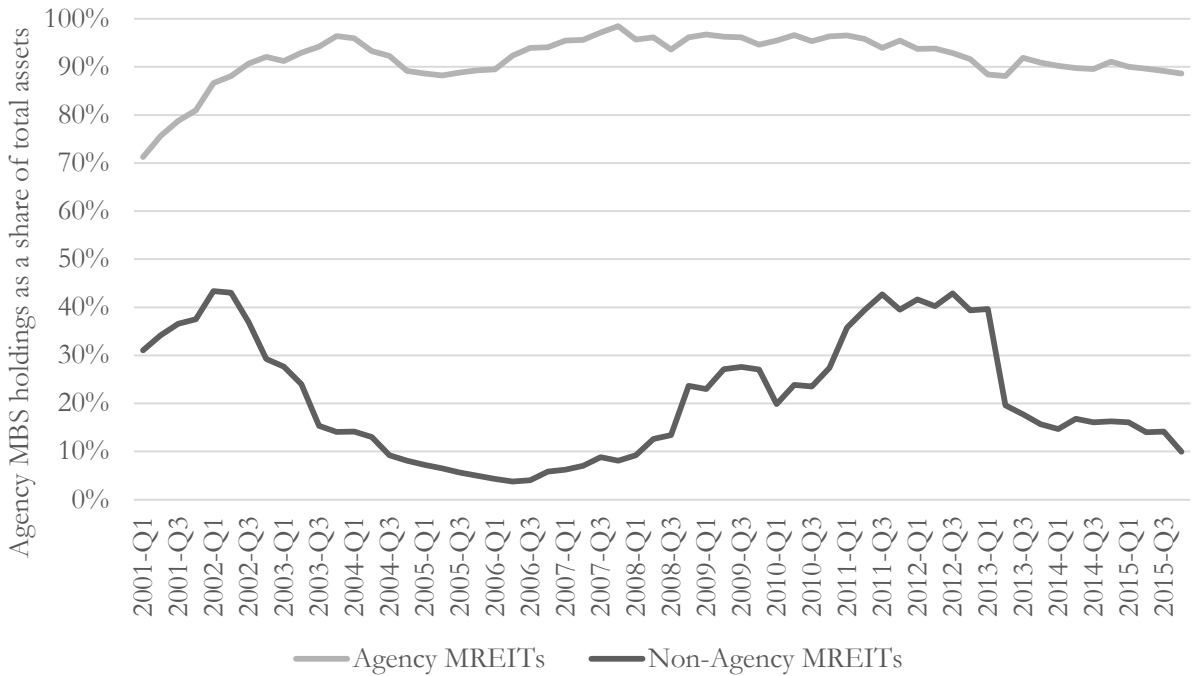


Figure 2: Mortgage REIT Asset Profile and Number of Firms: 2001-2015 (Quarterly)

Panel A: Mortgage REIT Holdings of Agency MBS (Percent of MREIT Total Assets)



Panel B: Number of Agency MREITs

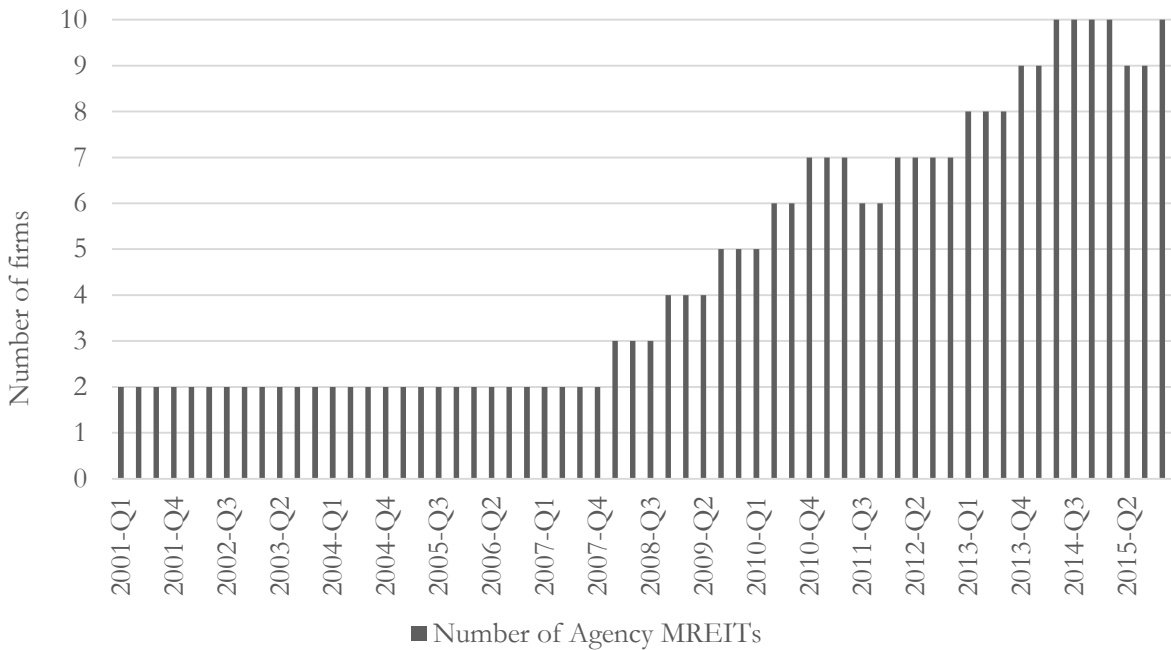


Figure 3: Agency MREIT Capital Structure: 2001-2015 (Quarterly)

