Introducing Transparency to the Mortgage Backed Security Market: Winners and Losers

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ABSTRACT

We examine the introduction of mandatory post-trade reporting in the TBA mortgage-backed securities market. With the improvement in transparency, the dispersion of prices across near-identical trades declined significantly. Trade reporting also reduced information asymmetries between market participants. Following the start of post-trade reporting, trading costs fell for institutional investors and less active dealers received better prices in their trades with more active dealers. Relationships became less important and, after controlling for the number of trades, dealers used more counterparties in interdealer trades. Profits became more evenly distributed across dealers in chains of trades.

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In this paper, we study the introduction of post-trade transparency on the too-be-announced (TBA) forward market for agency mortgage backed securities (MBS). Starting November 13, 2012, FINRA began requiring that TBA transactions be reported through TRACE no later than 45 minutes after the time of execution. The reporting delay was reduced to 15 minutes after May 10, 2013.[1] In contrast to the forward or TBA market, there was no corresponding change in specified pool (SP) reporting until July 22, 2013. In this paper, we focus on the five month period centered around the November 13, 2012 introduction of post-trade transparency in the TBA market. Hence our sample period includes only that change in post-trade transparency and none of the subsequent changes in TBA or SP reporting.

It is plausible that post-trade reporting would have little or no effect on the TBA market. The investors in this market are large, presumably sophisticated institutions. Indicative quotes were available to both dealers and investors before the introduction of post-trade reporting. Trading costs in the TBA market were only a few basis points without the post-trade transparency, and the market was regarded as highly liquid.

We find, however, that post-trade reporting did provide useful information to the market. 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 in the 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. Over the same period, the standard deviation of prices in clusters of SP trades did not change significantly.

In an opaque over-the-counter market like the market for MBS, we would expect some investors to be better informed about market conditions and market prices than others. We would expect active dealers who are continually buying, selling, and negotiating TBA trades to know the most about market conditions and prices. Less active dealers who trade less frequently could be assumed to know less. Finally, institutional investors who buy or sell infrequently in the TBA market would know the least

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

about market conditions and prices. With the initiation of post-trade transparency, we would expect that the informational advantage that active dealers held over inactive dealers and investors to be diminished. We would also expect that the information advantage that inactive dealers held over investors would be reduced.

That is what we find. TBA trading costs for investors decline with post-trade transparency. This could be because investors use information from reported trades to negotiate better prices. It is also possible that investors do not use recent trade prices at the time they trade, but that dealers fear investors will withhold future business if post-trade reporting reveals they received a poor execution.

We also find that less active dealers benefit from post-trade transparency in their trades with more active dealers. We examine dealer profits on round-trips, defined as two or three trades in which buy and sell volume are offsetting. In total, dealer profits fall with post-trade transparency, providing further evidence that it benefits investors. After the introduction of post-trade reporting, for round-trips consisting of just interdealer trades, active dealers' profits fall relative to inactive dealers' profits. This suggests that the increase in transparency reduces the informational advantage that active dealers have over inactive ones. It is interesting that for the round-trips consisting of just dealer-customer trades, profits of inactive dealers fall more than profits of active dealers. Inactive dealers charged customers more than active ones before post-trade reporting, and about the same afterwards.

With diminished information asymmetries following the start of post-trade transparency, the need for relationships with trusted counterparties decreases. We find that dealers conduct interdealer TBA trades with a larger number of counterparties following the initiation of post-trade transparency. Furthermore, following post-trade transparency, the number of counterparties with whom a dealer trades increases at a faster rate with the number of interdealer trades. In contrast, dealers did not increase the number of counterparties they used for SP trades after the start of TBA post-trade transparency. Further evidence on the importance of relationships comes from examining the likelihood of trading with the same counterparty two days in a row. It decreases with post-trade transparency.

