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Abstract

Most mortgages in the United States are securitized through the agency mortgage-backed-securities (MBS) market. These securities are generally traded on a "to-be-announced," or TBA, basis. This trading convention significantly improves agency MBS liquidity, leading to lower borrowing costs for households. Evaluation of potential reforms to the U.S. housing finance system should take into account the effects of those reforms on the operation of the TBA market.

Key words: mortgage-backed securities, TBA trading, liquidity, adverse selection

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The US residential mortgage market has experienced significant turmoil in recent years, leading to important shifts in the way mortgages are funded. Mortgage securitization by private financial institutions has declined to negligible levels since the onset of the financial crisis in mid-2007. In contrast, throughout the crisis there has continued to be significant ongoing securitization in the *agency* mortgage-backed securities (MBS) market, consisting of MBS with a credit guarantee from Fannie Mae, Freddie Mac or Ginnie Mae. $2.89 trillion of agency MBS were issued in 2008 and 2009, while no new non-agency securitizations occurred during this period. The outstanding stock of agency MBS also increased significantly over the crisis period, from $3.99 trillion as of June 2007 to $5.27 trillion by December 2009.[1]

A key distinguishing feature of agency MBS is that each bond either carries an explicit government credit guarantee or is perceived to carry an implicit one, protecting investors from credit losses in case of defaults on the underlying mortgages.[2] This government backing has been the subject of a long-running academic and political debate. A second, less widely recognized, feature is the existence of a liquid forward market for trading agency MBS, out to a horizon of several months.[3] The liquidity of this market raises MBS prices and improves market functioning. It also helps mortgage lenders manage risk, since it allows them to "lock in" sale prices for new loans as or even before those mortgages are originated. Ultimately, these benefits are passed on to mortgage borrowers in terms of lower and more stable interest rates.

[1] Data on MBS issuance are from the Securities Industry and Financial Markets Association (SIFMA) and the *Inside Mortgage Finance Mortgage Market Statistical Annual*. Data on agency MBS outstanding are from the Federal Reserve Flow of Funds table L.125. Note: throughout this paper, unless otherwise noted we use the term MBS to refer to residential MBS, not to securities backed by commercial mortgages.

[2] MBS insured by Ginnie Mae carry an explicit Federal government guarantee of the timely payment of mortgage principal and interest. Securities issued by Fannie Mae and Freddie Mac carry a credit guarantee from the issuer; although this guarantee is not explicitly government backed, it is very widely believed the Federal government would not allow Fannie and Freddie to default on their guarantee obligations. Consistent with this view, the U.S. Treasury has provided open-ended support to Fannie and Freddie during their period of conservatorship.

[3] In a forward contract, the security and cash payment for that security are not exchanged until after the date on which the terms of the trade are contractually agreed upon. The date the trade is agreed upon is called the "trade" date. The date the cash and securities change hands is called the "settlement" date.

The vast majority of agency MBS trading occurs in this forward market, which is known as the TBA market (TBA stands for "to be announced"). In a TBA trade, the seller of MBS agrees on a sale price, but does not specify which particular securities will be delivered to the buyer on settlement day. Instead, only a few basic characteristics of the securities are agreed upon, such as the coupon rate and the face value of the bonds to be delivered. This TBA trading convention enables an extremely heterogeneous market consisting of thousands of different MBS pools backed by millions of individual mortgages to be reduced – for trading purposes – to only a few liquid contracts. TBA prices, which are publicly observable, also serve as the basis for pricing and hedging a variety of other MBS that do not trade in the TBA market.

This paper describes the basic features and mechanics of the TBA market. It also reviews recent legislative changes that have affected the types of mortgages eligible for TBA trading, and presents some evidence that suggests TBA-eligibility increases MBS prices and reduces mortgage interest rates. Our analysis exploits changes in legislation to help disentangle the effects of TBA eligibility from other aspects of agency MBS. Our findings support the view that the TBA market serves a valuable role in the mortgage finance system, suggesting that evaluations of proposed reforms to U.S. housing finance should take into account potential effects of those reforms on the operation of the TBA market, and its liquidity.

I. Background

Most residential mortgages in the United States are *securitized*, rather than held as whole loans by the original lender. Securitized loans are pooled in a separate legal trust, which then issues the MBS and passes on mortgage payments to the MBS investors, after deducting mortgage servicing fees and other expenses. These MBS are actively traded, and held by a wide range of fixed-income investors.

Even in the wake of the subprime mortgage crisis, securitization remains central to the US mortgage finance system. This is because of continuing large issuance volumes of *agency* MBS. In the agency market, each MBS carries a credit guarantee from either Fannie Mae or Freddie Mac, two housing government-sponsored enterprises (GSEs) currently under public conservatorship, or from Ginnie Mae, a Federal government agency. (Hereafter we will sometimes refer to these three institutions as the Agencies). In return for monthly guarantee fees, the guarantor promises to forward timely payments of mortgage principal and interest payments to MBS investors, even if there are defaults on the underlying mortgages. In other words, mortgage *credit risk* is borne by the guarantor, not by investors. However, investors are still subject to uncertainty about when the underlying borrowers will prepay their mortgages. This *prepayment risk* is the primary source of differences in value among agency MBS.

Only mortgages that meet certain size and credit quality criteria ("conforming mortgages") are eligible for inclusion in pools of mortgages guaranteed by Fannie, Freddie, or Ginnie. Loans which meet the agencies' credit standards but exceed legal size restrictions known as "conforming loan limits" are referred to as "jumbo" loans. Such mortgages can be securitized only by private financial institutions and do not receive a government credit guarantee.[4] (These conforming size limits were raised significantly in 2008, as discussed in Section 3.1). Other non-agency MBS are generally backed by non-prime mortgages, which do not meet credit quality standards for inclusion in agency MBS pools.

1.1 Divergence of mortgages rates during the financial crisis

[4] Until 2008, the single-family conforming loan limit for loans securitized through Fannie and Freddie was $417,000. Lower limits applied for Ginnie. Higher limits apply to multifamily mortgages and loans from Alaska, Hawaii, Guam and the US Virgin Islands.

Only a handful of non-agency MBS have been issued since mid-2007, and over this period, secondary markets for trading non-agency MBS have been extremely illiquid. In contrast, issuance and trading in the agency MBS market remained relatively robust throughout the crisis period. As evidence of this trading liquidity, Table 1 presents data on daily average trading volumes for different types of US bonds. Agency MBS trading volumes have averaged around $300 billion since 2005, a level which did not decline significantly during the financial crisis of 2007-09. While in each year MBS trading volumes are lower than for Treasuries, they are significantly higher than for corporate bonds or municipal bonds.

The effects on primary mortgage rates of this divergence between the agency and non-agency MBS markets can be seen in Figure 1. The figure shows how interest rates on jumbo and conforming mortgages have evolved since 2007. Rates on both loan types are expressed as a spread to Treasury yields. Both spreads increased during the financial crisis, but the increase was much more pronounced for jumbo loans. Before the crisis, interest rates on jumbo loans were only around 25 basis points higher than for conforming mortgages; this increased to 150 basis points or more during the crisis. While this difference, known as the "jumbo-conforming spread", has narrowed more recently, it still significantly exceeds pre-crisis levels.