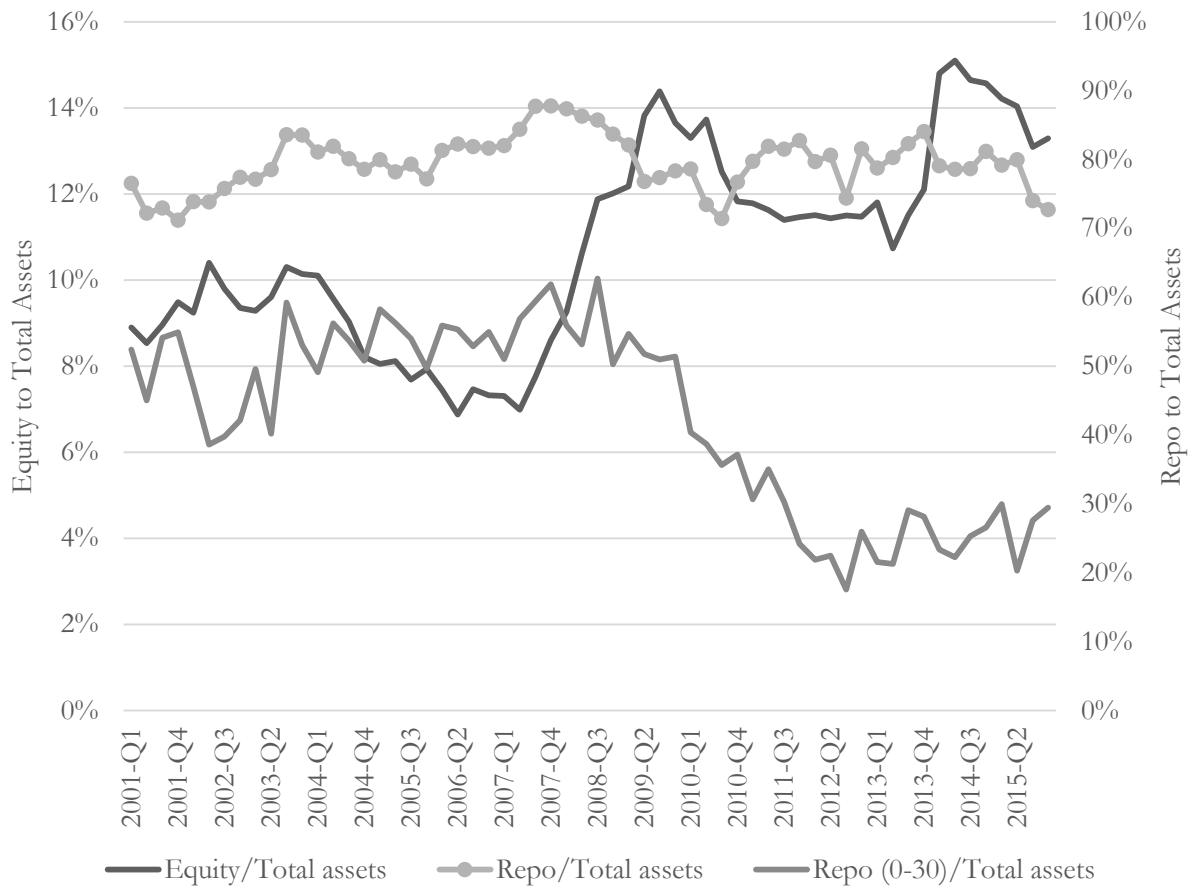


Figure 4: Agency MREIT Dividend Yields and the Slope of the U.S. Treasury Term Structure



Figure 5: Agency MREITs: Agency MBS Holdings and Market Share: 2001-2015 (Quarterly)

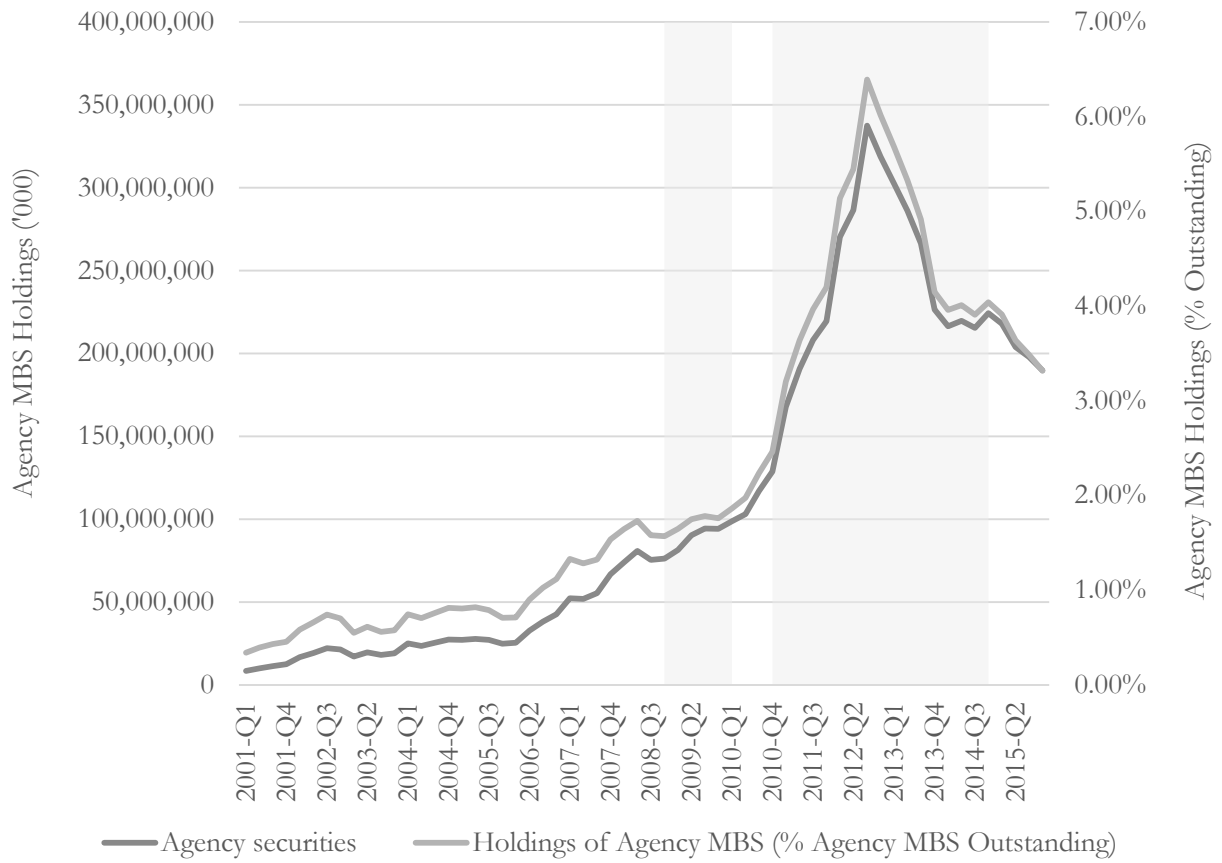


Figure 6: Agency MREIT Equity Issuance: 2001-2015 (Quarterly)

