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

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Abstract

The Federal Reserve's unconventional monetary policy since the financial crisis has raised concerns about the potential for excessive risk-taking by financial institutions. The U.S. Financial Stability Oversight Council was specifically concerned about the rapid growth of Agency mortgage REITs (Agency MREITs), a group of specialized, tax-exempt financial institutions investing in mortgage-backed securities (MBS). This paper studies whether and how the central banks' policy actions influenced the behavior of these institutions. We find that Agency MREIT growth was inversely associated with Federal Reserve activity in the Agency MBS market – consistent with the crowding-out of private investment as per the portfolio balance channel of unconventional monetary policy. Equity returns for these REITs also seem to reflect the presence or absence of growth opportunities for them in the Agency MBS market depending on the central banks' posture. Consistent with the risk-taking channel of monetary policy, Agency MREITs seemingly reduced their interest rate hedging during the initial stages of quantitative easing, as the Federal Reserve indicated policy rates would remain low for a considerable period of time. This trend later reversed after the central bank resumed Agency MBS purchases during QE3 and through their tapering of such purchases.

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 2016, the U.S. central banks' balance sheet grew from $0.9 trillion to $4.5 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] Recently, the Federal Reserve's Federal Open Market Committee (FOMC) has started to raise the short-term policy rate and announced a balance sheet normalization plan that intends to slowly and predictably reduce the central banks' portfolio via run-off.[2]

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 U.S. Treasury and Federal Agency mortgage-backed securities.[3] These effects are believed to result from reduced term premiums and from 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). The announcement of asset 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 amplified these effects.

As U.S. monetary policy accommodation has lingered, there is growing concern about the potential for financial stability risks to emerge. For example, Bernanke (2013) notes that maintaining low interest rates for

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[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] The June 2017 Addendum to the FOMC's Policy Normalization Principles and Plans is available at: https://www.federalreserve.gov/newsevents/pressreleases/monetary20170614c.htm. At its September 2017 meeting, the FOMC voted to implement this program starting in October.

[3] 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).

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." While such risk-taking behavior is seemingly an intended consequence of unconventional monetary policy, recent theoretical research points to it being potentially distorted by agency problems associated with delegated asset management (e.g., Rajan 2005; Feroli, Kashyap, Schoenholtz, and Shin 2014; Acharya and Naqvi 2015; Morris and Shin 2016). Specifically, very low interest rate environments make asset managers especially sensitive to a funds' relative performance, which induces them to take-on more risk than would otherwise be the case. Related empirical evidence is provided by Chodorow-Reich (2014), DiMaggio and Kacperczyk (2014), and Choi and Kronlund (2015); each of whom finds evidence of heightened risk-taking for different types of non-bank financial institutions since the Federal Reserve set its policy rate equal to the effective lower bound. This research is part of a new (and broader) literature describing the existence of a "risk taking channel" of monetary policy; one that is distinct from the familiar interest rate and credit channels (e.g., Adrian and Shin, 2010; Borio and Zhu, 2012).[4]

This paper examines 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). These shadow banks hold mortgage-backed securities (MBS) guaranteed by U.S. government agencies (Fannie Mae, Freddie Mac, and Ginnie Mae) and finance them primarily 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) raised the specter of financial stability concerns emanating from Agency MREITs. The Council's thesis is that these institutions are vulnerable to a sharp increase in interest rates that would erode the value of their assets. Given

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[4] Empirical analysis of bank behavior suggests that they make *ex ante* riskier loans as monetary policy becomes more accommodative – and that this effect that is stronger for better capitalized banks (Jimenez, Ongena, Peydro, and Saurina, 2014; Ioannidou, Ongena, and Peydro, 2015; Dell'Ariccia, Leaven, and Suarez, 2017). Related research finds that accommodative monetary policy is associated with tighter yield spreads for U.S. corporate loans – particularly for the riskiest borrowers (Delis, Hasan, and Mylolonidis, 2017; Paligorova and Santos, 2017).

Agency MREITs' reliance on short-term collateralized borrowing, this could lead to dealer margin calls, increases in 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 (or equivalently upward pressure on yields). The underlying assumption is that Agency MREITs are expected to act in unison in response to a shock given their homogenous business model. This thesis is supported by the fact that 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 and in the context of the Federal Reserve's unconventional monetary policies. First, we study the rapid growth of these institutions in terms of total assets and equity issuance. We find that Agency MREIT growth was inversely associated with Federal Reserve activity in the Agency MBS market – consistent with the crowding-out of private investment as per the portfolio balance channel. Our second analysis focuses on the relationship between Agency MREIT risk-taking and unconventional monetary policy. Consistent with the risk-taking channel, Agency MREITs seem to have curtailed their interest rate hedging during the initial stages of quantitative easing, as the Federal Reserve indicated policy rates would remain long for a considerable period of time. This trend subsequently reversed after the central bank resumed Agency MBS purchases during QE3 and through their tapering of such purchases.

The first part of our analysis relating unconventional monetary policy to the growth and profitability of Agency MREITs is most similar 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 defined-benefit pension funds. He finds significant benefits of the QE1 announcement 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 most closely related to three recent papers. First, DiMaggio and Kacperczyk (2016) find that, at the zero lower bound, money market funds increased their risk as measured by: yield spreads, the fraction of bank-issued obligations held, asset concentration, and weighted-average maturity.

Second, Choi and Kronlund (2017) study corporate bond mutual funds and find that "reaching for yield" behavior is more pronounced when the level and slope of the term structure are low. Finally, Chodorow-Reich (2014) provides some evidence that money funds and pension funds increased their risk-taking during 2009-2011.

Our study 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.[5] This is potentially important given the prominent role that these shadow banks could play going forward in the Agency MBS market given the post-conservatorship shrinkage of such holdings by Fannie Mae and Freddie Mac. Second, given that Agency MREITs do not take-on much credit risk, we are able to focus on whether these institutions alter instead their leverage, liquidity risk, and interest rate risk profiles during unconventional monetary policy periods. Our focus on the effects of unconventional monetary policy on the capital structure of these shadow banks is in sharp contrast to the extant literature, which has focused exclusively on credit risk-taking by banks, 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

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[5] Pellerin, Sabol, and Walter (2013) provide a descriptive overview of these institutions.

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.[6] 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.

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-backed securities that are secured by residential and commercial properties.[7] 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.[8] 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

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[6] 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.

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

[8] 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 their MBS in exchange for guarantee fees (insurance premiums) from mortgage originators.

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.[9] 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 a pre-specified amount. This explains why Agency MREITs hold 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.]

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[9] 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 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.

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 average Agency MREIT dividend yields from SNL Financial and the spread between 10-year and 3-month U.S. Treasury constant maturity rates 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 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.

[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. Policymakers were concerned about 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 short-term liabilities and a large-scale sell-off in the Agency MBS market. However, a systematic empirical analysis of agency MREIT growth

and risk taking in the context of the Federal Reserve's unconventional monetary policy measures is absent from the existing literature.

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 the 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 the remainder of their life in the sample; (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. These definitions of Agency MREIT types are stable throughout our sample period in the sense that no firm jumps in and then out of the Agency MREIT definition. Firms leave the sample when they become inactive/defunct.

For each Agency MREIT, we collect the following quarterly balance sheet information from SNL Financial: Total Assets, Total Agency MBS, Total Repo Debt (with sub-categories reflecting different maturities), and Total Equity. This information reflects the simplicity of the MREIT business model. We further obtain quarterly performance information as measured by equity price returns and dividend yields, as well as information about whether an Agency MREIT issued equity or repurchased shares in a particular quarter, and the amount issued or number of shares repurchased. We also gather daily total return data to calculate risk-adjusted performance. Finally, we hand-collect data on Agency MREIT's derivative positions from their respective 10-K and 10-Q reports.

The principal drivers of Agency MREIT activity and profitability are related to interest rates. The level of short-term interest rates corresponds to their funding costs, while the slope of the term structure provides a

measure of interest margin. We use interest rate data from the Federal Reserve Bank of St. Louis to construct measures of the level (3-month CMT) and slope of the U.S. Treasury yield curve (10-year CMT less 3-month CMT). The option-adjusted mortgage spread (OAS) is important as a measure of the "attractiveness" of Agency MBS versus holding long-term Treasury bonds.[10] We use Bloomberg Barclay's US MBS Fixed Rate Average OAS as a proxy.[11]

We are interested in learning about changes in the behavior of Agency MREITs during the late-2000s, and the extent to which their behavior responded 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. It 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 this 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 (2013:Q4-2014:Q3), the Federal Reserve continued but methodically slowed the pace of long-term asset purchases.

[Table 1 about here.]

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[10] The mortgages underlying the Agency MBS all include embedded continuous prepayment option, whose value increases in the volatility of mortgage rates. The OAS measures the yield spread of the MBS after adjusting for the value of the option.

[11] Ideally, one would want to know the holdings of each institution at each point in time and collect the related OAS in order to build-up an institution-specific portfolio OAS. Unfortunately, such information is not available because MREITs do not file form 13-f.

To supplement the information about the QE regimes, we obtain 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. Figure 7 presents the Federal Reserve's share of newly issued securities and share of total securities outstanding for each quarter over the 2008-2015 period. The central bank absorbed 86 percent of new issuance during 2009:Q1 (the start of QE1 purchases), before halting purchases one year later. The Federal Reserve renewed purchases of Agency MBS during 2011:Q4, although this amount steadily declined during the tapering period. In terms of holdings, the central bank first peaked at over 22 percent of Agency MBS outstanding by the end of QE1. This share leveled-off during QE2 and the MEP before ramping up and remaining steady at about 30 percent from 2014.

[Figure 7 about here.]

