

Macroprudential Mortgage-Backed Securitization: Can it Work?

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Abstract

We consider the feasibility of structuring hybrid mortgage securitizations—where private capital would typically bear mortgage default losses and the government would only provide catastrophic reinsurance—with macro-prudential features that would vary over the real estate cycle. Such securitization schemes have recently been the focus of U.S. housing finance reform efforts. Using data collected over the recent U.S. residential real estate boom and bust, we show that hybrid securitizations with actuarially-priced government-backed catastrophic insurance and first-loss capital requirements born by the private-sector would likely not have mitigated the effects of losses on mortgage loans during the recent financial crisis. If policymakers want to both retain the ubiquity of the 30-year fixed-rate mortgage in the U.S. and build a sufficiently large private-sector insurance fund to ensure that the government is only “on the hook” for mortgage losses when there is a catastrophic outcome, then the government may need to require that all mortgages, whether securitized privately or through a government-backed program, to be insured against catastrophic risk.

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Introduction

In early 2011, the Obama administration indicated that the government's primary role in the U.S. housing finance market "should be limited to robust oversight and consumer protection, targeted assistance for low- and moderate-income homeowners and renters, and carefully designed support for market stability and crisis response" (U.S. Department of Treasury and U.S. Department of Housing and Urban Development, 2011). In its housing finance white paper, the Obama Administration put forth three options for long-term reform.

Under the first option, the government's role in insuring or guaranteeing mortgages would be dramatically reduced by limiting it to the Federal Housing Administration (FHA) and other programs targeted to creditworthy lower- and moderate-income borrowers. While the government would continue to provide access for this targeted segment of borrowers, it would leave the vast majority of the mortgage market to the private sector (e.g., mortgages financed using balance-sheet funding by originators or mortgage pools financed using private-label securitization).

Under the second option, the government would also provide a guarantee mechanism that would normally have a minimal presence, but would stand ready to scale up to a larger share of the mortgage market as private capital withdraws in times of financial stress (see also Scharfstein and Sunderam, 2011). To implement this back-stop government guarantee mechanism, the guarantee fee for securitizations could be set at a sufficiently high level that it would only be competitive in the absence of private capital, or alternatively there could potentially be a restriction on the amount of public insurance that would be sold to the private market in normal conditions that could be relaxed to stabilize the mortgage market in times of stress.

Under the third option, the government would add to the first option the provision of catastrophic reinsurance for a targeted range of eligible mortgages with the private capital taking the primary credit risk (see also Hancock and Passmore, 2011a). This catastrophic reinsurance for securitizations would be provided by the government for an explicit guarantee fee. To implement either a government-provided back-stop guarantee mechanism (option 2) or government provided catastrophic reinsurance for securitizations (option 3), what we classify as "hybrid securitizations," it would be necessary to determine the guarantee fee (g-fee) used for

access to a full faith and credit guarantee by the government, as well as the amount of private capital that would take the primary (first-loss) credit risk during normal conditions and during periods when the mortgage market is stressed. The Administration was silent on the appropriate g-fee and private capitalization levels that are necessary to implement a hybrid securitization system with macroprudential features, a gap we seek to address.

Before previewing our results, it is useful to consider recent legislative efforts to implement the three options described above.² Several bills to reform the U.S. housing finance system have been put forth by legislators in the House of Representatives and in the Senate. The bill most consistent with the first option, which narrowly delimits the government's role, is the Protecting American Taxpayers and Homeowners (PATH) Act. This act would redefine the mission of the Federal Housing Administration (FHA) and would establish a nongovernmental, not-for-profit National Mortgage Market Utility to develop "best practice" standards for the private origination, servicing, pooling, and securitizing of mortgages.³ This utility would also operate a publicly accessible securitization outlet to match loan originators with investors and serve as a repository for mortgage data. Proponents of this act argue that no government back-stop is needed for securitizations because liquidity in the secondary market for mortgages would result from uniform standards, public disclosures, and transparency. Opponents argue this approach would leave the government with too few tools to ensure sufficient mortgage credit availability in a severe housing downturn.

The housing reform bill introduced by Senate Banking Chairman Tim Johnson and Senator Mike Crapo during the last Congress would have implemented a hybrid securitization system.⁴ Under this bill, a federal mortgage insurer would provide a government back-stop for eligible mortgage pools that have secured a private first loss piece equal to 10 percent through approved risk-sharing mechanisms (e.g., senior-subordinated structures or credit linked notes).

² A comprehensive review of the many non-legislative proposals is given Frame, Wall and White (2013).

³ For the text of the PATH Act, see <https://www.govtrack.us/congress/bills/113/hr2767/text>.

⁴ For text of the bill co-authored by Senators Johnson and Crapo, see http://www.banking.senate.gov/public/index.cfm?FuseAction=Newsroom.PressReleases&ContentRecord_id=f8f64d97-d732-3aa9-e966-6040d7dbf169&Region_id=&Issue_id=.

This 10 percent first loss position, however, could be reduced in periods of exigent circumstances. Issuers of government-backed MBS would pay a g-fee for catastrophic insurance on the eligible mortgage pools consisting of mortgages with an 80 percent loan-to-value ratio (using either a homeowner's down payment or some form of credit enhancement), and a minimum down payment of 3.5 percent for first-time homebuyers or a minimum down payment of 5 percent for other homebuyers. Depending on how the g-fee is priced, the design of this hybrid securitization system could range from a crisis-driven government back-stop (option 2 above) to the facilitation of government-backed securitization during normal conditions (option 3 above). Proponents of this bill argue that government support can help promote financial stability by ensuring the flow of credit through periods of economic stress; opponents argue that any time the government stands behind a loan it takes on some degree of risk, a risk that is difficult for the government to price.

While these options for GSE reform are debated, private sector securitization of mortgages has virtually disappeared since the onset of the financial crisis, and private sector securitization of conforming mortgages has always been small proportionally relative to securitization of conforming mortgage by the government. Figure 1 describes the recent evolution of the U.S. conforming mortgage market (that is, the market for mortgages that are eligible for GSE purchase and that are not FHA loans). As shown in the upper left panel, there are generally between one and two trillion dollars of conforming mortgages originated each year. In the upper right panel, the dollar amount of MBS issuance by Fannie Mae and Freddie Mac is similar in magnitude to conforming originations since 2008. Almost all conforming mortgages have been purchased and securitized by the GSEs since 2001 (lower left panel). Moreover, Fannie Mae and Freddie Mac currently securitize over sixty percent of all mortgages originated. (lower right panel). In recent years, the remainder are securitized by Ginnie Mae (FHA mortgages) or held in banks' portfolios (at about 20 percent each).

Our Analysis of Hybrid Securitization

In this study, we consider the following three questions about a hybrid securitization system under options 2 and 3 from a financial stability perspective:

- (1) How does the government set a guarantee fee (i.e., g-fee) where the private-sector bears some losses, but where the government provides a full faith and credit back-stop (i.e., the government provides catastrophic reinsurance)?
- (2) How much mortgage credit risk would the private sector bear (i.e., how much private equity capital can be put at risk) before the government guarantee would kick in?
- (3) Under what conditions is hybrid securitization feasible?

In today's mortgage market, the answers to the above questions are as follows. First, the "g-fee" is set based on the views of policymakers about the appropriate role of government-sponsored enterprises, Fannie Mae and Freddie Mac, in the mortgage market, and is not directly related to calculations of expected loss. Second, the private sector bears little or no risk with government securitizations, and the government bears almost all the credit risks associated with government-sponsored enterprise (GSE) mortgage-backed securities (MBS). Finally, the current system is viable only with open-ended government assistance to Fannie Mae and Freddie Mac.

Hybrid securitization supposedly resolve these problems by inducing the private sector to participate in government-backed securitizations. With hybrid securitizations, the goal is to set g-fees and private first-loss capital positions to provide private sector discipline in pricing and underwriting, while meeting policymaker macroprudential objectives. By macroprudential, we mean policies that are designed to make the macroeconomy more stable and that limit the need for government bailouts.

The second and third policy options described above invoke different approaches toward increasing macroeconomic stability. The second option envisions a government securitization program that is idle during boom times but active during a housing bust, when supposedly private securitization has ceased to function. This type of program increases macroeconomic stability because a securitization outlet for banks is still available during a financial crisis, thereby encouraging mortgage lending by banks when the private sector has

withdrawn from the secondary markets. However, investors who participated in private securitization during the boom may suffer large losses, and the economy might falter from any spillover effects created by these losses.

The third option provides a government securitization outlet and catastrophic insurance through both booms and busts. In this case, investors in mortgage-backed securities are protected from catastrophic losses during the bust, limiting the spillover effects created by losses imposed on them. If the spillover effects from investor losses are large, then the third option might provide greater stability. If the spillover effects are small, or if the government insurance program creates additional market distortions during the boom, then the second option might be preferred.

Of course, if market distortions created by either government securitization or insurance are large enough, then option one might dominate both options two and three. We do not address this issue here, but the first-loss position held by private sector participants has to be “large enough” to induce appropriate mortgage underwriting for home purchases.

Below, we use data collected over the recent U.S. residential real estate boom and bust to analyze outcomes had the government required the private sector to cover the losses associated with mortgage defaults in all but a catastrophic financial crisis. Our analysis demonstrates that a hybrid securitization system under option three would have been essentially unused during the real estate boom because the first-loss capital requirement would have made government-sponsored securitization uncompetitive relative to private sector securitization during that period. For option number three, the historical data from the previous cycle suggests that the relative cost of private capital is too low and the hedging costs for holding mortgage interest rate risks is too high during a real estate boom for a hybrid securitization macro-prudential policy to work well. These high hedging costs seem to be associated with the design of the 30-year fixed-rate mortgage.

Our evidence suggests that the Administration’s second option—standing ready in the absence of private capital—may be more feasible than its third option—funding a pool large enough to back catastrophic losses generated during a boom period—unless additional or alternative policy measures are taken as part of option three.⁵ However, if policymakers want to

⁵ Note, however, that if the government follows a macroprudential strategy under option two after a housing bust, it would tend to underprice mortgage default risk relative to the private sector’s perceptions of such risk. Government

(1) retain the ubiquity of the 30-year fixed-rate mortgage in the U.S., (2) insure all private sector investors against catastrophic outcome and minimize spillover effects during a financial crisis, and (3) build a sufficiently large private-sector insurance fund to ensure that the government is only “on the hook” for mortgage losses when there is a catastrophic outcome, then the government may need to require that all mortgages, whether securitized privately or through a government-backed program, to be insured against catastrophic risk.

Simulating Hybrid Securitization over the Last Housing Boom and Bust

As outlined in the introduction, many policymakers would like to encourage a minimum amount of private capital to be available to absorb the first losses from mortgage defaults in any government-backed program of mortgage securitization. What is different with hybrid securitization relative to purely-private securitization is that after the first losses from mortgage defaults are covered by private investors, the government backstop kicks-in and covers mortgage default losses when such losses are catastrophic. Hybrid securitization is basically GSE securitization with a higher cost of funding because of the capital costs associated with the private sector first-loss position and g-fees designed to build a fund to cover catastrophic default losses. But, would GSE securitization be used with these design features, in the presence of purely-private securitization?

From the perspective of the investor holding a hybrid public-private security, the securitization is government-backed. With hybrid securitization, the government sets two policy parameters: (1) the size of the “first-loss position” (which will define what is a catastrophe and what is not) and (2) the government “g-fee.”⁶ Thus, the MBS investor effectively has to pay two guarantee fees: one for the private sector backing of the first-loss position, and one for the

securitization would then be lower cost than private securitization. Consequently, the private sector may find it difficult to compete against government hybrid securitizations for many years after a housing bust if the government does not adjust its macroprudential hybrid securitization policy under option two once the housing crisis has passed.