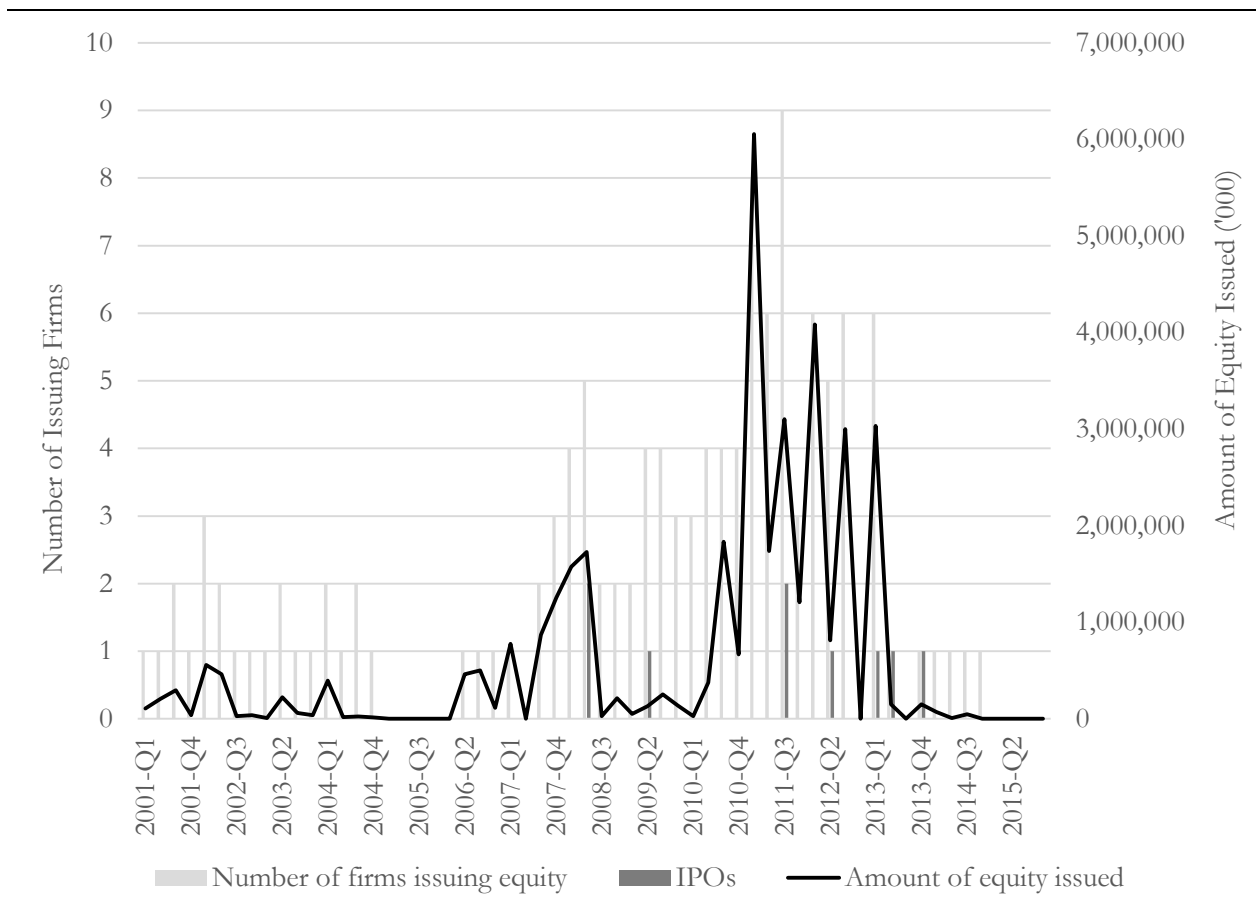
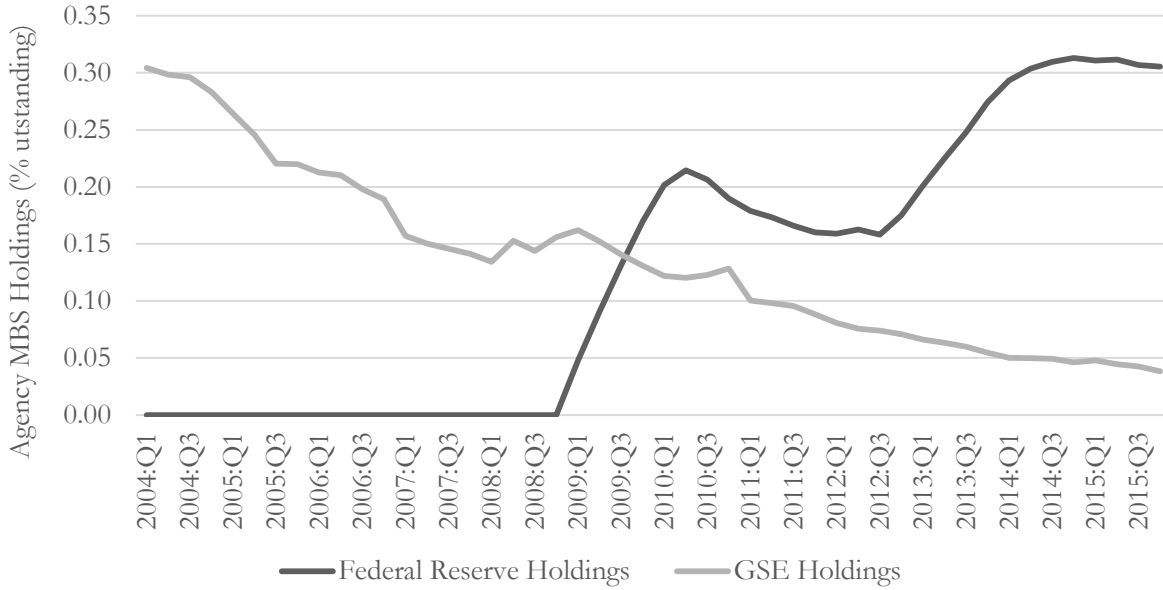