Why were interest rates on conforming mortgages – the only mortgages eligible for agency MBS securitization – relatively more stable during the financial crisis? Several factors were likely at play. (1) From an investor's perspective, jumbo mortgages and MBS have much greater *credit risk*, because of the lack of a credit guarantee. This difference in risk was amplified during the crisis, because of high mortgage default rates and an amplification of credit risk premia. (2) Jumbo loans have more *prepayment risk*, because refinancing by jumbo borrowers is more sensitive to interest rate movements. (3) The difference in *liquidity* between conforming and jumbo mortgages became significantly larger and became more valuable to investors as the crisis

deepened, due to the collapse of the non-agency MBS market. (4) From late 2008 onwards, the Federal Reserve has purchased large quantities of agency debt and agency MBS under its Large Scale Asset Purchase (LSAP) programs, helping to lower conforming mortgage rates.[5] (This is unlikely to be the dominant explanation, however, since the jumbo-conforming spread was extremely elevated even prior to the announcement of the LSAP programs on November 25, 2008).

1.2 Liquidity premia and the jumbo-conforming spread

Consistent with the view that liquidity effects were important during this period, the timing of the increase in the jumbo-conforming spread corresponds closely to the collapse in non-agency MBS liquidity and mortgage securitization during the second half of 2007. Furthermore, this spread remains significantly elevated even today, despite normalization in many measures of credit risk premia.

There is an academic literature on the size and source of the jumbo-conforming spread during the pre-crisis period, but that literature focuses on the debate on the value of the GSEs' implicit subsidy – in both their guarantee/securitization business line and their "retained" investment portfolios – and the degree to which this subsidy was passed on to consumers in the form of lower interest rates.[6] In most cases, these studies do not attempt to decompose the credit risk and liquidity risk components of this spread. However, Passmore, Sherlund and Burgess (2005) do find that the size of the jumbo-conforming spread moves inversely with jumbo MBS liquidity, and with factors affecting MBS demand and supply, consistent with the view that liquidity risk is an important driver of the jumbo-conforming spread.

[5] The Federal Reserve purchased $1.25 trillion in agency MBS and nearly $175 billion in agency debt between late 2008 and the first quarter of 2010. For an analysis of the purchases' effects, see Gagnon et al. (2010).

[6] Examples include Passmore, Sherlund and Burgess (2005), Ambrose, LaCour-Little and Sanders (2004) and Torregrosa (2001). See McKenzie (2002) for a literature review.

This still leaves open the question of *why* the agency MBS market is so liquid, given that it consists of literally tens of thousands of unique securities. One hypothesis is that the implied government credit guarantee for agency MBS alone is sufficient to guarantee market liquidity. However, prior academic literature shows significant differences in liquidity and pricing even amongst different government-guaranteed instruments of the same maturity. For example, on-the-run US Treasury securities trade at a significant premium to off-the-run Treasuries, and to government-guaranteed corporate debt like that issued under the FDIC's Temporary Liquidity Guarantee Program in 2008-09 or by the Resolution Funding Corporation in 1989-91.[7] Differences in liquidity amongst government-guaranteed bonds have also been documented in other countries, such as Germany.[8] This literature suggests that a pure liquidity premium for the most liquid government or government-like securities may be in the range of 10 to 30 basis points under "normal" financial market conditions, and significantly larger during periods of market stress like those experienced during the financial crisis.[9]

Thus, the presence of a government credit guarantee does not alone explain the liquidity of agency MBS and the wedge between jumbo and conforming mortgage rates. The sheer aggregate size of the market no doubt contributes to its liquidity, but this does not account for why agency MBS are more liquid than corporate bonds, whose market is similar in total size. The agency MBS market is substantially more homogenous than the corporate bond market, though, and prominent among the factors homogenizing agency MBS – at least in secondary trading – is the TBA convention. The role of TBA trading has received relatively limited attention in the

[7] For evidence on liquidity and pricing differentials amongst government-guaranteed bonds, see Longstaff (2004), Fleming (2003), Krishnamurthy (2002) Amihud and Mendelson (1991), and Goldreich, Hanke and Nath (2005), among others.
[8] See Ejsing and Sihvonen (2009) and Schwarz (2009).
[9] See Beber, Brandt, and Kavajecz (2007) for a discussion of liquidity premia amidst flight-to-quality flows.

academic literature, and the mechanics of this market are not well understood by many non-specialist observers.[10] To help fill this gap, we now turn to a detailed description of the mechanics of the TBA market.

II. The TBA Market

Similar to other forward contracts, in a TBA trade, the two parties agree on a price for delivering a given volume of agency MBS at a specified future date. The characteristic feature of a TBA trade is that the actual identity of the securities to be delivered at settlement is not specified on the trade date. Instead, participants agree on only six general parameters of the securities to be delivered: issuer, maturity, coupon, price, par amount, and settlement date.

A smaller but still significant portion of agency MBS trading volume occurs outside of the TBA market. This is known as "specified pool" trading, because the identity of the pool to be delivered is specified at the time of the trade, much like other securities markets. While many of these pools simply are not eligible for TBA trading, others trade outside the TBA market because they are backed by loans with more favorable prepayment characteristics from an investor's point of view, allowing them to achieve a higher price, as described below.[11]

Note that all TBA-eligible securities involve a so-called "pass-through" structure, whereby the underlying mortgage principal and interest payments are forwarded to security-holders on a *pro rata* basis, with no tranching or structuring of cash flows. Agency MBS are initially issued as pass-throughs, in part because the strength of the guarantee is such that there is no need for additional credit enhancement by establishing a hierarchy of claims.

[10] Most GSE reform commentaries have similarly overlooked the TBA market. Notable exceptions include SIFMA and the Mortgage Bankers Association (MBA).

[11] Similarly, some TBA trades will involve additional stipulations or "stips" beyond the six characteristics listed above, such as restrictions on the geographic composition of the pools to be delivered.

2.1 Mechanics of a TBA trade

A timeline for a typical TBA trade is shown in Figure 2, including three key dates. The detailed conventions that have developed around TBA trading are encoded in the "good delivery guidelines" published by the Securities Industry and Financial Markets Association (SIFMA), an industry trade group whose members include broker-dealers and asset managers, as part of its *Uniform Practices for the Clearance and Settlement of Mortgage-Backed Securities*. These conventions began developing as Ginnie Mae pioneered the MBS market in the 1970s, and became more detailed and formal in the ensuing decades.

Trade day. The buyer and the seller establish the six trade parameters listed above. In the example in Figure 2, a TBA contract agreed in July will be settled in August, for a security issued by Freddie Mac with a 30-year maturity, a 6% annual coupon, and a par amount of $200 million at a price of $102 per $100 of par amount, for a total price of $204 million. TBA trades generally settle within three months, with volumes and liquidity concentrated in the two nearest months. To facilitate the logistics of selecting and delivering securities from the sellers' inventory, SIFMA sets a single settlement date each month for each of several types of agency MBS.[12] Thus, depending on when it falls in the monthly cycle of settlements, the trade date will usually precede settlement by between 2 and 60 days.

Two days before settlement. No later than 3 p.m. two business days prior to settlement ("48-hour day"), the seller provides the buyer with the identity of the pools it intends to deliver on settlement day.

[12] A full calendar of future settlement dates can be found at: http://www.sifma.org/services/stdforms/settlement-dates.shtml.

Settlement day. The seller delivers the securities specified two days prior and receives the cash specified on the trade date. Amid the trading, lending, analysis, selection, and settling of thousands of individual securities each month, operational or accounting problems can arise, the resolution of which relies on a detailed set of conventions developed by SIFMA.

