Transparency and Dealer Networks: Evidence from the Initiation of Post-Trade Reporting in the Mortgage Backed Security Market

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ABSTRACT

We examine the introduction of mandatory post-trade reporting in the TBA mortgage-backed securities market. With post-trade reporting, trading costs fell for institutional investors. Trading costs declined more for investors' trades with peripheral dealers than for their trades with core dealers. Peripheral dealers' market share dropped after the introduction of post-trade reporting, suggesting that opacity was protecting inefficient high-cost dealers. Interdealer trades and volume declined as transparency made it easier to find natural counterparties. Relationships between dealers became less important and, after controlling for the number of trades, dealers used more counterparties in interdealer trades.

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1. Introduction

Decentralized over-the-counter (OTC) markets are extremely opaque. As a consequence, asymmetric information is a fundamental issue for OTC trading and liquidity. In this paper, we provide empirical evidence on the importance of asymmetric information for OTC liquidity and trading networks. We overcome econometricians' usual difficulty of identifying information in data by studying the introduction of post-trade transparency in the to-be-announced (TBA) forward market for agency mortgage backed securities (MBS). Starting November 13, 2012, FINRA began requiring that dealers report TBA transactions through TRACE no more than 45 minutes after the trade's execution.[1] We expect this event to cause a change in the relative information advantage of different market participants, through which we demonstrate the effect of asymmetric information on OTC trading and liquidity, and on the OTC dealer network.

Our empirical analysis focuses on the five month period centered around the November 13, 2012 introduction of post-trade transparency and studies changes before and after that. We first show that post-trade reporting reduced noise in TBA prices. We examine clusters of near identical trades, defined as trades of the same TBA CUSIP, for the same par value, on the same day, that are all dealer sales to investors, all dealer purchases from investors or all interdealer trades. The only difference between trades in a cluster is the time of day at which they occurred. The standard deviation of prices in these clusters fell by about 20% with post-trade transparency.

Furthermore, post-trade reporting decreased the informational advantage that dealers held over their customers. So, not surprisingly, we find that trading costs fell significantly for investors with the increase in transparency. Similar decreases in trading costs arising from increased transparency have been documented in the corporate and municipal bond markets by others. What sets our paper apart from these studies is that we use dealer identities for trades to show that increased transparency from post-trade

[1] See SEC Release 34-67798, footnote 11.

reporting has wide-ranging and significant effects on the dealer network. Like most other over-the-counter markets, the dealer network market for MBS consists of active core dealers who trade with many other dealers, and less active peripheral dealers who trade with a small number of other, mostly core, dealers. We show that prior to the initiation of post-trade reporting small peripheral dealers charged investors significantly more to trade. That difference was *eliminated* when post-trade reporting started. This decline in costs of trading with peripheral dealers was accompanied by a 20% decline in their TBA market share. It appears that the opacity of the market before post-trade reporting allowed small and inefficient dealers to trade profitably. With additional transparency, dealer-investor trading became more concentrated with the core dealers.

We also show that the number and volume of interdealer trades fall significantly both in absolute terms and relative to the number and volume of dealer-customer trades. When investors can observe recent trade prices, they are unwilling to pay a high price to buy from a dealer who needs to offset a short position through an interdealer trade. They are more likely to buy at a lower price from a natural counterparty who has a long position in that TBA. Likewise, they will be unwilling to sell at a low price to a counterparty who will unwind that position through an interdealer trade. Transparency makes them more likely to sell to a dealer who offers a higher price while trying to cover a short position.

If more trading takes place with natural counterparties dealers may not need to commit as much capital for a given volume of dealer-customer trading. That is what we find. Intraday capital commitment, measured as the average of the absolute value of dealers' inventory over each minute of the day, declines significantly with post-trade reporting.

We further document that dealers, while engaging in fewer interdealer trades, also spread their interdealer trades across significantly more counterparties. In part, this may be because transparency has made dealers better able to find natural counterparties, who may not be the dealers with whom they traded in the past. Using more counterparties may also reflect a decline in the importance of trading relationships. Specifically, in an opaque market, trading relationships may help to protect peripheral dealers from bad executions. With transparency, peripheral dealers are less likely to need this protection.

Finally, we examine spillover effects from TBA transparency to the specified pool (SP) market. TBA prices are used as benchmark prices for SP trades and dealers often hedge their SP inventories through TBA trades. So, it is not surprising that SP trading costs fall with TBA transparency, albeit with a lag. On the other hand, TBA transparency is unlikely to make it easier to find natural counterparties for SP trades. Consistent with this, there is no decline in interdealer SP trading following the initiation of TBA post-trade reporting. Instead, interdealer trading increases.

The rest of the paper is organized as follows. In Section 2 we introduce the institutional background on the MBS market and review the related literature, focusing on how they inform our empirical design. In Section 3 we discuss the data used here. Section 4 shows that the standard deviation of prices of near identical trades fell with transparency, indicating that post-trade reporting provided useful information. Section 5 looks at the effect of post-trade transparency on trading costs and dealer market share. Section 6 explores the impact of post-trade reporting on interdealer trading and the dealer network. Spillover effects from TBA transparency to the SP market are examined in Section 7. Section 8 offers conclusions.

2. Institutional Background, Empirical Design, and Literature Review

2.1 Institutional Background

Agency mortgage backed securities (MBS) are issued by the Federal National Mortgage Association (Fannie Mae), Federal Home Loan Mortgage Corporation (Freddie Mac), and the Government National Mortgage Association (Ginnie Mae). Agency backing makes these securities free from default risk, but their values are affected by changes in interest rates. Each MBS is composed of different mortgages and has its own unique prepayment characteristics.

Trading of MBS takes place in an over-the-counter (OTC) dealer market for institutional investors. They are traded in two ways: as SPs in which buyer and seller exchange a particular MBS that contains known mortgages, and in a forward or to-be-announced (TBA) market. In a TBA trade, buyer and seller agree on six trade parameters: the MBS issuer, the maturity, the coupon rate, the par value of the trade, the price, and the settlement date.[2] The seller of a TBA contract will deliver the MBS with the least favorable prepayment characteristics to fulfill the trade, so TBA pricing is based on the cheapest to deliver MBS. [3] While hundreds of specified pools trade in a given month, TBA volume is concentrated in a few contracts with a small number of maturity-coupon combinations. The action is in the TBA market. There are more TBA trades than SP trades, and the TBA trades are, on average, significantly larger. Trading costs are lower in the TBA market.

Like other OTC markets, the agency MBS market can be characterized as having a core-periphery structure. In a core-periphery trading network, a small number of core dealers trade frequently and with many other dealers while a large number of peripheral dealers trade infrequently, and seldom trade with each other.

Dealers and investors would like to have three types of information on MBS trading. First, they would like information on prices. Ultimately, they want to know what they could reasonably expect to pay or receive when buying or selling in the TBA market. Both indicative quotes and transaction prices are useful in determining reasonable trade prices. Second, they would like information on order flow. Information on volume and the number of trades can be used to determine the market's liquidity and the likelihood that informed trading is taking place. Finally, dealers and investors would like information on the activity of other dealers. Knowing which dealers have bought or sold and knowing how much they have traded tells investors and other dealers who is likely to be a willing counterparty to a trade and how eager they will be to transact.

Only part of this information was available on agency MBS trades before the November 13, 2012 introduction of post-trade reporting. Information on prices could be obtained in two ways during the

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[2] In a stipulated TBA trade, buyer and seller agree on additional parameters. See Vickery and Wright (2013) or Gao, Schultz and Song (2017a) for more details about TBA trading.

[3] During our sample period, the Treasury Market Practices Group (TMPG) recommended a daily charge for failures to deliver of 3% minus the Federal Open Market Committee's target level for the Federal funds rate. In November 2012, the TMPG first recommended margining for TBA trades, with the expectation that margining would be fully implemented by June, 2013, but the implementation deadline was pushed back to December, 2013.

trading day. Quotes could be solicited and trades executed in the old-fashioned way – by calling dealers one-by-one on the phone. A bit over half of the trading volume in MBS came from trades conducted in this way. Alternatively, market participants could get quotes or trade using the electronic platforms Tradeweb and Dealerweb. These platforms accounted for 40% to 50% of trading volume.

Tradeweb provides an electronic interface between institutional investors and dealers. For a specific TBA, Tradeweb provides a composite bid-ask quote from an algorithm that uses recent Tradeweb transaction prices. Trades that take place over the phone make up more than half of TBA volume but are not used in setting the Tradeweb quote. This composite quote does not include information on transaction sizes or dealers who have recently traded. An institutional investor who wants to trade clicks the CUSIP shown on Tradeweb and sees a list of dealers. The investor chooses 4-6 dealers and sends a request for a quote to them. Dealers see the identity of the institution, whether the institution wants to buy or sell, and the size of the order. The dealers do not know the identities of the other dealers who are contacted. Dealers have several minutes to submit a firm quote. The institution chooses a counterparty. Most often, but not always, it is the dealer offering the best price.

The second electronic platform, Dealerweb, is available to dealers but not institutional investors. Dealerweb is a central limit order book that displays anonymous quotes and associated quantities. Dealers can submit their own quotes or trade against existing quotes. Dealerweb intermediates as the counterparty to both sides of all trades.

Note that before the introduction of post-trade transparency, there was some quote information available, but no information about order flow during the day, and no direct information about dealer activity. Note also that there is a hierarchy for access to information. Dealers get information on prices from both Tradeweb and Dealerweb, while investors see only the composite quote on Tradeweb. Dealers also get information on prices in their phone conversations with other dealers. They can infer some information on order flow from the requests for quotes that they receive. They can also infer some information about dealer activity from their phone conversations with other dealers. Active, core dealers learn more about the market than inactive peripheral dealers. They transact more frequently, are called more often and receive more requests for quotes. Customers typically spend far less time talking to dealers and learn less from phone conversations.

2.2 Empirical Design

Our empirical design focuses on changes in market liquidity and the trading network before and after the November 13, 2012 introduction of post-trade transparency in TBA markets. We first show that post-trade reporting did provide useful information to market participants. Post-trade reporting provides a record of transaction prices and sizes. The prices are more transparent than algorithmically determined Tradeweb quotes. They also include all trades, not just those that occurred on Tradeweb. In addition, post-trade reporting provides information on order flow. Investors and dealers can get a better sense of the market's current liquidity. In consequence, post-trade reporting can reduce the overall market opacity. We find that, following the introduction of post-trade transparency, there is a significant decrease in the price dispersion of near identical trades that often characterizes OTC markets.

The increase in transparency allows us to study three ways in which post-trade reporting affects the relative information advantage of TBA market participants. First, investors are the least informed market participants and likely to benefit significantly from increased transparency. We find that trading costs fall significantly for investors with the introduction of post-trade transparency.

Second, core dealers are likely to be more informed than peripheral dealers, as discussed above, and may also benefit from lower inventory and order processing costs per trade and economies of scale. Both channels lead to higher transaction costs charged to clients by peripheral dealers than by core dealers. Under the former channel, peripheral dealers have less information than core dealers and need to charge more to compensate for the likely larger losses to informed investors. Under the latter channel, peripheral dealers need to charge more than core dealers to recover their higher costs, but can only get away with charging more if customers are uninformed about prices. Post-trade reporting shrinks the gap in transaction costs charged by peripheral dealers and core dealers through both channels. With post-trade transparency, peripheral dealers become better informed relative to core dealers and can charge less because of lower information risk. At the same time, with post-trade transparency it is more difficult for high-cost dealers to exploit uninformed investors. How can we differentiate the two channels? We look at trading activity. If peripheral dealers charged more than core dealers because they were less informed, we would expect them to trade as much or more following post-trade transparency. On the other hand, if peripheral dealers charged more than core dealers to cover their higher costs, we expect to see a decline in peripheral dealer trading with post-trade reporting. Hence, in our empirical analysis we study both the different changes in the trading costs charged by core and peripheral dealers, and also the changes in their trading activities.

Third, with greater knowledge of recent trade prices, investors and other dealers are better able to trade directly with a natural counterparty rather than trading with intermediating dealers. The identities of dealers who have acquired or sold in the TBA market are not directly revealed by post-trade reporting, but it does make it easier to determine if a possible counterparty is offering to trade at a reasonable price. If not, the investor or dealer can phone another dealer or submit another request for quotations on Tradeweb to different dealers. The dealer that offers a favorable price to buy (sell) is likely to be a natural counterparty with a long (short) position in the security. With post-trade transparency, an investor (or dealer) is less likely to trade with a counterparty who needs to acquire or layoff inventory with another dealer. Overall, post-trade transparency can make it easier for customers and peripheral dealers to locate natural counterparties, leading to less interdealer trading driven by inventory sharing, less capital commitment, and less reliance on trading relationships. Accordingly, we study such changes in dealer network in our empirical analysis.

In addition, we study spillovers from TBA transparency to the SP market. The SP market is affected by TBA transparency in two ways: TBA prices provide a benchmark for SP trades and dealers typically hedge SP positions through TBA trades. So, a decline in TBA trading costs can decrease an SP dealer's costs of market making. Consistent with this, we find that SP trading costs also fall with TBA reporting, albeit with a lag. On the other hand, TBA transparency is not helpful in determining natural counterparties for SP trades. So, while interdealer trading dropped sharply with post-trade reporting for TBA trades, interdealer SP trading increased with TBA trade reporting.