Figure 7: Federal Reserve and GSE Quarterly Holdings and Purchases of Agency MBS (Percentage of Quarterly Amounts Outstanding and New Issuance)

Panel A: Federal Reserve and GSE Holdings of Agency MBS Outstanding



Panel B: Federal Reserve and GSE Purchases of Agency MBS Issuance

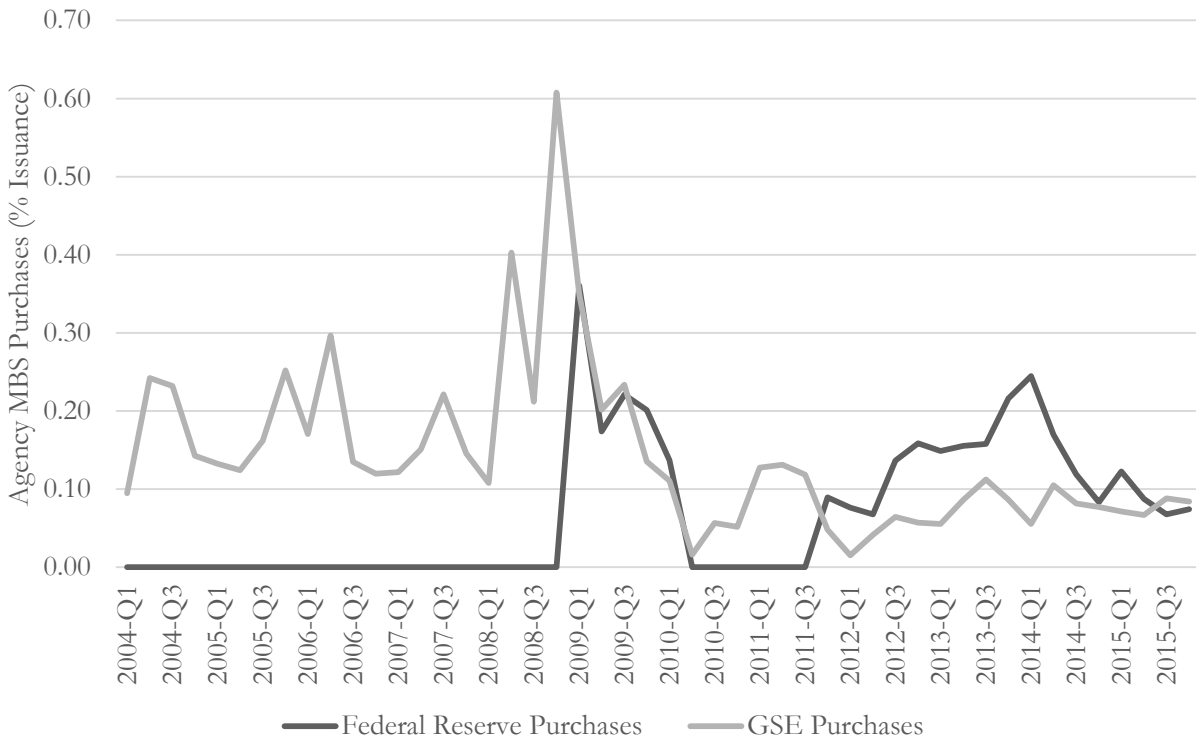


Table 1: Timeline of Federal Reserve Policy Actions: 2008-2014

	Announcement Date	Target End Date	Targeted Total Purchases	Composition of Purchases	Program Details as Announced
Quantitative Easing 1 (QE1) December 2008 – March 2010	November 25, 2008	Over Several Quarters	Agency Debt: Up to \$100b Agency MBS: Up to \$500b	Agency Debt and Agency MBS	Purchase up to \$100b of agency debt and up to \$500b of Agency MBS. Purchases expected to take place over several quarters.
	December 16, 2008	---	---	---	Lowered the Fed Funds rate to effective lower bound and stated that this was likely to remain for “some time”.
	March 18, 2009	Treasury Securities: September 30, 2009 (Completed Oct. 2009) Agency Debt & MBS December 31, 2009 (Completed Mar. 2010)	Agency Debt: Add \$100b Agency MBS: Add \$750b Long-Term Treasuries: \$300b	Agency Debt, Agency MBS, and Long-Term Treasuries	Total purchases of Agency MBS will now be up to \$1.25t and agency debt up to \$200b. Purchase up to \$300b of long-term Treasury securities over the next six months. Rates likely to remain at the effective lower bound for an “extended period”.
Quantitative Easing 2 (QE2) November 2010 – June 2011	November 3, 2010	June 30, 2011	Long-Term Treasuries: \$600b	Long-Term Treasuries	Purchase \$600b of long-term Treasury securities by the end of 2011:Q2 at a pace of about \$75b per month.
Policy Normalization Principles	June 22, 2011	---	---	---	
Maturity Extension Program (MEP) & Forward Guidance MEP: September 2011 – December 2012	August 9, 2011	---	---	---	Rates likely to remain at the effective lower bound at least until mid-2013.
	September 21, 2011	June 30, 2012	Long-Term Treasuries: \$400b	Long-Term Treasuries	Purchase, by the end of 2012:Q2, \$400b of Treasuries with remaining maturities between 6-30 years and sell an equal amount of Treasury securities with remaining maturities of 3 years or less.