2.2 "Cheapest to deliver" pricing

Similar to Treasury futures, TBAs trade on a "cheapest to deliver" basis: On settlement date, the seller selects which MBS in their inventory to deliver to the buyer. The seller has a clear incentive to deliver the lowest-value securities that satisfy the terms of the trade (recall that differences in value across securities are driven by pool characteristics affecting prepayment risk, such as past prepayment rates, or the geographic composition of the pool). This incentive is well understood by the TBA buyer, who therefore expects to receive a security of lower value than the average security. This is an example of a widespread market phenomenon known to economists as "adverse selection".[13] Reflecting this, the original trade price will be correspondingly lower, all else equal. However, all else is not equal, because the "cheapest to deliver" discount also generates a liquidity benefit that has a countervailing effect of raising the securities' market value compared to the price it would trade at in the less liquid specified pool market.

2.3 Temporary fungibility and TBA liquidity

TBA trading effectively applies a common cheapest-to-deliver price level to an intrinsically diverse set of underlying securities. While this practice also occurs in the Treasury futures market, this convention of homogenized prices seems more counterintuitive when applied to agency MBS, because of the greater heterogeneity of the underlying securities. Together, the securitization process and the TBA market transform what is a fundamentally heterogeneous

[13] For evidence of how adverse selection affects the types of securities resecuritized into multiclass MBS deals, see Downing, Jaffee, and Wallace (2009).

universe of individual mortgages (with myriad credit and prepayment characteristics) into groups of fungible – and therefore liquid – fixed-income instruments. Of course, this fungibility is only temporary, because after settlement the buyer observes additional characteristics about the specific pools that it has received, which provide information about prepayment behavior, and hence value.

More concretely, the TBA market directly facilitates transacting in large trade sizes by allowing loans of sizes on the order of $100,000 to $400,000 to be aggregated into pools of up to $10 million and traded in amounts of as much as $100 to $200 million with a high degree of liquidity. The number of distinct security identifier codes (CUSIPs) involved is also revealing: for trading purposes, all TBAs with the same six parameter values are treated as if aggregated into a single CUSIP, but once those trades settle, each security is attached to one of up to several hundred CUSIPs identifying individual– and no longer fungible – securities. While the mortgage pooling process reduces millions of mortgages to tens of thousands of MBS, TBA trading further streamlines the market to only about 10 to 20 different sets of contracts for each maturity point (30-year, 20-year, and 15-year mortgages).[14]

Similar to the MBS pooling process itself, TBA trading simplifies the analytical and risk management challenges for participants in agency MBS markets. Rather than attempting to value each individual security, participants need only analyze the more tractable set of risks associated with the parameters of each TBA contract. This helps encourage market participation from a broader group of investors, notably foreign central banks, and a variety of mutual funds and hedge funds, translating into a greater supply of capital for financing mortgages, and thus lower rates for homeowners.

[14] For each maturity point, there are usually only three or four coupons in active production at any one time, and usually not more than seven outstanding across three different issuers, depending on the level and previous path of interest rates.

The treatment of TBA pools as fungible is sustainable in part because a significant degree of actual homogeneity is present amongst the securities deliverable into any particular TBA contract. The most obvious source of commonality is the GSEs' guarantee of the cash flows of mortgage principal and interest, which essentially eliminates credit risk. However, the GSEs' standardization of underwriting and securitization practices also contributes meaningfully to homogeneity as well. At the loan level, the standardization of lending criteria for loans eligible for agency MBS constrains the variation among the borrowers and properties underlying the MBS. At the security level, homogenizing factors include the geographic diversification incorporated into the pooling process, the limited number of issuers, and the simple structure of "pass-through" security features.

2.4 Adverse selection without market failure

Because of the incentives associated with cheapest-to-deliver pricing, not all eligible MBS pools actually trade on a TBA basis. Higher-value pools (those with the most advantageous prepayment characteristics from an investor's point of view) can command a higher price in the less liquid specified pool market.[15] Specified pool trading (as well as the use of "stips") is more common for seasoned pools than for newly issued pools, reflecting their lower prepayment risk and therefore higher value. However, specified pools are much less liquid precisely because they are not fungible.

Most agency MBS trading occurs through the TBA market because the liquidity value of TBA trading generally more than compensates for any adverse selection discount implied by the

[15] Note that the term "specified pool" can also apply to an agency MBS that is not deliverable into a TBA contract, because it does not meet the good delivery guidelines set by SIFMA. These include pools backed by high-balance mortgages, 40-year mortgages and interest-only mortgages. These ineligible pools may trade at lower values than TBAs.

"cheapest to deliver" pricing. In part, this is because the significant level of homogeneity in the underwriting and pooling process constrains the variation in value amongst securities deliverable into a given TBA contract. Paradoxically, the limits on information disclosure inherent in the TBA market actually *increase* this market's liquidity, by creating fungibility across securities, and reducing information acquisition costs for buyers of MBS. A similar argument has been used to explain why DeBeers diamond auctions involve selling pools of diamonds in unmarked bags that cannot be inspected by potential buyers. More generally, the idea that limited information can reduce adverse selection and increase trade is known to economists as the "Hirshleifer paradox" (Hirshleifer, 1971).[17]

2.5 Hedging and financing mortgages through TBAs

TBAs also facilitate hedging and funding by allowing lenders to pre-arrange prices for mortgages that they are still in the process of originating, thereby hedging their exposure to interest rate risk. In the U.S., lenders frequently give successful mortgage applicants the option to lock in a mortgage rate for a period of 30 to 90 days. Lenders are exposed to the risk that the market price fluctuates in the period between when the rate-lock is set and the time the loan is eventually sold in the secondary market. The ability to sell mortgages forward through the TBA market hedges originators against this risk. This is critical for originators to offer applicants fixed-rate loan terms before a mortgage actually closes, which greatly facilitates the final negotiations of house purchases and the overall viability of the 30-year fixed-rate mortgage as a business line.

While this interest-rate risk could also be hedged with several other instruments, TBAs are a superior hedging instrument because they more directly offset the risks associated with a

[17] See French and McCormick (1984) for a discussion of the DeBeers example. Glaeser and Kallal (1997) present a formal model demonstrating how restricting the set of information provided to MBS investors may enhance liquidity by decreasing information asymmetries and hence opportunities for adverse selection.

mortgage. The price movements of Treasury futures, for instance, can diverge significantly from those of MBS for any of a number of reasons, including different sensitivities to interest rates. Mortgage options are more expensive than TBAs, less liquid, and only available for short time horizons (mortgage options are therefore used to hedge rate-locks rather than prepayment or market risk). Lenders should pass on at least some of the cost savings of a superior hedging instrument to mortgage applicants. While a mortgage futures contract might provide some of the benefits of TBAs, the several historical attempts to establish a mortgage futures contract in the US have each failed, in part because they could not compete with the TBA product.[18]

More indirectly, TBA trading has also led to the development of a funding and hedging mechanism unique to agency MBS: the dollar roll. A dollar roll is merely the combination of one TBA trade with a simultaneous and offsetting TBA trade settling on a different date. This allows investors and market makers great flexibility in adjusting their positions for either economic or operational reasons. An investor who has bought a TBA but faces operational concerns for receiving delivery as scheduled could sell an offsetting TBA on that date and simultaneously buy another TBA due one month later, effectively avoiding the operational issue but retaining much of the economic exposure. An investor could also obtain what amounts to a short-term loan at a favorable rate by selling a TBA for one date and buying another TBA for a later date. For market makers on the other side of such trades, dollar rolls provide efficient means for maintaining a neutral position while providing liquidity.