Table 2 presents descriptive statistics for our Agency MREIT sample, which includes 238 firm-quarter observations from 12 Agency MREITs over the 2005-2015 timeframe.[12] These 12 firms represent the universe of Agency MREITs during our study period. Total assets for Agency MREITs averaged $24.2 billion during this period. Consistent with the tremendous growth documented above, 29 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 -0.01 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 equity-to-assets 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 51 percent. The average share of swaps to repurchase agreements outstanding was 47 percent; adding in swaptions increased this figure to 52 percent. However, these shares ranged from zero to 131 percent. The average 3-month constant maturity Treasury rate was 0.50 percent, but ranged from 0.01 to 5.08 percent. In terms of other variables capturing the interest rate environment, the slope of the term structure averaged 2.25 percent and the option-adjusted mortgage spread

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[12] We start in 2005 due to some data limitations, although we lose little as there were only two firms previously operating.

averaged 0.46 percent. The Federal Reserve's quarterly average Agency MBS purchase share was 29 percent, but ranged from zero to 86 percent.

[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 periods. We find that Agency MREIT asset growth is positively correlated with QE2 and negatively correlated with QE3, suggesting an inverse relationship with the Federal Reserve's activity in the Agency MBS market. Equity issuance is positively correlated with the QE1, QE2, and MEP periods; it is negatively correlated with the QE3 and Tapering regimes. Trends in equity issuance thus appear in line with trends in asset growth. Share repurchase activity largely follows the opposite course. Agency MREIT equity price appreciation is negatively correlated with QE3. Dividend yields are positively related to QE1 and QE2, and negatively related to the Tapering period. In terms of financing, the equity to total assets ratio is positively correlated with the Tapering regime, and repurchase agreements skew longer term during this time, suggesting a more conservative approach to capital structure policy. The use of interest rate derivatives (swaps and swaptions) is negatively correlated with the QE1 period, but then positively related to the QE3 and Tapering periods. This suggests that Agency MREITs sought to protect themselves during periods of heightened risk to their business.

[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 business model is predicated on the level and slope of the term structure and the relative attractiveness of Agency MBS versus Treasury bonds. To capture this, we include three variables. First, we have the 3-month constant maturity Treasury rate (3-Month CMT). The second is 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. Finally, we include the option-adjusted mortgage spread (Option Adjusted Spread).

Next, we consider a set of relevant firm characteristics. Given that REITs must distribute a large fraction of their earnings as dividends, asset growth must largely be financed through new equity issuance. We examine this 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). Since REITs may also contract, we include either an indicator that the institution repurchased shares in a given quarter (Repurchased Shares) or the number of shares repurchased as a percentage of total shares outstanding at the end of the previous quarter (Number of Shares Repurchased).

Our empirical specification further 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. Given that we control for the level and slope of the term structure and option-adjusted spread, these indicators can be viewed as largely capturing QE-specific effects that may differ by episode. In some specifications, we also consider the effects of the Federal Reserve's quarterly purchase shares of Agency MBS that can be viewed as mainly reflecting the portfolio balance channel of monetary policy.

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

(1) Asset Growth$_{it}$ = f(Interest Rate Variables$_t$, Firm Characteristics$_{it}$, Monetary Policy Variables$_t$,) + α_i + ε_{it}

We next examine equity issuance further, given its important role in supporting Agency MREIT growth. Equation 2 examines the determinants of equity issuance (an indicator for Issued Equity and, alternatively, the Amount of Equity Issued) in the same general framework, using interest rate variables, firm characteristics, and monetary policy variables as predictors. Here, the relevant firm characteristic is the lagged value of the Agency MREITs' market-to-book ratio of equity, which captures market timing considerations that drive equity issuance decisions (Baker and Wurgler, 2000). L. denotes the lag operator. Fixed effects regressions are estimated via OLS with standard errors clustered by firm.

(2) Equity Issuance$_{it}$ = f(Interest Rate Variables$_t$, L.Firm Characteristics$_{it}$, Monetary Policy Variables$_{t, it-1}$) + α_i + ε_{it}

Next, we examine equity price returns and risk-adjusted returns using Sharpe Ratios. We use OLS regressions with firm fixed effects to estimate these return outcomes as a function of interest rate variables, lagged firm characteristics, and monetary policy variables. The relevant firm characteristics in this case are Repo Debt (0-30 days) to Total Repo Debt, Equity to Total Assets, Cash to Total Assets, Swaps and Swaptions to Total Repo Debt, and, in alternative versions of the model, indicators for Equity Issuance, Share Repurchases, the Amount of Equity Issued, or the Number of Shares Repurchased. We control for the firms' financing structure since it influences stock prices, as per the pecking order theory, and because it affects the riskiness of equity by increasing the exposure of the firm's equity to variation in the market return. Controlling for cash holdings reflects Agency MREIT liquidity positions and the use of interest rate derivatives to hedge their exposure to changes in interest rates. Equation (3) summarizes the regression model, where we employ either price returns or Sharpe Ratios as the dependent variable. Again, we estimate the model via OLS with standard errors clustered by firm.

(3) $\text{Returns}_{it} = f(\text{Interest Rate Variables}_t, \text{L.Firm Characteristics}_{it-1}, \text{Monetary Policy Variables}_t) + \alpha_i + \varepsilon_{it}$

Finally, we explore-various Agency MREIT risk measures in a similar framework. We estimate quarterly fixed-effect OLS panel models exploring the following variables: the ratio of equity to total assets, the ratio of repurchase agreements to total assets, the ratio of cash (and cash equivalents) to total assets, and the ratio of interest rate swaps (and swaptions) to repurchase agreements. Equation (4) summarizes these relationships, where the dependent variable, denoted Risk, stands for the risk measures outlined above. Again, we use interest rate variables, monetary policy variables, and firm characteristics as predictors. The relevant firm characteristics are different combinations of the lagged financing structure variables we used in the equity return regressions above. Firm fixed effects are included as before, and we estimate the model via OLS with standard errors clustered by firm.

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

5   Empirical Results

5.1   Agency MREITs: Growth and Equity Issuance

Table 4 presents the results of our asset growth regressions. Not surprisingly, both measures of equity issuance are strongly associated with Agency MREIT asset growth. This is especially true of the relative amount of equity issued, which dramatically improves the in-sample fit of the regressions. Conversely, we find that Agency MREIT growth is negatively related to our measures of share repurchase activity. The issuance findings reflect the strict pay-out requirements for REITs, and the resulting reliance on external funding to finance growth. Agency MREITs grew significantly during QE2. Conditioning on Federal Reserve purchase shares, we find that they also grew during QE3, although at a rate that declined with contemporaneous central bank purchases. Given that our sample firms invest almost exclusively in Agency MBS, their investment opportunities were highly constrained by central bank activity in this market.

[Table 4 about here.]

Given the important role of equity issuance for Agency MREIT growth, we examine this directly in Table 5. Columns (1)-(4) explore variation in the issuance decision. In each case, lagged market-to-book ratios are positive and statistically significant – consistent with market timing considerations. Turing to the indicators for the quantitative easing regimes, we find a positive effect on Agency MREIT equity issuance during the QE2 and MEP periods as the Federal Reserve halted its purchase activity. Conversely, Federal Reserve purchase shares are negatively related to equity issuance, particularly during the QE3 and Tapering periods.

Regression results for the amount of equity issued by Agency MREITs (as a share of last quarter's total assets) are shown in Columns (5)-(8). Here, the prior quarter's market-to-book ratio is again found to be strongly positively related to issuance activity. In terms of monetary policy regime indicators, we find a positive relationship between the amount of equity issued and QE2. Overall, Tables 4 and 5 suggest that Agency MREIT growth was inversely related to the Federal Reserve's unconventional monetary policy – most notably during QE2 when the central bank withdrew from the Agency MBS market and allowed private capital to return.

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Given that monetary policy influences financial markets broadly, one may wonder if our findings pertaining to Agency MREIT growth and equity issuance simply reflect market-wide trends. To examine this, we pooled our data with the same information for non-Agency MREITs in an effort to identify specific effects while holding the mortgage REIT structure constant. Within the mortgage REIT structure, Agency and non-Agency MREITs differ primarily in their exposure to the Agency MBS market, and thus in their sensitivity to the Federal Reserve's activity in this market. In other respects, these institutions are similar, as they are all subject to the same legal requirements.

These pooled regressions are specified and estimated as before, except that we include an Agency MREIT indicator and also interact this variable with all of the QE-related variables. Appendix A presents quarterly asset growth regression results. Here we again find that Agency MREIT growth was especially pronounced during QE2; but also that these institutions grew relatively more during QE1 in a manner tied to Federal Reserve purchase activity. Appendix B presents the related quarterly equity issuance regressions. Agency MREITs were more likely to issue equity over the entire sample period and that they issued relatively more equity during QE2. These findings support our prior results and suggest that our portfolio balance channel interpretation seems specific to agency MREITs.

5.2 Agency MREITs: Performance

The significant capital raising by Agency MREITs requires strong investor demand, which in turn should be related to the outlook for future dividends. Hence, we next analyze Agency MREIT equity returns. Table 6 present our results. In each case, returns are strongly positively related to share repurchase activity. We also consistently find that Agency MREIT equity returns increased during QE1 and QE2, although Federal Reserve purchase activity during QE1 had a dampening effect during that period. These results likely reflect: [1] A windfall gain for Agency MREITs from legacy asset values during QE1 that was muted somewhat by the Federal Reserve gradually crowding-out their investment opportunities; and [2] Significant growth opportunities during QE2 as the central bank halted purchases. Agency MREITs also experienced positive

equity returns during the MEP and Tapering periods. During the MEP, the Federal Reserve remained out of the Agency MBS initially but then instituted a reinvestment policy prior to the announcement of QE3. Agency MREIT equity returns during the Tapering period are positively related to the Federal Reserve's purchase share which was highest at the onset of this policy – suggesting this reaction was tied to the signal that the end of the central bank's quantitative easing was in sight.

[Table 6 about here.]