	January 25, 2012	---	---	---	Rates likely to remain at the effective lower bound at least through late 2014.
	June 20, 2012	December 31, 2012	Amount Limited by Remaining Short-Term Treasuries	Long-Term Treasuries	Purchase Treasuries with remaining maturities between 6-30 years at the current pace and sell or redeem an equal amount of Treasury securities with remaining maturities of approximately 3 years or less.
Quantitative Easing 3 (QE3) September 2012 – December 2013	September 13, 2012	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$40b per month and continue Twist through year-end, increasing holdings of long-term securities in aggregate by \$85b. Rates likely to remain at the effective lower bound at least through mid-2015.
	December 12, 2012	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$40b per month and long-term Treasuries at a pace of \$45b per month after Twist ends at year-end. Rates likely to remain at the effective lower bound, but now conditional on economic indicators.
Tapering	December 18, 2013	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$35b per month and long-term Treasuries at a pace of \$40b per month after Twist ends at year-end.
	January 29, 2014	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$30b per month and long-term Treasuries at a pace of \$35b per month after Twist ends at year-end.
	March 19, 2014	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$25b per month and long-term Treasuries at a pace of \$30b per month after Twist ends at year-end.
	April 30, 2014	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$20b per month and long-term

					Treasuries at a pace of \$25b per month after Twist ends at year-end.
	June 18, 2014	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$15b per month and long-term Treasuries at a pace of \$20b per month after Twist ends at year-end.
	July 30, 2014	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$10b per month and long-term Treasuries at a pace of \$15b per month after Twist ends at year-end.
	September 17, 2014	None Given	None Given	Agency MBS and Long-Term Treasuries	Purchase Agency MBS at a pace of \$5b per month and long-term Treasuries at a pace of \$10b per month after Twist ends at year-end. Issue revised Policy Normalization Principles, which suggest that the policy rate will be moved before reducing portfolio size.
	October 29, 2014	---	---	Agency MBS and Long-Term Treasuries	No additional purchases of Agency MBS and long-term Treasuries; maintain balance sheet size through reinvestment (as previous).
Rate Hike	December 2015	---	---	---	---

Table 2: Descriptive Statistics

The table presents descriptive statistics for the variables of interest over the study period (2004-2015) resulting in 246 firm-quarter observations.

Variable	Mean	SD	P25	Median	P75	Min	Max
Total Assets	23.70	32.40	4.28	8.48	19.70	0.36	142.00
Growth in Assets	0.09	0.25	-0.02	0.02	0.10	-0.27	1.65
Issued Equity	0.30	0.46	0.00	0.00	1.00	0.00	1.00
Amount of Equity Issued	0.01	0.03	0.00	0.00	0.00	0.00	0.20
Price Return	-0.01	0.11	-0.08	-0.01	0.06	-0.30	0.34
Dividend Yield	0.13	0.05	0.11	0.13	0.16	0.00	0.26
Equity to Total Assets	0.12	0.04	0.10	0.11	0.14	0.06	0.35
Repo to Total Assets	0.81	0.07	0.78	0.83	0.87	0.54	0.91
Repo (0-30 days) to Total Repo	0.52	0.25	0.33	0.49	0.76	0.03	1.00
Repo (>30 days) to Total Repo	0.48	0.25	0.24	0.51	0.67	0.00	0.97
QE1	0.11	0.31	0.00	0.00	0.00	0.00	1.00
QE2	0.09	0.28	0.00	0.00	0.00	0.00	1.00
MEP	0.16	0.37	0.00	0.00	0.00	0.00	1.00
QE3	0.19	0.39	0.00	0.00	0.00	0.00	1.00
Tapering	0.35	0.48	0.00	0.00	1.00	0.00	1.00
Fed Purchase Share	9.54	8.36	0.00	8.74	15.53	0.00	36.08
GSE Purchase Share	11.19	9.31	5.70	8.62	12.75	1.52	60.75
Federal Funds Rate	0.60	1.36	0.07	0.09	0.15	0.04	5.34
Term Structure	2.26	0.82	1.97	2.25	2.79	-0.52	3.58
Mortgage Yield Spread	0.79	0.30	0.59	0.74	0.93	0.13	1.96
Volatility Index	6.26	1.82	4.96	5.78	7.16	4.05	14.07

Table 3: Pairwise Pearson Correlation Coefficients

The table presents pairwise Pearson correlation coefficients for the 246 firm-quarter observations on the variables of interest in the final sample over the study period (2004-2015). Asterisks denote significant differences of the estimated correlation coefficients from zero at the 5% level.

		QE1	QE2	MEP	QE3	Tapering	Fed Purchase Share	GSE Purchase Share
(1)	Total Assets	-0.0538	-0.0147	0.1863*	0.1585*	-0.0966	0.0495	-0.0660
(2)	Growth in Assets	-0.0208	0.3630*	0.0951	-0.1722*	-0.2300*	-0.1905*	-0.0805
(3)	Issued Equity	0.1705*	0.2792*	0.1237	-0.1572*	-0.4016*	-0.1924*	0.1555*
(4)	Amount of Equity Issued	-0.0585	0.3179*	0.0602	-0.0990	-0.1765*	-0.1424*	-0.0929
(5)	Price Return	0.1780*	0.0725	0.0020	-0.1804*	-0.1005	-0.0064	0.0911
(6)	Dividend Yield	0.2848*	0.1620*	0.0964	0.0017	-0.0515	0.1724*	0.0048
(7)	Equity to Total Assets	0.0898	-0.0335	-0.0638	-0.0726	0.3220*	0.2149*	-0.1245
(8)	Repo to Total Assets	-0.0779	-0.0863	0.0589	0.0718	-0.1675*	-0.0822	0.1627*
(9)	Repo (0-30 days) to Total Repo	0.0686	-0.0108	-0.0955	-0.1421*	-0.1888*	-0.1979*	0.2080*
(10)	Repo (>30 days) to Total Repo	-0.0686	0.0108	0.0955	0.1421*	0.1888*	0.1979*	-0.2080*

Table 4: Agency MREITs: Quarterly Asset Growth

The table presents the panel regression results for Agency MREIT asset growth (quarterly percentage change in the book value of assets) as a function of unconventional monetary policy regimes, the level, slope, and expected volatility of the term structure, the mortgage yield spread, and equity issuance over the study period (2004-2015). All estimates are produced using OLS. Firm fixed effects are included as indicated and robust standard errors (clustered by firm) are reported in parentheses. Significance is indicated as follows: *** p<0.01; ** p<0.05; * p<0.1.