Our sample period is centered on the November 13, 2012 initiation of post-trade transparency for TBA trades. This was during a time when the market was still recovering from the financial crisis and numerous policy measures were implemented. We separate these policy initiatives into three categories and point out that they are unlikely to affect our results.

First, there were new regulations that affected the banks that provided most of the market making for TBA trades. In July, 2010 the Dodd-Frank act was signed into law. The Basel III banking accords were required to be finished in July, 2013. In April, 2014, the Volcker Rule was scheduled to take effect. All of these regulatory changes could be expected to affect the market making practices of banks in the TBA market and other OTC markets as well. None of the changes, however, took place during our September, 2012 through January, 2013 sample period.

Second, there were changes in housing market policies that affected the risk profiles of mortgage backed securities. In March, 2009, the Home Affordable Refinance Program (HARP) and the Home Affordable Modification Program (HAMP) were created. HARP allowed homeowners with high loan-to-value (LTV) ratios to refinance their mortgages without paying for mortgage insurance. HAMP was designed to allow homeowners to avoid foreclosure by modifying mortgages. In December, 2011, HARP 2.0 expanded the HARP program to allow mortgage owners with any level of negative equity to refinance without mortgage insurance. Neither of these changes occurred during our sample period.

Third, the Federal Reserve conducted policy operations in the MBA market. In January, 2009, the Federal Reserve began to purchase MBS in the TBA market, a practice known as Quantitative Easing (QE). In September, 2011, The Federal Reserve started to use proceeds from its MBS portfolios to purchase additional MBS. On September 13, 2012 the Federal Reserve announced its QE3 program in which it would purchase $40 billion in MBS per month through TBA trades. On December 12, 2012, the Federal Reserve announced it would increase the amount of purchases to $85 million per month. The initiation and expansion of QE3 did take place within our sample period. Nevertheless, we find similar results when we use shorter periods around the introduction of post-trade reporting that do not include changes in the QE3 program.

2.3 Related Literature

Academic studies of the market structure and liquidity of the agency MBS market have only appeared recently. Bessembinder, Maxwell, and Venkataraman (2013) document the average trading costs, whereas Gao, Schultz, and Song (2017a, b) investigate the market structure of agency MBS, focusing on the parallel trading in the TBA and SP markets.

Several studies examine the impact of the introduction of post-trade reporting for corporate bonds. Goldstein, Hotchkiss, and Sirri (2007) report results of a controlled experiment in which post-trade transparency was introduced for 120 BBB rated bonds on April 14, 2003. Trading costs fell significantly for the newly-transparent bonds relative to similar bonds without post-trade transparency. Edwards, Harris, and Piwowar (2007) find that TRACE transparency is associated with significantly greater liquidity, as measured by lower round-trip trading costs. Transparency seems particularly important for increasing liquidity for retail investors. Bessembinder, Maxwell, and Venkataraman (2006) show that public reporting of corporate bond transactions reduces trading costs both for bonds subject to reporting and for other bonds. They contend that trade reporting provides a “liquidity externality” for those securities that were not subject to reporting. O’Hara, Wang, and Zhou (2017) compare the execution quality received by insurance companies with large bond portfolios with the execution quality received by insurance companies with small bond portfolios. They find that insurance companies with larger portfolios receive better executions, but the difference declines with post-trade transparency.

Bessembinder and Maxwell (2008) provide three explanations for the finding that dealer market trading costs decline with increased transparency. First, transparency may make it more difficult for better informed dealers to extract rents from less-informed investors. Second, increased transparency can make it easier to enforce rules against excessive markups. Third, greater transparency may improve dealers’ ability to share risks. These explanations for transparency lowering trading costs would also apply to the MBS market.

A recent and rapidly expanding literature studies trading network in OTC markets. Li and Schürhoff (2017) empirically characterize the municipal bond market as a core-periphery market and demonstrate that investors trade off speed versus execution costs when deciding whether to trade with a core or peripheral dealer. Theoretical studies such as Hugonnier, Lester, and Weill (2016), Üslü (2016), Farboodi, Jarosch, and Shimer (2017), and Wang (2017) show that the core-periphery structure can arise endogenously. Core and peripheral dealers can charge different costs as a result of heterogeneity in such dealer characteristics as size, preference, search intensity, and bargaining power. We complement these papers by studying the importance of asymmetric information across core and peripheral dealers.

Several recent papers, including Glode and Opp (2016), Babus and Kondor (2016), and Brancaccio, Li, and Schürhoff (2017) study issues regarding asymmetric information in dealer markets. In particular, Glode and Opp (2016) argue that intermediation chains alleviate the information asymmetry between the end sellers and end buyers. Babus and Kondor (2016) assert that peripheral dealers are less informed than core dealers. This is one of the two potential channels consistent with peripheral dealers charging higher transaction costs, as discussed in Section 2.2. We study the trading activity of core vs peripheral dealers and find evidence consistent with the alternative channel that peripheral dealers, who are protected by opacity, charge more to cover higher costs. Brancaccio, Li and Schürhoff (2017) show that in opaque markets, information acquisition can serve as a motive for trading. With post-trade reporting, dealers are less likely to trade to gain information. This is consistent with the decline in interdealer trading we document. Yet, we also find that dealer-customer trading did not decline and dealers use more, not fewer counterparties following post-trade transparency. Neither of these findings seems consistent with interdealer trading decreasing because dealers have less need to acquire information.

3. Data

Our enhanced TRACE data contain information on every agency mortgage-backed security trade from May, 2011 through April, 2013. To minimize any possible impact of changes other than TBA post-trade transparency on the agency mortgage-backed security market, our work focuses on the shorter window from September, 2012 through January, 2013. Each trade record contains the price, time of the trade, trade date, settlement date, a buy or sell indicator, the par value of the trade, the CUSIP of the MBS, whether the trade was a TBA trade or a specified pool trade, and if a specified pool, whether it was eligible for delivery in a TBA trade. We also have masked dealer identities for each trade and for both counterparties in interdealer trades. These masked identities do not allow us to say who the dealer was, but do allow us to attribute all of a dealer's trades to the dealer.

Table 1 provides summary statistics. In many of the tests to come, we will characterize dealers by the number of trades they made during the six months prior to our sample period. Panel A categorizes the 543 dealers who traded at least once over this six months by their total number of trades, and provides statistics for each category. The first row of the table shows that the ten most active dealers account for about 1.2 million trades. TBA trades are 84.8% of the total trades of these ten dealers, and SP trades account for the remaining 15.2%. Successive rows characterize trades of dealers ranked 11-30, 31-50, 51-100, and 101-543 in total number of trades. The less dealers trade, the larger the proportion of trades that are specified pools. SP trades account for more than 95% of trades for dealers outside the top 100.

The last two columns provide means of two statistics commonly used to measure a dealer's place in a network. Closeness is the inverse of the average number of steps that a dealer needs to reach another network dealer. A higher closeness measure means that a dealer does not need to go through as many intermediating dealers to reach another dealer, so it means a dealer is closer to the center of the network. Degree is the percentage of other dealers in the network that the dealer trades with directly. A higher value for degree means the dealer occupies a more central place in the network. Mean closeness for the ten dealers with the most trading volume is 0.5107. It decreases monotonically with the categories for number of trades, and is 0.3460 for dealers outside of the top 100. Similarly, the mean degree is 0.2084 for the top ten dealers, and declines steadily, reaching 0.0108 for dealers outside of the top 100. The positive correlation between the number of trades and the closeness and degree measures indicate, as expected, that number of trades is a good measure of network centrality. In the remainder of the paper, we will use the natural log of the number of trades in the six months before the sample period as a measure of whether a dealer is a peripheral or core dealer.

Panel B of Table 1 provides daily trading statistics. For each day over the September 1, 2012 through January 31, 2013 sample period, we calculate the number of dealers who participate in any trades of mortgage backed securities, the total number of trades, and the total volume (in par value) traded. Each trade can be characterized as a TBA trade or a specified pool trade, an interdealer trade or a dealer-customer trade, and as a large (≥ $1 million par value) or small trade, so we calculate the number of trades in each of these categories as well. We calculate daily averages for these statistics for the days before and after the introduction of post-trade reporting. There is little change in the number of dealers participating. On average, 129.2 dealers participate in trades during a day before post-trade reporting and 129.7 participate afterwards. There are, however, large changes in trading volume and number of trades post-transparency. Average daily volume shrinks from about $257 billion per day to about $208 billion per day. The number of TBA trades declines from an average of 5,518 before transparency to 4,592 afterwards.

The ten weeks in the post-trade transparency period include three holidays: Thanksgiving, Christmas, and New Year’s Day. Financial markets are closed on these days, and trading volume is typically very low before and after them. To see if this accounts for the decline in trading and volume post-transparency, we recalculate daily averages after omitting the last trading day before, and the first trading day after these three holidays. Results are shown in the last column of Panel B. When days around holidays are omitted, daily volume is $224 billion after transparency as compared to $257 billion per day before post-trade reporting. The mean number of TBA trades per day following post-trade reporting is 4,906 when days around holidays are omitted, as compared to 4,592 when they are included. This still represents a decline from the 5,518 TBA trades per day before post-trade transparency.

Panel C provides a description of interdealer trading. Here, what is interesting is the breakdown of who is doing the interdealer trading rather than how it changed with transparency. We define an interdealer broker as a dealer that did at least 99% of its trades with other dealers and who was among the top 50 in total trades in the six months before the sample period. In total, nine dealers are defined as interdealer brokers. One is the most active dealer and the other eight are among the dealers ranked 11 – 50 in total trades. On average, over the entire sample period, there are 2,354 interdealer TBA trades per day. Trades between one of these interdealer brokers and a regular dealer make up 1,747 of these, or almost three out of four. Trades between regular dealers account for 606 interdealer trades per day. It is interesting that the interdealer brokers take part in almost 75% of interdealer trades but almost never trade with each other. Trades between interdealer brokers average less than one per day. The breakdown of who participates in interdealer trades seems to change very little with post-trade reporting.

Entry and exit of dealers and changes in trading strategies may only be fully realized over a longer time period. With this in mind, Panel D reports tests for changes in the mean daily number of participating dealers, in the mean daily number of various types of trades, and in the mean daily volume from different types of trades using the longer time period from June 1, 2012 through April 13, 2013. All days, including those around holidays are included. The mean number of dealers participating in trades is 129.1 per day before transparency and 128.0 afterwards. The t-statistic for the difference is -0.81. There is no evidence of dealer entry or exit surrounding the introduction of post-trade transparency.

Succeeding rows of Panel D report the average daily number of trades of various types along with average daily volume. The most striking result is that the number of TBA interdealer trades falls from 2,623 per day to 2,188. The t-statistic for the difference is a highly significant -4.45. Over the same time, the number of dealer TBA trades with customers falls from 2,720 to 2,629, a small and statistically insignificant change. Volume tells the same story. TBA trading volume between dealers and customers falls by a statistically insignificant amount, but there is a sharp and statistically significant decline in interdealer TBA trading volume. So, TBA volume and number of trades decline with post-trade transparency, but that decline is coming almost entirely from interdealer trading. We explore the decline in interdealer TBA trading in greater depth later.

4. Post-Trade Transparency and Price Dispersion

It is possible that post-trade reporting was inconsequential. The participants in this market are large, sophisticated institutions. In addition, most TBA trading occurs in a handful of coupon-maturity combinations, and market participants need to keep track of only a small number of prices. Finally, indicative quotes were available to both MBS dealers and investors before trade reporting.

To see whether post-trade reporting provides a significant increase in transparency, we examine the dispersion of prices for near-identical trades. In an opaque market where market participants are unable to observe trades, similar trades may occur at very different prices. The introduction of post-trade transparency should ensure that similar trades take place at similar prices. We search through all trades over our sample period to find clusters of two or more trades of the same MBS on the same day that are all for the same par value, and are either all interdealer trades, all dealer sales to customers, or all dealer purchases from customers. The trades in a cluster must match on all of the six TBA parameters and are indistinguishable at the time of the trade. The only potentially significant difference in the trades is that they occur at different times of the same day.

For each cluster of trades, we calculate the standard deviation of prices of trades within the cluster. Bid-ask spreads do not contribute to the standard deviations as all trades in a cluster are either buys or sells or interdealer trades. In most cases, there are two trades in a cluster, but the average number is slightly over four trades. If post-trade reporting increased transparency in the MBS market, we would expect the standard deviation of prices in a trade cluster to fall with post-trade reporting. To make sure that a change in standard deviations of prices in clusters is a result of increased transparency and not a coincident decline in volatility, we adjust for contemporaneous volatility using the volatility of an index of TBA prices that we create. For each minute between 8 am and 5 pm, we record a price for Fannie Mae and Freddie Mac 15 year 2.5%, 3%, and 3.5% TBA prices, and for 30 year 3%, 3.5%, 4%, and 4.5% TBA prices. We use only interdealer trades. If there is more than one interdealer trade for a coupon-maturity combination during the minute, we use the largest trade. If there is no trade during that minute, we use the price from the last previous minute of that day with a trade. The index is a simple average of all the prices for that minute. We calculate an index standard deviation corresponding to each cluster by taking the standard deviation of index prices using the same minutes as the trades in the cluster. So, if a cluster consists of trades that occurred at 9:30, 10:15, and 11 am, we calculate the index standard deviation using the index values from 9:30, 10:15 and 11 am. Our results are nearly identical when we calculate the index standard deviation using index values lagged by one minute.