The dollar roll market is similar to a repurchase transaction ("repo"), in which two parties simultaneously agree to exchange a security for cash in the near term and to reverse the exchange

[18] See Nothaft, Lekkas and Wang (1995) and Johnston and McConnell (1989).

at a later date.[19] Dollar rolls facilitate financing by providing an alternative and cheaper financing vehicle to MBS repo, drawing in market participants whose preferences are better suited to the idiosyncrasies of the dollar roll.[20] Note that dollar rolls also simplify the adjustment of originators', servicers' and other market participants' TBA commitments and hedges by reducing not only the total cost but also the cash outlay of hedging, since the cost of a dollar roll is only the difference between the price of two different TBAs.

By simplifying and lowering the cost of hedging, TBAs and dollar rolls help smaller originators participate in agency MBS directly. Without TBAs, originators would have to engage in sophisticated trading strategies using a variety of derivatives to replicate the effect of a TBA. This would like lead smaller originators to reduce their direct participation in agency MBS, further concentrating the market power of the largest commercial banks, who currently make up over 60% of mortgage origination in the U.S.[21] Some smaller banks already can and do engage in "correspondent" relationships, whereby they sell some or all of their whole loans to larger banks, who receive more attractive prices on the GSEs' guarantee and then sell the loans they purchased into the TBA market. Without TBAs this practice would likely become more widespread.

2.6 Legal basis of TBA trading

From a legal perspective, the TBA market as it currently operates is possible because of Fannie Mae's and Freddie Mac's exemption from the registration requirements of the Securities Act of

[19] As with repo, legally these are two separate purchase/sale transactions, but the economic effect is equivalent to secured borrowing/lending. Since the initial exchange of cash and security is reversed, the economic impact is measured by the difference in the prices of the two transactions and the allocation of principal and interest payments over the term of the dollar roll. The fundamental difference from repo is that while the second leg in a repo (reversing the original exchange) requires the return of the original security, in a dollar roll only a "substantially similar" security needs to be delivered, consistent with a definition of "substantially similar" directly tied to SIFMA's "good delivery" guidelines for TBAs.

[20] For instance, dollar rolls can be used to transfer prepayment risk, since unlike MBS repo, dollar rolls transfer rights to principal and interest payments over the term of the transaction.

[21] Source: http://www.mortgagestats.com/residential_lending/.

1933 with respect to their MBS. This exemption allows newly issued agency MBS to be offered and sold (including in TBAs) without registration statements filed with the SEC. In contrast, public offers and sales of newly issued private label MBS are subject to the registration requirements of the Securities Act.

Sales of newly issued agency MBS via TBA trading would not be possible without such an exemption from registration for agency MBS because, at the time of a TBA trade, the securities that will eventually be delivered often do not exist. Even if they do exist, the buyer is not told the identity of the specific securities that will be delivered until two days before settlement, which is usually significantly after the trade date itself. Indeed, for many MBS delivered to fulfill TBA contracts, the underlying mortgages have not even been originated as of the trade date (enabling the unique hedging functions described in the previous section). The inability to identify securities to be delivered at the time of trade would violate the prospectus delivery requirements of the Securities Act of 1933 related to sales of securities if not for the GSEs' exemptions.

In practice, while offers and sales of GSE MBS are exempt from SEC registration requirements, the agencies do publicly disclose information about the composition of each pool. This includes the average loan-to-valuation (LTV) ratio, debt to income ratio, borrower credit score, the number and value of mortgages from each US state, the distribution of mortgage coupon rates, and broker versus non-broker origination channels. Nevertheless, at the time of trade, the buyer of a TBA lacks access to any of this information, because it does not know which security it will receive.

III. TBA Eligibility of High-Balance Loans

3.1 Increases in conforming loan limits in 2008

Recent changes in the conforming loan limits provide a useful natural experiment that helps illustrate the value of the TBA market even for agency MBS pools that already enjoy a credit

guarantee. As discussed above, Fannie Mae and Freddie Mac are prohibited from purchasing mortgages larger than a set of conforming loan limits set by the Federal Home Financing Agency (FHFA). The FHFA adjusts the limits annually in line with the general level of home prices.[22] As the U.S. housing market deteriorated in 2007, and mortgage market stresses increased, market participants and policymakers looked to the GSEs to support the housing sector in a variety of ways, including expanding their retained portfolios and raising the conforming loan limit to allow the GSEs to support a broader range of residential mortgages, particularly the prime jumbo market.

The ensuing debate culminated in the Economic Stimulus Act of 2008 (ESA), passed on February 13, which temporarily raised the conforming loan limit in designated "high-cost" areas through December 31, 2008, to as high as $729,750 from a previous national level of $417,000.[23] Maximum FHA limits were also temporarily increased to the same levels as those applying to Fannie Mae and Freddie Mac. Further permanent changes to conforming loan limits were announced later in 2008, as described below and presented in Table 2.

[INSERT TABLE 2: CHANGES IN LOAN LIMITS]

3.2 TBA deliverability of high-balance conforming mortgages

While the GSEs' purchases are authorized by Congress and the FHFA, TBA trading conventions are set by SIFMA. Two days after the enactment of the ESA, SIFMA announced that high-balance loans (HBLs) between $417,000 and the new higher conforming loan limits would not be eligible for inclusion in TBA-eligible pools. Instead, these pools could only be securitized as a

[22] Under the 2008 Housing and Economic Recovery Act, the national conforming loan limit is set based on changes in average home prices over the previous year, but cannot decline from year to year.
[23] "High-cost areas" are designated by the FHFA based on median home values in a given census tract as estimated by the FHA.

new category of specialty products, and traded as specified pools. In Congressional testimony in May 2008, SIFMA explained its opposition to allowing the new HBLs to be included in TBA-eligible pools.[24] Two main concerns were cited. First, the initial increases in conforming loan limits were temporary, expiring at the end of 2008. SIFMA judged that the addition and subtraction of HBLs from TBA pools over such a short horizon could cause significant market disruption. Second, including HBLs would undermine the assumption of homogeneity underpinning the TBA market. SIFMA noted that higher-balance mortgages tend to prepay more quickly, consistent with the larger dollar-amount of incentive they provide to pay off the loan (given the larger loan balance), and could therefore establish a new and lower "cheapest-to-deliver" level for TBAs, leading to higher mortgage rates and counteracting the intent of the policy.

To support the HBL market in the face of this lack of TBA eligibility, Fannie Mae announced on May 6, 2008 that it would purchase pools of HBLs at a price on par with TBA-eligible pools throughout the remainder of 2008.[25] Supported by this announcement, issuance of HBL specified pools grew over the summer of 2008, and the underlying loans were originated at primary mortgage rates close to those for standard conforming loans. Nevertheless, the U.S. housing market continued to deteriorate, and on July 14, Congress passed the Housing & Economic Recovery Act (HERA), permanently increasing the conforming loan limit in high-cost areas to $625,500.[26] Noting the permanent nature of this change, SIFMA announced a month later that HBLs up to the HERA limit would be TBA-eligible. However, it imposed a *de minimis* limit that HBLs could comprise at most 10% of a TBA pool. The announcement had little immediate

[24] Written testimony by SIFMA Vice Chairman Thomas Hamilton to the House Committee on Financial Services (May 22, 2008). http://www.sifma.org/legislative/testimony/pdf/Hamilton-052208.pdf.
[25] Although this commitment expired in December 2008, to ease the transition to market-based pricing, in October 2008 Fannie Mae promised to continue in 2009 to purchase HBLs originated in 2008, but with a 175-basis point fee added to the TBA mortgage rates.
[26] HERA uses a slightly different calculation methodology from ESA for identifying high housing-cost areas, complicating comparison of the two sets of high-balance loan limits.

market impact due to Fannie's previous commitment to purchase HBLs at "TBA flat" pricing. However it proved critical in 2009 as Fannie's price support expired.