We next build on the equity return analysis by looking at risk-adjusted performance. Here, the dependent variable is the Sharpe Ratio, which is defined as the average daily return each quarter divided by the standard deviation of these same returns. As excessive risk-taking alters the risk-reward trade-off, the Sharpe Ratio should capture this effect during the unconventional monetary policy regimes. In all cases, we find risk-adjusted returns to be positively related to the option-adjusted mortgage spread and share repurchase activity, but negatively related to the level of short-term interest rates and the lagged ratio of interest rate hedging intensity. Looking at the indicators for the unconventional monetary policy regimes, we find a positive relationship during QE3, although Federal Reserve purchase activity had a dampening effect during that period. There is also evidence that risk-adjusted equity returns increased during the Tapering period, somewhat tied to central bank purchase activity.

[Table 7 about here.]

5.3   *Agency MREITs: Risk Profiles*

To this point, we find 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 whether our sample firms altered their risk-taking behavior by studying variation in leverage (equity-to-assets ratio), the use of repo financing (repo-to-total assets ratio and very short-term repo-to-total repo), liquidity risk (cash-to-total assets), and interest rate hedging activity using swaps and swaptions.

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Table 8 studies variation in Agency MREIT capital structure and liquidity risk profiles. In terms of equity-to-assets, we find a strong positive relationship with cash holdings and a negative relationship with the QE2 period. This latter finding is consistent with opportunities for Agency MREITs to expand, and finance that growth partially with debt, as the central bank halted its Agency MBS purchases. Turning to the use of debt financing via repurchase agreements, we find some evidence of a positive relationship with the option-adjusted spread. Repo financing also expanded during QE3 and the Tapering period. The use of very short-term repo (< 30 days) is mostly associated with higher cash holdings. In terms of liquidity, Agency MREITs tend to hold more cash concurrent with larger capital buffers and greater financing with very short-term repo. This suggests a rather defensive posture. Cash holdings also seem to have been higher during QE1, potentially reflecting initial gains on legacy assets followed by limited investment opportunities due to Federal Reserve activity. Taken together, these results are inconsistent with Agency MREITs becoming systematically riskier during the Federal Reserve's quantitative easing program.

[Table 8 about here.]

Table 9 examines the intensity of interest rate hedging by Agency MREITs. Given that the business model involves significant maturity transformation, that is, Agency MBS investments financed using short-term repurchase agreements, this analysis can provide insights into whether these institutions altered their interest rate risk profiles during the various unconventional monetary policy regimes. Columns (1)-(4) examine the ratio of total swaps to total repo debt, while Columns (5)-(8) focus on the ratio of both swaps and swaptions to total repo debt. Both sets of regressions suggest the same behavioral pattern. Agency MREIT hedging intensity is generally negative related to the three interest rate variables – 3-month Treasury bill, term structure slope, and option-adjusted spread. In terms of the relationship between hedging and unconventional monetary policy, we find that Agency MREITs reduced their use of interest rate derivatives during QE1, QE2, and MEP; but then ramped-up this activity during QE3. Furthermore, Agency MREIT hedging activity seems to be influenced by Federal Reserve purchase activity, particularly during QE3 and the Tapering period. Overall, this behavior seems consistent with the risk-taking channel of monetary policy, as these REITs seem to have curtailed their

interest rate hedging during the initial stages of quantitative easing, as the Federal Reserve indicated policy rates would remain long for a considerable period of time.

[Table 9 about here.]

6   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. Some recent related research suggests the presence of a "risk-taking channel" of monetary policy, although to date all related empirical work explores the relationship with credit risk-taking. In this paper, we study Agency mortgage REITs (Agency MREITs) that are specialized, tax-exempt financial institutions, whose rapid growth raised systemic risk concerns by the Financial Stability Oversight Council. We believe that our analysis is important for at least two reasons. First, despite the concerns of the U.S. government and the potential importance of these shadow banks in the future housing finance system, this is the first paper to empirically analyze Agency MREITs. Second, this is also the first paper to study the relationship between unconventional monetary policy and risk-taking with a focus on liquidity risk, leverage, and interest rate risk.

We conducted 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 growth of these institutions in terms of total assets and equity issuance. We found that Agency MREIT growth was inversely associated with Federal Reserve activity in the Agency MBS market – consistent with the central bank crowding-out private investment as per the portfolio balance channel. Equity returns for these institutions also seem to reflect the presence or absence of growth opportunities in the MBS market depending on the central banks' posture. Second, we studied the relationship between Agency MREIT risk-taking and unconventional monetary policy. Consistent with the presence of a risk-taking channel, Agency MREITs reduced their interest rate hedging during the initial stages of quantitative easing when the Federal Reserve indicated policy rates would remain low for a considerable period of time. This trend later reversed after the central bank resumed Agency MBS purchases during QE3 and through their tapering of such purchases.

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7   Bibliography

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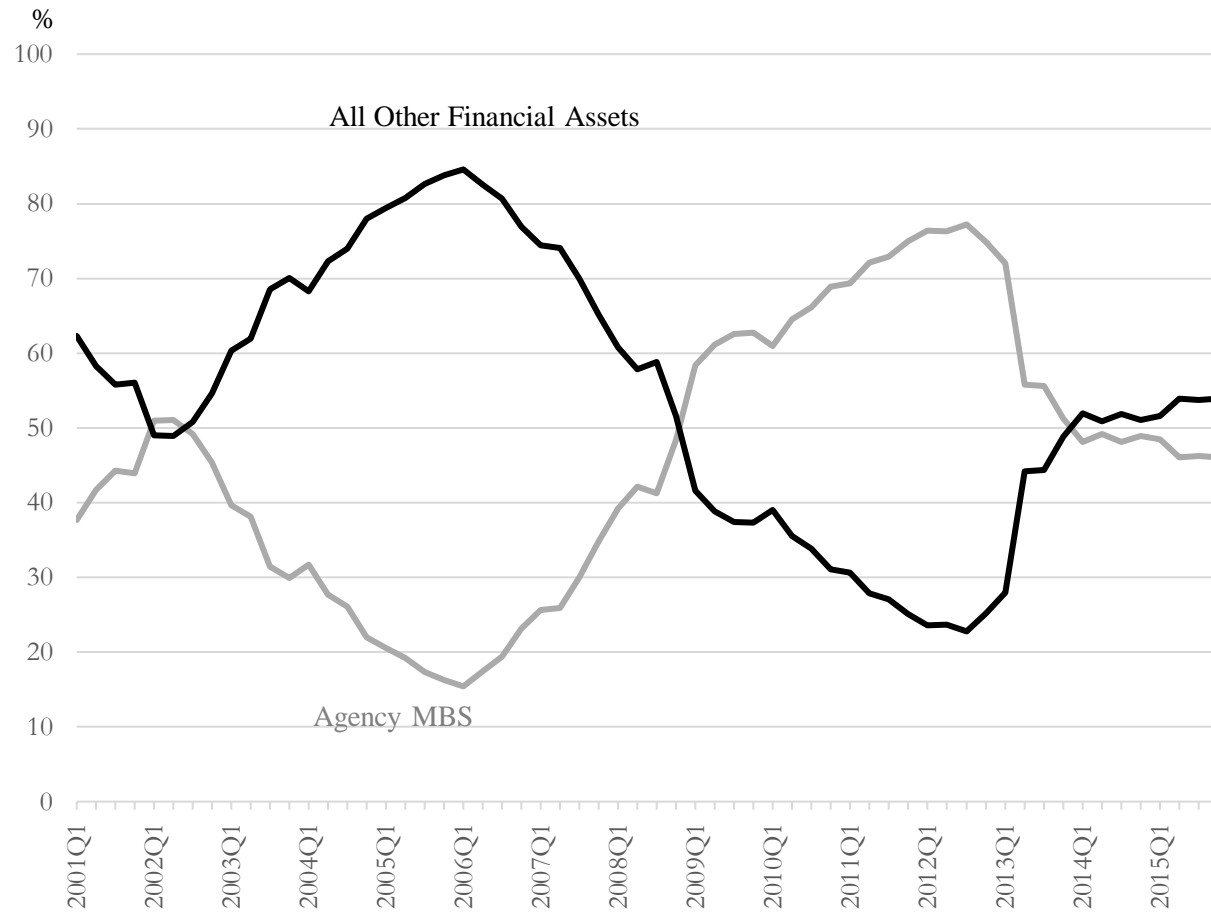
Figure 2: Mortgage REIT Asset Profile and Number of Firms: 2001-2015 (Quarterly)