The standard deviation of prices in a cluster is left-censored at zero. So, to see if post-trade transparency led to lower dispersion of prices for similar TBA trades, we run the following tobit regression

$$\sigma_i^* = \alpha_1 + \alpha_2 D_{PostTradeTrans} + \alpha_3 \sigma_{Index} + \alpha_4 D_{PostTradeTrans} \times \sigma_{Index} + \varepsilon_i \quad (1)$$

where σ_i^* is σ_i, the standard deviation of prices in trade cluster i if the standard deviation is greater than zero and zero otherwise, $D_{PostTradeTrans}$ takes a value of one for trade clusters that take place after November 12, 2012, σ_{Index} is the standard deviation of index prices and $D_{PostTradeTrans} \times \sigma_{Index}$ is the interaction between the post-trade transparency period and the index standard deviation.[4] For SPs we also include a dummy variable for TBA eligibility and an interaction between TBA eligibility and post-trade transparency.

Regression results are presented in Table 2. The first four regressions include the dummy for post-trade transparency as their only explanatory variable. The first regression examines price dispersion for clusters of interdealer trades of $1 million or more. As in all of the regressions in Table 2, the left-censoring of the dependent variable is a problem. There are a total of 29,626 clusters included in the

[4] We find very similar results with OLS regressions, but OLS coefficients are biased toward zero.

regression, with 10,440 of them having a price standard deviation of zero. The coefficient on the dummy variable for post-trade transparency is -0.0160, indicating that the standard deviation of prices in trade clusters was more likely to be zero following post-trade reporting, and the change in the expected standard deviation with post-trade transparency was -1.6 basis points. The t-statistic of -12.25 on the post-trade transparency dummy indicates that the reduction in the standard deviations with post-trade transparency was statistically significant at any conventional level. The next row reports regressions using large trades between dealers and customers. The regressions include both clusters when dealers bought from customers and clusters in which the dealers sold to customers. Each cluster, however, contains only dealer sales to customers or dealer purchases from customers. The coefficient of -0.0199 indicates that the standard deviation of dealer-customer trade prices for clusters of near identical trades was more likely to be zero following post-trade reporting, and likely to be smaller if it was positive.

The next two rows report results for interdealer and dealer-customer trades of less than $1 million. For small interdealer trades, price dispersion does not appear to be affected by port-trade transparency. For small dealer customer trades, the standard deviation of cluster prices falls significantly with post-trade reporting.

To summarize, the first four tobit regressions indicate that the standard deviation of prices of the near identical trades in our clusters fell significantly with post trade reporting. Post-trade reporting appears to have increased transparency in the TBA market.

It is possible that the volatility of MBS prices fell generally after November 12, 2012 for reasons unrelated to the introduction of post-trade reporting. In that case, the standard deviation of prices for trades in a cluster that took place at different times of the day would also be expected to decrease. To examine this, we include the standard deviation of our TBA index prices in the next four regressions. In each case, for large and small trades and for interdealer and dealer-customer trades, the coefficient on the index standard deviation is positive and highly significant. The coefficients on the post-trade reporting dummies are, however, almost unaffected by the inclusion of the index volatility. The decline in trade price volatility within clusters can't be attributed to lower volatility in the post-transparency period.

In the last four regressions, we include the interaction between the index standard deviation and the dummy for post-trade transparency. Coefficients on this term are negative and significant in all four regressions. At the same time, the coefficients on the dummy for post-trade transparency are no longer negative and significant in any of the regressions. So, post-trade reporting reduces the dispersion of prices for near identical trades, but only when the market is volatile. It is during times when there is uncertainty about prices that post-trade reporting matters.

5. Transparency, TBA Trading Costs, and Dealer Market Share

5.1 Changes in Trading Costs Around Post-Trade Transparency

Others have found that post-trade reporting led to lower trading costs for corporate bonds. To test whether this is true for TBA trades, we employ a regression methodology similar to Bessembinder, Maxwell, and Venkataraman (2013), Bessembinder, Jacobsen, Maxwell, and Venkataraman (2017), and Gao, Schultz, and Song (2017a, b) to estimate trading costs. Each observation is two consecutive trades between dealers and customers in an MBS with a specific CUSIP, but each regression includes observations from all TBA CUSIPs. With the change in price between two consecutive trades as the dependent variable, we estimate

$$\Delta P_t = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot D_{PostTrdTrans} + \alpha_3 \Delta Q_t \cdot \left(ln\left({Size_t}/{1{,}000{,}000} \right) + ln\left({Size_{t-1}}/{1{,}000{,}000} \right) \right) + \Sigma \beta_i \, Ret_{i,t} + \varepsilon_t, \qquad (2)$$

where ΔP_t is the percentage change in prices between trade t and trade t-1, ΔQ_t equals +1 if the dealer purchases in trade *t*-1 and sells in trade *t* and -1 if the dealer sells in trade *t*-1 and purchases in trade *t*,[5] and Size is the par value of the traded securities. Note that we divide trade sizes by $1,000,000 and take logs. Hence the size term in the regression drops out for $1,000,000 trades. To capture the effect of TBA post-trade reporting on trading costs, we interact ΔQ with a dummy variable $D_{PostTrdTrans}$ that equals one for trades occurring after November 12, 2012 and zero for earlier trades. We limit the sample period to the relative short window from 9/1/2012 to 1/31/2013 to suppress the potential effect of changes in other factors on trading costs.[6] In further tests, we examine changes in trading costs using and five, ten and twenty trading days before and after the start of post-trade reporting.

We also include five return variables to capture changes in MBS values when consecutive trades take place on different days: the percentage changes in 1) Barclay Capital's U.S. MBS index, 2) Barclay Capital's 7-10 Year U.S. Treasury Bond index, 3) Barclay Capital's U.S. Corporate Bond Index, 4) Barclay Capital's U.S. Corporate High-Yield Bond Index, and 5) the S&P 500 index. Index values are available daily, so if consecutive trades occur on the same day, all of these return values are zero. We include only 30-year MBS with coupon rates of 2.5%, 3.0%, 3.5%, 4.0%, 4.5%, 5%, 5.5%, and 6%, and 15-year MBS with coupon rates of 2.5%, 3.0%, 3.5%, and 4.0%. Together, these MBS account for 96% of our sample trades. We omit trades of less than $10,000 par value.

A potential concern is that changes in trading costs for TBA trades could be a result of other changes to fixed income trading that occurred around the same time.[7] To allay that concern, we also estimate the regression using quoted bid-ask spreads for treasury securities. Treasury spreads are

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[5] If both trades are dealer purchases or both are dealer sales, ΔQ equals zero and the observation is omitted.

[6] In studying how the public reporting of corporate bond transactions affects the trading cost, Bessembinder, Maxwell, and Venkataraman (2006) use a six month window after the transparency reporting to allow an enough time frame for participants to become accustomed to the reporting system. As MBS trade more frequently than corporate bonds, we expect a shorter time frame to be enough, while the shorter window mitigates concerns on confounding effects from other factors or events.

[7] It might seem that SP trades could be used as a control. They are not suitable for this purpose because the SP market is also affected by TBA transparency. As Vickery and Wright (2013, p.2) observe *"TBA prices, which are observable to market participants, also serve as a basis for pricing and hedging a variety of other MBS."*

indicative bid-ask quotes from the New Price Quote System by the Federal Reserve Bank of New York. These quotes are the best bid and ask prices across different trading platforms of Treasury securities at four times each day: 8:40 a.m., 11:30 a.m., 2:15 p.m., and 3:30 p.m. Quotes from two-year, five-year, ten-year, 20-year and 30-year securities are included.[8] In the treasury regression, ΔP_t is the percentage difference between quoted ask and bid prices for treasuries. Since the difference in treasury prices is always ask minus bid, ΔQ_t is always one for treasuries. When treasury spreads are used, we drop the trade size variable.

Results are in Table 3. The first regression uses TBA trades. The coefficient of 0.0472 on ΔQ indicates that round-trip trading costs for TBA trades of $1 million in par value were about 4.72 basis points before the start of post-trade reporting. The coefficient of -0.0061 on the product of ΔQ and the log of the ratio of trade size to $1,000,000 indicates that proportional trading costs fall with trade size. This is similar to results in Gao, Schultz, and Song (2017a, b) for mortgage backed securities and to results in numerous studies of the corporate bond market. The negative coefficient on the product of ΔQ and the dummy variable for TBA post trade disclosure indicates that TBA trading costs decreased significantly after mandatory TBA post-trade reporting. In particular, round-trip costs for $1,000,000 TBA trades decrease by about 0.87 basis points, or about 18% of the 4.72 basis points before the TBA transparency reporting. This finding is not surprising. Dealers have an informational advantage over the investors who buy and sell MBS in the TBA market. Dealers know more about recent trades and more about the latent demand or supply for MBS. Post-trade transparency reduced the informational advantage that dealers had over customers and thereby allowed customers to negotiate better prices. Post-trade transparency also made it easier for investors to learn, after the fact, whether a dealer provided good or bad executions and direct future business accordingly.

The next regression includes only quoted spreads from treasury securities. The coefficient on ΔQ is 0.0513, indicating that quoted spreads for treasuries were about 5.13 basis points. This is very close to

[8] The quality of these quotes is reflected in the fact that the Federal Reserve uses them to evaluate offers by primary dealers participating in Federal Reserve auctions.

the estimate of 4.72 basis points for TBA spreads. The coefficient on the interaction between ΔQ and $D_{PostTrdTrans}$ is -0.0008, less than one-tenth that of the coefficient on the interaction term for TBA trades. With TBA post-trade transparency, trading costs for treasuries fell by only about 0.08 basis points, a statistically insignificant amount. It doesn't appear that the decline in TBA trading costs around the introduction of post-trade transparency was part of a broader decline in trading costs for fixed income securities.

The next three regressions examine the impact of post-trade transparency on TBA trading costs using successively narrower windows around the introduction of post-trade reporting. The original regression used observations from September 1, 2012 through January 31, 2013, or about 50 days before and after. The next three regressions use 20, 10, and five days before and after the introduction of post-trade transparency. In each case, the coefficient on $\Delta Q \cdot D_{PostTrdTrans}$ is negative. It is statistically significant for periods of ten and 20 days before and after the start of post-trade reporting. For the five day window, the coefficient is -0.0136, but with the small number of observations the t-statistic is only -1.51. The finding that TBA trading costs fell in such a short window around the introduction of post-trade transparency suggests that is unlikely that other market changes are responsible for the decline.

5.2 TBA Trading Costs with Core vs Peripheral Dealers

Theory provides reasons to expect trading costs to differ for investors trading with core and peripheral dealers. Babus and Kondor (2016) provide a model of dealer networks in which more central dealers face less information asymmetry and can trade with lower spreads. Neklyudov (2013) and Weller (2013) provide models in which faster dealers are core dealers and trade with narrower spreads. Glode and Opp (2016) show how the impact of information asymmetries can be reduced through chains of intermediating dealers. Hollifield, Neklyudov, and Spatt (2017) model a dealer market with heterogeneous investors and dealers. Core dealers will offer lower trading costs than peripheral dealers if investors are sufficiently sophisticated and there is enough heterogeneity across investors. On turning to the data, they find that core dealers receive smaller spreads in the market for asset-backed securities, collateralized debt obligations, commercial mortgage-backed securities, and collateralized mortgage obligations.

In the six months prior to our sample period, 543 dealers traded MBS at least once. The ten most active dealers handled 67% of all TBA trades, while the 443 least active dealers participated in less than 1% of all TBA trades. There are at least two reasons why we might expect the introduction of post-trade transparency to affect the costs of trading with core dealers and peripheral dealers differently. First, core dealers, who trade numerous times during the day, and communicate frequently with investors and other dealers, are likely to have an accurate idea of market conditions without post-trade transparency. Peripheral dealers, who are less informed about market conditions, are exposed to greater risks of trading against a better-informed investor. This risk, and their markups, are likely to decline for peripheral dealers when they can learn from reported trades. Second, core dealers are likely to be more efficient, lower-cost dealers. In an opaque market, high-cost dealers may be able to survive by charging higher prices to trade to uninformed investors (See Duffie, Dworczak, and Zhu (2017)). With increased transparency, peripheral, high-cost dealers may have to reduce the amount they charge to trade to bring costs into line with core dealers.[9]

To test how costs of trading with core and peripheral dealers are affected by transparency, we estimate the following regression using TBA trades:

$$\Delta P_{td} = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot Ln(DlrVol) + \alpha_3 \Delta Q_t \cdot D_{PostTrdTrans} + \alpha_4 \Delta Q_t \cdot D_{PostTrdTrans} \cdot Ln(DlrVol) + \alpha_5 \Delta Q_t \cdot \left(ln\left({Size_t}/{1{,}000{,}000} \right) + ln\left({Size_{t-1}}/{1{,}000{,}000} \right) \right) + \sum \beta_i Ret_{i,t} + \varepsilon_t. \quad (3)$$

where $Ln(DlrVol)_d$ is the natural log of the total trading volume (measured by the number of trades) of dealer d six months before our sample period. Hence, the α_4 coefficient on $\Delta Q_t \cdot D_{PostTrdTrans} \cdot Ln(DlrVol)$

[9] We differentiate between core and peripheral dealers based on total number of trades. Of the 40 dealers ranked 11-50, eight are interdealer brokers. That is, more than 99% of their trades were interdealer trades. We hold that these dealers were not more central or more connected than full service dealers ranked in the top ten. Every one of the top ten dealers had more *interdealer* trades than the interdealer brokers ranked between 11 and 50.

measures how the change in round-trip trading costs with post-trade transparency is affected by dealer activity.