⁶ The government also determines that the structure of the securitization has three tranches: a highly liquid, information-insensitive tranche (guaranteed by the government), a mezzanine tranche held by the private sector, and a residual tranche that concentrates credit risk and is held by the private sector. This three tranche structure captures the major motivations for tranching a pool of assets: the creation of a highly liquid security for uninformed investors and a risky security for well-informed investors (DeMarzo, 2005). The mezzanine tranche is sometimes broken in more pieces depending on the distribution of private risk information of issuers versus purchasers.

coverage of any additional catastrophic losses born by the government. We assume that both of these fees are set in an actuarially-fair manner, that is:

$$g_{PG} = r_{Mez}(\phi_{PG} - \theta) + r_e \theta.$$

$$g_{GOV} = r_{AAA}(1 - \phi_{PG})(1 - \text{CDF}(\phi_{PG})).$$

The first premium, g_{PG} , is paid to the private guarantor of the MBS security. It has two components: the expected loss θ , and the loss that is incurred if the loss outcome exceeds the expected loss but is smaller than a catastrophe; that is, smaller than the loss outcome threshold set by the government, ϕ_{PG} . The private guarantor is assumed to have to provide a competitive return on equity to the capital (r_e) that is raised to cover expected losses, and a competitive return on a more senior mezzanine tranche (r_{Mez}) for the unexpected, non-catastrophic loss outcomes. We estimate the return on equity using a forward-looking stock-market return and the return on the mezzanine tranche using the “BBB” corporate bond rate.⁷ We judge that these are realistic alternative investments for the types of risks investors would face under a hybrid-securitization structure.

The government’s catastrophic insurance is priced in a similar manner; the expected loss is based on the cumulative distribution function of loss outcomes, $(1 - \text{CDF}(\phi_{PG}))$. If a tail event occurs, the government only pays out the portion of the loss that exceeds the first-loss position of the private guarantor, $(1 - \phi_{PG})$. The government’s opportunity cost of the funds disbursed is assumed to be the “AAA” corporate rate (effectively, the Treasury rate plus a very small spread that accounts for a small probability of loss).⁸

We consider the two alternative government policy options described earlier. First, we formalize of the Administration’s option 2. The government might want to pursue a “through-the-cycle” macroprudential policy, where the government structures a constant first-loss position

⁷ The equity premium is calculated from a dynamic dividend discount model developed by Campbell and Schiller (1988).

⁸ The loss structure envisioned is structured to be similar to bank regulatory capital requirements. However, in the current mortgage finance system, the bank capital risk-weights are designed to set capital levels to cover the unexpected loss outcomes in a high percentage of cases (usually 98 percent, or 99 percent, or 99.9 percent of potential outcomes). In contrast, under hybrid securitization the first-loss position of the private sector is set by other means (e.g., legislation or regulation).

so that it covers the average credit loss over the housing cycle. During a financial crisis, the government wants government-sponsored securitization to be used if private securitization is not available, but prior to a crisis (that is, during a housing “boom”) the program sits idle because the capital costs seem too high to private market participants. Private sector investors bear the losses during the bust from investments made during the boom, but mortgage securitization remains available through the government at the average, “through-the-cycle” price.⁹

As for option number three, suppose that the government sets its g-fee during “normal times” in a manner so that the private sector would be indifferent between private-sector and GSE securitization.¹⁰ In other words, the government would not directly provide a subsidy to the private sector participants, but the government would set the g-fee and first-loss capital requirement so that the estimated benefits to MBS investors would be equal to the costs of the guarantee fees. Under this policy, the government would need to cover more than catastrophic mortgage losses during a crisis (the private sector first loss position will be insufficient during the bust and, if the securitizer purchased the government insurance, the government will bear some of the non-catastrophic losses). In addition, some private-market firms and households would go bankrupt (those that did not participate in the government-backed securitization product), albeit fewer than under option two if the government does not bailout holders of mortgage-backed securities.

Loss Outcomes for Portfolios of Conforming Mortgages

Zandi and deRitis (2013) have calculated the actual average lifetime loss on a GSE mortgage during the most recent economic crisis as 2.7 percent.¹¹ This approximation of the losses to mortgages that were originated in 2007 was calculated by dividing all GSE realized residential mortgage loan losses during 2006-2012 by the outstanding debt in 2007.

⁹ One might argue that the Federal Housing Administration (FHA) already performs this role. During the most recent housing boom and bust, the FHA was almost unused during the boom and needed capital injections during the bust. In this sense, the government already has a backstop mortgage securitizer.

¹⁰ Supposedly, the government sees some positive externality from making government credit available alongside private sector. We don’t describe the externality, but note that the US government has followed such a policy with Fannie Mae and Freddie Mac for many decades.

¹¹ The original figure presented in Zandi and deRitis (2013) was 3.7, but based on other underlying data provided in their paper, we believe this was in error.

In contrast, for our assessment of the feasibility of alternative options for housing finance reform, we created an expected loss distribution for conforming mortgages using a three-step process. In the first step, we constructed an estimate of expected losses for mortgages using loan-level mortgage data from Lender Processing Services Inc. (LPS). More specifically, we calculated annual cumulative foreclosure rates for conforming mortgages stratified by year of origination. In Figure 2, these cumulative foreclosure rates are provided for “normal” times (top panel) and for “stressed times” (bottom panel), where these “stressed times” are defined as the years in which the household would experience the financial crisis soon after their mortgage was originated. For conforming loans originated between 1998 and 2005—the years when the financial crisis was not experienced early on—cumulative foreclosure rates averaged 4.25% (upper panel). However, mortgage borrowers that experienced “stressed times” early in the life of their mortgage had cumulative foreclosure rates that averaged 12.3% (bottom panel), an average cumulative foreclosure rate more than 2.8 times the “normal” average cumulative foreclosure rate.

In the second step, we considered losses given default and constructed expected lifetime mortgage default rates during “normal” and “stressed” periods. Historical loss-given-default data for conforming mortgages is both difficult to find and difficult to calculate. Fannie Mae has reported a “single-family initial charge-off severity rate” in their annual report (10-K) since 2008. We would argue that the loss severity rates for mortgages originated in the years 2008 through 2013 reflected mortgage cohorts with relatively tight underwriting standards. In these years, the expected loss severity rates for foreclosures had values around 25%.

The peak for Fannie Mae’s reported initial loss severity measure was 37.2%. This loss severity rate, which likely reflected mortgages underwritten in 2006 and 2007, likely represents the peak of Fannie Mae’s losses given default, given the loose underwriting standards prior to the crisis combined with the extreme depth of the financial crisis itself.

With an expected lifetime mortgage default rate for a cohort of mortgages and the loss severities associated with those mortgages, we then calculated expected losses. Based on a “normal” foreclosure rate of 4.25 percent and a loss given default of 25 percent, the expected losses were approximately 1.06% for the mortgages that defaulted, but did not experience a financial crisis soon after origination. Similarly, we calculated “stressed” expected losses for the

years 2006-2008 of 4.3%, which were based on a 12.3 percent foreclosure rate and a 35 percent loss given default.

The third step entails the calculation of value-at-risk; this step requires information about the frequency of financial crises. To generate a distribution of expected losses, we assumed that expected losses follow a log-normal distribution. Such an assumption is common, and is embedded in the Basel II capital standards (See Jones and Mingo, 1999). Then, we set the typical loss of 1.06% to the median value of our distribution, assumed that the financial crisis is a “1-in-50” event, and placed 4.3% loss rate at the 98th percentile of the loss distribution. The resulting distribution of implied mortgage loan losses is shown in Figure 3. This long horizon expected loss distribution is roughly consistent with the Basel assumptions concerning mortgage risk. The standard Basel risk-weight on a conforming mortgage is 4.0 percent and with our distribution, 4.0 percent additional capital would cover slightly less than 98 percent of the expected loss outcomes. More detail on the variations in the calculation of “through-the-cycle” first-loss capital requirements (along with the private sector “g-fee” and the government “g-fee”) are provided in Table 1.

But with so little information about potential mortgage losses available, the calculation of an appropriate first-loss position is very difficult since small changes in the estimates of the “tail” of the expected loss distribution can result in substantial changes in the first-loss capital needed for the private sector to cover most expected loss outcomes. As a result, we provide a time-series for calculations for the needed first-loss capital requirement based on (1) variations in the expected frequency of financial crises and (2) variations in the acceptable strike point for government intervention during a financial crisis (Table 1). These simulations demonstrate that either a higher frequency of crises or standards that would require a higher proportions of loss outcomes covered by the private sector, or both, can result in very high levels of private sector capital needed to avoid a government intervention—sometimes more than 15 percent.

Returning to the second policy option described earlier, we estimate that a government guarantor who uses the standard that private sector capital must cover 99.9 percent of expected loss outcomes would require a first-loss position of 8.7 percent (the solid red line shown in Figure 4); if this expected loss coverage threshold was lowered to 95 percent, then the government guarantor would require only a 3.3 percent first-loss position (indicated by the dashed red line). Consequently, small changes in the expected loss coverage threshold combined

with the uncertainty of the loss data can yield meaningful differences in the amount of first loss capital required by the government guarantor. This makes a “through-the-cycle” macro-prudential first-loss position difficult to construct. If the government backstop is to “spring to life” during a financial crisis, policymakers will need to decide the degree and rationale for the capital subsidy given to mortgage securitizations during the crisis using limited and highly uncertain loss information.

Under the third policy option, the government would set the first-loss positions and g-fees for government securitization to be competitive with private sector securitizations. The size of the first loss position shifts over time depending on the estimate of the government benefit and the cost of capital. As a result of the widespread use of government catastrophic insurance during the boom, the spillover effects of mortgage defaults are mitigated during a housing bust. We now turn to how to measure the benefits of government securitization over the previous housing cycle.

Measuring the Historical Benefits of GSE MBS to the Private Sector (Option 3)

To analyze hybrid securitization under option 3, where the government is concerned that private-sector securitizers of conforming mortgages voluntarily use the government insurance program, we will first need to understand why private securitization of conforming mortgages was dominated by government securitization before the crisis and is currently non-existent after the crisis. The underlying capital structures of private securitization and hybrid securitization are similar, and thus understanding the failure of private securitization might help us understand the relative potential success, or failure, of hybrid securitization.

The Return to the Bank from Holding the Mortgage Directly

The return to the bank from holding the mortgage credit risk directly would be:

$$r_{PORT} = r_M - s - r_e \theta + -[r_{mez} \phi_M + r_D(1 - \phi_M)](1 - \theta) - r_{swap} (r_T - r_{repo}) \alpha \delta_M,$$

where the mortgage rate is denoted by r_M , which we assume is set in a competitive market; the cost of servicing the mortgage is denoted by s ; the bank’s cost of financing the mortgage is the weighted-average of the desired return on equity, r_e , and the cost of deposits and other liabilities

(the cost of funds), which is denoted r_D ; the risk-weighted capital requirements are ϕ_M for mortgages; the regulatory risk-weight is set to a value-at-risk (VAR) standard so that all but the most improbable losses will be covered by capital, whereas the loan loss reserve portion of capital is set to cover the average loss rate; and the mean expected loss over the lifetime of a representative mortgage portfolio is denoted by θ .

If the bank chooses to hold the mortgage in its portfolio, it bears both the credit and interest rate risks of the mortgage. It funds a loan loss reserve of $r_e \theta$ to cover expected credit losses. A loan loss reserve is simply an allocation of capital that is expected to bear losses over the life of the loan. It is usually set to cover the average losses observed across the bank's mortgage portfolios.

Standing behind the loan loss reserve is the unencumbered capital generated either by market expectations concerning capitalization of the bank, or by binding regulatory capital requirements. Because of its "second loss" position, we assume that the expected yield needed to attract this capital is similar to the yield that exists on high-yield corporate debt or on mezzanine debt in a securitization, and we denote this yield as r_{mez} .

To offset interest rate risk, the bank purchases a swap with equal duration to the expected duration of the mortgage. This swap hedges interest rate risk, but leaves the bank holding the prepayment risk associated with the swap. Thus, the bank may purchase another financial derivative (such as options or swaps with options) to hedge prepayment risk. We denote the net cost of the financial derivatives needed to hedge a bank's portfolio against interest rate risk by r_{swap} . We include in r_{swap} all of the transactions that would be needed to hedge against prepayment risks and other risks (e.g., the basis risks incurred when hedging instruments with different reference rates from the underlying instruments).