VARIABLES	(1) Asset growth	(2) Asset growth	(3) Asset growth	(4) Asset growth	(5) Asset growth
Federal Funds Rate	0.011 (0.02)	0.017 (0.02)	0.004 (0.01)	0.047* (0.02)	0.012** (0.01)
Term Structure	0.019 (0.03)	-0.003 (0.02)	-0.024* (0.01)	0.024 (0.03)	0.000 (0.01)
Mortgage Yield Spread	-0.062 (0.09)	-0.163 (0.10)	-0.104*** (0.03)	-0.111 (0.08)	-0.098*** (0.03)
Volatility Index	-0.004 (0.01)	0.007 (0.01)	0.007 (0.00)	0.030* (0.01)	0.010* (0.01)
QE1	-0.040 (0.04)	-0.054 (0.06)	0.030 (0.03)		
QE2	0.236** (0.08)	0.181** (0.07)	0.081*** (0.02)		
MEP	0.028 (0.02)	0.001 (0.04)	0.013 (0.01)		
QE3	-0.168** (0.06)	-0.128*** (0.04)	-0.077*** (0.02)		
Tapering	-0.196** (0.08)	-0.114** (0.05)	-0.064*** (0.02)		
Issued Equity		0.212** (0.07)		0.266** (0.09)	
Amount of Equity Issued			7.632*** (1.02)		8.131*** (1.01)
Fed Purchase Share				-0.002 (0.00)	-0.002** (0.00)
GSE Purchase Share				-0.006** (0.00)	0.002 (0.00)
Observations	246	246	246	246	246
R-squared	0.268	0.384	0.831	0.327	0.810
Firm FE	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12

Table 5: Agency MREITs: Quarterly Equity Issuance

The table presents the OLS panel regression results for Agency MREIT equity issuance as a function of monetary policy regimes, interest rate controls, and the prior quarter's equity performance. L. denotes the lag operator. Columns (1), (3) and (5) show results for a binary issuance indicator. Columns (2), (4) and (6) show results for the amount of equity issued, scaled by total assets at the end of the previous quarter. Firm fixed effects are included as indicated; and robust standard errors (clustered by firm) are reported in parentheses. Significance is indicated as follows: *** p<0.01; ** p<0.05; * p<0.1.

VARIABLES	(1) Equity issued	(2) Amount issued	(3) Equity issued	(4) Amount issued	(5) Equity issued	(6) Amount issued
Federal Funds Rate	0.006 (0.03)	0.003 (0.00)	0.061* (0.03)	0.005 (0.00)	0.059 (0.04)	0.006 (0.00)
Term Structure	0.074 (0.07)	0.004 (0.00)	0.125 (0.08)	0.008 (0.01)	0.125 (0.08)	0.009 (0.01)
Mortgage Yield Spread	0.454*** (0.13)	0.004 (0.01)	0.413** (0.14)	0.003 (0.01)	0.407** (0.13)	0.006 (0.01)
Volatility Index	-0.060** (0.02)	-0.002 (0.00)	-0.045** (0.02)	-0.002 (0.00)	-0.046*** (0.02)	-0.001 (0.00)
L.Dividend Yield	2.642*** (0.83)	0.149*** (0.04)	3.948*** (0.91)	0.150** (0.06)	3.929*** (0.93)	0.160** (0.06)
L.Price Return	0.817*** (0.14)	0.068** (0.03)	1.066*** (0.21)	0.071** (0.03)	1.064*** (0.20)	0.072** (0.03)
QE1	-0.030 (0.18)	-0.017* (0.01)				
QE2	0.236*** (0.07)	0.017** (0.01)				
MEP	0.051 (0.11)	-0.004 (0.00)				
QE3	-0.128* (0.06)	-0.008 (0.01)				
Tapering	-0.329*** (0.10)	-0.015 (0.01)				
L.Fed Purchase Share			-0.010** (0.00)	-0.001 (0.00)	-0.067*** (0.02)	0.000 (0.00)
L.GSE Purchase Share					0.005 (0.04)	-0.000* (0.00)
Observations	246	246	246	246	246	246
R-squared	0.331	0.263	0.252	0.172	0.253	0.188
Firm FE	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12

Table 6: Agency MREITs: Quarterly Equity Price Return

The table presents the panel regression results for Agency MREIT equity price returns as a function of monetary policy regimes, interest rate controls, financing structure, and equity issuance over the study period. L. denotes the lag operator. All estimates are produced using OLS. Robust standard errors (clustered by firm) are reported in parentheses. Significance is indicated as follows: *** p<0.01; ** p<0.05; * p<0.1.

VARIABLES	(1) Price return	(2) Price return	(3) Price return	(4) Price return	(5) Price return	(6) Price return
Federal Funds Rate	-0.031** (0.01)	-0.033** (0.01)	0.000 (0.01)	-0.001 (0.01)	0.002 (0.01)	-0.017*** (0.00)
Term Structure	-0.060** (0.02)	-0.068** (0.02)	-0.019 (0.02)	-0.019 (0.02)	-0.022 (0.02)	0.012* (0.01)
Mortgage Yield Spread	-0.024 (0.05)	-0.044 (0.05)	0.010 (0.04)	0.009 (0.04)	-0.008 (0.04)	0.023* (0.01)
Volatility Index	-0.006 (0.01)	-0.006 (0.01)	0.005 (0.01)	0.005 (0.01)	0.006 (0.01)	0.005 (0.00)
L.Repo (0-30 days) to Total Repo	0.100 (0.08)	0.103 (0.08)	0.108 (0.08)	0.106 (0.08)	0.102 (0.08)	0.003 (0.01)
L.Repo (>30 days) to Total Repo	0.067 (0.07)	0.067 (0.07)	0.045 (0.06)	0.044 (0.06)	0.041 (0.07)	-0.011 (0.02)
L.Equity to Total Assets	0.161 (0.45)	0.137 (0.48)	0.613 (0.47)	0.606 (0.49)	0.680 (0.41)	-0.305 (0.17)
L.Issued Equity	-0.039 (0.02)		-0.023 (0.02)	-0.023 (0.02)		
l.Amount of Equity Issued		-0.120 (0.29)			0.192 (0.19)	0.149** (0.07)
QE1	0.082*** (0.02)	0.083*** (0.02)				
QE2	0.058* (0.03)	0.057 (0.03)				
MEP	-0.048 (0.03)	-0.062** (0.03)				
QE3	-0.083** (0.03)	-0.080** (0.03)				
Tapering	-0.071** (0.02)	-0.062** (0.03)				
Fed Purchase Share			0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
GSE Purchase Share				0.000 (0.00)		0.000 (0.00)
Observations	246	246	246	246	246	246
R-squared	0.157	0.140	0.038	0.038	0.032	0.586
Firm FE	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12