Table 4 reports results. The first regression uses only TBA trades before post-trade transparency. Here, the coefficient on ΔQ x Dealer Volume is -0.018 with a t-statistic of -4.43. Prior to post-trade transparency, small or peripheral dealers charged higher round-trip costs to customers, on average. This contrasts with the finding by Li and Schürhoff (2017) that it was more expensive to trade with central dealers in the municipal market. Instead, our finding is consistent with the hypothesis that small dealers do not possess as much information about TBA prices as large dealers, so they charge higher round-trip costs to compensate for the higher risk they face from informed trading. It is also consistent with the idea that inefficient small market makers had higher costs and therefore needed to charge more to make money on trades. In this case, they could only get away with charging more if customers were uninformed about prices.

Column 2 shows results of regressions that use only the TBA trades after November 12, 2012. In this regression the coefficient on the interaction between ΔQ and log of dealer volume is 0.10 with a t-statistic of 2.87. This is a striking contrast to the results in the regression using just trades from before post-trade reporting. Before the introduction of post-trade reporting, peripheral dealers charged *higher* round-trip tading costs. Afterwards, they charged *lower* round-trip costs. The significantly positive coefficient on ΔQ x Dealer Volume x TBA PostTrdTrans, reported in column (3) for the full regression (2), further confirms that the round-trip cost charged by peripheral dealers *declined* significantly relative to the round-trip cost charged by core dealers, when TBA transparency is increased through post-trade reporting. [10]

In the first part of our sample period, investors paid more to trade with peripheral dealers than core dealers. This difference was eliminated with the introduction of post-trade reporting. If peripheral

[10] This contrasts with the finding of Li and Schürhoff (2017) that the price of immediacy only fell for central and mid-tier dealers following the 2005 introduction of post-trade reporting in the municipal bond market.

dealers charged more because they had less information than core dealers and were more likely to lose to informed investors, we would expect them to trade as much or more following post-trade transparency. On the other hand, because peripheral dealers trade less frequently than core dealers, they can expect to hold positions longer and face larger inventory holding costs and order processing costs. That is, they may need to commit capital to a position for a longer period and may face risk from adverse price moves for a longer holding period than core dealers. As shown in Table 1, it does not appear that dealers exited the TBA market in the weeks immediately after the introduction of post-trade transparency. It is possible, though, that some of the trades that were profitable for peripheral dealers when spreads were wide were no longer worthwhile when trading costs fell. In this case, we may see a decline in peripheral dealer trading with post-trade reporting.

To test this, we separate dealers into four groups based on the number of trades they conducted in the six months before our sample period. The groups are the top ten dealers in number of daily trades in the six months before our sample period, dealers ranked 11 through 50, dealers ranked 51 through 100, and all dealers outside the top 100. We then regress the percentage of daily dealer-customer TBA volume accounted for by all dealers in each group on a dummy variable that takes a value of one for days after the introduction of post-trade reporting. Panel A of Table 5 reports regressions of the percentage of daily dealer customer volume on the dummy for post trade transparency. Each row reports two regressions, one using the entire sample period and the same regression using just September 12, 2012 through December 12, 2012. The point of using this shorter window is that the Federal Reserve announced the QE3 program to buy MBS on September 12, 2012 and announced an expansion of the program on December 12, 2012. The Federal Reserve purchased MBS through large dealers, so this could affect the proportion of total volume accounted for by the core dealers. The shorter period includes the change in post-trade transparency but no changes in the QE3 program.

The first row of Panel A of Table 5 reports the regressions for the percentage of volume for the top ten core dealers.[11] For the regression including the whole sample period, the intercept is 0.8745, indicating that these top ten dealers averaged over 87% of all dealer-customer TBA trading volume prior to the introduction of post trade transparency. The coefficient on the dummy for post-trade transparency is 0.0200, which suggests that the top ten dealers' share of dealer-customer TBA volume went from 87.45% to 89.45% with post-trade transparency. This is a statistically significant difference. The t-statistic on the post-trade transparency dummy is 3.34. In the second regression, which uses the shorter sample period, the coefficient on the dummy for post-trade transparency is 0.0161, indicating that the top ten dealers' share of customer volume went from 87.63% before post-trade reporting to 89.24% afterwards. The t-statistic for the coefficient is 1.99.

The next row reports the regressions with percentage of dealer-customer volume for dealers 11-50 as the dependent variable. For the full sample period, the intercept coefficient is 0.1232. This, together with the intercept for dealers 1-10 indicates that the top 50 dealers accounted for over 99.75% of dealer-customer volume. If the top ten dealers gained market share, it had to come from dealers 11-50. That is what we find. The coefficient on the post-trade transparency dummy is -0.0198 with a t-statistic of -3.33. Dealer 11-50 were responsible for 12.32% of volume before post-trade reporting but only 10.34% afterwards. In the regression with the shorter sample period, the coefficient on the post-trade transparency dummy is -0.0159 with a t-statistic of -1.98. So, the shift in dealer-customer volume from dealers 11-50 to the core dealers does not appear to be a result of the Federal Reserve's QE3 program. The next two rows provide regression results for other dealers. Dealers outside of the top 50 accounted for very little of the dealer-customer trading volume before post-trade transparency, and their proportion of the volume did not change significantly with post-trade reporting.

[11] Rankings are based on trades in the six months prior to the sample period, but they are persistent. We compare rankings from the six months before the sample period with rankings based on trades from the beginning of the sample period until the introduction of post-trade transparency. Nine of the top ten dealers before the sample period are in the top ten afterwards, with the tenth slipping to 11th place. Of the 40 dealers ranked 11 to 50 before the sample period, 38 remain in that ranking category, one rises from 11th to 9th, and one slips below the top 50.

Panel B show how the percentage of dealer-customer trades handled by core and peripheral dealers changed with post-trade reporting. Panel B shows that, regardless of whether the whole sample period or the period without QE3 changes is used, that there is a statistically significant increase in the proportion of trades handled by the top ten (core) dealers and a statistically significant decrease in the proportion of trades handled by dealers 11-50. This is further evidence that the shift in trading from less active dealers to core dealers is not a result of QE3 trades.[12]

To summarize, Table 4 shows that it was more costly for investors to trade through peripheral dealers before transparency, but not afterwards. Table 5 shows that peripheral dealers lost a significant portion of their market share with post-trade reporting. Part of the reason that peripheral dealers charged more than core dealers before post-trade transparency may have been that they had less information and faced greater costs of trading against informed investors (see Babus and Kondor (2016)). Our results suggest that was not the only reason they charged more. It appears that opacity was protecting inefficient, high cost dealers.

5. The Impact of Post-Trade Reporting on Dealer Networks

Post-trade transparency may also make it easier for customers and peripheral dealers to locate counterparties with long positions when they want to buy and short positions when they want to sell. When trades are reported, they do not include the identity of the dealers. But, armed with knowledge of recent trade prices, customers and peripheral dealers will be more likely to buy from a dealer with a long position who is offering a low price, and more likely to sell to a dealer with a short position who is willing to pay a high price. More trades with natural counterparties means there is less need to eliminate

[12]Similar results are obtained when we separately examine large trades (> $1,000,000) and small trades (≤ $1,000,000). In both cases, core dealers increase their market share after the introduction of post-trade transparency.

inventory through interdealer trading. It also means that dealers may trade with new counterparties if they offer more favorable prices.

5.1 The Likelihood of an Interdealer Trade

If post trade reporting makes it easier for investors and other dealers to locate a natural counterparty for a trade, the need for interdealer trading will decrease. In Table 1 we showed that interdealer trading fell after post-trade reporting. Dealer-customer trading also declined, but by a smaller and statistically insignificant amount. To test whether interdealer trading is reduced by post-trade transparency after adjusting for dealer-customer trading, we estimate the following regression for each of the dealers that ranked in the top ten in total TBA trades in the six months before the sample period

$$\mathrm{NDD_t} = \alpha_0 + \alpha_1 \mathrm{D_{PostTrdTrans}} + \alpha_2 \mathrm{NDC_d} + \varepsilon_t. \quad (4)$$

Here NDD_t is the number of interdealer trades on day t, $D_{PostTrdTrans}$ is one if day t is after November 12, 2012, and NDC_t is the number of dealer-customer trades on day t. For interdealer volume, we run a similar regression

$$\mathrm{VolDD_t} = \alpha_0 + \alpha_1 \mathrm{D_{PostTrdTrans}} + \alpha_2 \mathrm{VolDC_t} + \varepsilon_t \quad (5)$$

Where $VolDD_t$ is the volume from interdealer trades on day t and $VolDC_t$ is the volume from trades with customers on day t. For comparison purposes, the number of interdealer and dealer-customer trades (volume) is aggregated across dealers outside of the top ten and separate regressions are run for total volume and total trades of these less active dealers.

The idea behind these regressions is that much of the need for interdealer trades arises from dealer trades with investors. An interdealer trade may occur when a dealer lays off inventory acquired in a customer trade or when a dealer acquires a position from another dealer before completing a trade.

Regression results are shown in Table 6. The first row contains regression results for the dealer with the most TBA trades in the six months before the sample period. This dealer is the only one of the top ten that trades exclusively with other dealers. The intercept coefficient for the number of trade regressions is 1,570, indicating that before post-trade reporting was introduced, this dealer averaged 1,570 interdealer TBA trades each day. The coefficient on $D_{PostTrdTrans}$ is -415.83, indicating that the number of interdealer trades per day by this dealer fell by about 416 with post-trade reporting. The last four columns of the table report coefficients and the adjusted R^2 for the regression of the dealer's volume of interdealer trades on the post-trade transparency dummy and the volume from dealer-customer trades. The intercept in the first regression is 37,737, indicating that before the introduction of post trade transparency, the most active dealer had average daily interdealer volume of $37.7 billion par value. The coefficient of 11,687 on the post trade transparency dummy indicates that for the most active dealer, daily interdealer volume fell by $11.7 billion with post-trade transparency.

Regressions for other core dealers are shown in the following rows. In each of the regressions with the number of interdealer trades as the dependent variable, the coefficient on the number of dealer-customer trades is positive and highly significant. This does not mean, of course, that core dealers' trades with customers are the cause of their interdealer trades. It is as plausible that peripheral dealers lay off inventory through trades with core dealers, and these interdealer trades result in the core dealers trading with customers.

The coefficient on the post trade transparency dummy is negative and statistically significant for the trade regressions for eight of the ten most active dealers. Even after adjusting for the number of customer trades, core dealers did significantly less interdealer trading after the initiation of post-trade reporting. The last four columns report the regression results when interdealer volume is the dependent variable. In each case, the coefficient on volume from dealer customer trades is positive and highly significant. In each case the coefficient on the dummy or post-trade transparency is negative. It is significant at the 1% level for two of the dealers, at the 5% level for two more, and at the 10% one additional dealer.

There are differences in the amount of interdealer trading done by the ten core dealers and in the relation between customer trading and interdealer trading. Nevertheless, it is clear that as a whole, after adjustment for customer trades, core dealers decreased both the number and volume of interdealer trades with post-trade transparency. This is consistent with peripheral dealers and institutional investors trading more often with natural counterparties following the introduction of post-trade reporting.

Brancaccio, Li, and Schürhoff (2017) provide another explanation for the decline in interdealer trading following the introduction of post-trade transparency: dealers have less need to trade to gain information on market conditions. It seems likely that this is one factor behind the decline in interdealer volume. Nevertheless, a couple of our findings seem at odds with the Brancaccio, Li, and Schürhoff explanation. First, we find little evidence of a decline in dealer-customer trades with post-trade transparency. In contrast, Brancaccio et al do find a decline in trading between dealers and investors following the increase in municipal bond market transparency. Second, we show later that dealers use more dealers as counterparties following the introduction of post-trade transparency. It would seem that dealers with less need to acquire information through trading would trade with fewer counterparties.

The last two rows of the table provide regression results for the aggregate interdealer trades and volume for regular peripheral dealers and for the eight peripheral dealers that act as interdealer brokers. For the regular peripheral dealers, customer trades are an especially strong determinant of interdealer trades. Likewise, in the interdealer volume regression, the coefficient on customer volume of 0.8321 is far greater than the coefficient on customer volume in any of the core dealer regressions. The coefficient on the post-trade transparency dummy is negative but insignificant in both the interdealer trade and interdealer volume regressions. These regression results are consistent with peripheral dealers laying off customer trades through interdealer trades, and continuing to do so with post-trade transparency.

For the peripheral interdealer brokers, the coefficient on number customer trades is 10.8052 with a t-statistic of 1.84 in the regression with number of interdealer trades as the dependent variable. We define interdealer brokers as those with at least 99% of their trades with other brokers, so some do have trades with customers. In addition, it is likely that the number of interdealer broker trades with customers is correlated with the total number of dealer-customer trades and hence with other dealers' need to lay off inventory through interdealer brokers. The coefficient on the post-trade transparency dummy is a statistically significant -88.30. This is consistent with regular dealers finding natural counterparties more often and not having to rely as much on interdealer brokers. Results for the volume regression are stronger. The coefficient on volume from customer trades is 144.56 with a t-statistic of 4.49. It seems likely that for interdealer brokers, volume from trades with customers proxies for volume with customers for all dealers, and that is a determinant of interdealer trades. The coefficient on the post-trade transparency dummy is negative and highly significant. This is again consistent with dealers being better able to find natural counterparties with post-trade reporting and hence using fewer interdealer trades.