Finally, the bank is required by regulators to hold a liquidity portfolio. Let α denote the 30-day run-off rate of liabilities during a financial panic. We assume that the bank meets its liquidity holdings requirement by financing a government Treasury portfolio with reverse repurchase obligations, which has a spread, $(r_T - r_{repo})$. Holding the mortgages in portfolio is treated less favorably than holding GSE mortgage-backed securities (MBS), which are perceived as being more liquid during a financial panic. The liquidity haircut applied to holding mortgages is δ_M .

On its balance sheet, the bank holds mortgages and Treasury securities funded by deposits and equity. Equity is divided into a loan-loss reserve and into unencumbered capital, which is sufficient to meet regulatory requirements and can also be used to finance additional mortgages. In this analysis, we assume other regulatory capital requirements, such as the bank leverage ratio, are not binding.

The Return to the Bank from Selling the Mortgage

If the bank sells its mortgage portfolio to the private sector, the return is:

$$r_{PLS} = r_M - s + b_{pls} - [r_{MBS}(1 - \phi_M) + r_{Mez}\phi_M](1 - \theta) - r_e\theta.$$

The first loss reserve ($r_e\theta$), or residual part of a private-sector mortgage securitization is like the loan loss reserve at the bank. It is assumed to be large enough so that expected credit losses are covered. Beyond the residential tranche, the mortgage can be broken into two components: a low-risk component that has little default risk (the “AAA” component, which can be made equivalent to a GSE MBS security with enough loss protection, and thus yields r_{MBS} and a higher-risk component that bears the expected loss (the “subordinated” component or $r_{Mez}\phi_M$). Using this tranching scheme, the subordinated component bears all normal credit losses, whereas the “AAA” component bears credit losses that occur only under the most catastrophic conditions. The subordinated (i.e., junior) portion of the security is similar to the unencumbered capital at the bank, and this portion is only expected to take losses if losses run above the average expected level. By providing mortgages for private mortgage securitization, the bank may also capture some of the benefits that such securitization gives to other market participants (e.g., higher liquidity), denoted by b_{pls} .

However, historically, conforming mortgages were rarely sold into the private market. Instead, most banks, particularly the largest banks that originated the bulk of all mortgages, swapped their mortgages for GSE MBS. The return in this case is:

$$r_{GSE} = [r_M + b_{gse} - s - r_{MBS}] - [r_{mez}\phi_{MBS} + r_D(1 - \phi_{MBS})] + r_{MBS} - r_{swap} + (r_T - r_{repo})\alpha\delta_{MBS}.$$

The yield on MBS, r_{MBS} , is the current-coupon yield. This is the hypothetical coupon associated with an MBS pool that trades at par value (that is, the MBS trades at a price of \$100 dollars for \$100 of mortgages in the pool).¹² The bank financing for the GSE MBS is a combination of bank deposits and capital, where the capital earns a return that is equivalent to mezzanine financing, r_{mez} , because the GSEs' capital bears the first-loss position, and the bank only suffers losses if the GSE fails and the government does not bail out the GSE. (Of course, the U.S. government did bail out GSE MBS investors in 2008, but this outcome was not certain prior to that bail out).

Estimating the Benefits of GSE Securitization

The difference in returns from GSE securitization and private securitization is:

$$r_{PLS} - r_{GSE} = b_{pls} - b_{gse} + g_{gse} - [r_{MBS}(1 - \phi_M) + r_{mez}\phi_M](1 - \theta) - r_e\theta + r_{swap} \\ + [r_{mez}\phi_{MBS} + r_D(1 - \phi_{MBS})] - (r_T - r_{repo})\alpha\delta_{MBS}.$$

If banks strive to equate the returns from selling mortgages to either private securitizers to the returns from selling to the GSEs, then the following relationship can be deduced:

$$r_{MBS} = \frac{1}{(1 - \phi_M)(1 - \theta)} (r_{swap} + (1 - \phi_{MBS})r_D + [\phi_{MBS} - (1 - \theta)\phi_M]r_{mez} - r_e\theta - \\ (r_T - r_{repo})\alpha\delta_{MBS} + b_{pls} - b_{gse}).$$

Thus, we estimate the equation:

$$r_{MBS} = c_0 + c_1 r_{swap} + c_2 r_D + c_3 r_{mez} + c_4 (r_T - r_{repo}) + \varepsilon$$

where $b_{pls} - b_{gse} = c_0 + \varepsilon$ is an estimate of the extent to which the benefits of private securitization must exceed the benefits of GSE securitization for private securitization to be feasible. The constant term is the expected value of the government advantage to MBS

¹² For details on the calculation of the current-coupon MBS yield, see Hancock and Passmore (2014).

investors. It is the amount of extra return the private sector must offer the originator to equate the implied mortgage rate financed by private sector securitization to the implied mortgage rate financed by government-backed (GSE) securitization. The larger the advantage of government-sponsored MBS over privately-sponsored MBS is, the larger the constant term in the above equation will become.

In other words, the regression attempts to equate the mortgage rate created by the government-sponsored entity to a hypothetical mortgage rate created by summing the banks' cost-of-funds and a weighted-average of private sector yields that capture three types of risk: interest rate risk (proxied by the yields on interest rate swaps and by bond volatility), credit risk (proxied by the yields on BBB debt), and liquidity risk (proxied by the Treasury-repo spread). In normal times, we would expect the constant to be positive because the liquidity benefits and regulatory capital savings of government-sponsorship of MBS are positive. But as our analysis shows below, when hedging costs are high, when private-sector capital is especially cheap, or when the value of government-backing or government policy is in question, the relative benefits of government-sponsorship of MBS are diminished and this constant term can become small or even negative.

Our regression estimates for the r_{MBS} specification over the past 14 years are provided in Table 2. The coefficients are generally significant and suggest that the average benefit of GSE securitization over private sector securitization is 87 basis points over the July 2000 to March 2014 period.¹³ As shown in Figure 5, the regression residual is stationary and there is no unit root. Note that the variation in the residual can be large relative to the constant, especially during the financial crisis. However, the expected value of the residual is zero, so we focus on the constant estimate as the long-run average value of the GSE benefit advantage.

¹³ Note that this liquidity/capital advantage of GSE MBS is distinct from most calculations of the GSE subsidy. This is the advantage that accrues to a holder of a GSE MBS from holding near-sovereign debt, which arises from the regulation of the holders and the structure of the secondary market. The GSE subsidy is usually a calculation of the debt advantage the GSEs have relative to private sector funders of mortgages and MBS (see Jeske, Kruger, and Mitman, 2013, and Passmore, Sherlund and Burgess, 2005). Of course, the GSEs can capture more of this liquidity/capital advantage created by the government-backing of GSE MBS by raising the g-fee for securitization, which might increase their profitability if banks and other originators continued to sell mortgages to the GSEs.

As suggested above, the estimated constant in this regression is likely varies over time. A more appropriate estimation technique for our estimate of the relative value of the GSE advantage to investors is to use rolling regressions (the intercept coefficients of these rolling regressions are shown in Figure 6). These rolling regressions update the coefficients in the r_{MBS} specification to reflect the evolving views of market participants. They also allow the underlying regulatory and loss distribution parameters to evolve over time. Here, we use a two-year rolling window to estimate each regression.¹⁴ Private securitization—most of the time—was unable to compete with GSE securitization since the constant term is positive and statistically significant from zero during most of the rolling windows. The exceptions are during the end of 2006 and beginning of 2007, as well as during the financial crisis, where the private benefits dominated the GSE benefits on average. Private-label securitizations would have been perhaps very valuable to investors during this period of GSE MBS market chaos because of the abnormally low MBS yields, but private-label securitizers themselves were in turmoil, making them unable to take advantage of the abnormally high prices and low yields for mortgage risk found in the government-backed MBS market during 2009.

During the financial crisis of 2008 and 2009, our estimates suggest that market participants would have benefited from private securitization. Fannie Mae and Freddie Mac were in conservatorship and the Federal Reserve’s QE1 MBS purchases were rapidly driving down MBS yields. However, the private market was in such disarray that such an alternative was not actually available. Our rolling regressions highlight this point; our model yields stationary regressions except during the turmoil of 2009 (Figure 7). In that year, we likely have failed to account for an important common factor in our regression, which is the Federal Reserve’s QE1 program (see Hancock and Passmore, 2014).

Macroprudential Policy with Hybrid Securitization

If the government follows the “through the cycle” policy (option 2), private securitization would dominate government securitization some of the time. For example, if the private sector uses the “normal times” expected loss distribution in a boom period, the capital backing of many private mortgage pools will prove to be inadequate during stressed times. The government might

¹⁴ These regressions are generally stationary, except during the financial crisis, as is demonstrated by unit root tests for each respective estimation window (Figure 7).

be indifferent to this outcome. But if many private mortgage pools are undercapitalized, then the government may actually bear the resulting credit risks if mortgage pools become distressed and financial institutions fail (as did occur in 2008).

As for the third policy option (i.e., where the government would set the first-loss position to be competitive with requirements that are set in the private sector), the government would select the first-loss private sector position such that the cost of capital equals all of the benefits received by the private sector when using the government-backed system (using the rolling regression estimates from above). Under this policy, the benefits of private label securitization are set equal to the benefits of government securitization. The size of the first loss position shifts over time depending on the estimate of the government benefit and the cost of capital (the black line in Figure 4 that is surrounded by the standard error band in blue). This is the highest requirement of first loss capital (and the lowest level of the government g-fee, which is set to zero) that is consistent with private sector participation in the hybrid securitization program. If the first loss private-sector capital requirement is set higher than what is specified by the upper-bound for the black line, then private sector participation in the third policy option would likely cease.

Under the third option, the government can solve the problem of private market participants not using the government insurance program by making the government program “competitive” and lowering the amount of capital needed to meet the first-loss capital requirements. But if it meets the competition, it creates a new problem: the amount of capital collected for the first-loss position will be inadequate to cover all losses in a catastrophe because many mortgages will be privately-securitized, rather than flow through the hybrid securitization system.

Hybrid securitization under option three is difficult to implement because of the benefits of government-backed securitization relative to the cost of the “first-loss” capital position vary a lot. Why are these benefits of government-backed securitization so volatile?

Recall that banks are assumed to be the marginal investors in MBS and one key element of their return calculation for holding mortgages versus holding MBS is the cost of hedging interest rate risk. We have assumed that 30-year fixed-rate rate mortgages underlie the GSE MBS in our estimate of GSE benefits. As a result, when hedging costs are high, the benefit of government securitization decreases. The banking industry may “disgorge” the 30-year fixed–

rate MBS into the GSDE MBS secondary market when these hedging costs are too high, where they might be purchased by non-hedging entities (e.g. foreign sovereigns).

Turning to Figure 8, it is apparent that hedging costs were relatively high and the cost of equity was relatively cheap compared to a bank's cost-of-funds during the 2006 to 2007 period which resulted in much lower estimates of the GSE benefit advantage than was needed on average to equate MBS yields to a hypothetical current-coupon, private-sector MBS. Our results suggest that banks might find private securitization more appealing than hybrid securitization if these historical conditions were ever repeated.

We can measure the importance of the hedging costs using the following thought experiment. Suppose the dominant mortgage was an adjustable-rate mortgage tied to the bank's cost-of-funds rather than a 30-year, fixed-rate mortgage. If that were the case, then the return to a bank from a hybrid securitization would exclude the cost of hedging; the mortgage pool is naturally hedged because it is based on a bank's cost-of-funds.

In Table 3, we re-estimate the government advantage excluding hedging costs. Without the need to hedge, the resulting estimate of the government advantage is almost three times as large at 2.48 on average. As shown in Figure 9, the government is outcompeted by private sector securitization in 2008, when the lagging investor expectations of a low cost of "BBB" capital are out-of-sync with the rapid increases in interest rates. Our two-year rolling regression does not update itself rapidly enough to capture the shift in rates, and thus underestimates the cost of capital for private securitization. Similarly, the rolling regression structure misses the (smaller) uptick in 2013. Otherwise, the government could have set the macroprudential level of "first-loss" capital for hybrid securitizations based on cost of funds mortgages at a level that limits the government liability without having mortgages flow into the private securitization markets.