Table 7: Agency MREITs: Quarterly Dividend Yields

The table presents the panel regression results for Agency MREIT dividend yields as a function of monetary policy regimes, interest rate controls, financing structure, and equity issuance over the study period. L. denotes the lag operator. All estimates are produced using OLS. Robust standard errors (clustered by firm) are reported in parentheses. Significance is indicated as follows: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

VARIABLES	(1) Dividend yield	(2) Dividend yield	(3) Dividend yield	(4) Dividend yield	(5) Dividend yield	(6) Dividend yield
Federal Funds Rate	-0.016*** (0.00)	-0.016*** (0.00)	-0.017*** (0.00)	-0.017*** (0.00)	-0.017*** (0.00)	-0.017*** (0.00)
Term Structure	0.016** (0.01)	0.018* (0.01)	0.011** (0.01)	0.011** (0.01)	0.012** (0.01)	0.012* (0.01)
Mortgage Yield Spread	0.015 (0.01)	0.018 (0.01)	0.016 (0.01)	0.017 (0.01)	0.021 (0.01)	0.023* (0.01)
Volatility Index	0.003 (0.00)	0.004 (0.00)	0.004 (0.00)	0.005 (0.00)	0.005* (0.00)	0.005 (0.00)
L.Repo (0-30 days) to Total Repo	-0.004 (0.01)	-0.006 (0.01)	0.001 (0.01)	0.003 (0.01)	0.000 (0.01)	0.003 (0.01)
L.Repo (>30 days) to Total Repo	-0.006 (0.02)	-0.008 (0.02)	-0.010 (0.02)	-0.009 (0.02)	-0.013 (0.02)	-0.011 (0.02)
L.Equity to Total Assets	-0.382** (0.16)	-0.360* (0.17)	-0.329* (0.16)	-0.322* (0.16)	-0.314* (0.17)	-0.305 (0.17)
L.Issued Equity	0.009* (0.01)		0.015* (0.01)	0.015* (0.01)		
L.Amount of Equity Issued		0.114* (0.06)			0.150* (0.07)	0.149** (0.07)
QE1	0.005 (0.01)	0.006 (0.01)				
QE2	-0.016** (0.01)	-0.017** (0.01)				
MEP	0.010 (0.01)	0.013 (0.01)				
QE3	-0.012** (0.00)	-0.011** (0.01)				
Tapering	-0.011 (0.01)	-0.011 (0.01)				
Fed Purchase Share			0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
GSE Purchase Share				0.000 (0.00)		0.000 (0.00)
Observations	246	246	246	246	246	246
R-squared	0.634	0.632	0.600	0.600	0.584	0.586
Firm FE	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12

Table 8: Agency MREITs: Quarterly Risk Measures

The table presents the panel regression results for measures of Agency MREIT risk: The ratio of total equity to total assets, the ratio of repurchase agreements to total assets, and the share of repo with less than 30 days maturity. These risk measures are each regressed on indicator variables for monetary policy regimes, interest rate controls and equity issuance. All estimates produced using OLS. Robust standard errors (clustered by firm) are reported in parentheses. Significance is indicated as follows: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Panel A: Equity to Total Assets

VARIABLES	(1) Equity/ Assets	(2) Equity/ Assets	(3) Equity/ Assets	(4) Equity/ Assets	(5) Equity/ Assets	(6) Equity/ Assets
Federal Funds Rate	-0.008** (0.00)	-0.008** (0.00)	-0.006 (0.00)	-0.006 (0.00)	-0.006 (0.00)	-0.006 (0.00)
Term Structure	0.002 (0.00)	0.002 (0.00)	0.006 (0.00)	0.006 (0.00)	0.006 (0.00)	0.006 (0.00)
Mortgage Yield Spread	-0.012** (0.01)	-0.010* (0.01)	-0.003 (0.01)	-0.004 (0.01)	-0.002 (0.01)	-0.003 (0.01)
Volatility Index	-0.001 (0.00)	-0.001* 0.00	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	-0.001 (0.00)
L.Issued Equity	0.000 (0.00)		-0.002 (0.00)	-0.001 (0.00)		
L.Amount of Equity Issued		-0.076 (0.06)			-0.084 (0.07)	-0.079 (0.07)
QE1	0.012*** (0.00)	0.011** (0.00)				
QE2	-0.003 (0.01)	-0.002 (0.01)				
MEP	-0.006 (0.00)	-0.006 (0.00)				
QE3	-0.01 (0.01)	-0.011* (0.01)				
Tapering	0.002 (0.01)	0.000 (0.01)				
L.Fed Purchase Share			0.000* (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
L.GSE Purchase Share				0.000* (0.00)		0.000 (0.00)
Observations	246	246	246	246	246	246
R-squared	0.425	0.433	0.365	0.370	0.375	0.378
Firm FE	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12