3.3 Further adjustments in conforming loan limits

The temporary conforming loan limits (up to $729,750) established under the ESA expired at the end of 2008. However, in February 2009, these temporary limits were re-established, and in November 2009, were extended until the end of 2010. Without any further changes in policy, as of January 2011, conforming loan size limits will revert to the permanent levels established under the 2008 HERA (which specify a single-family maximum loan size of $625,500).

IV. Effects on the MBS market

4.1 Issuance of high-balance MBS pools

Figure 3 presents data on issuance of high-balance conforming MBS since the agency loan limits were raised in February 2008 by the ESA. As the Figure shows, issuance of HBL pools has been volatile. There was little issuance of MBS backed by high-balance mortgages in the months immediately following the passage of the ESA, reflecting the time needed by each of the issuers to set up their HBL securitization program. Spurred by Fannie Mae's announcement that they would purchase pools backed by HBLs at par to TBA pricing, issuance of HBL specified pools grew over summer 2008, concentrated in Fannie Mae and Ginnie Mae pools.

Issuance of high-balance pools dropped sharply in the Fall of 2008. This likely reflected both the overall turmoil in financial markets during this period, as well as uncertainties specific to HBLs that may have discouraged originators from extending such loans. First, lenders faced significant regulatory risk because the FHFA did not publish its list of "high-cost" census tracts eligible for the permanent high-balance loan limit until November 2008. In addition, market participants were uncertain how high-balance loan prices would respond to the expiration of Fannie Mae's

commitment to TBA-equivalent pricing and some originators may have simply waited to deliver their HBLs into TBA pools starting in January 2009.

[INSERT FIGURE 3 HERE]

Issuance of HBL pools remained low between January and April 2009, reflecting the withdrawal of Fannie Mae's price support for this market.[27] HBL issuance rose more steeply in the summer of 2009, likely for two reasons: (i) the sharp rise in mortgage rates during this period led many borrowers to close on pending mortgages out of fear that rates would rise further, and (ii) bank-driven demand for short-duration Collateralized Mortgage Obligation (CMO) tranches substantially rose over that period, increasing demand for faster-prepaying agency MBS.[28]

4.2 Secondary market pricing of high-balance MBS pools

Table 3 presents data on the price premium (or discount) for Fannie Mae HBL pools relative to standard TBA-eligible pools.[29] In the period after Fannie Mae's price support of HBLs expired in December 2008, HBL pools consistently traded at a significant discount to the corresponding TBA contract. Three possible explanations for this price discount are: (1) The price differential reflects an illiquidity discount for HBL pools, since these pools trade on a specified pool basis, rather than in the TBA market; (2) the price discount reflects greater prepayment risk for HBL pools; (3) the higher price for TBA pools reflects the effects of the Federal Reserve MBS purchase program, which purchased only TBA-eligible MBS.

[27] Although overall issuance was low during this period, HBL issuance rose modestly in February 2009 as pressures on financial institutions' balance sheets began to subside.

[28] A CMO is a structured MBS that distributes payments and prepayments of mortgage principal across a number of different tranches in order of seniority. Banks tend to demand more short-duration CMO tranches in steep yield curve environments to avoid an asset-liability mismatch when rates rise.

[29] While Table 3 focuses on Fannie Mae pools, data for Ginnie Mae HBL pools indicates a similar price discount. The magnitude of the price discount is less uniform than for Fannie Mae pools, however, likely reflecting the lower issuance volumes and consequent lack of liquidity.

Although it is difficult to fully disentangle these explanations, we note that over this period, the HBL price discount was persistent and relatively homogenous across the coupon stack. This is notable because both differences in prepayment risk, and the effects of the Federal Reserve's purchases, would be likely to have differential price effects across different coupons. Prepayment risk should have a larger price impact for higher-coupon securities, for which the prepayment option is further "in the money", and thus more likely to be exercised. In contrast, the Federal Reserve's purchases of TBAs over this period were concentrated in lower-coupon securities. The consistency of the discount across securities with different coupon rates suggests that illiquidity is likely to be a more important explanation for the spreads observed in Table 3. Furthermore, these HBL pools were sought after as collateral for the growing CMO market precisely because of their higher prepayment rates, suggesting that the price discount reflected in Table 3 may be lower than would have otherwise been the case.

[INSERT TABLE 3 HERE]

V. Effects on primary market mortgage supply

5.1 Effects on mortgage pricing

Other evidence suggests the secondary market price discount for HBL pools shown in Table 3 also translated into higher interest rates for mortgage borrowers. Figure 4 shows how mortgage rates on high-balance conforming mortgages compare to jumbo and standard conforming rates during the crisis period. Overall, rates for HBLs were quite close to conforming rates over the period when the GSEs were permitted to securitize such loans. However, the rates did not fully converge; HBL rates remained above those for standard conforming loans over this entire period, consistent with the secondary market price discounts shown in Table 3.

Panel B of Figure 4 focuses on trends in this interest rate spread between high-balance loans and standard conforming mortgages. This spread declined sharply after Fannie Mae announced it would begin purchasing them at prices equivalent to those for TBAs. It rose towards the end of 2008 and early 2009, reflecting the rise in liquidity premia during the financial crisis of this period, as well as the expiration of Fannie Mae's price support for the HBL market. The interest rate premium on HBLs then declined over 2009 and 2010. This interest rate spread would have been larger still without the *de minimis* TBA eligibility – and concomitant liquidity benefits – allowed for HBLs.

[INSERT FIGURE 4 HERE]

5.2 Effects on the quantity of credit

Figure 5 shows the fraction of total new mortgages whose size exceeds the national conforming loan limit of $417,000, as well as the fraction of originations between $417,000 and the higher conforming loan limits introduced under the ESA.[30]

The figure shows that the fraction of jumbo mortgages decreased sharply in the second half of 2007, as both non-agency MBS markets and bank balance sheets came under extreme stress. After high-balance loans became eligible for securitization through the agency market, their share began to rise, particularly after Fannie Mae announced it would purchase such MBS at TBA-equivalent pricing. In contrast, the fraction of jumbo mortgages above the new higher conforming loan limits remained low until early 2010.

[30] These shares are calculated from loan-level LPS data. To calculate the share of loans between $417,000 and the new high-balance conforming loan limits, each mortgage in the LPS data is geographically matched to the high-balance loan limits applying in that MSA at the time the mortgage was originated.

Together, Figures 4 and 5 suggest the decision to make HBLs eligible for agency securitization significantly increased secondary market demand for these mortgages. This correspondingly increased the supply of mortgage credit for the HBL market segment, increasing the quantity of loans that homeowners could obtain and decreasing mortgage interest rates. Part of this increase in mortgage supply reflects the direct effect of the government guarantee. But the fact that HBL rates did not fully converge to standard conforming rates suggests secondary market MBS liquidity is also an important determinant of the cost of mortgage credit.