5.2 The Number of Trading Counterparties

In an opaque market, peripheral dealers can protect themselves from bad executions by forming relationships with other dealers. A counterparty who trades regularly with a dealer has more to lose if the dealer withdraws business following bad executions. With more transparent prices, peripheral dealers do not need as much protection from bad executions and are likely to rely less on relationships with specific core dealers. They will instead spread trades among a larger number of counterparties. To test for changes in the number of trading counterparties, we regress the log of the total number of interdealer trading counterparties on day t for dealer d (LogN_{td}) on a dummy variable that equals one if day t is after the introduction of post-trade transparency ($D_{PostTradeTrans}$), the natural log of dealer d's total TBA trading in the six months before our sample period ($\ln(DlrVol)_d$), the log of the total number of interdealer trades executed by dealer-d on day t ($LogNDDTrade_{td}$), and two interaction terms:

$$\text{LogN}_{td} = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 Ln(DlrVol)_d + \alpha_3 D_{PostTradeTrans} \times Ln(DlrVol)_d + \alpha_4 LogNDDTrade_{td} + \alpha_5 D_{PostTradeTrans} \times LogNDDTrade_{td} + \varepsilon_{td}. \quad (6)$$

Table 7 reports the reports the regression results for interdealer TBA trades. The first column considers the number of interdealer trading counterparties for all interdealer TBA trades. We observe that the regression coefficient on $D_{PostTradeTrans}$ is 0.114 with a t-statistic of 2.07, indicating that overall, individual dealers have significantly more trading counterparties in a given day after the introduction of TBA transparency reporting. The regression coefficient on $Ln(DlrVol)_d$ is also significantly positive, as expected, because larger dealers tend to have more trading counterparties. Importantly, the coefficient on the interaction term $D_{PostTradeTrans} \times Ln(DlrVol)_d$ is -0.029 with a robust t-statistic of -2.89. That is, the increase in the number of TBA trading counterparties of a peripheral dealer following the introduction of TBA transparency reporting, is larger than that of a core dealer. This is consistent with the idea that small dealers, who are at an information disadvantage to large dealers, rely less on relationship trading and spread trades among additional large dealers after post-trade transparency is introduced. The coefficient on the log of the number of interdealer trades by dealer d on day t, LogNDDTrade_{td}, is a positive 0.452 with a t-statistic of 44.61. Not surprisingly, a dealer who conducts more interdealer trades uses a larger number of other dealers as counterparties. The coefficient on the interaction between the log of the number of interdealer trades and post-trade transparency, $\text{D}_{\text{PostTradeTrans}} \times \text{LogNDDTrade}_{td}$, is 0.048 with a t-statistic of 3.60. Following post-trade transparency, the number of counterparties increases with the number of interdealer trades at a faster rate. Using the median values of 2.3 for LogNDDTrade_{td} and 4.54 for Ln(DlrVol) produces an increase of about 10% from 3.43 counterparties in a trading day before post-trade transparency to 3.75 afterwards.

The second and third columns of Table 7 report the regression results for the selling and buying sides of interdealer TBA trades, respectively. That is, we consider the number of interdealer trading counterparties a dealer sells to and buys from separately. We observe that the coefficient on the interaction term $D_{PostTradeTrans} \times Ln(DlrVol)_d$ is -0.031 with a t-statistic of -3.05 for the selling counterparties, similar to the coefficient of -0.025 with a t-statistic of -2.61 for the buying counterparties. That is, the number of counterparties of a peripheral dealer increases relative to the number for a core dealer both for buying and selling trades.

The fourth and fifth columns of Table 7 reports the results of regression (6) using the interdealer TBA trades with par values of more than $1 million and using those with par values of less than $1 million, respectively. We observe that the coefficient on the interaction term $D_{PostTradeTrans} \times Ln(DlrVol)_d$ is 0.062 with a t-statistic of 4.70 for the counterparties of trades of more than $1 million, larger and more significant than the coefficient of 0.033 with a t-statistic of 2.93 for the counterparties of trades of less than $1 million. That is, the increase in the number of counterparties of a peripheral dealer relative to a core dealer is greater for large trades than for small trades.

To summarize, the results in Table 7 indicate that after the introduction of post-trade transparency, dealers allocated the same number of interdealer trades across more dealers. All else equal, the increase in the number of counterparties is greater for small dealers than large dealers. The number of dealer counterparties increases with the number of interdealer trades, but it increases more with post-trade transparency. With post-trade transparency, it appears that relationships between dealers become less important.

5.3 Herfindahl Indices for Interdealer Trading and Post-trade Transparency

As an alternative to the number of counterparties as a measure of relationships, we calculate the Herfindahl index for each dealer's interdealer trades each day. The index is calculated as

$$Herf_{d,t} = \sum_{i=1}^{N} \left(\frac{NDD_{d,i,t}}{NDD_{d,total,t}} \right)^2 \quad (6)$$

Where $NDD_{d,i,t}$ is the number of interdealer trades between dealer d and dealer i on day t, and $NDD_{d,total,t}$ is the total number of interdealer trades for dealer d on day t. The greater the concentration of interdealer trades with a few dealers, the greater the Herfndahl index. If trades are evenly distributed across N dealers, the Herfindahl index will equal 1/N. If a dealer trades with N other dealers, but trades are concentrated with a smaller number, the Herfindahl index will be greater than 1/N. So, a high Herfindahl index, all else equal, means stronger relationships between dealers. As an alternative, we use the volume rather than the number of trades to calculate Herfindal indices.

To see if post-trade reporting affected interdealer Herfindahl indices, we estimate the following regression

$$Herf_{d,t} = \alpha_0 + \alpha_1 D_{PostTrdTrans} + \alpha_2 \left({}^{1}\!/_{NumberTrades_{d,t}} \right) + \varepsilon_{d,t} \quad (7)$$

where $NumberTrades_{d,t}$ is the number of interdealer trades by dealer d on day t. We use the inverse of the number of interdealer trades because that is the minimum possible Herfindahl index for dealer d on day t. If we instead use the natural logarithm of the number of trades, it is less significant in the regressions but results are otherwise similar. We also include fixed effects for the dealers.

Regression results are provided in Table 8. The first two columns report regression results using all dealer-day observations. The first regression is for Herfindahl indices based on the number of TBA trades. The number of observations, that is the total number of dealer day combinations, is 6,534. The coefficient on 1/Number Trades is 0.7929, with a t-statistic of 43.81. Herfindahl indices increase with the minimum possible index value. For our purposes, the most important result in this regression is that the coefficient on the dummy for post-trade transparency is -0.00784 with a t-statistic of -2.49. Dealers tended to spread their interdealer trades across more dealers after the initiation of post-trade transparency. The post-trade transparency dummy is insignificant in the regressions in which the Herfindahl index is based on volume.

The dealer-day observations often include just a handful of trades. With a small number of trades, Herfindahl indices are large, with large standard deviations. They can have a strong influence on regression estimates. As an alternative, we calculate the 75th percentiles of the number of interdealer TBA trades across all dealer-days. We then re-estimate the regressions using only dealer-day combinations with number of trades in the top quartile. Results are shown in the third and fourth columns of Table 8. The third column reports the regression when the Herfindahl index is calculated with the number of TBA trades. The number of dealer fixed effects is now only 30, as compared to 126 when all dealer day combinations are used. The coefficient on the dummy variable for post-trade transparency is -0.0301 with a t-statistic of -8.11. The next column presents regression results when Herfindahl indices are calculated using TBA volume. Here, the coefficient on the dummy variable for post-trade transparency is -0.0196 with a t-statistic of -3.46. Regardless of whether the Herfindahl indices are calculated using the number of trades or trading volume, the indices fall with post-trade transparency for core dealers. Individual core dealers are being used as counterparties by more peripheral dealers.

5.4 The Likelihood of Continued Trading with the Same Counterparties

As a third test of the impact of transparency on dealer relationships, we examine the likelihood of dealers trading with the same counterparties on successive days. On each day t, we find all pairs of dealers that traded with each other at least once. We set I_{tp} equal to one if they also traded with each other on day t+1, and zero otherwise. We then estimate a logit regression of the probability that a pair of dealers traded with each other on day t+1 if they traded with each other on day t. Explanatory variables include a dummy variable that takes a value of one after the initiation of post trade transparency, the natural log of the number of trades in the six months prior to the sample period for the more active of the dealers, and the interaction between the two variables. That is

$$\text{Log}[I_{tp}/(1-I_{tp})] = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 Larger\ Dealer\ LnVol_p + \alpha_3 D_{PostTradeTrans} \times Larger\ Dealer\ LnVol_p + \varepsilon_{tp} \quad (9).$$

Results are shown in Table 9. The first column provides results when the only explanatory variable is the dummy for post-trade transparency. Here the coefficient is negative and significant at the 1% level. The likelihood that two dealers will trade with each other if they traded with each other the previous day decreases with post-trade transparency. In the logit regression reported in the second column fixed effects for the less active dealer are included, but the only other explanatory variable is the log of the volume of the larger of the two dealers. As expected, the coefficient is positive and highly significant. A dealer is more likely to trade with a core dealer than a peripheral one. The logit regression described in the third column includes the dummy for post-trade transparency, the volume of the larger dealer, the interaction of the two, and also fixed effects for the more peripheral dealer. In this regression, the coefficient on the post-trade reporting dummy is negative with a t-statistics of -4.01. Dealers are less likely to trade with the same counterparties day after day following the introduction of post-trade transparency. The coefficient on the interaction between the post-trade transparency dummy and the volume of the larger dealer is positive with a t-statistic of 2.13, suggesting that the tendency to trade less frequently with the same counterparty is muted for trades with core dealers.

5.5 Transparency and Capital Commitment

If market participants are better able to find natural counterparties with post-trade reporting, dealers may not need to commit as much capital. We follow Bessembinder, Jacobsen, Maxwell and Venkataraman (2017) and estimate dealer capital commitment by calculating, as of the end of each minute, the absolute value of the difference between the dealer’s accumulated principal TBA buy volume and the dealer’s accumulated principal TBA sell volume. We then average this measure across all minutes of the day to get an average capital commitment during the day.

We regress average capital commitment by each dealer each day on the dummy variable for post-trade transparency and dealer fixed effects. As additional explanatory variables, we include the absolute value of the volume of all trades by the dealer before noon and the absolute value of the volume of all of the dealer's trades after noon. Greater activity and higher volume will generally be associated with greater capital commitment. We separate morning and afternoon volume because positions acquired during the morning volume could be held for longer and add more to the average capital commitment. In some regressions we also include the squared total volume over the day to capture non-linear effects of volume on capital commitment.

Results are presented in Table 10. The first regression has as its dependent variable the average capital commitment calculated over the entire 24 hours in each day. The coefficient on $D_{PostTrdTrans}$ is -20,788 with a t-statistic of -7.46. Capital commitment declined significantly with transparency. In the next regression, morning and afternoon volume are included as explanatory variables. In this regression, as in the ones to follow, the coefficient on morning volume is larger than the coefficient on afternoon volume. The coefficient on $D_{PostTrdTrans}$ declines in absolute value to -7,080 but remains highly significant with a t-statistic of -3.25. When squared volume is added in the third regression, the coefficient on the post-trade transparency dummy is -8,463 with a t-statistic of -3.94.

The next three regressions are similar, but the capital commitment dependent variable is calculated using only minutes from 8 am to 5 pm. Results are almost unchanged, with the post-trade transparency dummy remaining negative and statistically significant. Finally, the last regression includes only minutes from 8 am to 5 pm and only dealer/days with at least 100 trades. The coefficient on $D_{PostTrdTrans}$ remains negative and highly significant.

Capital commitment falls with post-trade transparency. The regressions include volume, so the fall in capital commitment appears to be the result of quicker inventory turnover, not declining volume. In other words, the decline in capital commitment may mean dealers don't need as much capital with transparency rather than that they are reluctant to commit it.

6. Spillover Effects

Only TBA trades were required to be reported within 45 minutes as of November 13,2012. Nevertheless, we might expect TBA reporting to have spillover effects on the SP market. One reason for this is that TBA prices serve as a benchmark price for SPs with similar coupons and maturity. That is, SPs are often priced at a "payup" to TBA prices. Hence, more accurate information about TBA prices will reduce uncertainty about SP values. Second, dealers often hedge SP inventory with TBA trades.[13] Greater liquidity in the TBA market makes it easier and cheaper for dealers to hedge SP trades and thereby increases liquidity in that market.

In Table 11, we examine trading costs for specified pools around the introduction of TBA post-trade reporting. We do this using the same regressions used to estimate the impact of TBA post-trade reporting on TBA trading costs in Table 3. The first column reports the regression using trades of TBA-eligible SPs over the entire sample period. The coefficient on ΔQ is 0.6277. This means that the cost for a round-trip trade of $1 million worth of SPs was 62.77 basis points, far, far greater than the five basis points or so estimated for TBA trades. The coefficient on the interaction between ΔQ and the post-trade reporting dummy is -0.0570. This suggests that trading costs fell by about 5.7 basis points with TBA transparency, consistent with a spillover effect from the TBA to the SP market.