Policymakers, however, have shown a strong preference for maintaining the 30-year fixed-rate mortgage. Since moving away from the 30-year fixed rate mortgage may be politically infeasible, another approach might be for the government "back-stop" insurance to be required also for pools purchased by private-label MBS investors. Based on historical experience, the government could have kept the government catastrophic insurance competitive if it levied an insurance premium on all mortgage securitizations, regardless of whether the securitization is in the purely private sector or is government-sponsored. The mortgage insurance premium in this case would be structured like an FDIC premium, which capitalizes the FDIC insurance fund by

taxing deposits, regardless of whether the bank engages in very risky lending or very safe lending. As shown in Figure 10, our estimates suggest that this premium would vary between zero and 60 basis points; if the crisis period is excluded, the premium would be very small. This small premium could be reduced even further if the catastrophic insurance program was designed with deductibles and/or mandatory pay-backs of government outlays by industry participants. Similar to the Terrorism Risk Insurance program (TRIA) or the structure of the FDIC's line of credit from the Department of the Treasury for its insurance fund, these types of insurance pricing methods (along with mandatory premiums) could create a low-cost government backstop that would credibly insure both GSE and private-label MBS investors against mortgage credit risks, while maintaining a 30-year fixed-rate mortgage for mortgage borrowers.

A Discussion of Our Results

Mirroring the forgoing alternative visions to reform and to recapitalize the U.S. housing system are two alternative views of “What went wrong with securitization?” One explanation for the demise of securitization is that agency problems were endemic. Proponents of this view point to evidence that lending standards were progressively lowered in the years leading up to the financial crisis (see Mian and Sufi, 2009; Keys, et al., 2010; Demyanyk and van Hemert, 2011; Duca, Muellbauer, and Murphy, 2011; Rajan, 2005; and Kashyap et al., 2008). In addition, information frictions have been identified in the securitization process. Ashcraft and Schuermann (2008) provide a taxonomy of such frictions, including information frictions between the borrower and the originator, or between the originator and the issuer of securities. Uniform standards, public disclosure, and transparency proposed by those who favor “pure privatization” are viewed as mitigating agency problems and information frictions.

Alternatively, one can argue that securitization affects the housing boom and/or the housing bust. Shin (2009) argues that securitization shifts the mix between internal and external funding by banks and other originators of mortgages. This shift toward securitization results in greater aggregate lending to borrowers even if the leverage of individual banks or originators remains unchanged. In turn, the increased lending, which is made feasible through securitization, results in a higher asset price (i.e., house price) and a lower probability of default for the borrower (i.e., the mortgagor). In this manner, securitization can kick-start and then

amplify a lending boom. In addition, Brunnermeier and Sannikov (2014) argue that that risk sharing among experts [via securitization] reduces inefficiencies from idiosyncratic risk on one hand, but on the other hand emboldens them to maintain smaller net worth buffers and attain higher leverage. Finally, as recently shown by Gorton and Ordoñez (2014), very small shocks (e.g., small reductions in valuations for mortgage-backed securities) can encourage investors in “information-insensitive debt to require more information regarding their collateralized debt. Inevitably, more information requirements lead to a decline in output (e.g., a real estate bust) and possibly a large financial crisis. These three elements—a lending boom, low capitalization of financial intermediaries, and run-prone capital investors—are viewed as the toxic mix that generated the last financial crisis.

Hybrid securitization is often viewed as a way to “thread the needle” between these views and policy positions. A high first-loss capital position held by MBS guarantors creates a set of institutions that have a strong incentive to monitor the securitization process and resolve agency problems. A very limited catastrophic insurance program might provide just enough government backing to limit the most harmful outcome of a securitization-driven lending boom. Moreover, as argued in Hancock and Passmore (2011a), explicitly-priced government-backed catastrophic insurance on mortgage pools comprised of only eligible mortgages would improve financial stability compared to the government-sponsored enterprise reinsurance scheme that was in place before the financial crisis. This is because *explicit* pricing of a government-backed guarantee combined with a substantial private sector loss position would mitigate market distortions that were created by *implicit* government guarantees during prosperity. Moreover, an explicitly-priced fully government-backed catastrophic insurance program would help ensure that mortgage credit is provided at reasonable cost both in times of prosperity and during downturns since guarantee-sensitive investors in securitized mortgage pools would not engage in a “run” if they would be certain that their money would be repaid with interest.

One recent development that may indicate that hybrid securities are feasible are the credit risk sharing securities issued by Fannie Mae under Connecticut Avenue Securities (C-deals) and by Freddie Mac under Structured Agency Credit Risk (STACR) debt securities. C-deals and STACR debt securities are credit risk sharing securities that provide an opportunity to invest in a portion of the credit risk that the GSE retains when it guarantees single-family MBS. (More

details are provided in Appendix Table 1.) The C-deals and STACR securities are neither guaranteed and nor secured, with the payments based on the performance of the mortgage loans in a *reference pool* of recently securitized MBS. *Reference pools* are large, diversified pools of fully amortizing, full documentation, and single-family mortgage loans with a loan-to-value within the range of 60-97 percent, and are composed of a random sample of one quarter's single-family loan acquisitions deemed to be representative of recently securitized MBS. The crucial difference between these securities and other debt securities that have been issued by Fannie Mae and Freddie Mac is that if loans in the reference pool experience credit defaults, the investors in the credit risk sharing securities could bear losses and may not even recoup their principal.

Despite the design of the securities to transfer credit risk, the market prices of these securities issued by Fannie Mae and Freddie Mac may indicate that investors do not believe that they are truly bearing the risk associated with mortgage defaults (Figure 11). The declining spread between the price of these reference-pool specific securities and the LIBOR rate between the first offering and the most recent offerings relative to benchmark spreads suggests that investors may assume they are not taking on the credit risks associated with these securities, and implies they believe there to be an implicit government guarantee on these securities despite Fannie Mae and Freddie Mac's stated position that these securities are not guaranteed. For such securities to truly convince the private sector that private investors would actually bear the credit risk, an institutional structure may be needed that makes clear that there is no mechanism for bailing out such investors.

But ultimately the Achilles heel of hybrid securitization proposals may be the 30-year fixed-rate mortgage. As shown above, the need to hedge the substantial interest rate risks may imply that establishing a sizable first-loss private-sector position in government-backed securitizations combined with bearing the costs of interest rate risk makes the cost of such securitization too high, except when a catastrophe has recently occurred. The consequences of this problem depend on whether or not under private securitization the losses during a financial crisis are purely borne by the private-sector, or whether because of the social externalities associated with such losses, the government will always step in and bailout failed private market participants (i.e., the government owns the tail-risk under all circumstances). If the government is perceived to be likely to engage in a bailout, then a mandatory insurance fund or a known

method of collecting revenues to cover the costs of a bailout may be an efficient, and more equitable, approach to covering such losses.

Conclusion

This paper seeks to provide an empirical analysis of the appropriate guarantee fee (g-fee) and private sector first-loss (i.e., capitalization levels) that would be necessary to implement a hybrid securitization system. Mortgage originators consider the government g-fee, as well as other government requirements such as capital requirements, when deciding whether or not to securitize a mortgage. Hybrid-securitization systems, proposed as possible replacements for Fannie Mae and Freddie Mac by U.S. legislators, would require more private capital to back the housing finance system than the capital that backed traditional GSE securitization as it would explicitly provide government-backing of catastrophic losses. However, hybrid securitization may be difficult to successfully implement without considering the competitive and regulatory environment in place for mortgage securitization.

Hybrid securitization lowers the cost of capital and adds liquidity to privately-backed securitizations. But if the government follows a macroprudential policy of always having enough first loss capital in place to cover almost all (expected) losses, the program may be uncompetitive during normal economic times. If private sector investors do not use the program, then government insurance will not cover their losses during a financial crisis. If private investors are unable to bear the mortgage-related losses associated with a financial crisis without significant bankruptcies and non-payment on private-label MBS, which would be similar to the most recent financial crisis, then other government interventions or bailouts may be necessary to prevent a persistent decline in economic activity.

Our study of the historical evidence suggests that the benefits of the hybrid securitization system would be too small to create a constant first-loss capital position for private-sector participants that would be both competitive and adequate for generating a pool that would cover most mortgage loss outcomes. This low level of benefits associated with a hypothetical hybrid-securitization program seems to be caused by the substantial interest rate risk associated with the 30-year fixed-rate mortgage. Thus to achieve the desired goals of policymakers of creating a sufficiently large insurance fund that could be used to smooth out the boom and bust cycles in U.S. real estate markets while maintaining the provision of the 30-year-fixed-rate mortgage, the

government might need to require that all mortgages be insured against catastrophic mortgage outcomes, regardless of whether or not they are securitized with the government-backed catastrophic insurance.

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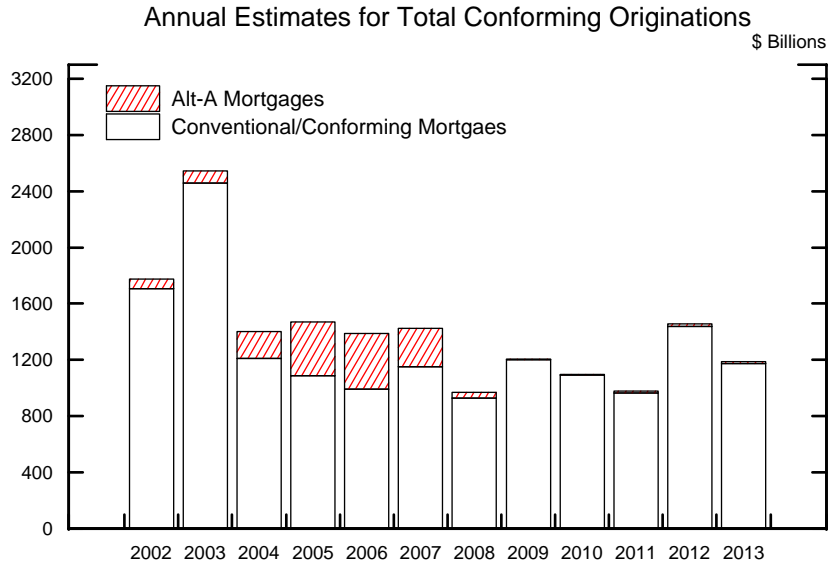
Table of Variables

Symbol	Variable	Details/Source
r_{PORT}	Return to bank from holding mortgage in portfolio	Endogenous
r_{GSE}	Return to bank from private securitization	Endogenous
r_{PLS}	Return to bank from private securitization	Endogenous
r_M	30-year fixed conventional mortgage rate	Federal Reserve – Housing and Real Estate Finance Section
s	Cost of servicing	Mortgage market convention
r_{swap}	Net hedging costs for interest rate, prepayment, and basis risks	Swap rates: Federal Reserve – H.15; Bond volatility: Bloomberg, Federal Reserve staff calculations
r_{mez}	Return on mezzanine financing	Corporate BBB 5-year yield: Computed using the Nelson Siegel yield curve model, and data from the Bank of America Merrill Lynch Bond Indexes
ϕ_M, ϕ_{MBS}	Risk-weighted capital requirements for mortgages and MBS	Regulatory constants
θ	The mean expected loss over the lifetime of a representative mortgage portfolio, as fraction of principal	Derived from estimating the expected loss distribution.
r_D	Cost of funds	Interest expense divided by interest-bearing liability for all commercial banks: Federal Reserve – Banking Analysis Section
r_e	Equity Return	DDDM model: 10-year horizon
$r_T - r_{repo}$	Treasury Repo Spread	3-month Treasury Rate minus Overnight Repo Rate: Federal Reserve – H.15
α	Amount of run-off of liabilities during the first 30 days of a financial panic	Assumed to be 5%, based on required Basel III liquidity holdings.
δ_M	Percent of MBS holdings that the bank can count toward its liquidity requirement	Regulatory requirement, assumed to be 85%

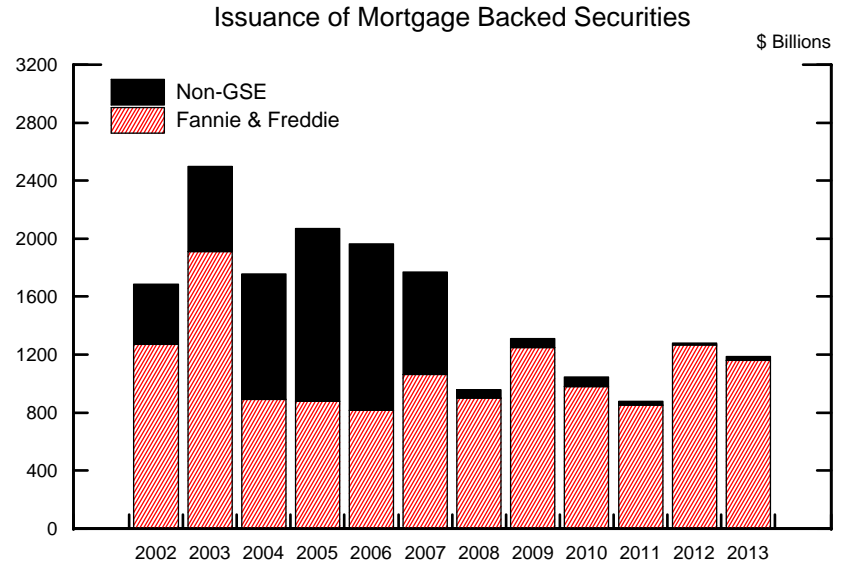
r_{GSE}^{es}	Excess Servicing	Derived from the difference between mortgage and the MBS yield plus servicing plus the GSE guarantee fee.
b_{gse}, b_{pls}	Benefits of GSE and private sector securitization respectively	The difference between the two benefits is estimated using the regression described in the text.
r_{MBS}	Current coupon MBS yield	Authors' calculations using Bloomberg MBS coupon price data. See Hancock and Passmore (2014)
ϕ_{PG}	The first-loss capital position held by the private sector in a hybrid-securitization system.	Set by policymakers and estimated using the distribution of expected losses.