VI. Prospects for the TBA market

The U.S. Treasury Department and Congress are currently considering different options for reshaping Fannie Mae and Freddie Mac. As part of this process, the Treasury has released a list of questions for public comment on the future of the housing finance system as a whole. Market observers including Federal Reserve Chairman Ben Bernanke and then-Treasury Secretary Henry Paulson have laid out a spectrum of options ranging from full privatization to full nationalization. Intermediate options between these extremes include an industry-owned mortgage cooperative,[31] the introduction of a public tail-risk insurer, covered bonds, and the conversion of Fannie and Freddie into "public utilities". However, many discussions of these reforms make little mention of the unique secondary market structure that has developed to serve the core of U.S. mortgage borrowers, lenders, and investors.

Consideration of these options should take into account the benefits of TBA trading and its historical development. This market structure is likely compatible with a number of different reform options but not all of them. For example, excessive fragmentation could have several adverse consequences. A greater diversity of loan and mortgage-backed security features would likely reduce liquidity and pose a serious challenge to TBA trading. There is no consensus on

[31] For a more complete description of the cooperative model, see Dechario et al. (2010).

exactly how much actual homogeneity in the underlying mortgages and securities is necessary to support the fungibility and liquidity created by the TBA market, as SIFMA's debates on HBL-eligibility and other revisions of TBA delivery guidelines demonstrate. Standardization of documentation, structuring and mortgage underwriting criteria within the TBA-eligible universe are likely important to help maintain fungibility across securities. Product differentiation due to competitive pressures or an inability to agree on common underwriting standards and operations could complicate investors' relative value analysis, and potentially lead to a race to the bottom of the credit spectrum.

As a matter of law, a fully private TBA market might be possible with sufficient amendment of current securities law. The key would be to make new exceptions to the 1933 Act for private mortgage securities, such that commitments to purchase mortgage pools could become binding before the receipt of the pool's prospectus. However, this could be challenging given the current trend in securities law toward greater disclosure. Also, it is not clear whether greater disclosure could itself impair the operation of the TBA market, by increasing sellers' ability to discriminate value among MBS pools, and siphon off the most valuable securities into the specified pool market.

The history of the TBA market shows that the consequences of planned changes to market structure are unpredictable and sometimes negative. Over the last three decades, mortgage futures contracts have been launched several times, but none has been able to sustain investor participation. In addition, when Freddie Mac significantly altered its monthly schedule for cash flows from underlying loans to MBS holders, it was poorly received and contributed to a negative spread between Freddie Mac and Fannie Mae MBS that persists over 15 years later.

In sum, evaluation of changes to secondary mortgage market structures should take into account the value of the TBA market and the risks that any particular set of reforms would pose to it. The deep liquidity of agency MBS cannot be attributed solely to the implicit government guarantee of agency MBS, and changing the secondary market structure of government-supported mortgages could reduce liquidity and raise borrowing rates for households.

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Figure 1: Jumbo and Conforming Mortgage Rates

Interest rates on jumbo and conforming mortgages, based on survey data collected by HSH Associates. Mortgage rates are expressed as a spread to the average of the 5-year and 10-year Treasury yield. Crisis onset is marked at August 2007, the month that BNP Paribas suspends convertibility for two hedge funds, reflecting problems in subprime MBS markets.

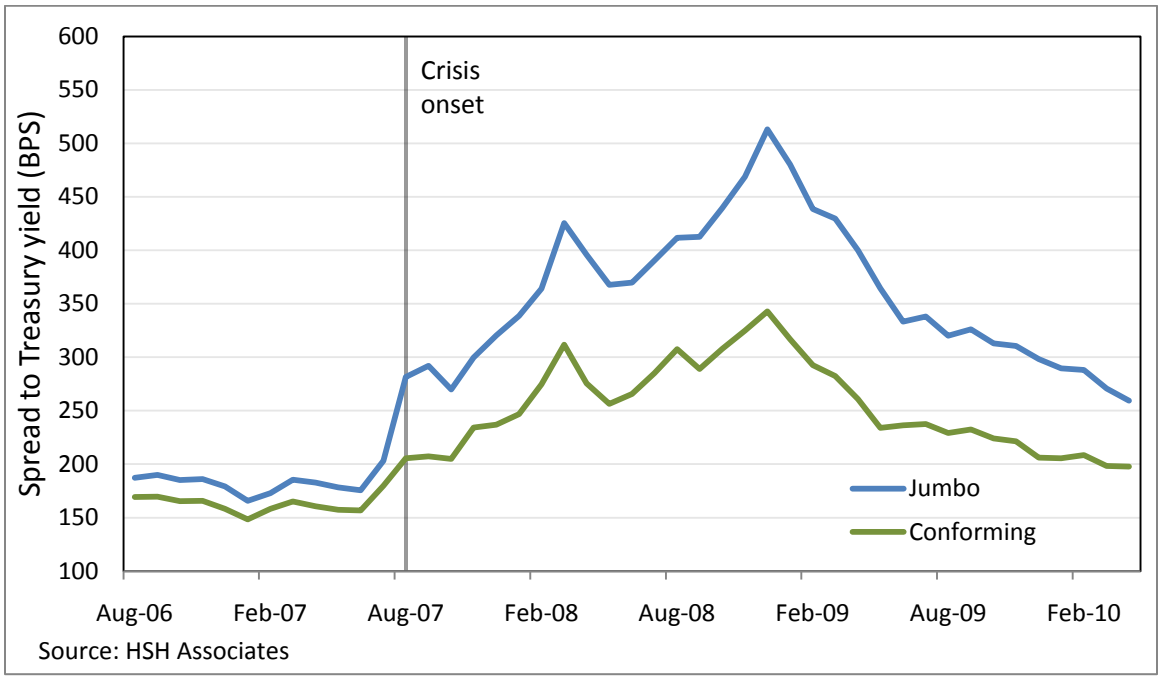
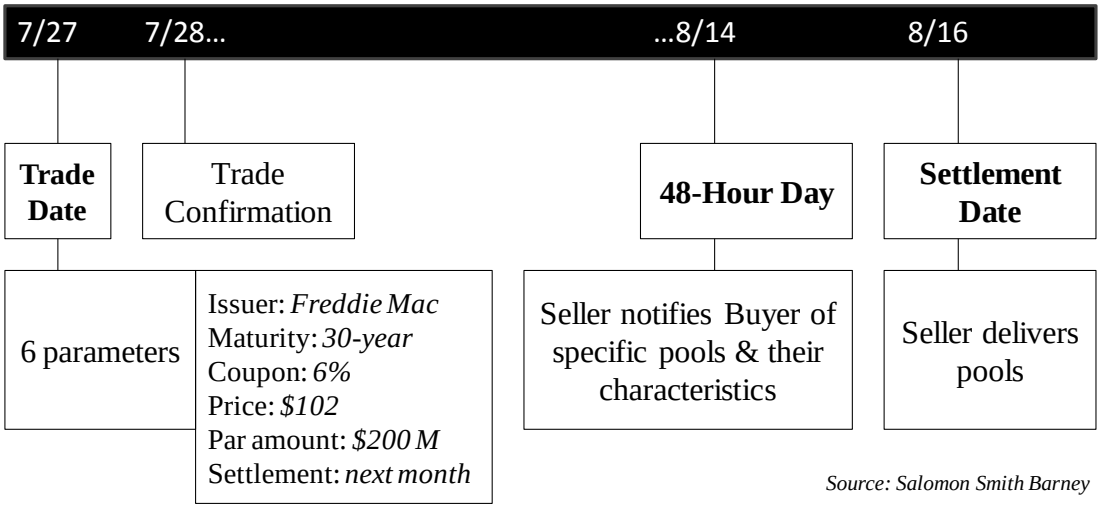


Figure 2: Timeline for a TBA trade



Source: Salomon Smith Barney

Figure 3: Issuance of high-balance conforming MBS

Issuance of non-TBA-eligible high-balance loan (HBL) pools sponsored by the agencies Fannie Mae, Freddie Mac and Ginnie Mae. Note that after August 2008, SIFMA also allowed HBLs to be securitized in TBA-eligible pools in *de minimis* amounts (up to 10% of the pool balance). Figure does not reflect HBL securitization through these TBA-eligible pools.