The rest of the table provides regression estimates for SP trades occurring within 20, ten and five days around the change in TBA transparency. For the five-day window, the coefficient on ΔQ x $D_{PostTrdTrans}$ is -0.0767, which is similar in magnitude to the coefficient for the entire period but the t-statistic is only -0.85. For the ten and 20-day windows the coefficients are small or of the wrong sign. So, when the entire sample period is considered, SP trading costs appear to fall with post-trade transparency for TBA trades. This spillover could be a result of more accurate TBA benchmark prices for SPs or from lower dealer hedging costs. Unlike TBA trading costs, SP costs did not decline in shorter windows around

[13] See Gao, Schultz, and Song (2017a).

the introduction of TBA post-trade reporting. Perhaps some learning was required on the part of SP market participants.

We observed that with post-trade transparency, market participants may be able to more accurately determine buy and sell prices for TBA trades. In this case, they will more easily identify natural counterparties for trades. That is they will be more likely to buy from dealers with long positions and sell to dealers with short positions. This means less need for interdealer trades.

SP trading is different. Each SP has unique prepayment risk so SPs with the same coupon and maturity can trade at very different prices. A particular SP will trade infrequently. At any point in time few if any dealers will have a long position in a particular SP and dealers are reluctant to go short as it is very difficult to cover a short position. So, information on TBA prices, even if they help to determine a fair price for the trade, will not help investors choose a natural counterparty. A dealer without a long position in a particular SP is unlikely to sell it, and dealers will not be natural counterparties when an investor wants to sell an SP because they very rarely short them. Hence there should be no change in the need for interdealer SP trades with TBA transparency.

In Table 12, we regress the number of interdealer SP trades by each dealer each day on the number of dealer-customer SP trades, a dummy variable for TBA post-trade transparency, and the interaction between the two. This is the same as the regression reported in Table 6 for TBA trades. Here though, the number of interdealer trades does not decrease with TBA post-trade reporting. Instead, the coefficient on the dummy for post-trade transparency is positive and significant in each regression. TBA post-trade transparency is associated with more interdealer SP trades.

7. Conclusions

On November 13, 2012, FINRA began requiring dealers to report TBA trades of mortgage-backed securities within 45 minutes. Prior to that date, dealers were only required to report trades at the end of the day. The introduction of post-trade transparency provided useful information to the market on recent transaction prices. The least-informed market participants, investors, could be expected to learn the most from post-trade transparency. Peripheral dealers, could also be expected to gain valuable information from post-trade reporting. Core dealers, who trade often and communicate with other dealers frequently, could expect their informational advantages over other market participants to decline.

We find that with the initiation of post-trade transparency, TBA trading costs fell for investors. The fall in trading costs was particularly large for trades with peripheral dealers. It appears that, with higher order processing and inventory costs than core dealers, some trades were only worthwhile for peripheral dealers when trading costs were high. Consistent with this, the decline in the costs of trading with peripheral dealers was accompanied by a loss of about 20% of their market share.

With post-trade reporting, investors and peripheral dealers are more likely to know if they are being offered a good price to trade. This means they will be more likely to purchase from dealers with long positions and sell to dealers with short positions. More trading between natural counterparties means dealers can commit less capital and have less need for interdealer trading. Accordingly, we do find a sharp decline in interdealer trading with post-trade transparency. We also find that dealers spread their interdealer trades across significantly more counterparties with post-trade transparency, suggesting a decline in the importance of trading relationships.

Broadly speaking, the introduction of post-trade transparency appears to have been a great success. Trading costs have fallen. Dealers are able to avoid committing as much capital and thus take less risk. Trading has migrated from inefficient high-cost dealers to more efficient low-cost dealers.

References

Babus, A., Kondor, P.,2016, Trading and information diffusion in OTC markets, working paper, Federal Reserve Bank of Chicago and Central European University.

Bessembinder, H., Jacobsen, S., Maxwell, W., Venkataraman, K., 2017, Capital commitment and illiquidity in corporate bonds, forthcoming, Journal of Finance.

Bessembinder, H., Maxwell, W., 2008, Transparency and the corporate bond market, Journal of Economic Perspectives 22, 217-234.

Bessembinder, H., Maxwell, W., Venkataraman, K., 2006, Market transparency, liquidity externalities, and institutional trading costs in corporate bonds, Journal of Financial Economics 82, 251-288.

Bessembinder, H., Maxwell, W., Venkataraman, K., 2013, Trading activity and transaction costs in structured credit products, *Financial Analysts Journal* 69, 55-68.

Brancaccio, G., Li, D., Schürhoff, N., 2017, Learning by trading: The case of the U.S. market for municipal bonds, working paper, Princeton University.

DiMaggio, M., Kermani, A., Song, Z., 2017, The value of trading relations in turbulent times, Journal of Financial Economics, 124-2, 266-284

Duffie, D., Dworczak, P., Zhu, H., 2017, Benchmarks in search markets, Journal of Finance, 72, 1983--2044. |

Farboodi, M., Jarosch, G., Shimer, R., 2017, The emergence of market structure, NBER working paper 23234.

Gao, P., Schultz, P., Song, Z., 2017a, Liquidity in a market for unique assets: Specified pool and TBA trading in the mortgage backed securities market, *Journal of Finance 72*, 1119-1170.

Gao, P., Schultz, P., Song, Z., 2017b, Trading methods and trading costs for agency mortgage backed securities, working paper, forthcoming, Journal of Investment Management.

Glode, V., Opp, C., 2016. Adverse selection and intermediation chains, American Economic Review, 106 (9), pp. 2699-2721

Goldstein, M., Hotchkiss, E., Sirri, E., 2007, Transparency and liquidity: A controlled experiment on corporate bonds, Review of Financial Studies 20 (2), 235-273.

Hollifield, B., Neklyudov, A., Spatt, C., 2017, Bid-ask spreads, trading networks, and the pricing of securitizations, forthcoming, Review of Financial Studies.

Hugonnier, J., Lester, B., Weill, 2016, P., Heterogeneity in decentralized asset markets, working paper, Swiss Finance Institute.

Li, D., Schürhoff, N., 2017, Dealer networks, forthcoming, Journal of Finance.

Neklyudov, A., 2013, Bid-ask spreads and the over-the-counter interdealer markets: Core and peripheral dealers. Working paper, University of Lausanne.

O'Hara, M., Wang, Y., Zhou, X., 2017, The execution quality of corporate bonds, forthcoming, Journal of Financial Economics

Üslü, S., 2016, Pricing and liquidity in decentralized asset markets, working paper, Johns Hopkins Corey Business School.

Vickery, J., Wright, J., 2013, TBA trading and liquidity in the agency MBS market, FRBNY Economic Policy Review May, 1-16.

Wang, C., 2017, Core-periphery trading networks, working paper, Stanford University.

Weller, B., 2013, Fast and slow liquidity, working paper, Northwestern University.

Table 1

Summary statistics.

For each day from September 1, 2012 through January 31, 2013, we count the number of dealers participating in mortgage backed security trades, the total volume of MBS trades, the total number of trades, the number of TBA trades, the number of specified pool trades, the number of interdealer trades, the number of dealer to customer trades, the number of large trades, defined as $1 million in par value or more, and the number of small trades. Pre-transparency is defined as the days in the sample period before November 13, 2012, while post transparency is the sample period days from November 13, 2012 on. Omit days around, Thanksgiving, Christmas, and New Year's. Interdealer brokers are the nine dealers among those ranked in the top 50 by total number of trades for whom interdealer trades accounted for more than 99% of all trades.

Panel A. Number of trades by dealers, March, 2012 – August, 2012.

Dealers	Total Trades	Mean Percent TBA	Mean Percent SP	Mean Closeness	Mean Degree
1-10	1,192,967	84.8%	15.2%	0.5107	0.2084
11-30	469,446	76.5%	23.5%	0.4815	0.1548
31-50	178,642	49.3%	50.7%	0.4583	0.1223
51-100	156,351	27.1%	72.9%	0.4270	0.0794
101-543	49,891	4.7%	95.3%	0.3460	0.0108

Panel B. Mean daily values of trading variables for the whole period, pre- and post-transparency.

	All	Before Transparency	After Transparency	After: Omit Days Around Holidays
Number Dealers	129.5	129.2	129.7	132.7
Volume ($Millions)	230,710	256,639	208,142	224,032
Daily Number Trades	7,852	8,225	7,528	8,019
Number TBA	5,023	5,518	4,592	4,906
Number SP	2,829	2,707	2,936	3,114
Number Customer	4,629	4,736	4,535	4,818
Number Large	6,228	6,508	5,575	5,906
Number Small	1,892	1,717	1,952	2,059

Panel C. Mean daily number of interdealer trades.

	All	Before Transparency	After Transparency	After: Omit Days Around Holidays
Total	3,224	3,489	2,993	3,201
Total TBA	2,354	2,658	2,089	2,246
TBA Reg. Dealer-Interdealer Broker	1,747	2,009	1,519	1,637
TBA Reg. Dealer – Reg. Dealer	606	648	569	610
TBA Interdealer Broker – Int. Broker	0.3	0.3	0.2	0.3

Panel D. T-tests for differences in means before and after post-trade reporting using data from 6/1/2012 through 4/30/2013. All days used.

	Mean Before 11/13/2012	Mean After 11/13/2012	Difference	T-statistic for Difference
Number of Dealers	129.1	128.0	-1.13	-0.81
Daily Number Trades	8,029	7,752	-277	-1.03
Daily Customer Trades	4,586	4,695	109	0.65
Daily Interdealer Trades	3,443	3,057	-386	-3.39
Daily Number SP Trades	2,686	2,934	248	2.65
Daily SP Customer Trades	1,866	2,065	200	2.73
Daily SP Interdealer Trades	821	869	49	1.44
Daily TBA Trades	5,343	4,818	-526	-2.50
Daily TBA Customer Trades	2,720	2,629	-91	-0.75
Daily TBA Interdealer Trades	2,623	2,188	-435	-4.45
Daily Volume	241,829	209,372	-32,457	-2.40
Daily Customer Volume	160,781	148,731	-12,049	-1.22
Daily Interdealer Volume	81,048	60,641	-20,407	-4.81
Daily SP Volume	17,682	17,829	147	0.16
Daily SP Customer Vol.	14,355	14,830	476	0.55
Daily SP Interdealer Vol.	3,327	2,998	-329	-2.25
Daily TBA Volume	224,147	191,543	-32,604	-2.53
Daily TBA Customer Vol.	146,426	133,901	-12,525	-1.34
Daily TBA Interdealer Vol.	77,721	57,642	-20,079	-4.80
Percent TBA Trades	66.19%	61.23%	-4.95%	-5.46
Percent Customer TBA Trades	33.76%	33.39%	-0.36%	-0.52
Percent Interdealer TBA Trades	32.43%	27.84%	-4.59%	-9.39
Percent Interdealer Trades	42.88%	39.35%	-3.53%	-6.86
Percent Large Trades	77.96%	73.34%	-4.62%	-7.37

Table 2
Post-trade transparency and the dispersion of prices of clusters of near identical trades.
We define a trade cluster as two or more trades of the same mortgage backed security (same CUSIP), for the same par value of securities, on the same day, and which are all either i) interdealer trades, ii) dealer purchases from customers, or iii) dealer sales to customers. We calculate the standard deviation of prices within each cluster. We use the largest interdealer trades each minute to get a minute by minute price series for Fannie Mae and Freddie Mac 15 year TBA trades with coupons of 2.5%, 3.0% and 3.5% and for 30 year TBA trades of 2.0%, 3.5%, 4.0%, and 4.5%. The average of these prices each minute is the index. We calculate a standard deviation of index prices corresponding to each cluster using index prices from the same minutes as each trade in the cluster. We then regress the standard deviations across clusters on a dummy variable that equals one if the cluster occurred on a day after post-trade transparency was required for TBA trades the index standard deviation, and the interaction of the index standard deviation and the dummy variable for post-trade transparency. For TBA trade clusters, we run the following Tobit regression:

$$\sigma_i^* = \alpha_1 + \alpha_2 D_{PostTradeTrans} + \alpha_3 \sigma_{Index} + \alpha_4 D_{PostTradeTrans} \times \sigma_{Index} + \varepsilon_i$$

where σ_i^* is σ_i, the standard deviation of prices in trade cluster i is greater than zero and zero otherwise.