In this paper, we examine the impact of post trade reporting of TBA trades on both TBA and SP trading. There was no change in SP transparency during our sample period. Nevertheless, SP trading's usefulness as a control is limited because it is affected by TBA transparency in two ways. First, TBA prices provide a benchmark for SP trades. In fact, SPs are typically priced at a "payup" to TBA prices. Vickery and Wright (2013, p.2) observe that

> *"TBA prices, which are observable to market participants, also serve as a basis for pricing and hedging a variety of other MBS."*

Second, Gao, Schultz, and Song (2017a) show that 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.

The rest of the paper is organized as follows. In Section I we review the literature on the MBS market and on transparency in over-the-counter markets. In Section II we discuss the data used here. Section III shows the impact of post-trade transparency on the dispersion of prices for near-identical trades. Section IV examines the impact of transparency on trading costs. In Section V we explore the impact of transparency on the trading structure of the MBS market. Section VI summarizes and offers conclusions.

I. Literature Review

A. The Market for Agency Mortgage Backed Securities

Government agencies, specifically the Federal National Mortgage Association (Fannie Mae), Federal Home Loan Mortgage Corporation (Freddie Mac), and the Government National Mortgage Association (Ginnie Mae) issue agency mortgage backed securities (MBS), making them free from default risk. Each MBS however, is composed of different mortgages and each has its own unique prepayment risks.

Trading of MBS takes place in an over-the-counter dealer market for institutional investors. Investors can trade in two ways. First, they can buy or sell specified pools (SPs). That is they can trade one of the many thousands of unique MBS directly. Second, they can buy or sell in the forward or TBA market. In TBA, or too-be-announced trading, buyer and seller agree on six parameters of the trade: the price, the par value of the securities, the maturity, coupon rate, agency issuing the securities, and the delivery date. The seller then delivers the cheapest securities that meet the requirements of the trade. Most, but not all MBS traded as specified pools can be delivered to fulfill TBA trades. The MBS with the most desirable prepayment characteristics, are however, worth more than the cheapest-to-deliver TBA price and are therefore traded separately.

At any point in time, there are thousands of different specified pools available for trading, but almost all TBA trading takes place in a half-dozen or so contracts. By forcing so many MBS to be traded in so few contracts, TBA trading takes an illiquid, fragmented market and turns it into a liquid market for homogeneous MBS. In addition, eligibility for TBA trading makes SPs more liquid by giving dealers an option to lay off SP inventory through the more liquid TBA market.

Gao, Schultz, and Song (2017a) find that TBA trading increases liquidity for MBS traded as SPs. They show that trading costs for specified pools are lower on the days before TBA settlement dates when TBA volume is high. One reason why TBA trading may provide liquidity externalities to SPs is that dealers often use TBA trades to hedge SP positions. Gao, Schultz, and Song show that daily changes in dealer SP inventory are mostly offset by TBA trades of MBS with the same coupon and maturity.

B. Transparency and Post-Trade Reporting in Over-the-Counter Markets

Several studies examine the impact of the similar 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 that did not have 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 transaction reporting of corporate bonds reduced 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 subjected to reporting.

Bessembinder and Maxwell (2008) note three reasons why dealer market trading costs could decline with an increase in 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.

There are significant differences between the MBS market and the corporate bond market. The corporate bond market is fragmented with thousands of thinly traded bonds. Trading costs are large. In contrast, the TBA market is a thick market in which thousands of MBS are traded through the same handful of forward contracts. This is a highly liquid market with low trading costs. We find however, that even though trading costs in the TBA market are low, they fall significantly with post-trade transparency.

II. Data

Our enhanced TRACE data contains information on every agency mortgage-backed security trade from September, 2012 through February, 2013. The data 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 interdealer trades, we have masked identities of both counterparties. These masked identities do not allow us to say who the dealer was, but do allow us to attribute all of a dealers trades to the dealer.

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.