Figure 1

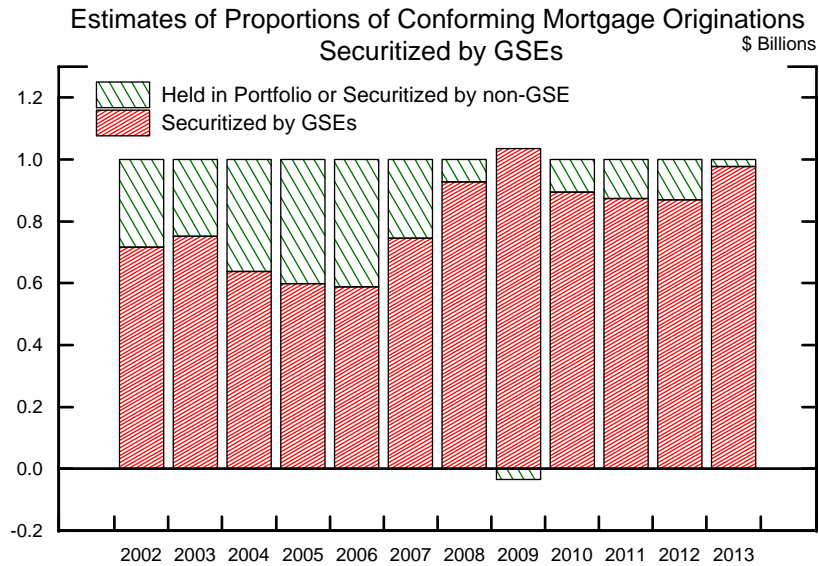
Total Annual Mortgage Originations and MBS Issuance



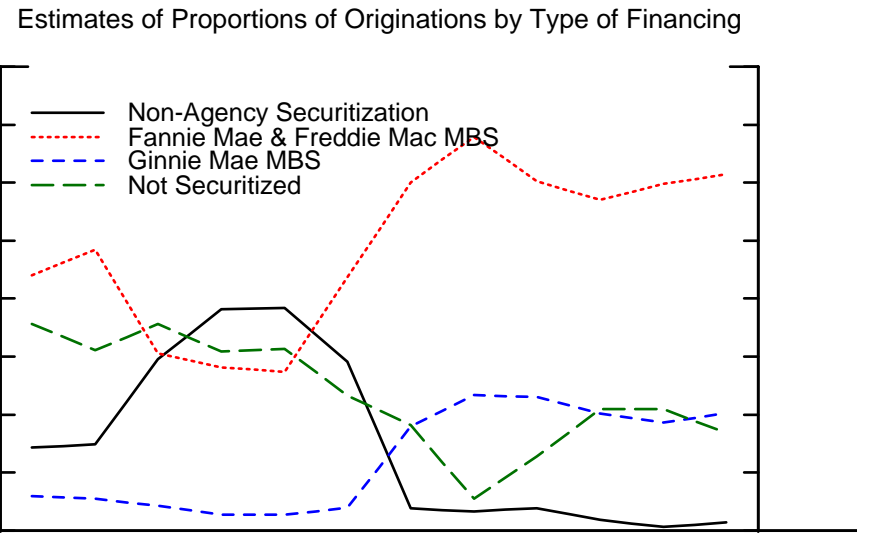
Includes both fixed-rate and ARMs, and both purchases and refis.



Source: Inside Mortgage Finance



Denominator is total conforming as shown above.



Denominator is total, both conforming and non-conforming.

Figure 2

**Cumulative Foreclosure Rates for "Conforming" Mortgages
(Single-Family, First-Lien, Conventional 30-year Fixed, All FICO scores)
by Year of Origination**

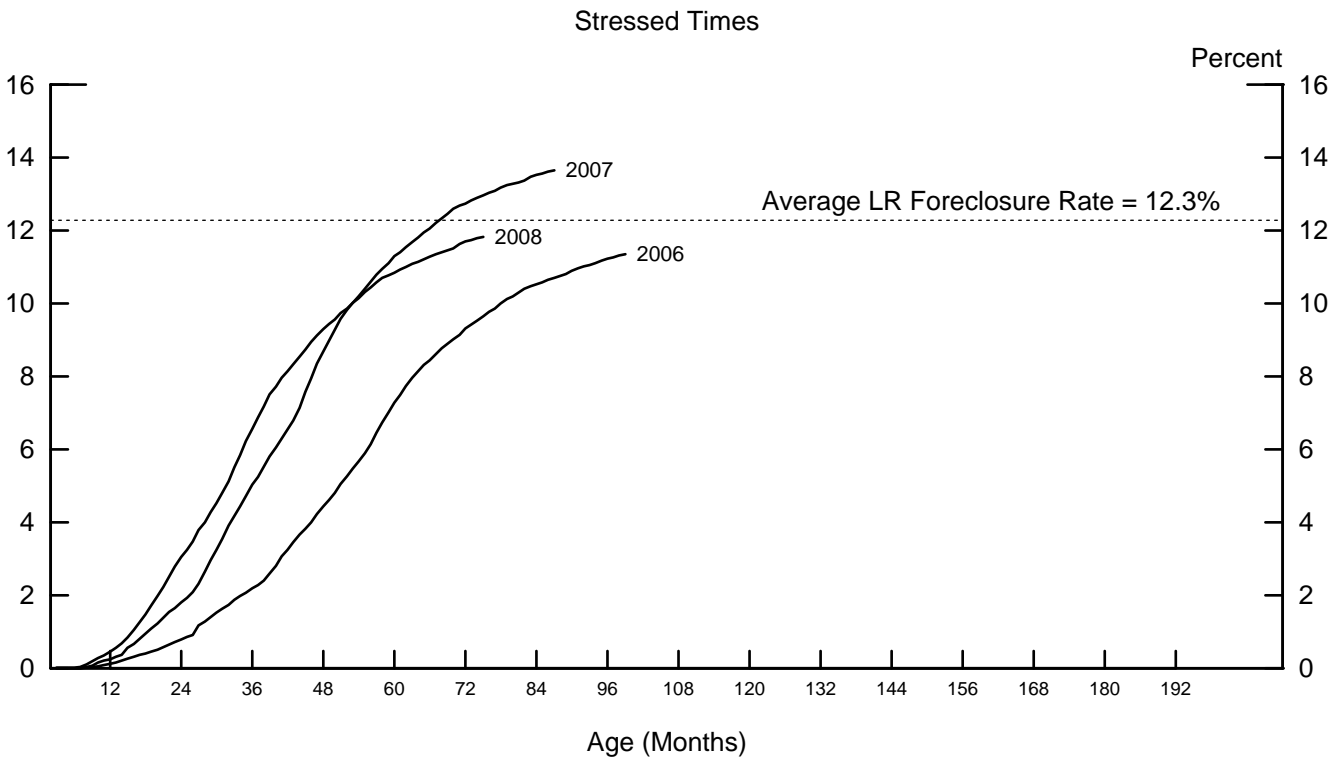
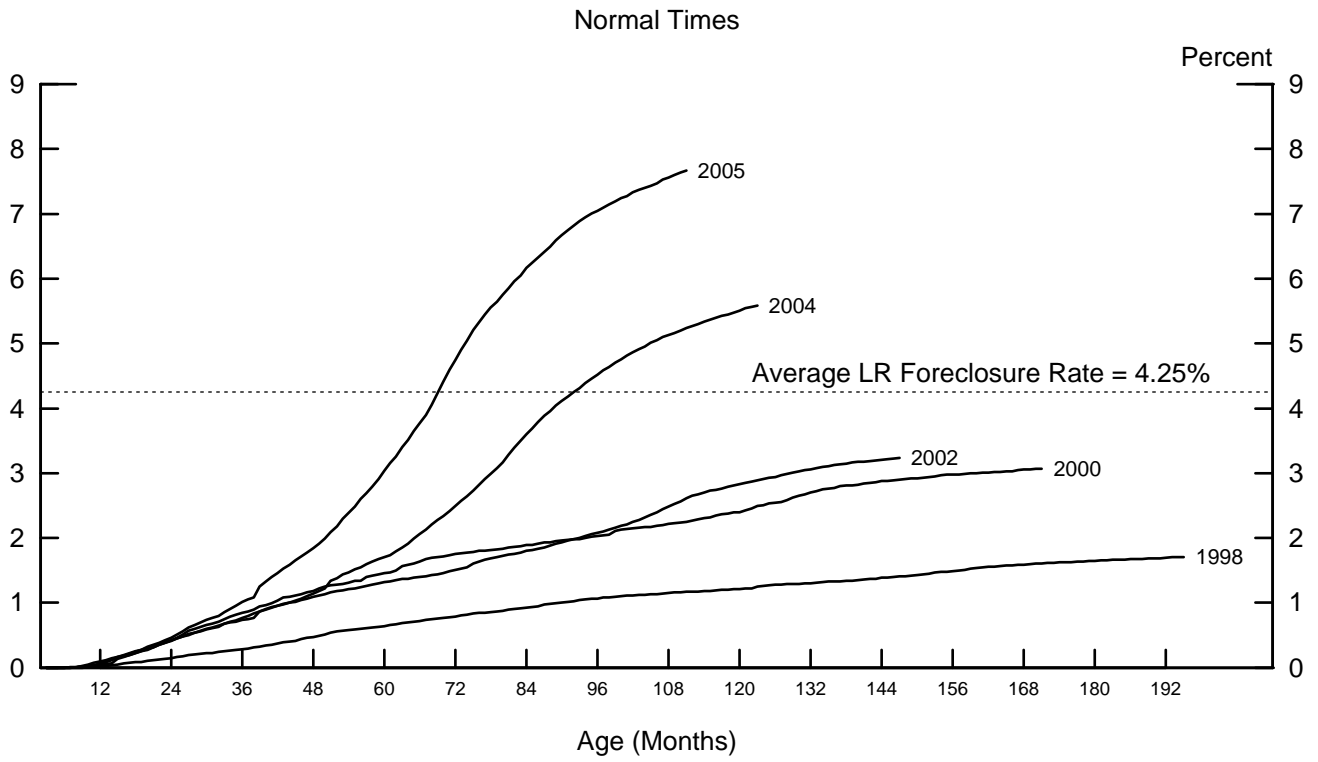