Panel A: Mortgage REIT Holdings of Agency MBS (Percent of MREIT Total Assets)
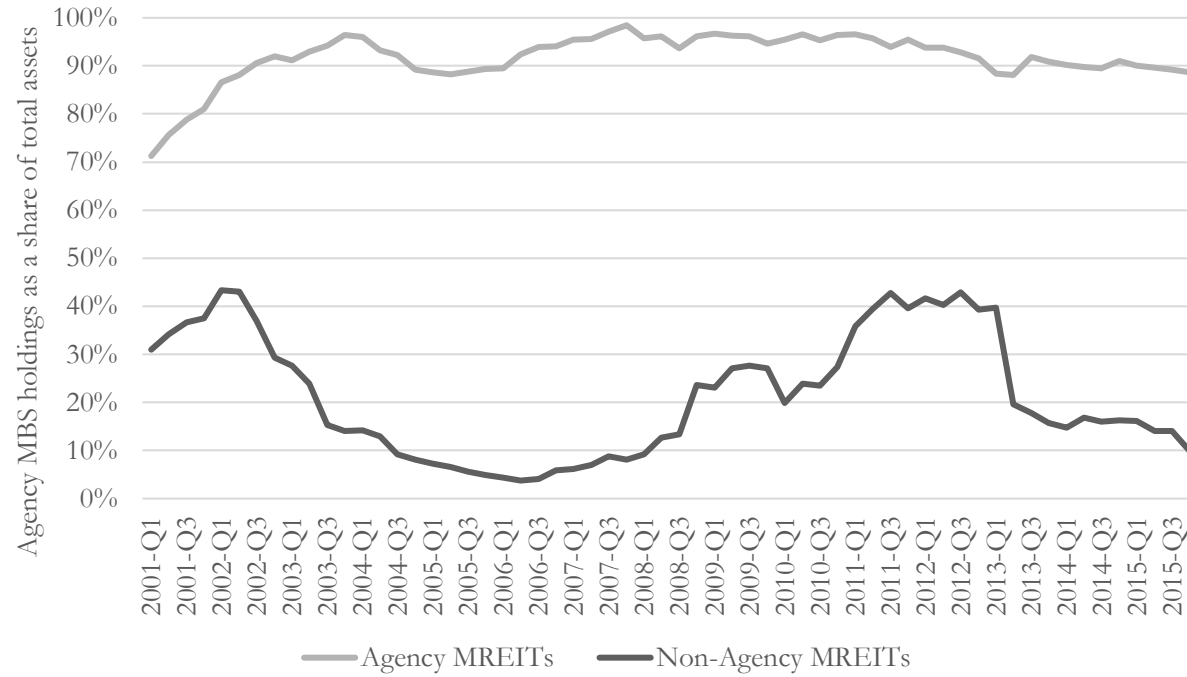
Panel B: Number of Agency MREITs
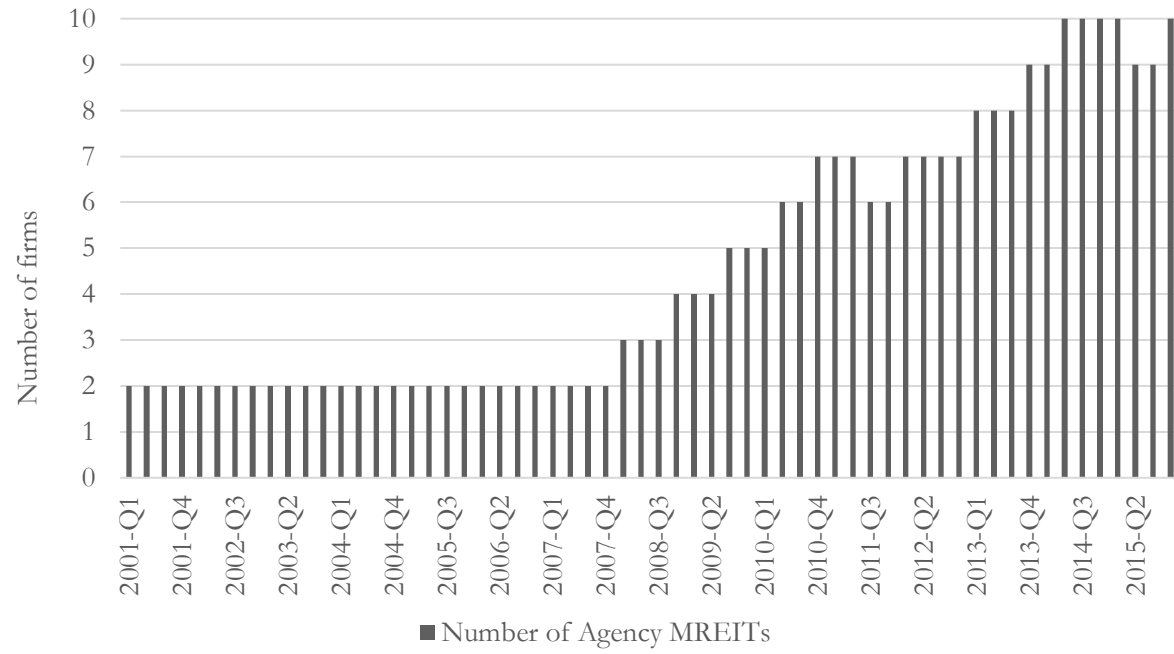
Figure 3: Agency MREIT Capital Structure: 2001-2015 (Quarterly)
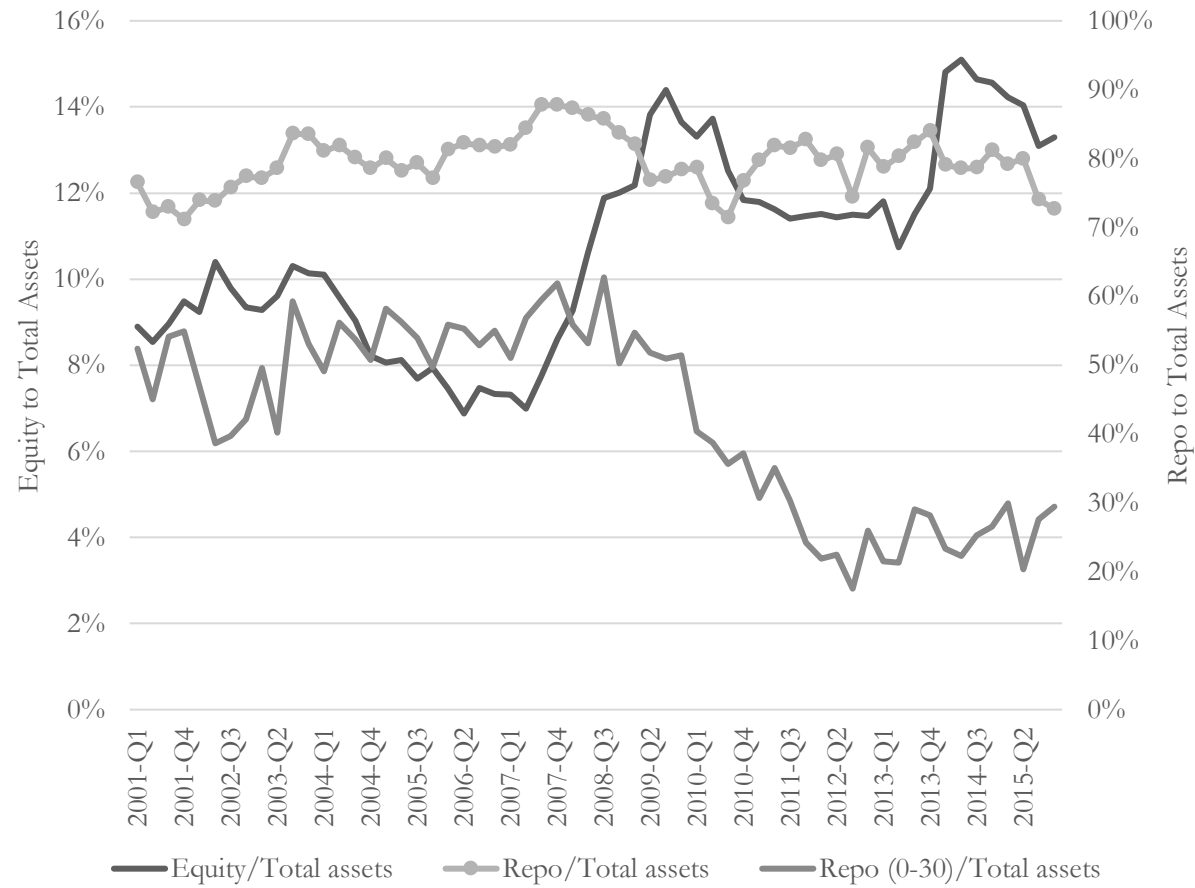
Figure 4: Agency MREIT Dividend Yields and the Slope of the U.S. Treasury Term Structure