Panel A of Table I provides the distributions, across days, of the number of trades, number of active dealers, and volume. The mean, 25^{th} and 75^{th} percentiles of these variables over the entire period are shown in the first three columns. On average, 129.5 dealers participate in trades during a day. The number of active dealers doesn't change much day-to-day. The 25^{th} percentile is 124 dealers and the 75^{th} percentile is 137. This is a very active market, with an average of over $230 billion in trades taking place daily. TBA trades are more common than SP trades, with an average of 5,023 per day as compared to an average of 2,829 SP trades. Trades with customers are more common than interdealer trades, while large trades occur more often than small ones.

The next six columns provide the distributions of these variables for the periods before and after the introduction of post-trade transparency. When we compare the pre-transparency and post-transparency periods, we see that the number of participating dealers per day is almost the same. Pre-transparency, the mean number of dealers is 129.2, while post-transparency it is 129.7. Both volume and number of trades per day appear to be larger pre-transparency than post-transparency. In part, this may be because the post transparency period contains the days around Thanksgiving, Christmas, and New Years that typically have very low volume.

Panel B reports the results for t-tests of differences in daily means across the pre and post-transparency periods. Neither the difference in the number of dealers nor the difference in the number of trades is significant. On the other hand, the proportion of different types of trades changed in the post-transparency period. TBA trades, interdealer trades, and large trades each became a smaller proportion of total trades.

Over the entire sample period, 543 dealers make at least one trade. Panel C shows number of trades, percentage of trades that are TBA trades, and percentage of trades that are SP trades for dealers categorized by their total number of trades. The ten dealers with the most trades account for about 1.2 million trades between them. TBA trades account for 84.8% of the total trades of these ten dealers, and SP trades account for the remaining 15.2%. Panel C shows that the less active the dealer the larger the proportion of trades that are SP trades. SP trades account for more than 95% of trades for dealers outside the top 100.

III. Post-Trade Transparency and Price Dispersion

A. The Variance of Prices for Near-Identical Trades

Did post-trade reporting really increase the transparency of the TBA market? It is possible that it 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 represented 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 of MBS, and are either all interdealer trades, all dealer sales to customers, or all dealer purchases from customers. If the trades in a cluster are TBA trades, they match on all of the six TBA parameters and are indistinguishable at the time of the trade. If they are SP trades, they are trades of the same pool. The only potentially significant difference in the trades is that they occur at different times of the same day.

We calculate the standard deviation of prices of trades within a cluster for each cluster of trades. 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.

To see if post-trade transparency led to lower dispersion of prices for similar TBA trades, we run the following 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 the standard deviation of prices in trade cluster i, and $D_{PostTradeTrans}$ 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. For SPs we also include a dummy variable for TBA eligibility and an interaction between TBA eligibility and post-trade transparency. The regression we run for SP trade clusters is

$$\sigma_i = \alpha_1 + \alpha_2 D_{PostTradeTrans} + \alpha_3 D_{TBA\,Elig.} + \alpha_4 D_{PostTradeTrans} \times D_{TBA\,Elig.}$$

$$+\alpha_5 \sigma_{Index} + \alpha_6 D_{PostTradeTrans} \times \sigma_{Index} + \varepsilon_i \quad (2)$$

where $D_{TBA\ Elig}$ is a dummy variable that equals one if the SP is TBA eligible. This variable is intended to capture similarity to TBA trades.

Regression results are presented in Table II, with Panel A showing the TBA regressions. 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. The intercept of 0.0526 means that before post-trade reporting, the average standard deviation of prices in a cluster was 5.26 basis points. The coefficient on the dummy variable for post-trade transparency is -0.0108, indicating that the standard deviation of prices in trade clusters fell by 1.08 basis points with post-trade reporting. The robust t-statistic of -12.07 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 intercept in this regression is 0.0701, indicating a mean standard deviation of 7 basis points for dealer-customer trades before post-trade reporting. The coefficient of -0.0142 indicates that the standard deviation of dealer-customer trade prices for clusters of near identical trades fell 1.4 basis points with post-trade reporting.