Figure 3

Long-Horizon Expected Loss Distribution of U.S. Mortgage Loan Losses

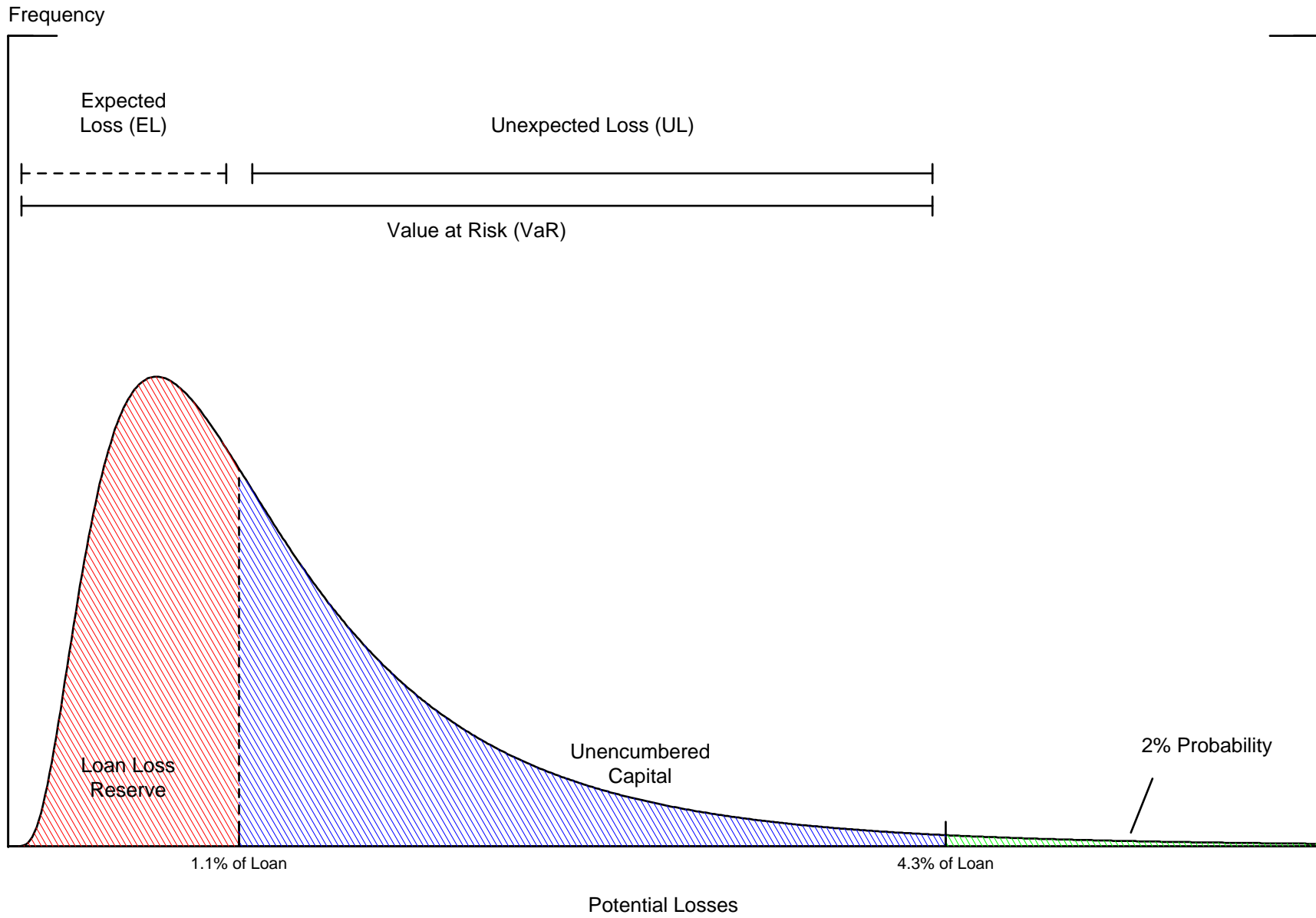


Table 1

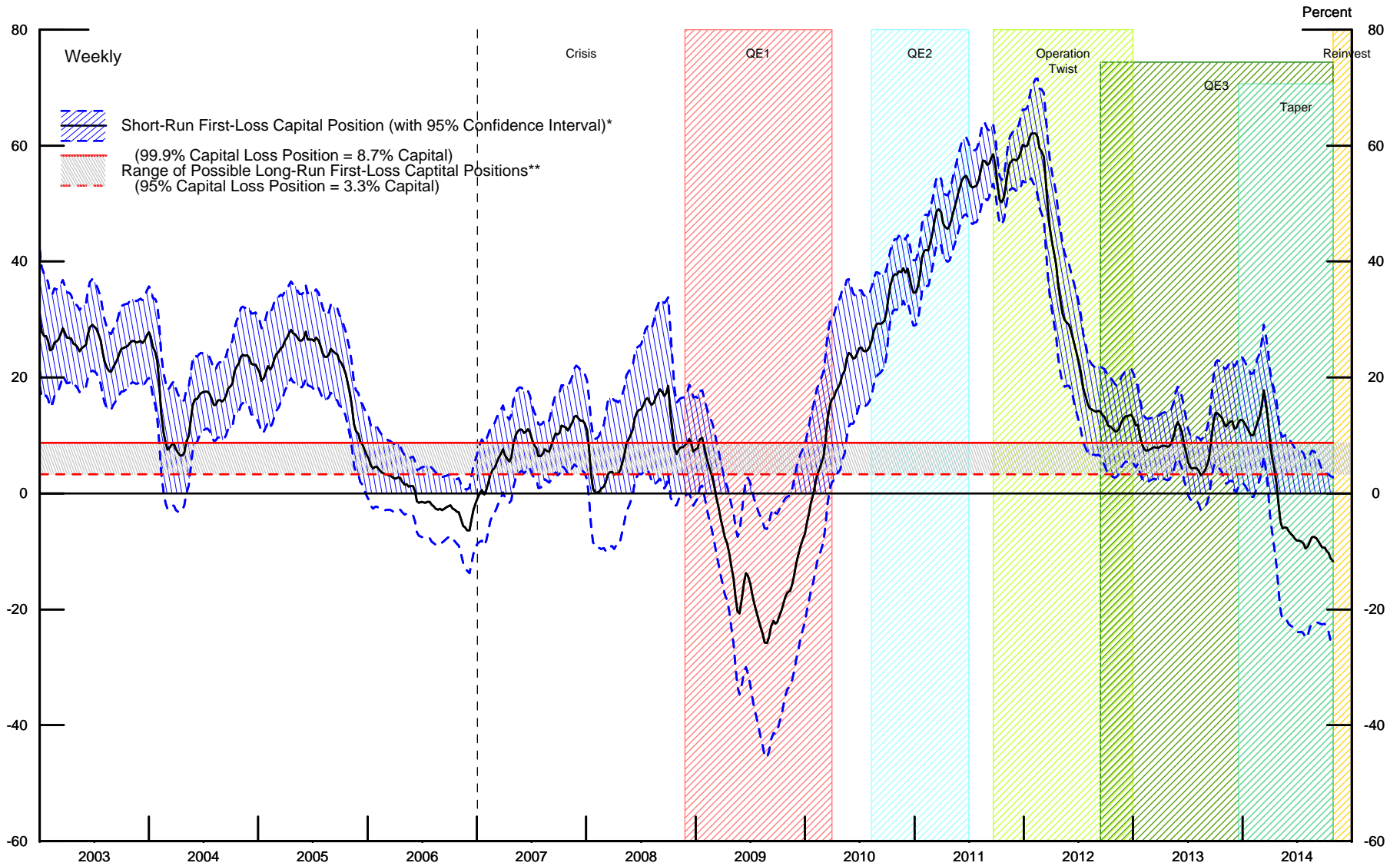
**Variation in "Through-The-Cycle" First-Loss Capital Requirements,
Private Sector G-Fees, and Government G-Fees using Alternative
Assumptions on Frequency of Crises and Loss Scenarios**

First Loss Position [Private Guarantee Fee] {Government Guarantee Fee}		Estimated Underlying Loss Distributions					
		Assuming the Recent Financial Crisis was a 1-in-50 event			Assuming the Recent Financial Crisis was a 1-in-20 event		
		(1)	(2)	(3)	(4)	(5)	(6)
Extreme Loss Standard Set by Government	95%	2.9 [21] {18}	3.3 [23] {18}	3.6 [25] {18}	3.7 [25] {18}	4.3 [28] {18}	4.9 [31] {18}
	98%	3.7 [25] {7}	4.3 [28] {7}	4.9 [31] {7}	5 [32] {7}	6.1 [37] {7}	7.2 [43] {7}
	99%	4.3 [28] {4}	5.2 [33] {4}	6 [37] {4}	6.2 [38] {4}	7.7 [45] {3}	9.3 [53] {3}
	99.5%	5.1 [32] {2}	6.1 [37] {2}	7.3 [43] {2}	7.5 [44] {2}	9.5 [54] {2}	11.7 [65] {2}
	99.9%	6.9 [41] {0}	8.7 [50] {0}	10.6 [60] {0}	11 [62] {0}	14.7 [80] {0}	18.9 [101] {0}
		Assumes median loss rate of 1.1% = (4.25% foreclosure rate ('98-'05) * 25% Loss Given Default) and a "stressed" foreclosure rate of 12.3% ('06-'08)					
		(a) "Low" Expected Loss Scenario assumes a "stressed" loss rate of 3.69% (30% Loss Given Default)		(b) "Mid" Expected Loss Scenario assumes a "stressed" loss rate of 4.3% (35% Loss Given Default)		(c) "High" Expected Loss Scenario assumes a "stressed" loss rate of 4.91% (40% Loss Given Default)	

Source: Author's calculations

Figure 4

Estimates of Private Sector, First-Loss Positions for 30-Year Fixed-Rate Mortgage Pools with Confidence Intervals



*Short-run first-loss positions adjusts private sector capital holdings to equate GSE benefit to GSE Guarantee Fees

**Long-run first loss positions are constant throughout housing cycle. The Variation is created by deflating government standards for "catastrophic losses".

Table 2

**MBS Yield Determinants where the Intercept Measures the GSE Benefit
Relative to Private-Sector Securitizations**

<i>Dependent Variable:</i> MBS Yield		
	<i>Independent Variable</i>	<i>Parameter Estimate</i>
(1)	Long Swap	0.78 ***
(2)	Short Swap	-0.03 **
(3)	Bond Volatility	0.65 ***
(4)	Cost of Funds	0.09 ***
(5)	BBB Yield	0.05 ***
(6)	Treasury -- Repo Spread	-0.10 ***
(7)	Intercept	0.87 ***

Adjusted R-Squared = 0.989		
Weekly Data from July 7, 2000 to September 26, 2014 (n = 743)		

Asterisks *** represent significance at the 99% confidence level, ** at the 95% level, and * at the 90% level.