Figure 5: Agency MREITs: Agency MBS Holdings and Market Share: 2001-2015 (Quarterly)
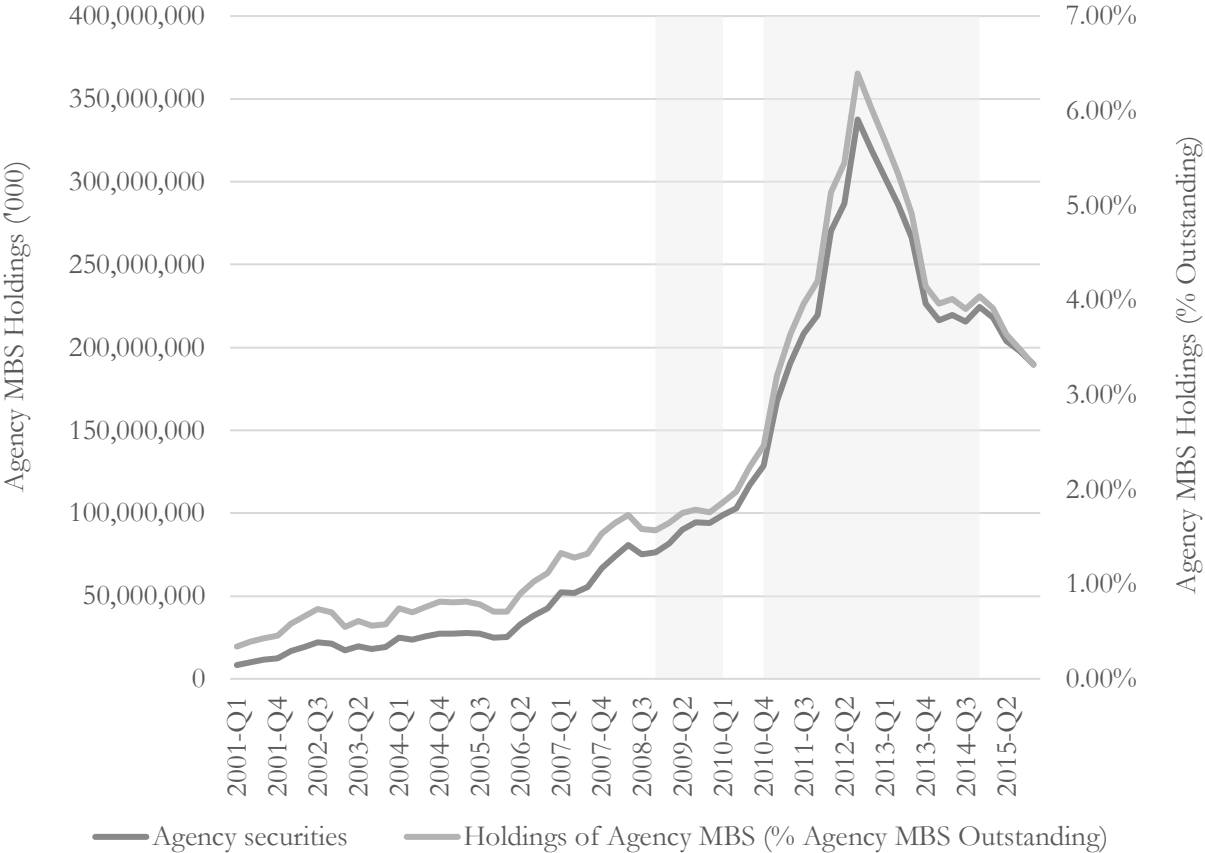
Figure 6: Agency MREIT Equity Issuance: 2001-2015 (Quarterly)
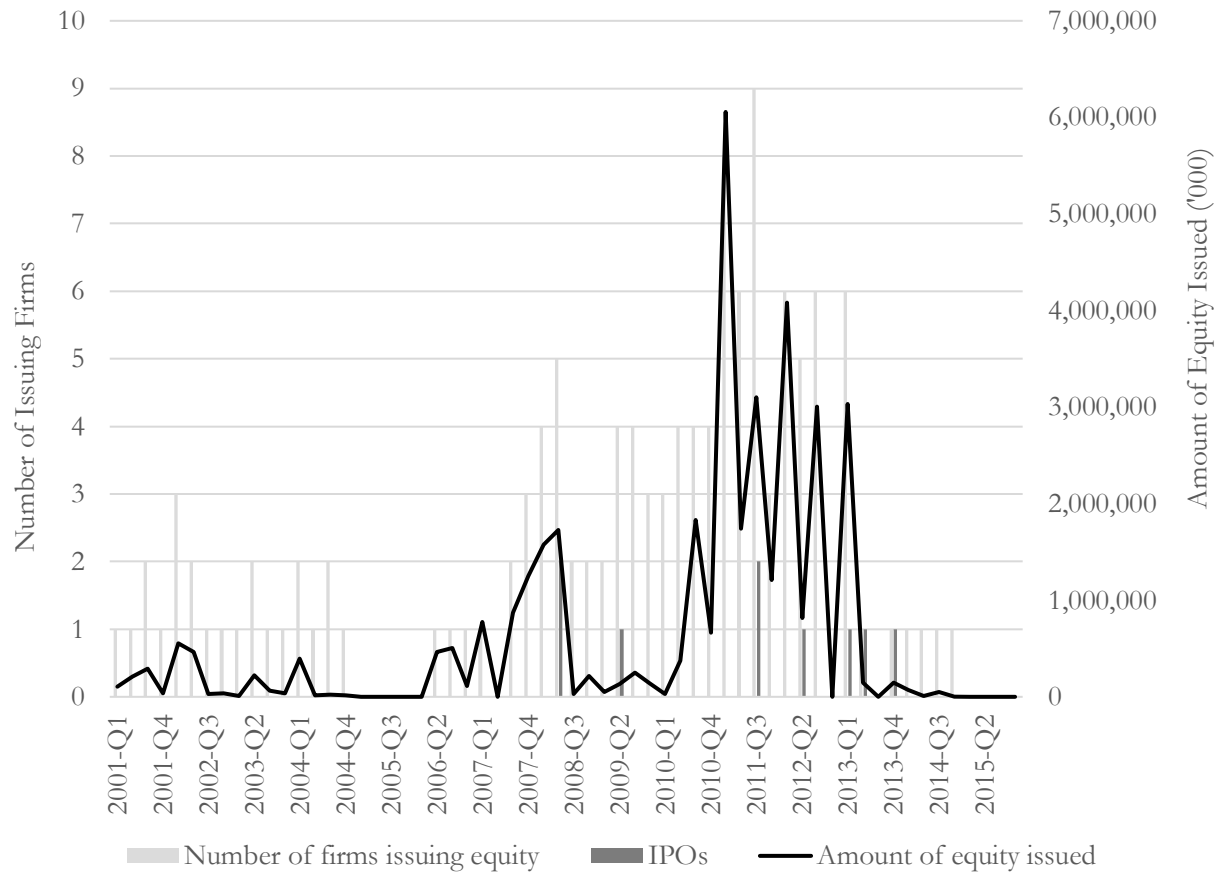
Figure 7: Federal Reserve Quarterly Holdings and Purchases of Agency MBS
(Percentage of Quarterly Amounts Outstanding and New Issuance)

Purchase Share (% of Total Issuance) ——— Holdings Share (% of Total Outstanding)
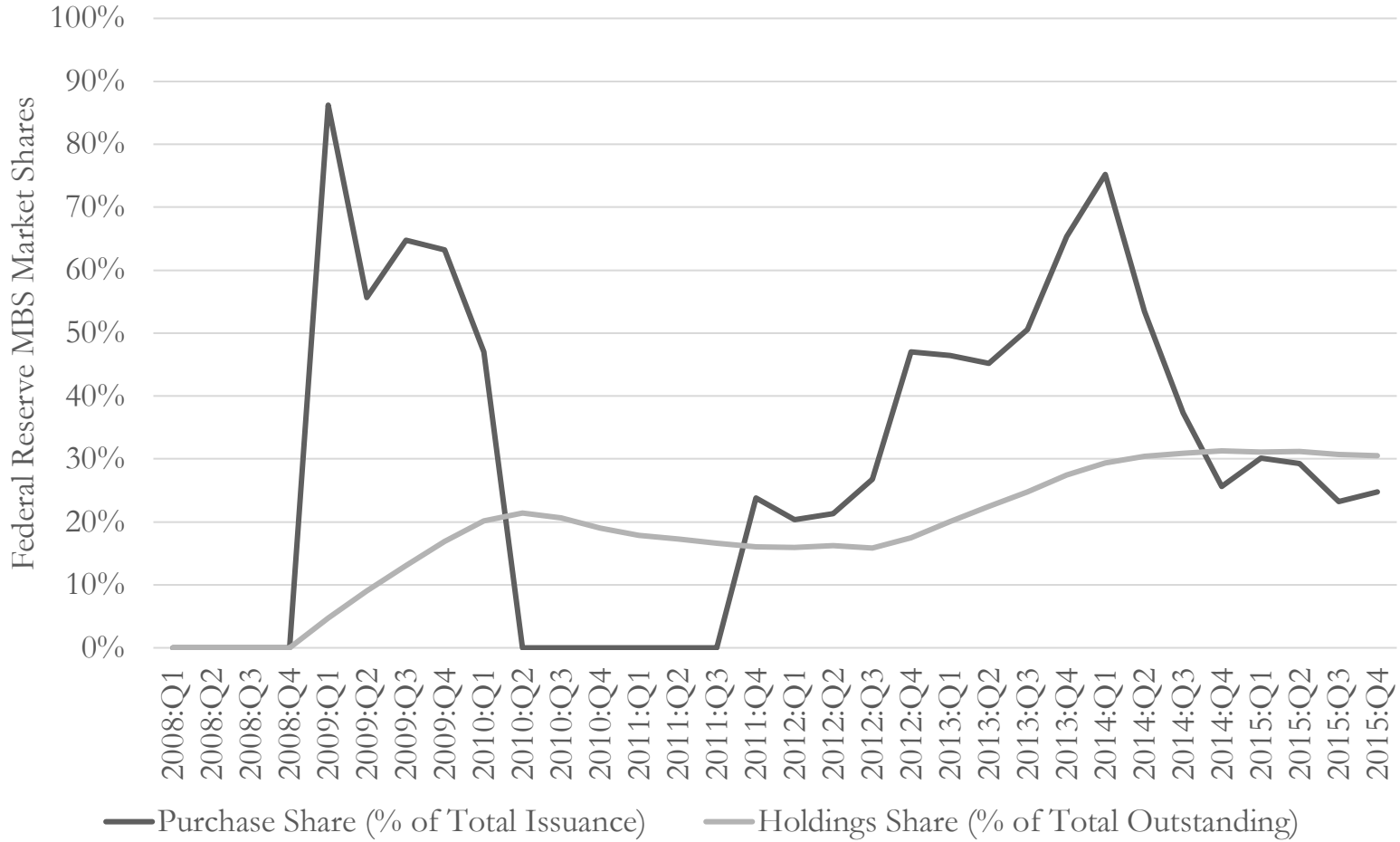
Table 1: Timeline of Federal Reserve Policy Actions: 2008-2014

	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	August 9, 2011	---	---	---	Rates likely to remain at the effective lower bound at least until mid-2013.
MEP: September 2011 – December 2012	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

This table presents descriptive statistics for the variables of interest over the study period (2005-2015) that results in 238 firm-quarter observations. All variables as defined in the text.