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 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 standard deviations within clusters can’t be attributed to lower volatility in the post-transparency period.

In the last four regressions in panel A, 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.

The new post trade reporting rules required TBA trades to be reported within 45 minutes, though dealers could report them sooner. If post-trade transparency is behind the decline in price dispersion, we would expect the decline to be sharper for clusters of trades that occurred more than 45 minutes apart. To test this, we form new clusters of near-identical trades. This time, we form two separate types of clusters: one in which all trades occurred within 45 minutes of the 1st trade, and another where the second trade of the cluster occurred at least 45 minutes after the first trade. In the first clusters, all subsequent trades occur before the dealer is required to report the first one. In the second group of clusters, the first trade was reported before any subsequent trades occurred. An individual trade can only be in one cluster. If a second trade occurred within 45 minutes of the first trade, and the third trade occurred an hour later, the second trade is only in the cluster of trades that occurred within 45 minutes.

Panel B reports regressions of the standard deviation of prices in trade clusters on a dummy variable for the dates after post trade reporting was required. These regressions are the same as the first four regressions in Panel A, except that the clusters are divided into those with less than 45 minutes between trades, and those with more than 45 minutes between trades. The first two rows report results for interdealer trades of more than $1 million par value. The intercept is 0.0626 for clusters of more than 45 minutes, and 0.0260 for clusters of less than 45 minutes. There is a greater dispersion of prices for near identical trades if the trades take place at very different times of the day. This is not surprising. Fundamental values do change, and the further apart the trades, the greater the difference in fundamental values. The next column reports coefficients on the dummy variable for the post-trade transparency period. The coefficients are negative and statistically significant for both types of clusters. The standard deviation of trade prices fell by 0.3 basis points for trades that occurred within 45 minutes, but by 1.25 basis points for trades that occurred more than 45 minutes apart. Post-trade transparency reduced the standard deviation of prices in clusters of near-identical trades, but the reduction was especially large when the first trade was reported before subsequent trades took place.

Similar results are obtained for clusters of interdealer trades with values of less than $1 million, and for dealer-customer trades of more than $1 million and less than $1 million. In each case, coefficients on the dummy variable for the post-trade transparency period are larger in magnitude for clusters of trades that occur more than 45 minutes apart. It is likely that with post-trade reporting, some trades were reported immediately or shortly after they were completed for convenience. Nevertheless, when the first trade is a cluster is required to be reported before other trades occur, the reduction in price dispersion is particularly large.

Panel C replicates Panel A with clusters of SP trades. We would expect the relation between post-trade transparency and the standard deviation of prices within a cluster to be weaker for SP trades. TBA prices may be a benchmark for SP prices, but SP prices can differ significantly from them. The first regression in Panel C shows that for large interdealer trades, the most common type of SP cluster, the coefficient on the TBA eligible dummy is negative and significant, as is the interaction between the post-trade transparency dummy and TBA eligibility. TBA trades provide a better benchmark for TBA-eligible SPs than others, and their usefulness as a benchmark for TBA eligible SPs increases with post-trade transparency. For small trades, and large customer-dealer trades, as reported in the next three regressions, the coefficient on this interaction is not significant. Remaining regressions in Panel B introduce σ_{Index} and the interaction between σ_{Index} and $D_{PostTrdTrans}$. After inclusion of these variables, there is evidence that price dispersion of large, interdealer trades of TBA-eligible SPs declined with post-trade transparency. Panel C provides no evidence, however, that post-trade reporting decreased price dispersion for small SP trades or dealer-customer SP trades.

IV. Transparency and Trading Costs

A. *Changes in Trading Costs Around Post-Trade Transparency*

Our finding that price dispersion declined with post-trade transparency for clusters of near-identical trades suggests that post-trade transparency did result in useful information being conveyed to the MBS market. This is likely to have decreased information asymmetries between dealers and investors. Hence we expect trading costs for investors to fall with post-trade transparency.