Trade Size	Trade Type	Intercept	$D_{PostTrdTrans}$	σ_{Index}	σ_{Index} x $D_{PostTrdTrans}$	Obs.	Left Censored
≥ $1 mill	Interdealer	0.0279***	-0.0160***			29,626	10,440
		(30.33)	(-12.25)				
≥ $1 mill	Dealer - Customer	0.0365***	-0.0199***			28,736	8,627
		(25.42)	(-9.79)				
< $1 mill	Interdealer	0.0020	0.0056			1,930	774
		(0.37)	(0.77)				
< $1 mill	Dealer - Customer	0.0386***	-0.0181**			2,067	622
		(9.31)	(-3.12)				
≥ $1 mill	Interdealer	0.0095***	-0.0154***	0.1918***		29,626	10,440
		(8.98)	(-12.04)	(35.03)			
≥ $1 mill	Dealer - Customer	0.0176***	-0.0209***	0.2169***		28,736	8,627
		(10.85)	(-10.39)	(25.53)			
< $1 mill	Interdealer	-0.0166***	0.0046	0.2666***		1,930	774
		(-2.86)	(0.64)	(8.59)			
< $1 mill	Dealer - Customer	0.0184***	-0.0198***	0.2434***		2,067	622
		(4.06)	(-3.50)	(10.46)			
≥ $1 mill	Interdealer	0.0012	0.0005	0.2773***	-0.1617***	29,626	10,440
		(0.98)	(0.30)	(34.87)	(-14.85)		
≥ $1 mill	Dealer - Customer	0.0088***	-0.0044	0.3164***	-0.1802***	28,736	8,627
		(4.81)	(-1.74)	(24.96)	(-10.58)		
< $1 mill	Interdealer	-0.0282***	0.0249***	0.4283***	-0.2698***	1,930	774
		(-4.37)	(2.91)	(8.77)	(-4.30)		
< $1 mill	Dealer - Customer	0.0095	-0.0036	0.3480***	-0.1791***	2,067	622
		(1.86)	(-0.52)	(9.66)	(-3.81)		

Table 3

The impact of post-trade transparency on TBA trading costs.

We regress the percentage change in prices between two consecutive trades of the same TBA and the percentage difference in ask and bid prices of the Treasury securities on the change in trade type (ΔQ), on the interaction between ΔQ and $D_{PostTrdTrans}$ (a dummy variable that equals one for trades occurring after November 12, 2012 and zero for earlier trades), on the interaction between ΔQ and D_{TBA} (a dummy variable that equals one for TBA and zero for Treasury securities), on the product of ΔQ, $D_{PostTrdTrans}$, and D_{TBA}, on the interaction between ΔQ and the sum of the natural logs of the trade sizes of the two consecutive trades for TBA, and on changes in the 1) a U.S. Agency Fixed Rate MBS index, 2) a U.S. Treasury 7-10 Year Bond index, 3) a U.S. Investment Grade Corporate Bond Index, 4) a U.S. Corporate High-Yield Bond index, and 5) the S&P 500 index:

$$\Delta P_t = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot D_{PostTrdTrans} + \alpha_3 \Delta Q_t \cdot D_{TBA} + \alpha_4 \Delta Q_t \cdot D_{PostTrdTrans} \cdot D_{TBA}$$
$$+ \alpha_5 \Delta Q_t \cdot \left(ln\left({Size_t}/{1{,}000{,}000} \right) + ln\left({Size_{t-1}}/{1{,}000{,}000} \right) \right) + \Sigma \beta_i \, Ret_{i,t} + \varepsilon_t,$$

where ΔQ equals +1 when the current TBA trade is a dealer sale and the previous TBA trade was a dealer purchase, equals -1 when the current TBA trade is a dealer purchase and the previous TBA trade was a dealer sale, and equals +1 for a pair of bid and ask quote prices of Treasury securities. Consecutive trades are always of the same TBA, but trades from all TBAs with the same coupon and maturity are included in the regressions. TBA trades of less than $10,000 face value are deleted. The sample period is from 9/1/2012 to 1/31/2013 in the first three columns, whereas the last three columns use time windows of 20, 10, and 5 days before and after November 12, 2012. Robust t-statistics are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

Explanatory Variables	TBA	Treasury	TBA (20 days)	TBA (10 days)	TBA (5 days)
ΔQ	0.0472***	0.0513***	0.0559***	0.0603***	0.0405***
	(17.15)	(136.03)	(14.37)	(11.18)	(4.43)
ΔQ x $D_{PostTrdTrans}$	-0.0087***	-0.0008	-0.0100**	-0.0136**	-0.0136
	(-3.41)	(-1.64)	(-2.34)	(-2.37)	(-1.51)
ΔQ x Trade Size	-0.0061***		-0.0077***	-0.0072***	-0.0024**
	(-14.54)		(-11.18)	(-7.94)	(-2.23)
MBS Index	60.8377***	0.1198	96.7458***	120.4200***	127.1753***
	(4.14)	(0.14)	(17.50)	(17.69)	(16.90)
Treasury Index	3.9733	0.4786	13.9197***	-4.8411	-8.4209**
	(0.50)	(0.99)	(5.41)	(-1.27)	(-2.13)
Corporate Bond Index (IG)	2.7439	-0.4872	2.4807	25.1034***	23.6662***
	(0.38)	(-1.08)	(0.93)	(6.69)	(5.79)
Corporate Bond Index (HY)	-3.3219	0.0454	-21.7383***	-26.9381***	-22.9420***
	(-1.09)	(0.13)	(-17.71)	(-16.01)	(-11.57)
S&P 500 Index	-1.4959	-0.0164	1.9321***	1.6549**	-2.0742**
	(-1.06)	(-0.20)	(3.52)	(2.01)	(-2.30)
Constant	0.0009		0.0008	0.0014	0.0013
	(1.60)		(0.63)	(0.86)	(0.70)
Obs	173,018	107,762	43,452	24,082	12,863
Adj. R^2	0.0565	0.2716	0.0387	0.0591	0.0760

Table 4

Customers' MBS trading costs when trading with core vs peripheral dealers.

We regress the percentage change in prices between two consecutive trades executed by the same dealer of the same MBS on the change in trade type (ΔQ), on the interaction between ΔQ and the sum of the natural logs of the trade sizes of the two consecutive trades (ΔQ x Trade Size), on the interaction between ΔQ and the natural logs of the total TBA trading volume of the dealer six months before November 12, 2012 (ΔQ x Ln(DlrVol)), on the interaction between ΔQ and a dummy variable that equals one for trades occurring after November 12, 2012 and zero for earlier trades (ΔQ x $D_{PostTrdTrans}$), on the interaction term ΔQ x Ln(DlrVol) x $D_{PostTrdTrans}$, and on changes in the 1) a U.S. Agency Fixed Rate MBS index, 2) a U.S. Treasury 7-10 Year Bond index, 3) a U.S. Investment Grade Corporate Bond Index, 4) a U.S. Corporate High-Yield Bond index, and 5) the S&P 500 index:

$$\Delta P_{td} = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot \left(ln\left({Size_t}/{1{,}000{,}000} \right) + ln\left({Size_{t-1}}/{1{,}000{,}000} \right) \right) + \alpha_3 \Delta Q_t \cdot D_{PostTrdTrans}$$
$$+ \alpha_4 \Delta Q_t \cdot Ln(DlrVol)_d + \alpha_5 \Delta Q_t \cdot Ln(DlrVol)_d \cdot D_{PostTrdTrans} + \Sigma \beta_i \, Ret_{i,t} + \varepsilon_t,$$

where ΔQ equals +1 when the current trade is a dealer sale and the previous trade was a dealer purchase and -1 when the current trade is a dealer purchase and the previous trade was a dealer sale. Consecutive trades are always of the same MBS and executed by the same dealer, but trades from all MBS with the same coupon and maturity are included in the regressions. Trades of less than $10,000 face value are deleted. Robust t-statistics are in parentheses. The sample period is from 9/1/2012 to 1/31/2013. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

Explanatory Variables	Before	After	All
ΔQ	0.209***	-0.094***	0.218***
	(4.96)	(-2.61)	(5.18)
ΔQ x Ln(DlrVol)	-0.018***	0.010***	-0.018***
	(-4.43)	(2.87)	(-4.70)
ΔQ x $D_{PostTrdTrans}$			-0.284***
			(-5.26)
ΔQ x $D_{PostTrdTrans}$ x Ln(DlrVol)			0.025***
			(5.10)
ΔQ x Trade Size	-0.002***	-0.003***	-0.002***
	(-3.09)	(-4.34)	(-4.68)
MBS Index	94.282***	48.759***	71.220***
	(23.31)	(11.26)	(24.15)
Treasury Index	-5.107**	42.807***	17.052***
	(-2.48)	(19.00)	(11.25)
Corporate Bond Index (IG)	12.344***	-27.563***	-4.051**
	(6.11)	(-10.10)	(-2.50)
Corporate Bond Index (HY)	-11.709***	-2.924***	-6.523***
	(-12.42)	(-3.73)	(-10.68)
S&P 500 Index	1.217**	-3.283***	-0.722**
	(2.57)	(-6.42)	(-2.12)
Constant	0.855	0.360	-0.007
	(1.26)	(0.00)	(0.00)
Observations	84,389	86,323	170,712
Agency FE	Yes	Yes	Yes
Maturity FE	Yes	Yes	Yes
Coupon FE	Yes	Yes	Yes
Adj. R^2	0.438	0.294	0.365

Table 5

Changes in the proportion of TBA customer trading volume by core and peripheral dealers.

Core dealers are the top ten dealers in total trades in the six months before the sample period, category 2 is firms 11-50, category 3 is firms 51-100, and category 4 (peripheral) is all firms outside of the top 100. We regress the total percentage of volume from all dealers in each category each day on a dummy variable that takes a value of one for days from November 13, 2012 on when post-trade reporting was required. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

	9/1/2012 – 1/31/2013				9/13/2012 – 12/12/2012			
	Int.	$D_{PostTrdTrans}$	Adj. R^2	Obs.	Int.	$D_{PostTrdTrans}$	Adj. R^2	Obs.
Panel A. Daily percent of dealer-customer volume from dealers in each activity category.								
Core Dealer	0.8745***	0.0200***	0.0924	101	0.8763***	0.0161*	0.0470	61
(Top 10)	(200.29)	(3.34)			(184.95)	(1.99)		
2 (11-50)	0.1232***	-0.0198***	0.0918	101	0.1214***	-0.0159*	0.0463	61
	(28.33)	(-3.33)			(25.68)	(-1.98)		
3 (51-100)	0.0015***	0.0001	-0.0082	101	0.0015***	0.0001	-0.0122	61
	(12.86)	(0.43)			(11.81)	(0.52)		
Peripheral	0.0008***	-0.0002	0.0153	101	0.0008***	-0.0002	0.0107	61
(101+)	(8.67)	(-1.60)			(7.63)	(-1.29)		
Panel B. Daily percent of dealer-customer trades from dealers in each activity category.								
Core Dealer	0.6615***	0.0256***	0.0902	101	0.6589***	0.0344***	0.1431	61
(Top 10)	(116.53)	(3.30)			(3.32)	(3.32)		
2 (11-50)	0.3170***	-0.0237***	0.0846	101	0.3201***	-0.0325***	0.1429	61
	(58.54)	(-3.20)			(55.67)	(-3.32)		
3 (51-100)	0.0179***	-0.0006	-0.0071	101	0.0175***	-0.0007	-0.0124	61
	(23.93)	(-0.55)			(20.98)	(-0.51)		
Peripheral	0.0036***	-0.0014***	0.1341	101	0.0035***	-0.0011**	0.0639	61
(101+)	(14.38)	(-4.06)			(12.10)	(-2.26)		

Table 6

The impact of transparency on the number and volume of interdealer trades.

Each day, we find the number of TBA interdealer trades and the number of TBA trades with investors for each of the top ten dealers in trades over the six months prior to the sample period and for all other interdealer brokers and for all other regular dealers combined. We then estimate the following regression for each core dealer and category of peripheral dealer:

$$NDD_t = \alpha_0 + \alpha_1 D_{PostTrdTrans} + \alpha_2 NDC_t + \varepsilon_t$$

where NDD_t is the number of interdealer trades on day t, $D_{PostTrdTrans}$ is one if day t is after November 12, 2012, and NDC_t is the number of trades with customers on day t. A similar regression is run for interdealer volume:

$$VolDD_t = \alpha_0 + \alpha_1 D_{PostTrdTrans} + \alpha_2 VolDC_t + \varepsilon_t$$

where $VolDD_t$ is the total volume exchanged in interdealer trades on day t, and $VolDC_t$ is the volume from customer trades on day t. T-statistics are shown in parentheses below coefficient estimates. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

	Interdealer Trades				Interdealer Volume			
	Intercept	$D_{PostTrdTrans}$	Cust. Trades	Adj. R2	Intercept	$D_{PostTrdTrans}$	Cust. Volume	Adj. R2
Most	1,570***	-415.83***	NA	0.1576	37,737***	-11,687***	NA	0.1107
Active	(22.94)	(-4.44)			(16.19)	(-3.67)		
2	112.0***	-33.91**	0.8727***	0.5672	4,392***	-1,001	0.2692***	0.5614
	(4.41)	(-2.14)	(10.97)		(5.84)	(-1.62)	(10.66)	
3	123.9***	-51.11***	0.6099***	0.5611	3,790***	-1,259**	0.2357***	0.5159
	(8.30)	(-4.46)	(10.37)		(6.55)	(-2.20)	(9.91)	
4	66.75***	-35.22***	0.7750***	0.7111	2,478***	-715*	0.2018***	0.4000
	(4.53)	(-3.63)	(14.80)		(5.41)	(-1.84)	(7.82)	
5	65.61***	-11.66	0.6320***	0.5684	2,319***	-623	0.3127***	0.6469
	(4.48)	(-1.13)	(11.42)		(4.82)	(-1.45)	(13.32)	
6	80.00***	-22.01***	0.4607***	0.4690	2,723***	-1.259***	0.3023***	0.4217
	(6.46)	(-2.53)	(8.61)		(4.41)	(-2.59)	(7.80)	
7	50.36***	-22.70***	0.4751***	0.6038	3,609***	-690	0.2247***	0.2420
	(3.87)	(-3.06)	(10.76)		(5.57)	(-1.33)	(5.30)	
8	74.54***	-32.39***	0.8511***	0.6548	1,974***	-811**	0.2508***	0.5001
	(5.78)	(-3.47)	(12.97)		(4.64)	(-2.09)	(9.80)	
9	83.04***	-20.87**	0.5803***	0.4500	6,089***	-1,922	0.2363***	0.2676
	(6.87)	(-2.04)	(8.63)		(4.86)	(-1.63)	(5.58)	
10	51.60***	1.78	0.4457***	0.5360	849***	-265	0.3000***	0.6379
	(6.49)	(0.31)	(10.84)		(2.86)	(-0.89)	(13.21)	
Peripheral Dealers								
Regular	-22.75	-39.45	1.4678***	0.8601	7,556***	-1,676	0.8321***	0.5918
Dealers	(-0.35)	(-1.13)	(22.95)		(4.30)	(-1.22)	(10.96)	
Interdlr	438.83***	-88.30***	10.8052*	0.0615	31,589***	-9,866***	144.56***	0.1821
Brokers	(17.77)	(-2.62)	(1.84)		(15.25)	(-3.32)	(4.49)	

Table 7

The impact of transparency on the number of counterparties for interdealer trades.