Figure 5
Residuals from MBS Yield Regression



Figure 6

GSE Benefit Advantage (Based on Rolling Regression Intercept Coefficients)

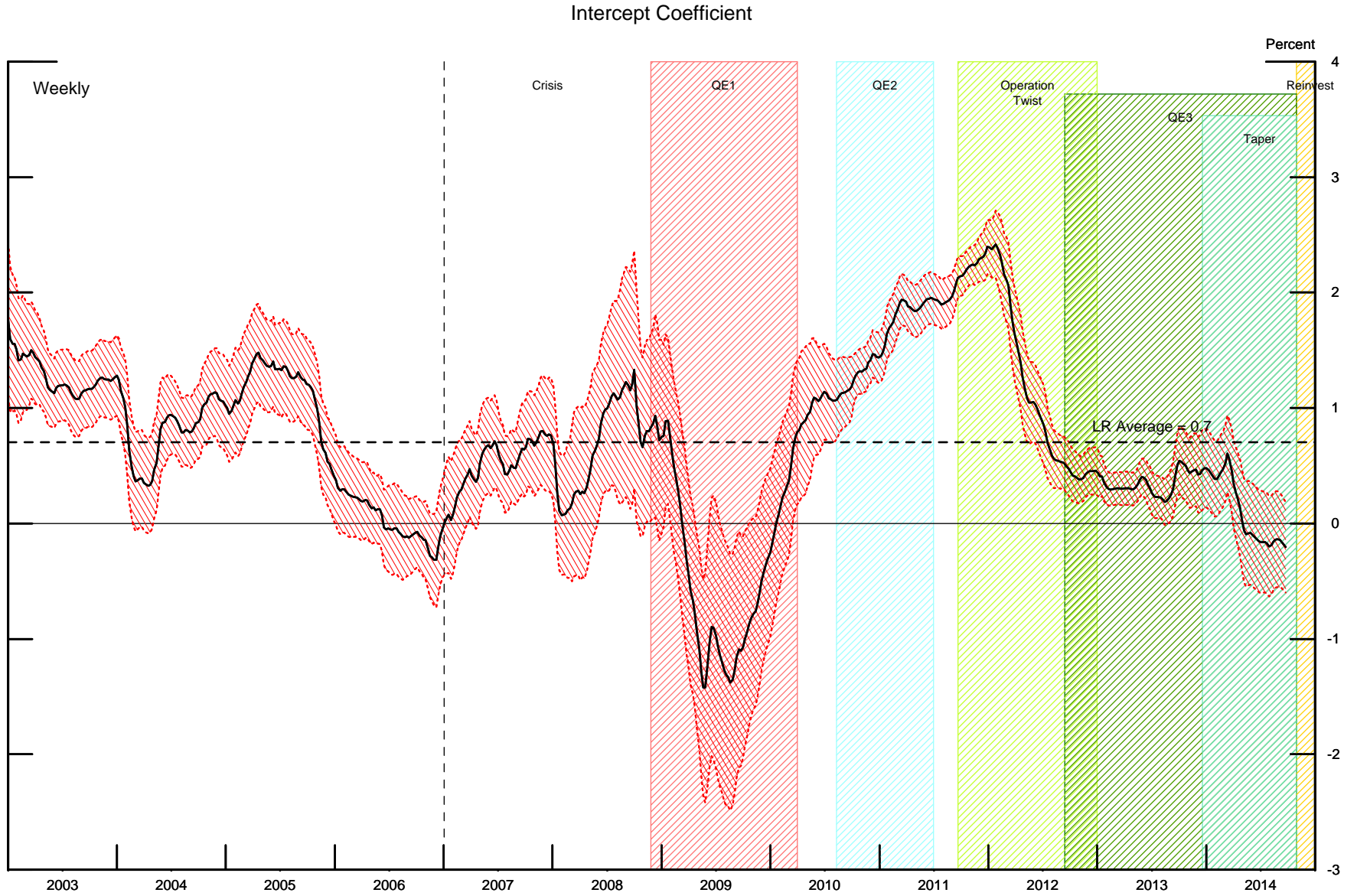
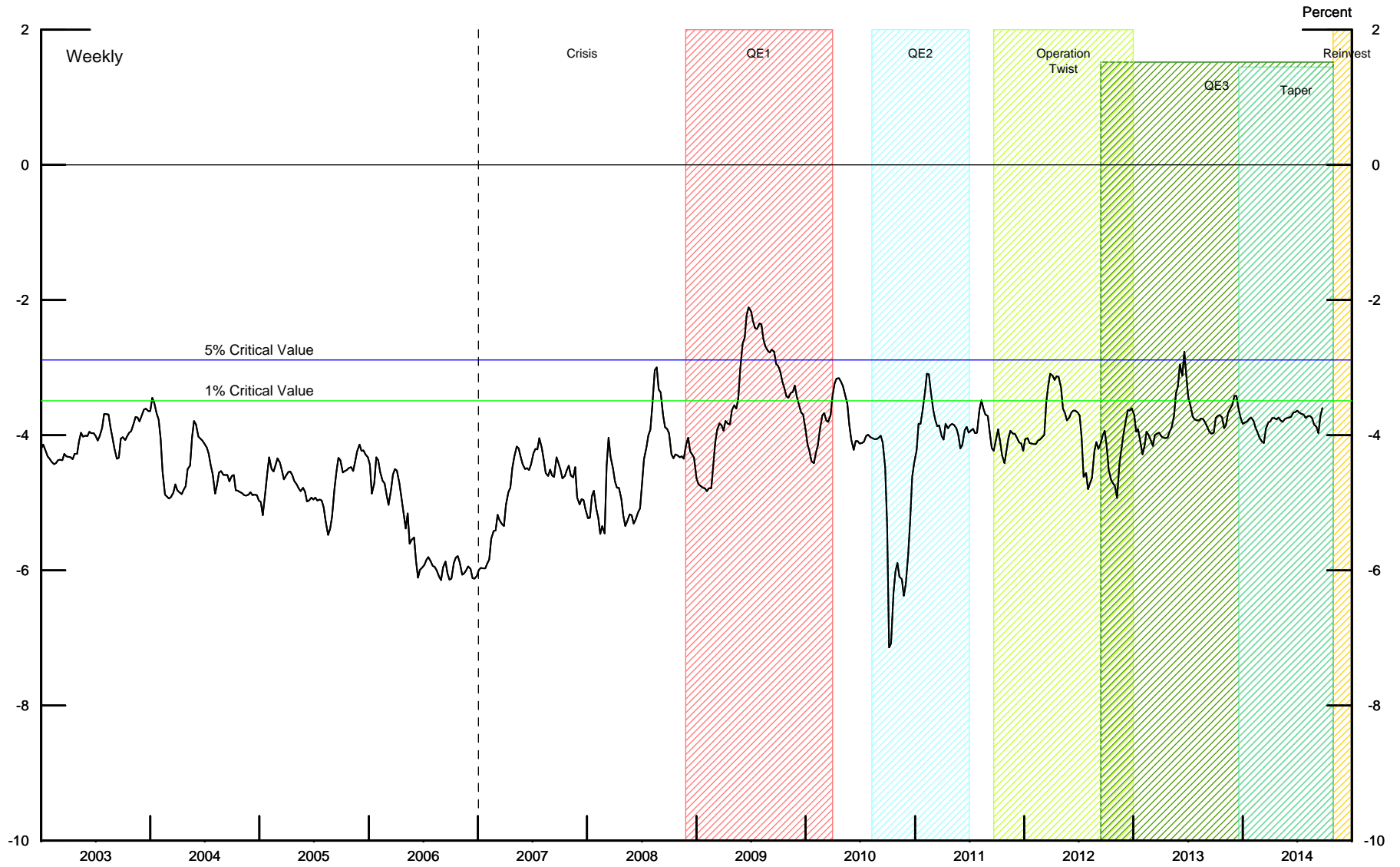


Figure 7
Test for Stationarity Using Rolling Regressions*



*Based on Augmented Dickey-Fuller Unit Root T-tests

Figure 8
Hedging and Capital Costs



*Using 5-year BBB yield

Sources: Hedging costs estimated using data from Reuters Ltd.

BBB/Cost of Funds calculated from Y9 Bank Call Report and Merrill Lynch

Table 3

Estimate of Government Advantage Using Cost-of-Funds and no Hedging Costs (Intercept)

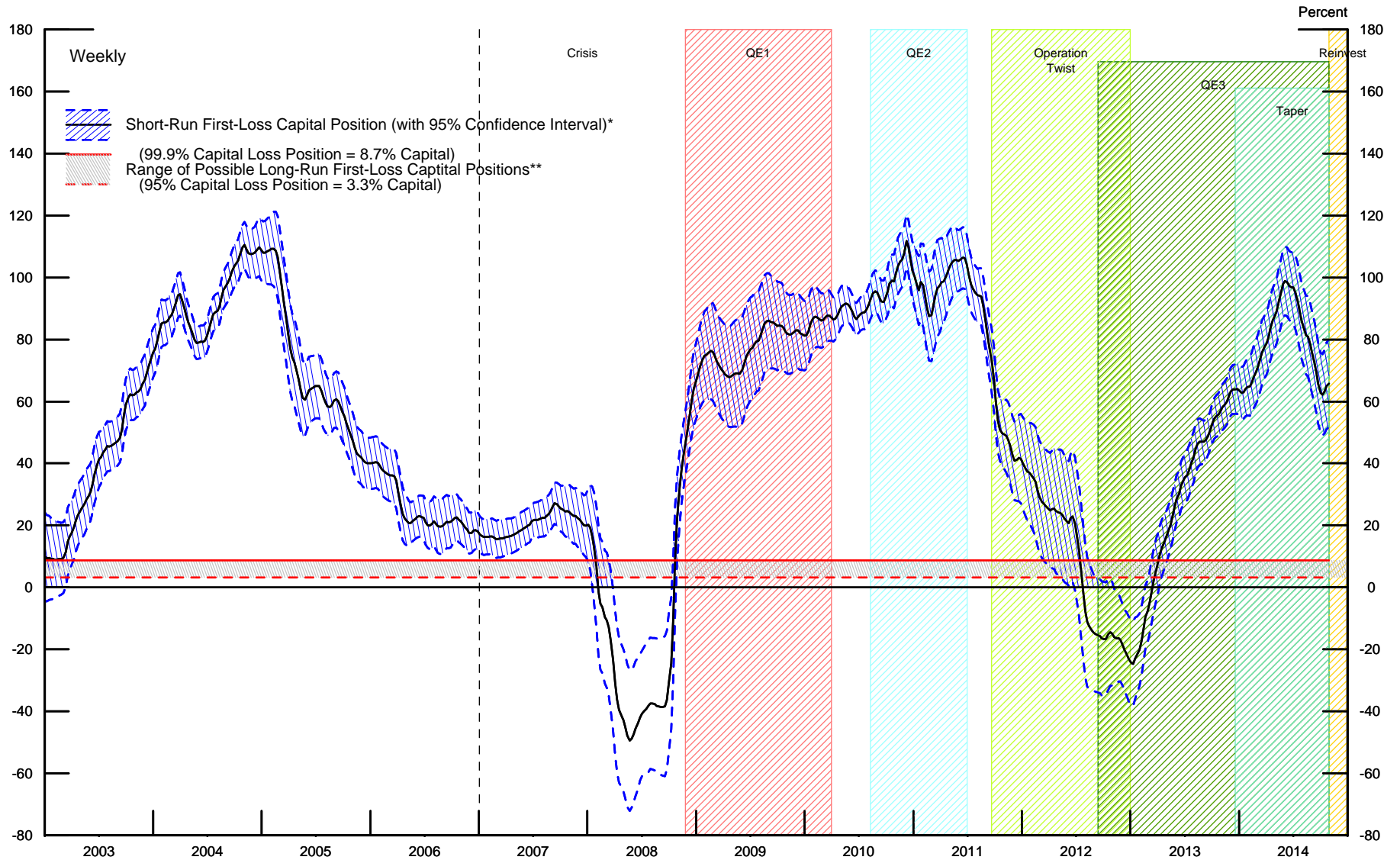
<i>Dependent Variable:</i> MBS Yield		
	<i>Independent Variable</i>	<i>Parameter Estimate</i>
(1)	Cost of Funds	0.83 ***
(2)	BBB Yield	0.15 ***
(3)	Treasury -- Repo Spread	1.14 ***
(4)	Intercept	2.48 ***

Adjusted R-Squared = 0.860		
Weekly Data from June 30, 2000 to September 26 2014, 2014 (n = 744)		

Asterisks *** represent significance at the 99% confidence level, ** at the 95% level, and * at the 90% level.

Figure 9

Estimates of Private Sector, First-Loss Positions for 30 Year Fixed Rate Mortgage Pools with Confidence Intervals without Hedging Cost (Basis Points)



*Short-run first-loss positions adjusts private sector capital holdings to equate GSE benefit to GSE Guarantee Fees

**Long-run first loss positions are constant throughout housing cycle. The Variation is created by deflating government standards for "catastrophic losses".