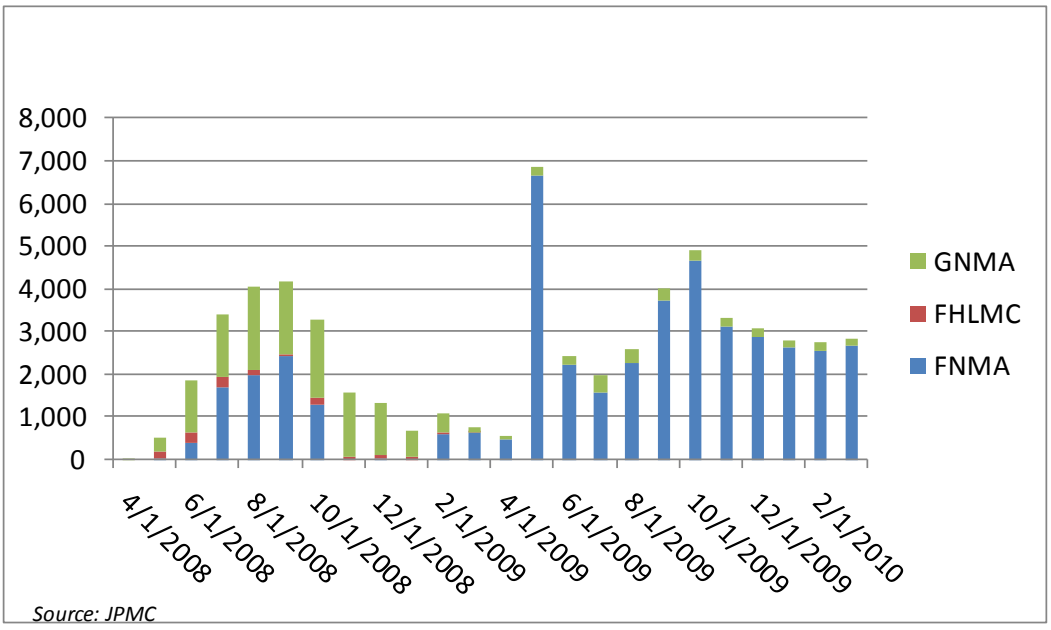
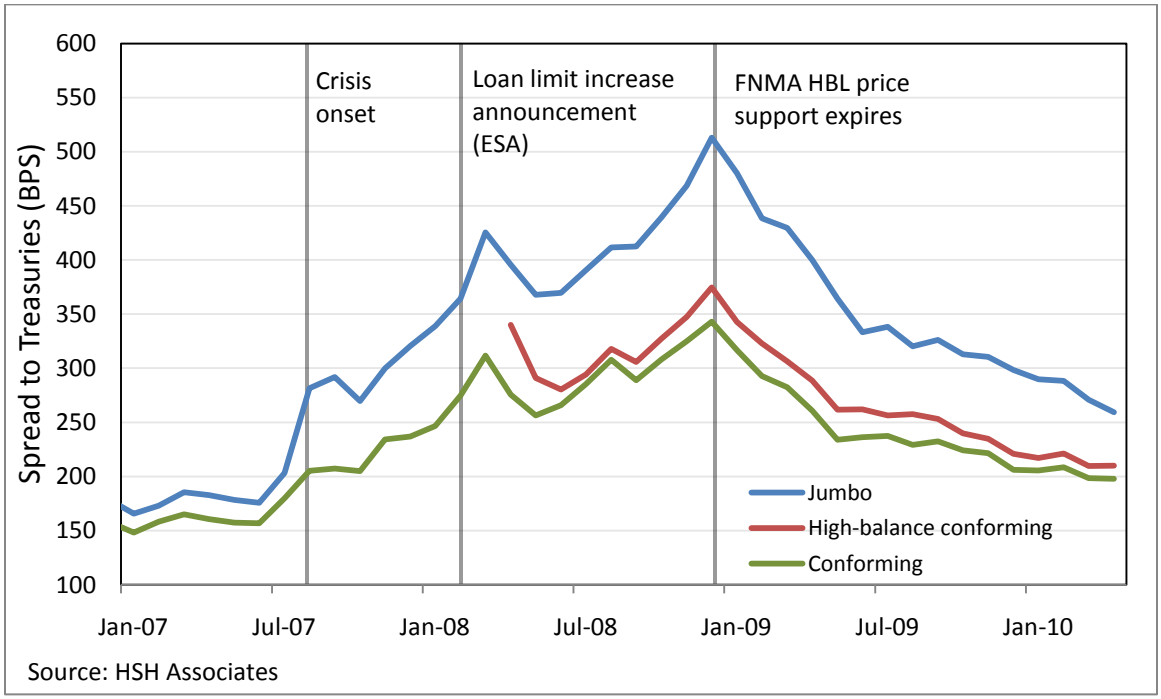


Figure 4: Mortgage spreads on jumbo and high-balance conforming loans

Mortgage rates are expressed as a spread to the average of the 5- and 10-year Treasury yield.