We regress the natural log of the total number of interdealer trading counterparties on day t of a dealer d (LogN_{td}) on a dummy variable that is one if day t is after the introduction of post-trade transparency ($D_{PostTradeTrans}$), the natural log of dealer d's total trading volume six months before the sample period ($\mathrm{Dealer\ Volume}_{d}$), the natural log of the total number of interdealer trades executed by dealer d on day t ($LogNDDTrade_{td}$), and two interaction terms:

$$\mathrm{LogN}_{td} = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 Ln(DlrVol)_d + \alpha_3 D_{PostTradeTrans} \times Ln(DlrVol)_d + \alpha_4 LogNDDTrade_{td} + \alpha_5 D_{PostTradeTrans} \times LogNDDTrade_{td} + \varepsilon_{td}.$$

In each panel, the regressions use all TBA trades in the first column, selling trades of dealers in the second column, buying trades of dealers in the third column, trades with par values of more than $1 million in the fourth column, and trades with par values of less than $1 million in the fifth column.. Robust t-statistics are in parentheses. The sample period is from 9/1/2012 to 1/31/2013. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

Explanatory Variables	All	Sell	Buy	≥ $1 mill	< $1 mill
$D_{PostTrdTrans}$	0.114**	0.116*	0.101*	0.218***	0.085*
	(2.07)	(1.86)	(1.78)	(3.69)	(1.76)
Ln(DlrVolume)	0.031***	0.026***	0.050***	0.037***	0.053***
	(3.97)	(3.16)	(7.04)	(4.62)	(11.89)
$D_{PostTrdTrans}$ x Ln(DlrVol.)	-0.029***	-0.031***	-0.025***	-0.046***	-0.013**
	(-2.89)	(-3.05)	(-2.61)	(-4.40)	(-2.12)
LogNDDTrade	0.452***	0.442***	0.454***	0.431***	0.642***
	(44.61)	(43.99)	(47.21)	(42.38)	(74.44)
$D_{PostTrdTrans}$ x LogNDDTrade	0.048***	0.065***	0.047***	0.062***	0.033***
	(3.60)	(4.98)	(3.66)	(4.70)	(2.93)
Intercept	0.048	0.075	-0.164***	0.056	-0.413***
	(1.13)	(1.55)	(-3.90)	(1.25)	(-11.56)
Obs	6,956	6,135	6,241	6,551	4,126
Adj. R^2	0.792	0.761	0.804	0.782	0.812

Table 8
The Impact of Post-Trade Transparency on Herfindahl Indices of Interdealer Trades.

For each dealer d and each day t, we estimate the Herfindahl index of their interdealer trades

$$Herf_{d,t} = \sum_{i=1}^{N} \left(\frac{NDD_{d,i,t}}{NDD_{d,total,t}} \right)^2 \quad (9)$$

where $NDD_{d,i,t}$ is the number of trades (or volume) with dealer i on day t, and $NDD_{d,total,t}$ is the total number of interdealer trades by dealer d on day t. Each dealer-day Herfindahl observation is then regressed on a dummy that takes a value of one with post-trade transparency and the inverse of the total number of interdealer trades by dealer d on day t. That is

$$Herf_{d,t} = \alpha_0 + \alpha_1 D_{PostTrdTrans} + \alpha_2 \left(1/_{NumberTrades_{d,t}} \right) + \varepsilon_{d,t}.$$

Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$, where p is the p-value.

	All Dealer Days		Top Quartile Interdealer Volume	
	TBA Number Trades	TBA Volume	TBA Number Trades	TBA Volume
Intercept	0.3292***	0.3611***	0.4451***	0.3621***
	(109.31)	(102.36)	(80.78)	(42.92)
$D_{PostTradeTrans}$	-0.00784**	0.00325	-0.0301***	-0.0196***
	(-2.49)	(0.88)	(-8.11)	(-3.46)
1/Number Trades	0.7929***	0.7712***	-3.2220***	1.3690
	(43.81)	(36.38)	(-3.43)	(0.95)
Number Dealer FE	126	126	30	30
Observations	6,534	6,534	1,842	1,842
Adj. R^2	0.7521	0.6560	0.8647	0.5868

Table 9

The likelihood of continuing to trade with the same counterparties.

We estimate Logit regressions of the probability of a pair of dealers trading with each other on day t+1 if they traded on day t (I_{tp}), on a dummy variable that is one if day-t is after the introduction of post-trade transparency ($D_{PostTradeTrans}$), the total trading volume six months before November 12, 2012 of the dealer who has higher total trading volume ($Larger\ Dealer\ Volume_p$), and their interaction term:

$$\text{Log}[I_{tp}/(1-I_{tp})] = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 Larger\ Dealer\ LnVol_p + \alpha_3 D_{PostTradeTrans} \times Larger\ Dealer\ LnVol_p + \varepsilon_{tp}.$$

Robust z-statistics are in parentheses. The sample period is from 9/1/2012 to 1/31/2013. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

	TBA Trades		
Explanatory Variables	(1)	(2)	(3)
$D_{PostTrdTrans}$	-0.072***		-0.212***
	(-2.73)		(-4.01)
Larger Dealer LnVol		0.150***	0.142***
		(35.38)	(26.66)
$D_{PostTrdTrans}$ x Lrg Dlr LnVol			0.015**
			(2.13)
Intercept	0.428***	-14.955***	-14.551***
	(22.42)	(-2.53)	(-8.78)
Smaller Dealer FE	No	Yes	Yes
Observations	23,963	23,780	23,780
Pseudo R^2	0.0002	0.204	0.205

Table 10

Capital commitment and post-trade transparency.

Capital commitment is the mean, across minutes, of the absolute value of the dealer's inventory at that minute as estimated by the trades of that day. Capital commitment is regressed on $D_{PostTrdTrans}$, which takes a value of one after post-trade reporting is initiated, MornVol, the absolute value of volume during the morning, AftVol the absolute value of volume from all of the dealers afternoon trades, and the squared value of the volume for the entire day. We use only principal trades, and use every minute from midnight until midnight to calculate capital commitment. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

Intercept	$D_{PostTrdTrans}$	$MornVol_{d,t}$	$AftVol_{d,t}$	$Vol^2_{d,t} \times 10^8$	Adj. R^2	Obs.
71,294***	-20,788***				0.7397	7,544
(35.33)	(-7.46)					
7,693***	-7,080***	0.1600***	0.1185***		0.8426	7,544
(4.23)	(-3.25)	(40.87)	(26.35)			
22,960***	-8,463***	0.0945***	0.0499***	1.11***	0.8470	7,544
(11.06)	(-3.94)	(15.99)	(7.72)	(14.61)		
Using only 8 AM to 5 PM						
78,514***	-22,972***				0.7244	7,501
(34.27)	(-7.26)					
9,474***	-8,419***	0.2051***	0.0959***		0.8284	7,501
(4.52)	(-3.36)	(45.01)	(18.31)			
26,366***	-9,933***	0.1320***	0.0187**	1.27***	0.8329	7,501
(11.02)	(-4.01)	(19.19)	(2.48)	(14.05)		
Using only 8 AM to 5 PM and only dealers with 100+ trades per day						
75,081***	-28,968***	0.1253***	0.0083	1.37***	0.8172	2,630
(8.56)	(-4.17)	(10.74)	(0.65)	(8.95)		

Table 11
The impact of post-trade transparency on TBA-eligible SP trading costs.
We regress the percentage change in prices between two consecutive trades of the same SP and the percentage difference in ask and bid prices of the Treasury securities on the change in trade type (ΔQ), on the interaction between ΔQ and $D_{PostTrdTrans}$ (a dummy variable that equals one for trades occurring after November 12, 2012 and zero for earlier trades), on the interaction between ΔQ and D_{SP} (a dummy variable that equals one for SP and zero for Treasury securities), on the product of ΔQ, $D_{PostTrdTrans}$, and D_{SP}, on the interaction between ΔQ and the sum of the natural logs of the trade sizes of the two consecutive trades for SP, and on changes in the 1) a U.S. Agency Fixed Rate MBS index, 2) a U.S. Treasury 7-10 Year Bond index, 3) a U.S. Investment Grade Corporate Bond Index, 4) a U.S. Corporate High-Yield Bond index, and 5) the S&P 500 index:

$$\Delta P_t = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot D_{PostTrdTrans} + \alpha_3 \Delta Q_t \cdot D_{SP} + \alpha_4 \Delta Q_t \cdot D_{PostTrdTrans} \cdot D_{SP}$$
$$+ \alpha_5 \Delta Q_t \cdot \left(ln\left({Size_t}/{1{,}000{,}000} \right) + ln\left({Size_{t-1}}/{1{,}000{,}000} \right) \right) + \Sigma \beta_i \, Ret_{i,t} + \varepsilon_t,$$

where ΔQ equals +1 when the current SP trade is a dealer sale and the previous SP trade was a dealer purchase, equals -1 when the current SP trade is a dealer purchase and the previous SP trade was a dealer sale, and equals +1 for a pair of bid and ask quote prices of Treasury securities. Consecutive trades are always of the same SP, but trades from all TBA-eligible SPs with the same coupon and maturity are included in the regressions. SP trades of less than $10,000 face value are deleted. The sample period is from 9/1/2012 to 1/31/2013 in the first three columns, whereas the last three columns use time windows of 20, 10, and 5 days before and after November 13, 2012. Robust t-statistics are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

Explanatory Variables	SP	SP (20 days)	SP (10 days)	SP (5 days)
ΔQ	0.6277***	0.5371***	0.5516***	0.6859***
	(45.38)	(21.74)	(14.40)	(8.27)
ΔQ x $D_{PostTrdTrans}$	-0.0570***	0.0345	-0.0075	-0.0767
	(-2.92)	(1.01)	(-0.139)	(-0.85)
ΔQ x Trade Size	-0.1581***	-0.1583***	-0.1800***	-0.1839***
	(-59.02)	(-35.15)	(-25.34)	(-21.81)
MBS Index	89.7301***	96.1534***	103.3613***	133.1171***
	(26.38)	(16.25)	(10.45)	(9.75)
Treasury Index	-25.1947***	-17.5542***	-13.4083***	-18.6413***
	(-16.52)	(-8.52)	(-2.99)	(-2.88)
Corporate Bond Index (IG)	10.9918***	-4.9221*	-13.6604***	-19.5834***
	(6.74)	(-1.67)	(-2.71)	(-2.93)
Corporate Bond Index (HY)	-4.5357***	-0.2807	2.4095	4.4602**
	(-8.49)	(-0.28)	(1.57)	(2.12)
S&P 500 Index	-2.8065***	-4.4317***	-6.0530***	-10.0550***
	(-5.95)	(-5.74)	(-4.94)	(-5.51)
Constant	0.0359***	0.0082	-0.0090	-0.0540**
	(6.09)	(0.76)	(-0.56)	(-2.40)
Obs	112,324	34,758	16,676	9,988
Adj. R^2	0.1357	0.1356	0.1436	0.1585

Table 12

The impact of transparency on the number of SP interdealer trades.

Each day, we find the number of SP interdealer trades and the number of SP trades with investors for each dealer. We then estimate the following regression:

$$NDD_{d,t} = \alpha_0 + \alpha_1 D_{PostTrdTrans} + \alpha_2 NDC_{d,t} + \alpha_3 D_{PostTrdTrans} \times NDC_{d,t} + \varepsilon_{d,t}$$

where $NDD_{d,t}$ is the number of interdealer trades by dealer d on day t, $D_{PostTrdTrans}$ is one if day t is after November 12, 2012, and $NDC_{d,t}$ is the number of trades between dealer d and customers on day t. Significance levels: *** p<0.01, ** p<0.05, * p<0.1, where p is the p-value.

Intercept	14.3338	14.3029
	(41.58)	(39.32)
$D_{PostTrdTrans}$	1.6562	1.7086
	(3.78)	(3.56)
Number Customer Trades	0.2244	0.2261
	(29.68)	(22.98)
$D_{PostTrdTrans}$ x Number Customer Trades		-0.0027
		(-0.27)
Number Dealer FEs	503	503
Observations	12,525	12,525
Adj. R^2	0.6186	0.6185