Variable	Mean	SD	P25	Median	P75	Min	Max
Total Assets	24.20	32.80	4.32	8.48	23.50	0.36	142.00
Growth in Assets	0.09	0.25	-0.02	0.02	0.10	-0.27	1.65
Issued Equity	0.29	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
Repurchased Shares	0.24	0.43	0.00	0.00	0.00	0.00	1.00
Number of Shares Repurchased	0.01	0.02	0.00	0.00	0.00	0.00	0.13
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 Debt to Total Assets	0.81	0.07	0.78	0.83	0.87	0.54	0.91
Repo Debt (0-30 days) to Total Repo	0.51	0.25	0.33	0.48	0.72	0.03	1.00
Repo Debt (>30 days) to Total Repo	0.49	0.25	0.28	0.52	0.67	0.00	0.97
Cash to Total Assets	0.02	0.01	0.01	0.02	0.03	0.00	0.06
Swaps to Repo Debt	0.47	0.24	0.38	0.47	0.62	0.00	1.31
Swaps and Swaptions to Total Repo	0.52	0.28	0.38	0.48	0.70	0.00	1.31
Share of Institutional Ownership	0.52	0.18	0.42	0.52	0.62	0.03	0.99
QE1	0.10	0.30	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	0.11	0.31	0.00	0.00	0.00	0.00	1.00
QE3	0.20	0.40	0.00	0.00	0.00	0.00	1.00
Tapering	0.16	0.37	0.00	0.00	0.00	0.00	1.00
Fed Purchase Share	0.29	0.24	0.00	0.26	0.47	0.00	0.86
Fed Holdings Share	0.20	0.10	0.16	0.20	0.30	0.00	0.31
3-Month CMT	0.50	1.25	0.03	0.07	0.14	0.01	5.08
CMT Term Structure	2.25	0.83	1.97	2.25	2.79	-0.52	3.58
Option-Adjusted Spread	0.46	0.28	0.26	0.37	0.58	0.11	1.45

Table 3: Pairwise Pearson Correlation Coefficients

This table presents Pearson correlation coefficients for the variables of interest over the study period (2005-2015) that results in 238 firm-quarter observations. All variables as defined in the text. Asterisks denote significant differences of the estimated correlation coefficients from zero at the 5% level.

		QE1	QE2	MEP	QE3	Tapering
(1)	Total Assets	-0.0526	-0.0188	0.1127	0.1532*	-0.0405
(2)	Growth in Assets	0.0036	0.3624*	0.1214	-0.1761*	-0.0738
(3)	Issued Equity	0.1946*	0.2869*	0.1878*	-0.1581*	-0.1861*
(4)	Amount of Equity Issued	-0.0466	0.3160*	0.0989	-0.1040	-0.0501
(5)	Repurchased Shares	-0.1479*	-0.1376*	-0.1625*	0.2474*	0.0220
(6)	Amount of Shares Repurchased	-0.1110	-0.1073	-0.1177	0.1271	0.0356
(7)	Price Return	0.1186	0.0672	0.0805	-0.1988*	0.0997
(8)	Dividend Yield	0.2649*	0.1580*	0.1244	-0.0072	-0.1295*
(9)	Equity to Total Assets	0.0915	-0.0420	-0.0645	-0.0866	0.2356*
(10)	Repurchase Agreements to Total Assets	-0.0952	-0.0805	0.0619	0.0834	-0.0431
(11)	Repurchase Agreements (0-30 days) to Total Repo	0.0884	0.0015	-0.0372	-0.1262	-0.1660*
(12)	Repurchase Agreements (>30 days) to Total Repo	-0.0884	-0.0015	0.0372	0.1262	0.1660*
(13)	Cash and Cash Equivalents to Total Assets	0.0856	-0.1233	0.0297	0.0314	0.2096*
(14)	Swaps to Repo Debt	-0.1122	0.0354	0.0309	0.1117	0.1434*
(15)	Swaps and Swaptions to Total Repo	-0.1451*	-0.0083	-0.0014	0.1717*	0.2083*

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 the level and slope of the term structure, option-adjusted mortgage spread, equity issuance, unconventional monetary policy regimes, and Federal Reserve purchase share of Agency MBS. The study period is 2005-2015. 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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3-Month CMT	0.026	0.009	0.024	-0.010	0.024	-0.015*	0.064*	0.020
	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.03)	(0.02)
CMT Term Structure	0.020	0.002	0.014	-0.043**	0.014	-0.043***	0.088	0.016
	(0.04)	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)	(0.06)	(0.03)
Option-Adjusted Spread	-0.100	-0.022	-0.098	-0.021	-0.098	-0.027*	-0.122	-0.031*
	(0.07)	(0.02)	(0.07)	(0.01)	(0.08)	(0.01)	(0.08)	(0.02)
Issued Equity	0.255**		0.222**		0.222**		0.207**	
	(0.09)		(0.08)		(0.08)		(0.08)	
Repurchased Shares	-0.099**		-0.080*		-0.080*		-0.061	
	(0.04)		(0.04)		(0.04)		(0.04)	
Amount of Equity Issued		8.017***		7.739***		7.724***		7.592***
		(1.08)		(1.08)		(1.03)		(1.01)
Number of Shares Repurchased		-1.617***		-1.211**		-1.050**		-0.899*
		(0.47)		(0.47)		(0.47)		(0.46)
QE1			-0.051	0.085**	-0.052	0.145**	-0.491	-0.144
			(0.10)	(0.03)	(0.11)	(0.05)	(0.30)	(0.11)
QE2			0.189**	0.118***	0.189***	0.099***	0.147**	0.081***
			(0.06)	(0.03)	(0.06)	(0.02)	(0.05)	(0.02)
MEP			0.048	0.015	0.048	0.019	0.106*	0.053*
			(0.05)	(0.02)	(0.05)	(0.02)	(0.05)	(0.03)
QE3			-0.044	-0.034**	-0.044	0.004	0.323**	0.242***
			(0.03)	(0.01)	(0.04)	(0.02)	(0.12)	(0.08)
Tapering			-0.028	-0.012	-0.029	0.024	-0.120	0.030
			(0.04)	(0.01)	(0.03)	(0.02)	(0.09)	(0.05)
Fed Purchase Share					0.001	-0.126*		
					(0.11)	(0.06)		
Fed Purchase Share QE1							0.607	0.280
							(0.35)	(0.17)
Fed Purchase Share QE3							-0.744**	-0.558***
							(0.28)	(0.16)
Fed Purchase Share Taper							0.170	-0.106
							(0.21)	(0.11)
Observations	238	238	238	238	238	238	238	238
R-squared	0.313	0.810	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

Table 5: Agency MREITs: Quarterly Equity Issuance

The table presents panel regression results for Agency MREIT quarterly equity issuance as a function of the level and slope of the term structure, option-adjusted mortgage spread, the prior quarter's equity performance, unconventional monetary policy regimes, and Federal Reserve purchase shares of Agency MBS. The study period is 2005-2015. L. denotes the lag operator. All estimates are produced using OLS. 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; 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	Issued Equity				Amount Issued			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3-Month CMT	0.119**	0.095***	0.078**	0.163***	0.006*	0.008**	0.008**	0.011*
	(0.04)	(0.02)	(0.03)	(0.05)	(0.00)	(0.00)	(0.00)	(0.01)
CMT Term Structure	0.166*	0.084**	0.085**	0.220**	0.008	0.010*	0.010*	0.016
	(0.08)	(0.04)	(0.04)	(0.09)	(0.00)	(0.01)	(0.01)	(0.01)
Option-Adjusted Spread	0.271	0.255	0.241	0.291	-0.002	-0.004	-0.004	-0.005
	(0.15)	(0.18)	(0.17)	(0.18)	(0.01)	(0.01)	(0.01)	(0.01)
L.Market-to-Book Value of Equity	1.143***	0.840***	0.737***	0.664***	0.049*	0.036*	0.037*	0.029*
	(0.26)	(0.22)	(0.20)	(0.19)	(0.02)	(0.02)	(0.02)	(0.01)
QE1		0.273	0.506**	0.179		-0.010	-0.010	-0.043
		(0.24)	(0.22)	(0.57)		(0.01)	(0.01)	(0.04)
QE2		0.367***	0.309***	0.306***		0.019**	0.019**	0.016**
		(0.09)	(0.10)	(0.09)		(0.01)	(0.01)	(0.01)
MEP		0.262***	0.280***	0.350**		0.013	0.013	0.018*
		(0.08)	(0.08)	(0.11)		(0.01)	(0.01)	(0.01)
QE3		-0.037	0.114*	0.788*		-0.004	-0.004	0.032
		(0.03)	(0.06)	(0.36)		(0.00)	(0.01)	(0.02)
Tapering		-0.013	0.119	0.074		-0.002	-0.002	-0.015
		(0.11)	(0.10)	(0.09)		(0.01)	(0.00)	(0.01)
Fed Purchase Share			-0.474**				0.000	
			(0.16)				(0.02)	
Fed Purchase Share QE1				-0.015				0.045
				(0.68)				(0.04)
Fed Purchase Share QE3				-1.653**				-0.071
				(0.70)				(0.04)
Fed Purchase Share Taper				-0.215**				0.026
				(0.08)				(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