A. Interest rates on jumbo, high-balance conforming and conforming mortgages



B. Interest rate differential between high-balance loans and standard conforming mortgages

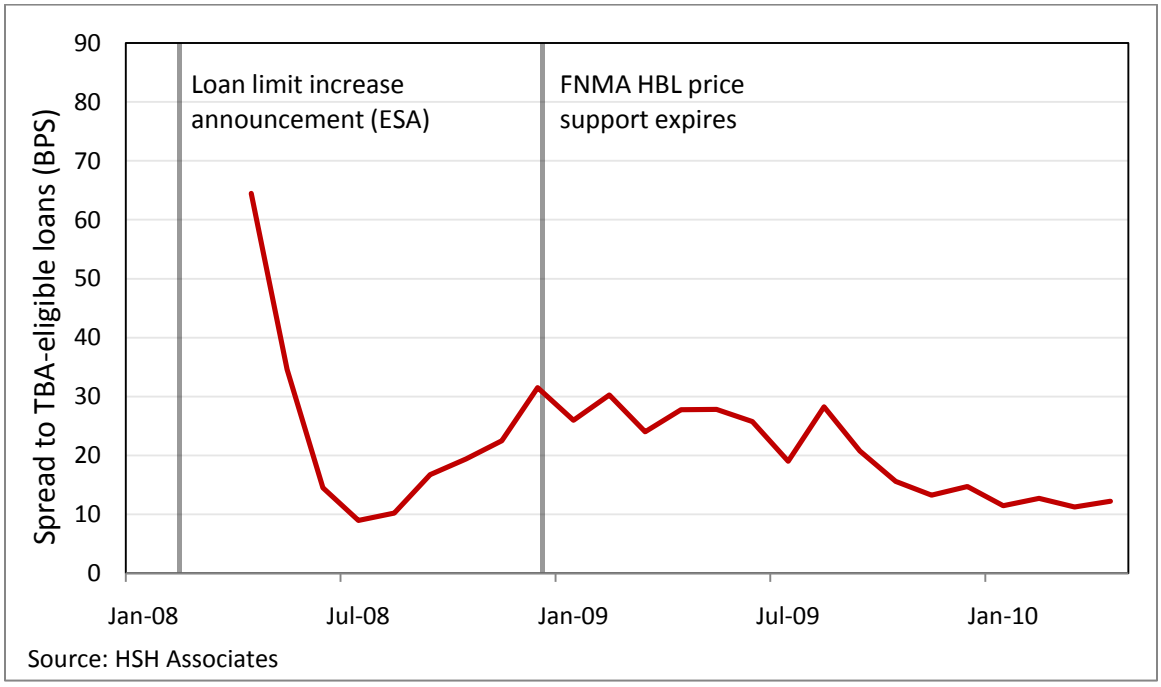


Figure 5: Share of mortgage originations in the high-balance conforming segment

Figure plots the total fraction of mortgage originations above $417,000 (blue line), and the fraction of mortgage originations between $417,000 and the temporary loan limits established under the ESA (red line). Recall that under the ESA, conforming loan limits in high-housing cost areas were increased to as high as $729,750.

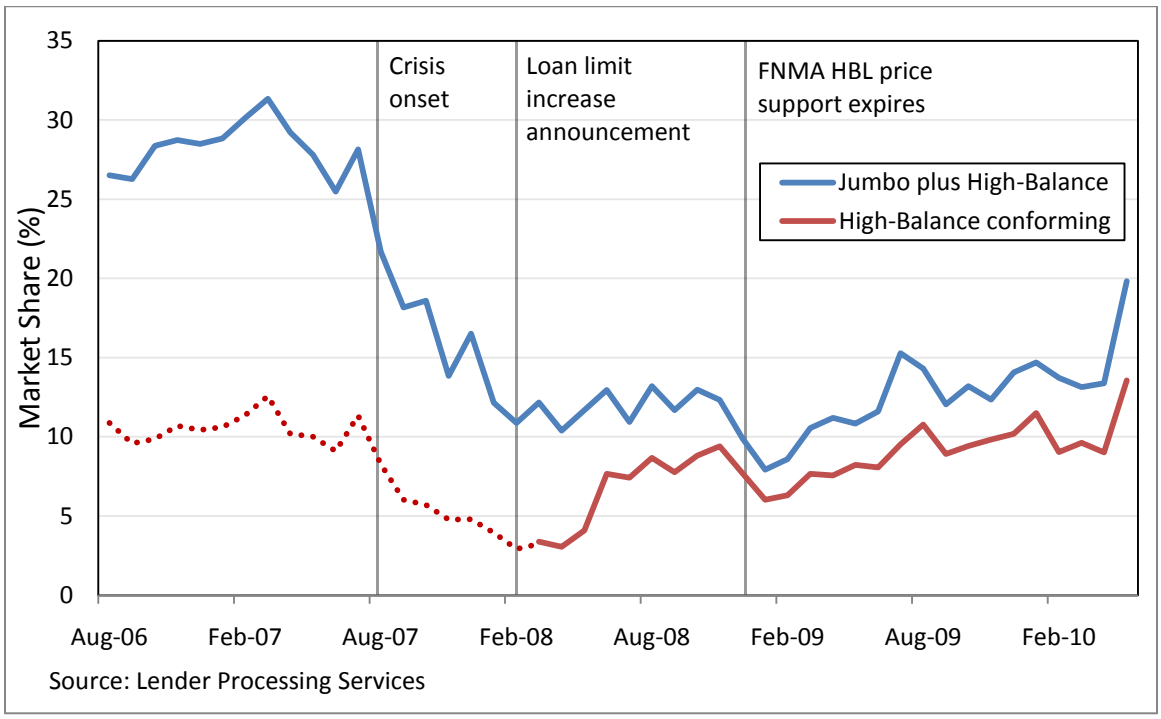


Table 1: Daily average trading volumes ($bn) in major US bond markets

Table is based on purchases and sales of securities by primary dealers, as reported to the Federal Reserve Bank of New York. Figures for corporate bonds refer only to securities with a maturity greater than one year. This data is available on a weekly basis at: http://www.ny.frb.org/markets/gsds/search.cfm.

Year	Municipal Bonds	Treasury securities	Agency MBS	Corporate Bonds
2005	16.88	554.53	251.80	16.71
2006	22.50	524.70	254.60	16.88
2007	25.15	570.24	320.15	16.39
2008	19.37	553.06	344.92	11.83
2009	12.47	407.90	299.86	16.76
2010, first half	13.71	499.28	273.15	17.20

Table 2: Loan Limit Timeline

February 13, 2008	Economic Stimulus Act (ESA) temporarily expands conforming loan limit for GSE purchases.
February 15, 2008	SIFMA announces high-balance loans won't be eligible for TBA pools.
May 6, 2008	Fannie Mae announces "TBA flat" pricing for pools of HBLS.
July 14, 2008	Housing and Economic Reform Act (HERA) permanently increases loan limit in high-cost areas.
August 14, 2008	SIFMA announces that HBLs up to HERA's permanent limit will be eligible for up to 10% of TBA pools, for HBLs originated on or after October 1, 2008, but only for TBAs settling from January 1, 2009 onward.
Fall 2008	Fannie Mae announces TBA flat pricing will expire on December 31, 2008.
November 2008	FHFA publishes list of "high-cost" areas eligible for HBL limits.
January 1, 2009	ESA's temporary higher limits ($729,750) expire; HERA's permanent limits ($625,500) become binding.
February 17, 2009	American Recovery & Reinvestment Act (ARRA) re-establishes the temporary $729,750 limit to the end of 2009.
November 2009	Temporary $729,750 limit extended to the end of 2010.

Table 3: Price discounts on Fannie Mae high-balance pools, by coupon

Table reports indicative prices, obtained from trading desks of a number of major market participants. Pools of Fannie Mae HBLs are marketed with a "CK" CUSIP prefix, as opposed to the "CL" prefix used to indicate a benchmark Fannie Mae fixed-rate 30-year TBA-eligible pool.

Coupon rate	4.0	4.5	5.0	5.5	6.0	6.5	**Average**
2010 Q1	-1.2	-0.5	-0.8	-1.3			**-1.0**
2009 Q4	-1.1	-0.6	-0.9	-1.1	-1.3	-1.3	**-1.1**
2009 Q3	-1.5	-1.2	-1.0	-1.1	-1.2	-1.3	**-1.2**
2009 Q2	-1.0	-0.9	-0.9	-1.0	-1.0	-1.3	**-1.0**
2009 Q1		-1.6	-1.4	-1.3	-1.1	-1.3	**-1.3**
Average	**-1.2**	**-1.0**	**-1.0**	**-1.2**	**-1.2**	**-1.3**	**-1.1**