Panel B: Repurchase Agreements to Total Assets

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Repo/ Assets	Repo/ Assets	Repo/ Assets	Repo/ Assets	Repo/ Assets	Repo/ Assets
Federal Funds Rate	0.024** (0.01)	0.024** (0.01)	0.008 (0.01)	0.008 (0.01)	0.008 (0.01)	0.008 (0.01)
Term Structure	0.009 (0.01)	0.008 (0.01)	-0.013 (0.01)	-0.013 (0.01)	-0.014 (0.01)	-0.014 (0.01)
Mortgage Yield Spread	0.037* (0.02)	0.033 (0.02)	0.015 (0.02)	0.015 (0.02)	0.013 (0.02)	0.012 (0.02)
Volatility Index	0.004 (0.00)	0.004 (0.00)	0.001 (0.00)	0.001 (0.00)	0.002 (0.00)	0.002 (0.00)
L.Issued Equity	-0.004 (0.01)		0.000 (0.01)	0.000 (0.01)		
L.Amount of Equity Issued		0.140* (0.07)			0.134** (0.05)	0.136*** (0.04)
QE1	-0.006 (0.02)	-0.005 (0.02)				
QE2	0.020 (0.02)	0.018 (0.02)				
MEP	0.048** (0.02)	0.047** (0.02)				
QE3	0.040** (0.02)	0.042** (0.02)				
Tapering	0.035* (0.02)	0.039* (0.02)				
L.Fed Purchase Share			0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
L.GSE Purchase Share				0.000 (0.00)		0.000 (0.00)
Observations	246	246	246	246	246	246
R-squared	0.212	0.215	0.133	0.133	0.137	0.137
Firm FE	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12

Panel C: Repurchase Agreements (0-30 days maturity) to Total Repurchase Agreements

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Repo (0-30)/ Repo	Repo (0-30)/ Repo	Repo (0-30)/ Repo	Repo (0-30)/ Repo	Repo (0-30)/ Repo	Repo (0-30)/ Repo
Federal Funds Rate	0.028 (0.06)	0.027 (0.06)	0.029 (0.06)	0.025 (0.06)	0.029 (0.06)	0.025 (0.06)
Term Structure	0.047* (0.03)	0.045 (0.03)	0.052* (0.03)	0.050* (0.02)	0.054** (0.02)	0.052** (0.02)
Mortgage Yield Spread	0.025 (0.05)	0.026 (0.04)	0.025 (0.05)	0.009 (0.05)	0.033 (0.05)	0.017 (0.04)
Volatility Index	0.004 (0.01)	0.003 (0.01)	0.004 (0.01)	-0.001 (0.01)	0.003 (0.01)	-0.001 (0.01)
L.Issued Equity	-0.012 (0.03)		0.003 (0.04)	0.004 (0.04)		
L.Amount of Equity Issued		-0.426 (0.43)			-0.330 (0.49)	-0.260 (0.50)
QE1	0.001 (0.02)	-0.002 (0.02)				
QE2	-0.026 (0.04)	-0.019 (0.04)				
MEP	0.025 (0.04)	0.021 (0.03)				
QE3	-0.051 (0.04)	-0.054 (0.04)				
Tapering	-0.045 (0.06)	-0.049 (0.06)				
L.Fed Purchase Share			-0.003 (0.00)	-0.003* (0.00)	-0.003 (0.00)	-0.003* (0.00)
L.GSE Purchase Share				0.002 (0.00)		0.002 (0.00)
Observations	246	246	246	246	246	246
R-squared	0.073	0.076	0.065	0.075	0.067	0.076
Firm FE	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12

9 Appendix

Appendix 1 Agency MREITs: Quarterly Equity Issuance

The table presents the OLS panel regression results for Agency MREIT equity issuance as a function of monetary policy regimes, interest rate controls, and the prior quarter's equity performance. L. denotes the lag operator. Columns (1), (3) and (5) show Logit models for a binary issuance indicator. Columns (2), (4) and (6) show Tobit models for the amount of equity issued, scaled by total assets at the end of the previous quarter. Firm fixed effects are included as indicated; and robust standard errors (clustered by firm) are reported in parentheses. Significance is indicated as follows: *** p<0.01; ** p<0.05; * p<0.1.

VARIABLES	(1) Equity issued	(2) Amount issued	(3) Equity issued	(4) Amount issued	(5) Equity issued	(6) Amount issued
Federal Funds Rate	0.139 (0.27)	0.002 (0.01)	0.393** (0.17)	0.012* (0.01)	0.380** (0.18)	0.013* (0.01)
Term Structure	0.286 (0.52)	0.001 (0.01)	0.722 (0.47)	0.018 (0.01)	0.713 (0.45)	0.017 (0.01)
Mortgage Yield Spread	2.170*** (0.80)	0.031 (0.03)	2.409** (0.97)	0.041 (0.03)	2.364** (0.96)	0.044 (0.03)
Volatility Index	-0.352** (0.16)	-0.009* (0.01)	-0.289** (0.12)	-0.008* (0.01)	-0.299*** (0.09)	-0.007* 0.00
L.Dividend Yield	20.525*** (5.50)	0.626*** (0.22)	24.048*** (4.70)	0.707*** (0.25)	24.057*** (4.73)	0.709*** (0.25)
L.Price Return	5.499*** (1.48)	0.196** (0.08)	6.731*** (1.44)	0.206*** (0.08)	6.742*** (1.46)	0.207*** (0.08)
QE1	-0.303 (0.83)	-0.035 (0.02)				
QE2	1.071*** (0.41)	0.024*** (0.01)				
MEP	0.106 (0.70)	-0.015 (0.01)				
QE3	-0.898** (0.45)	-0.032*** (0.01)				
Tapering	-2.473** (1.03)	-0.068** (0.03)				
L.Fed Purchase Share			-0.066*** (0.02)	-0.002*** 0.00	-0.067*** (0.02)	-0.002*** 0.00
L.GSE Purchase Share					0.005 (0.04)	-0.001 0.00
Observations	246	246	246	246	246	246
R-squared	n/a	n/a	n/a	n/a	n/a	n/a
Firm FE	N	N	N	N	N	N
Firm clusters	12	12	12	12	12	12