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 the level and slope of the term structure, option-adjusted mortgage spread, financing structure, equity issuance, unconventional monetary policy regimes, and Federal Reserve purchase shares of Agency MBS. The study period is 2005-2015. 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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3-Month CMT	0.013	0.012	0.004	0.003	0.003	0.004	-0.005	-0.009
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
CMT Term Structure	0.012	0.010	-0.017	-0.016	-0.016	-0.016	-0.034*	-0.040**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Option-Adjusted Spread	0.028*	0.021	0.041***	0.030**	0.041***	0.031*	0.077***	0.059***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
L.Repo Debt (0-30 days) to Total Repo	0.041	0.035	0.039	0.035	0.038	0.035	0.027	0.025
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
L.Equity to Total Assets	0.252	0.305	0.076	0.063	0.064	0.068	0.147	0.145
	(0.58)	(0.55)	(0.55)	(0.55)	(0.57)	(0.57)	(0.53)	(0.52)
L.Cash to Total Assets	0.110	0.012	-0.109	-0.167	-0.124	-0.158	-0.367	-0.399
	(0.86)	(0.88)	(0.74)	(0.78)	(0.76)	(0.81)	(0.87)	(0.90)
L.Swaps and Swaptions to Total Repo	-0.070	-0.065	-0.070	-0.068	-0.066	-0.069	-0.063	-0.067
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)
L.Issued Equity	-0.011		-0.023		-0.025		-0.032	
	(0.02)		(0.02)		(0.02)		(0.02)	
L.Repurchased Shares	0.035***		0.052***		0.054***		0.051***	
	(0.01)		(0.01)		(0.01)		(0.01)	
L.Amount of Equity Issued		0.089		-0.131		-0.125		-0.194
		(0.22)		(0.25)		(0.26)		(0.29)
L.Number of Shares Repurchased		1.056**		1.187**		1.166**		1.132**
		(0.36)		(0.54)		(0.50)		(0.42)
QE1			0.094***	0.077***	0.107***	0.071**	0.468***	0.422***
			(0.02)	(0.02)	(0.03)	(0.03)	(0.13)	(0.12)
QE2			0.087***	0.075**	0.084**	0.076**	0.109***	0.099***
			(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
MEP			0.060**	0.047**	0.061**	0.047**	0.049*	0.031
			(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
QE3			-0.013	-0.011	-0.006	-0.014	0.045	0.012
			(0.02)	(0.02)	(0.01)	(0.01)	(0.07)	(0.05)
Tapering			0.069***	0.069***	0.075***	0.066***	-0.007	-0.021
			(0.01)	(0.01)	(0.02)	(0.02)	(0.04)	(0.03)
Fed Purchase Share					-0.024	0.011		
					(0.06)	(0.05)		
Fed Purchase Share QE1							-0.552**	-0.505**
							(0.21)	(0.18)
Fed Purchase Share QE3							-0.123	-0.051
							(0.16)	(0.14)
Fed Purchase Share Taper							0.170**	0.204***
							(0.06)	(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

Table 7: Agency MREITs: Sharpe Ratios

The table presents the panel regression results for Agency MREIT Sharpe Ratios (average daily equity return during a quarter divided its standard deviation) as a function of the level and slope of the term structure, option-adjusted mortgage spread, equity issuance, unconventional monetary policy regimes, and Federal Reserve purchases and holdings shares of Agency MBS over the study period (2005-2015). 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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3-Month CMT	-0.573***	-0.577***	-0.567***	-0.572***	-0.568***	-0.571***	-0.547***	-0.559***
	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)
CMT Term Structure	0.073*	0.059	0.082	0.077	0.082	0.076	0.117	0.099
	(0.04)	(0.03)	(0.06)	(0.05)	(0.06)	(0.06)	(0.08)	(0.06)
Option-Adjusted Spread	0.268**	0.229**	0.262**	0.223**	0.262**	0.225**	0.304**	0.245**
	(0.10)	(0.08)	(0.10)	(0.08)	(0.10)	(0.08)	(0.10)	(0.09)
L.Repo Debt (0-30 days) to Total Repo	-0.143	-0.159	-0.138	-0.148	-0.139	-0.146	-0.153	-0.160
	(0.11)	(0.10)	(0.10)	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)
L.Equity to Total Assets	0.418	0.738	0.159	0.381	0.140	0.408	0.274	0.524
	(0.70)	(0.71)	(0.83)	(0.91)	(0.85)	(0.96)	(0.78)	(0.86)
L.Cash to Total Assets	-0.531	-1.121	-0.613	-1.086	-0.637	-1.046	-1.123	-1.498
	(1.21)	(1.11)	(1.17)	(0.96)	(1.16)	(0.96)	(1.36)	(1.17)
L.Swaps and Swaptions to Total Repo	-0.245**	-0.238**	-0.279**	-0.288**	-0.272**	-0.297**	-0.244**	-0.267**
	(0.08)	(0.10)	(0.10)	(0.12)	(0.11)	(0.13)	(0.09)	(0.12)
L.Issued Equity	-0.092		-0.096		-0.098		-0.114*	
	(0.06)		(0.06)		(0.06)		(0.06)	
L.Repurchased Shares	0.077***		0.086***		0.089***		0.096***	
	(0.01)		(0.02)		(0.02)		(0.02)	
L.Amount of Equity Issued		-0.191		-0.261		-0.233		-0.329
		(0.66)		(0.58)		(0.59)		(0.61)
L.Number of Shares Repurchased		3.043**		2.728*		2.630*		2.936**
		(1.02)		(1.27)		(1.28)		(1.27)
QE1			0.015	-0.025	0.036	-0.053	0.280	0.136
			(0.07)	(0.07)	(0.09)	(0.10)	(0.24)	(0.23)
QE2			0.008	-0.027	0.004	-0.021	0.001	-0.034
			(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
MEP			0.085*	0.051	0.087**	0.049	0.111*	0.065
			(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
QE3			-0.018	-0.012	-0.007	-0.028	0.335*	0.248*
			(0.03)	(0.03)	(0.03)	(0.03)	(0.16)	(0.12)
Tapering			0.095***	0.100***	0.105***	0.086***	0.036	0.008
			(0.03)	(0.02)	(0.03)	(0.02)	(0.04)	(0.04)
Fed Purchase Share					-0.038	0.054		
					(0.09)	(0.09)		
Fed Purchase Share QE1							-0.433	-0.270
							(0.32)	(0.29)
Fed Purchase Share QE3							-0.721**	-0.530**
							(0.32)	(0.23)
Fed Purchase Share Taper							0.110	0.185*
							(0.09)	(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

Table 8: Agency MREITs: Risk Measures

The table presents the panel regression results for Agency MREIT leverage, defined as the ratio of total equity to total assets, as a function of the level and slope of the term structure, option-adjusted mortgage spread, financing structure, equity issuance, unconventional monetary policy regimes, and Federal Reserve purchases and holdings shares of Agency MBS over the study period (2005-2015). 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	Equity/Total Assets				Repo/Total Assets				Repo (0-30)/Total Repo				Cash/Total Assets			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3-Month CMT	-0.004	-0.007*	-0.007*	-0.007	0.009	0.017	0.018*	0.015	0.028	0.016	0.015	0.019	-0.004***	-0.004***	-0.004***	-0.003***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.07)	(0.06)	(0.06)	(0.06)	(0.00)	(0.00)	(0.00)	(0.00)
CMT Term Structure	0.007*	0.004	0.004	0.003	-0.007	0.000	0.000	-0.004	0.041	0.025	0.025	0.032	0.000	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)
Option-Adjusted Spread	-0.008	-0.006	-0.006	-0.007	0.025**	0.025*	0.026*	0.022	0.030	0.017	0.016	0.001	0.002	0.002	0.002	0.002
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)	(0.07)	(0.06)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)
L.Swaps and Swaptions to Total Repo	0.003	-0.002	-0.002	-0.003	-0.001	-0.009	-0.018	-0.014	-0.093	-0.042	-0.034	-0.047	-0.002	-0.002	-0.002	-0.002
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.04)	(0.04)	(0.09)	(0.09)	(0.10)	(0.10)	(0.00)	(0.00)	(0.00)	(0.00)
L.Equity to Total Assets									-0.586	-0.732	-0.760	-0.752	0.104***	0.094**	0.094**	0.096**
									(1.33)	(1.41)	(1.44)	(1.44)	(0.02)	(0.03)	(0.03)	(0.03)
L.Repo (0-30 days) to Total Repo	0.003	0.003	0.003	0.003	-0.001	0.006	0.008	0.008					0.006**	0.006*	0.006*	0.006*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)					(0.00)	(0.00)	(0.00)	(0.00)
L.Cash to Total Assets	0.472*	0.386*	0.381*	0.402*	-0.500	-0.378	-0.321	-0.313	2.293**	2.135**	2.098**	2.299**				
	(0.22)	(0.21)	(0.20)	(0.20)	(0.99)	(0.87)	(0.84)	(0.86)	(0.96)	(0.82)	(0.76)	(0.89)				
QE1		0.003	0.005	-0.004		0.000	-0.021	-0.022		0.021	0.039	-0.158		0.005***	0.005*	0.006
		(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.05)		(0.06)	(0.10)	(0.12)		(0.00)	(0.00)	(0.01)
QE2		-0.006	-0.007**	-0.006*		0.021	0.027	0.024		-0.008	-0.013	-0.015		-0.002	-0.002	-0.002
		(0.00)	(0.00)	(0.00)		(0.02)	(0.02)	(0.02)		(0.05)	(0.05)	(0.05)		(0.00)	(0.00)	(0.00)
MEP		-0.006	-0.006	-0.007		0.029*	0.028*	0.027		-0.017	-0.017	-0.012		0.002	0.002	0.002
		(0.01)	(0.01)	(0.01)		(0.02)	(0.02)	(0.02)		(0.06)	(0.06)	(0.06)		(0.00)	(0.00)	(0.00)
QE3		-0.008	-0.007	-0.018		0.036**	0.023*	-0.008		-0.072	-0.061	-0.099		0.002	0.002	0.007
		(0.01)	(0.01)	(0.02)		(0.01)	(0.01)	(0.03)		(0.05)	(0.06)	(0.19)		(0.00)	(0.00)	(0.00)
Tapering		0.007	0.008	0.011		0.031*	0.020	0.043***		-0.083***	-0.074*	-0.073		0.003	0.003	0.001
		(0.01)	(0.01)	(0.01)		(0.02)	(0.01)	(0.01)		(0.03)	(0.04)	(0.05)		(0.00)	(0.00)	(0.00)
Fed Purchase Share			-0.004				0.042				-0.036				0.000	
			(0.02)				(0.03)				(0.11)				(0.00)	
Fed Purchase Share QE1				0.011				0.039				0.269				-0.002
				(0.01)				(0.06)				(0.17)				(0.01)
Fed Purchase Share QE3				0.021				0.091**				0.058				-0.010
				(0.03)				(0.04)				(0.35)				(0.01)
Fed Purchase Share Taper				-0.010				-0.024				-0.025				0.004
				(0.01)				(0.02)				(0.11)				(0.00)
Observations	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238
R-squared	0.405	0.456	0.456	0.460	0.148	0.216	0.225	0.225	0.057	0.098	0.098	0.102	0.377	0.411	0.411	0.414
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm clusters	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Table 9: Agency MREITs: Interest Rate Derivatives

The table presents the panel regression results for Agency MREIT use of interest rate derivatives (measured as the sum of swaps and swaptions to total repurchase agreements outstanding) as a function of the level and slope of the term structure, option-adjusted mortgage spread, equity issuance, unconventional monetary policy regimes, and Federal Reserve purchases and holdings shares of Agency MBS over the study period (2005-2015). L. denotes the lag operator. All estimates produced using OLS. Robust standard errors (clustered by firm) are reported in parentheses. Significance is indicated as follows: *** $p<0.01$; ** $p<0.05$; * $p<0.1$.