Figure 10

Estimates of Insurance Premium under a Catastrophic Insurance Regime

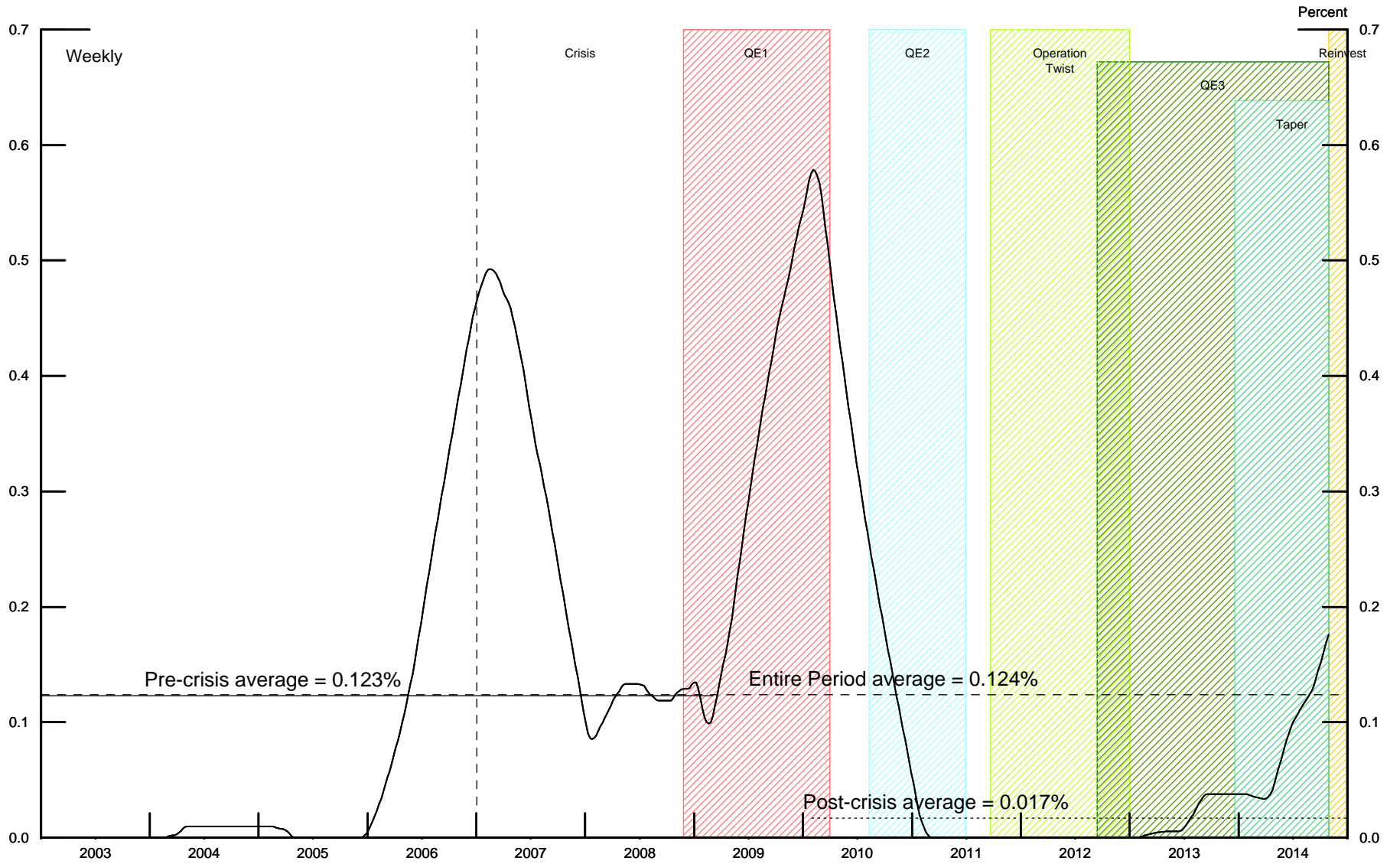
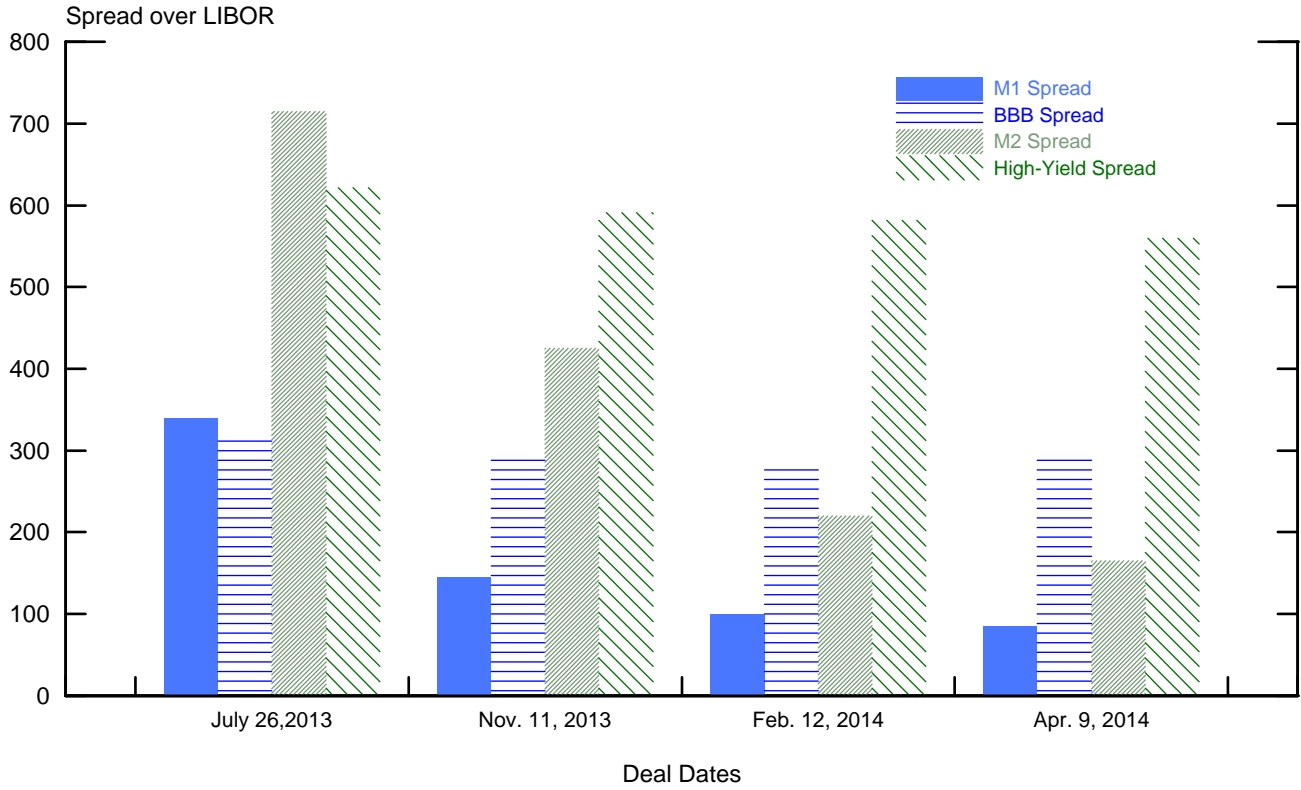
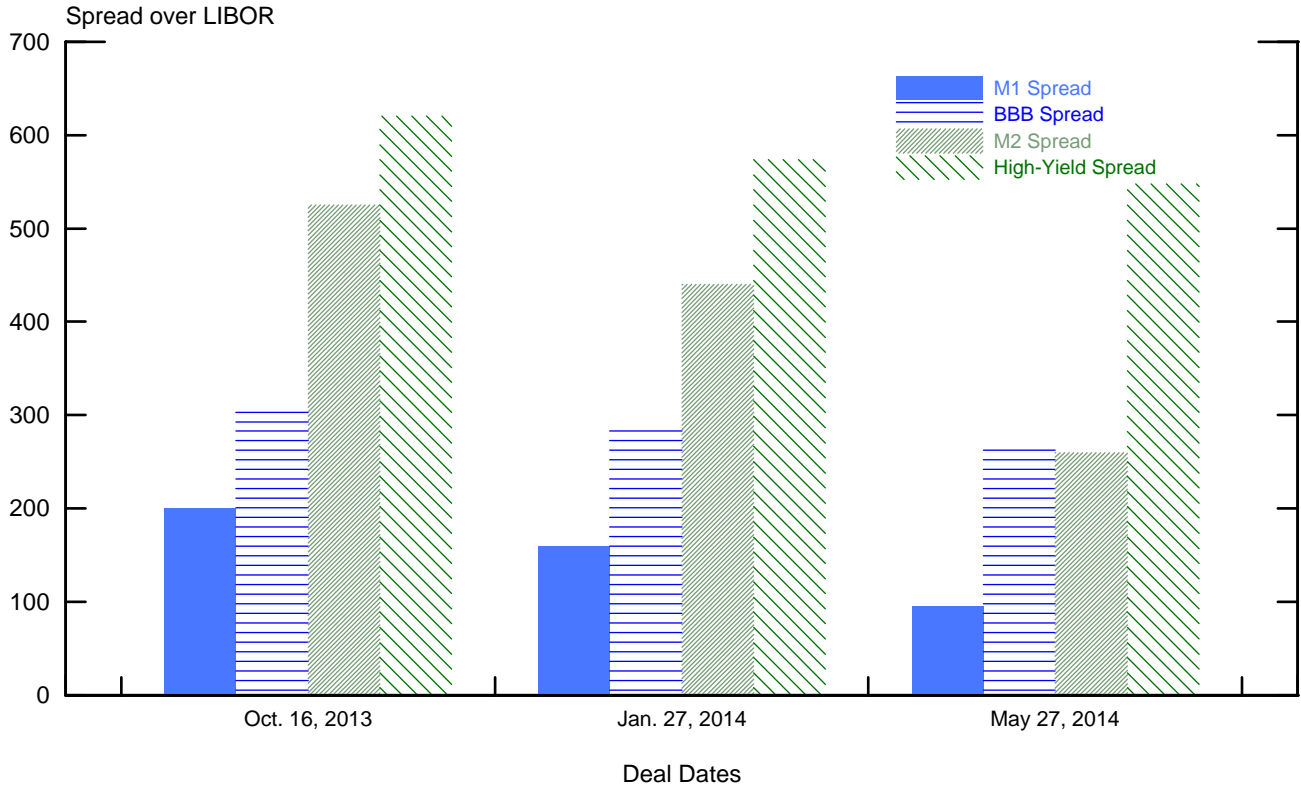


Figure 11

Freddie Mac STACR M1 and M2 Tranches Spread over LIBOR compared to BBB and High-Yield Corporate Bond Spreads over LIBOR



Fannie Mae C-Deal M1 and M2 Tranches Spread over LIBOR compared to BBB and High-Yield Corporate Bond Spreads over LIBOR



Appendix Table 1

Fannie Mae C-Deal and Freddie Mac STACR Initial Offerings

Date	Jul. 26, 2013	Oct. 16, 2013	Nov. 12, 2013	Jan. 27, 2014	Feb. 12, 2014	Apr. 9, 2014	May 27, 2014	Aug. 11, 2014	Oct. 28, 2014
Security (Issuer)	STACR (Freddie Mac)	C-Deal (Fannie Mae)	STACR (Freddie Mac)	C-Deal (Fannie Mae)	STACR (Freddie Mac)	STACR (Freddie Mac)	C-Deal (Fannie Mae)	STACR (Freddie Mac)	STACR (Freddie Mac)
Total Volume	\$500 Million	\$675 Million	\$630 Million	\$750 Million	\$1 Billion	\$966 Million	\$1.6 Billion	\$672 Million	\$611 Million
M-1 Coupon (Spread over LIBOR)	3.59% (340 bps)	2.18% (200 bps)	\$1.62% (145 bps)	1.77% (160 bps)	1.15% (100 bps)	1.00% (85 bps)	1.10% (95 bps)	1.51% (135 bps)	1.55% (140 bps)
M1-Rating	Not Rated	BBB- (Fitch)	BBB- (Fitch) Baa1 (Moody's)	BBB- (Fitch) Baa2 (Moody's)	A1 (Moody's) A (Kroll)	A (Fitch) A (Kroll)	BBB (Fitch) BBB- (S&P)	A- (Fitch) A1 (Moody's)	A- (Fitch) A1 (Moody's)
M-2 Coupon (Spread over LIBOR)	7.34% (715 bps)	5.43% (525 bps)	4.42% (425 bps)	4.57% (440 bps)	2.35% (220 bps)	1.80% (165 bps)	2.75% (260 bps)	2.56% (240 bps)	2.55% (240 bps)
M-2 Rating	Not Rated	Not Rated	Not Rated	Not Rated	Baa1 (Moody's) BBB (Kroll)	BBB- (Fitch) BBB (Kroll)	Not Rated	BBB- (Fitch) A3 (Moody's)	BBB- (Fitch) A3 (Moody's)

Source: Information from market source compiled by authors