VARIABLES	Swaps/Total Repo				Swaps and Swaptions/Total Repo			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3-Month CMT	-0.127***	-0.125**	-0.107**	-0.163***	-0.123**	-0.103*	-0.083	-0.150***
	(0.04)	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
CMT Term Structure	-0.072**	-0.041	-0.042	-0.122**	-0.071*	-0.017	-0.018	-0.117**
	(0.03)	(0.04)	(0.04)	(0.05)	(0.03)	(0.04)	(0.04)	(0.05)
Option-Adjusted Spread	-0.147***	-0.127***	-0.104***	-0.124***	-0.153***	-0.124***	-0.097**	-0.120***
	(0.04)	(0.03)	(0.03)	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)
L.Repo Debt (0-30 days) to Total Repo	-0.056	-0.032	-0.009	-0.022	-0.155	-0.110	-0.083	-0.098
	(0.12)	(0.10)	(0.09)	(0.09)	(0.14)	(0.12)	(0.11)	(0.11)
L.Equity to Total Assets	-0.830	-1.233*	-0.955*	-1.174**	-0.698	-0.936	-0.607	-0.859*
	(0.89)	(0.60)	(0.47)	(0.52)	(0.84)	(0.54)	(0.44)	(0.44)
L.Cash to Total Assets	-0.724	-0.164	0.132	0.246	-0.105	0.540	0.890	1.046
	(1.46)	(1.26)	(1.10)	(1.32)	(1.46)	(1.34)	(1.10)	(1.39)
QE1		-0.135***	-0.308***	0.038		-0.163***	-0.368***	0.051
		(0.03)	(0.04)	(0.10)		(0.04)	(0.07)	(0.11)
QE2		-0.112***	-0.049*	-0.050		-0.124***	-0.050*	-0.047
		(0.03)	(0.03)	(0.03)		(0.04)	(0.03)	(0.04)
MEP		-0.092**	-0.094**	-0.134***		-0.073*	-0.076**	-0.125***
		(0.04)	(0.04)	(0.03)		(0.04)	(0.03)	(0.03)
QE3		-0.055	-0.160***	-0.473***		0.005	-0.120**	-0.510***
		(0.05)	(0.04)	(0.10)		(0.06)	(0.05)	(0.12)
Tapering		0.026	-0.074	-0.074		0.074	-0.044	-0.054
		(0.06)	(0.05)	(0.06)		(0.07)	(0.06)	(0.07)
Fed Purchase Share			0.361***				0.426***	
			(0.08)				(0.12)	
Fed Purchase Share QE1				-0.160				-0.196
				(0.14)				(0.17)
Fed Purchase Share QE3				0.851***				1.048***
				(0.22)				(0.30)
Fed Purchase Share Taper				0.234**				0.299**
				(0.10)				(0.10)
Observations	238	238	238	238	238	238	238	238
R-squared	0.310	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

Appendix A: Agency versus Non-Agency MREITs: Quarterly Asset Growth

The table presents the panel regression results for Agency versus Non-Agency MREIT asset growth (quarterly percentage change in the book value of assets) as a function of the level and slope of the term structure, option-adjusted mortgage spread, equity issuance, unconventional monetary policy regimes, and Federal Reserve purchase share of Agency MBS. The study period is 2005-2015. 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) Asset growth	(2) Asset growth	(3) Asset growth	(4) Asset growth
3-Month CMT	-0.002	0.023*	0.018	0.038**
	(0.03)	(0.01)	(0.01)	(0.02)
CMT Term Structure	-0.026	-0.005	-0.007	0.025
	(0.04)	(0.03)	(0.03)	(0.05)
Option-Adjusted Spread	-0.084	-0.083	-0.093	-0.089
	(0.06)	(0.06)	(0.06)	(0.06)
Amount of Equity Issued	2.054**	1.966***	1.962***	1.954***
	(0.77)	(0.72)	(0.72)	(0.71)
Number of Shares Repurchased	-2.490***	-1.705***	-1.652***	-1.457***
	(0.57)	(0.44)	(0.40)	(0.34)
Agency MREIT	0.005	0.014	0.013	0.013
	(0.04)	(0.04)	(0.05)	(0.04)
QE1		-0.011	0.041	0.031
		(0.03)	(0.05)	(0.20)
QE2		0.031	0.013	0.009
		(0.05)	(0.05)	(0.06)
MEP		0.080	0.080	0.097
		(0.06)	(0.06)	(0.06)
QE3		0.185	0.218	0.304
		(0.18)	(0.18)	(0.40)
Tapering		0.054	0.085*	0.101
		(0.04)	(0.05)	(0.08)
Agency MREIT*QE1		0.065	0.061	-0.292
		(0.07)	(0.07)	(0.22)
Agency MREIT*QE2		0.251**	0.252**	0.251**
		(0.11)	(0.11)	(0.12)
Agency MREIT*MEP		0.054	0.054	0.055
		(0.08)	(0.08)	(0.08)
Agency MREIT*QE3		-0.197	-0.199	0.056
		(0.18)	(0.19)	(0.36)
Agency MREIT*Taper		-0.047	-0.048	-0.136
		(0.06)	(0.05)	(0.09)
Fed Purchase Share			-0.111	
			(0.07)	
Agency MREIT*Fed Purchase Share			0.005	
			(0.14)	
Fed Purchase Share QE1				-0.111
				(0.27)
Fed Purchase Share QE3				-0.237
				(0.49)
Fed Purchase Share Taper				-0.105
				(0.11)
Agency MREIT*Fed Purchase Share QE1				0.573*
				(0.31)
Agency MREIT*Fed Purchase Share QE3				-0.537
				(0.45)
Agency MREIT*Fed Purchase Share Taper				0.186
				(0.15)
Constant	0.172*	0.058	0.086	-0.013
	(0.10)	(0.09)	(0.09)	(0.14)
Observations	925	925	925	925
R-squared	0.047	0.055	0.055	0.056
Firm clusters	41	41	41	41

Appendix B: Agency versus Non-Agency MREITs: Quarterly Equity Issuance

The table presents panel regression results for Agency versus Non-Agency MREIT quarterly equity issuance as a function of the level and slope of the term structure, option-adjusted mortgage spread, the prior quarter's equity performance, unconventional monetary policy regimes, and Federal Reserve purchase shares of Agency MBS. The study period is 2005-2015. L. denotes the lag operator. All estimates are produced using OLS. Results are shown for a binary issuance indicator. 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) Equity issued	(3) Equity issued	(4) Equity issued
3-Month CMT	-0.003	0.004	-0.003	0.045
	(0.02)	(0.02)	(0.02)	(0.03)
CMT Term Structure	0.033	-0.001	-0.001	0.080
	(0.04)	(0.03)	(0.03)	(0.06)
Option-Adjusted Spread	0.063	0.067	0.050	0.041
	(0.06)	(0.07)	(0.07)	(0.07)
L.Market-to-Book Value of Equity	0.028	0.022	0.021	0.021
	(0.03)	(0.02)	(0.02)	(0.02)
Agency MREIT	0.089**	0.108**	0.197***	0.109**
	(0.04)	(0.05)	(0.06)	(0.05)
QE1		0.013	-0.007	-0.120
		(0.05)	(0.08)	(0.21)
QE2		0.263***	0.248***	0.198**
		(0.09)	(0.08)	(0.08)
MEP		0.142*	0.131*	0.189**
		(0.08)	(0.08)	(0.08)
QE3		0.208***	0.190***	0.742***
		(0.06)	(0.06)	(0.20)
Tapering		0.128**	0.107***	-0.064
		(0.05)	(0.04)	(0.09)
Agency MREIT*QE1		0.323	0.714***	0.054
		(0.20)	(0.18)	(0.36)
Agency MREIT*QE2		0.248*	0.159	0.247*
		(0.14)	(0.14)	(0.14)
Agency MREIT*MEP		0.134	0.174	0.133
		(0.13)	(0.12)	(0.13)
Agency MREIT*QE3		-0.266***	0.015	-0.040
		(0.08)	(0.08)	(0.28)
Agency MREIT*Taper		-0.228*	0.050	-0.020
		(0.12)	(0.10)	(0.13)
Fed Purchase Share			0.009	
			(0.14)	
Agency MREIT*Fed Purchase Share			-0.778***	
			(0.19)	
Fed Purchase Share QE1				0.085
				(0.30)
Fed Purchase Share QE3				-1.088***
				(0.38)
Fed Purchase Share Taper				0.385*
				(0.22)
Agency MREIT*Fed Purchase Share QE1				0.428
				(0.54)
Agency MREIT*Fed Purchase Share QE3				-0.478
				(0.52)
Agency MREIT * Fed Purchase Share Taper				-0.446**
				(0.20)
Constant	0.070	0.049	0.071	-0.132
	(0.14)	(0.10)	(0.09)	(0.15)
Observations	925	925	925	925
R-squared	0.020	0.109	0.125	0.130
Firm clusters	41	41	41	41