To test this, we employ a regression methodology similar to Bessembinder, Maxwell, and Venkataraman (2013) and Gao, Schultz, and Song (2017) 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 CUSIPs with a particular maturity. With the change in price between two consecutive trades as the dependent variable, we estimate

$$\Delta P_t = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot \left(ln\left({}^{Size_t}/_{1{,}000{,}000} \right) + ln\left({}^{Size_{t-1}}/_{1{,}000{,}000} \right) \right)$$
$$+ \alpha_3 \Delta Q_t \cdot TBA\ PostTrdTrans_t + \alpha_4 \Delta Q_t \cdot TBA\ Eligible + \ \Sigma \beta_i\ Ret_{i,t} + \varepsilon_t, \qquad (3)$$

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*, Size is the par value of the traded securities, *TBA Eligible* is a dummy variable that equals one if the SP is eligible to be traded TBA. 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 the TBA transparency reporting on the trading cost, we interact ΔQ with a dummy variable $TBA\ PostTrdTrans_t$ 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 other factors on trading costs..[2]

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. This regression is run separately for SP and TBA trades, but the variables for TBA eligibility are, of course, omitted in the regressions using TBA trades. 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%,

[2] 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, which mitigates concerns on confounding effects from other factors or events.

and 4.0%. Together, these MBS account for 96% of our sample trades. In addition, we omit trades of less than $10,000 par value.

Regression results are in Table III. Panel A reports estimates of trading costs for TBA trades. The coefficient of 0.040 on ΔQ indicates that round-trip trading costs for TBA trades of $1 million in par value were about 4 basis points. The coefficient of -0.006 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 (2017) 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, for 30-year TBA trades, round-trip costs decrease by about 0.6 basis points, or about 14% of the 4.4 basis points before the TBA transparency reporting. For 15-year TBA trades, round-trip costs decrease by about 1.9 basis points, or about 31% of the 6.2 basis points before the TBA transparency reporting.

It is not surprising that TBA trading costs fell with post-trade reporting. 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 allowed them to negotiate better prices.

During our sample period, there was no change in post-trade transparency for specified pool trades. Nevertheless, TBA trades provided a benchmark for pricing SPs, and so it is reasonable to expect post-trade transparency for TBA trades to affect trading costs for SPs. Transaction cost regressions similar to those in Panel A of Table III are reported in Panel B for SPs with 16-30 years to maturity and in Panel C for SPs with 15 or fewer years to maturity.

The first regression reported in Panel B estimates the impact of post-trade disclosure of TBA trades on SP trading costs using trades of TBA-eligible SPs with 16-30 years to maturity. All of these maturities can be delivered to fulfill delivery requirements on a 30-year TBA trade. The coefficient of

0.655 on ΔQ indicates that round-trip trading costs for SP trades of $1,000,000 are 65.5 basis points, much, much greater than the 4 basis points trading costs for TBA trades. More interesting for our purposes is that trading costs for TBA-eligible specified pools with time to maturities of 16-30 years decreased by a statistically significantly 8.2 basis points after the start of TBA post-trade reporting. In the next columns, we run the regression using all SPs and interactions between ΔQ and a dummy for TBA eligibility, and between ΔQ, a dummy for TBA eligibility, and a dummy for post-trade transparency. This regression reveals that trading costs are lower for TBA-eligible SPs than for TBA-ineligible SPs, and that trading costs fall only for TBA-eligible SPs with post-trade reporting.

It makes sense that trading costs would fall for TBA-eligible SPs but not TBA-ineligible SPs with reporting of TBA trades. SPs are TBA-ineligible if the mortgages in the pool have features that are different from those of typical MBS. They could, for instance, have jumbo mortgages or mortgages with unusually high loan-to-value ratios. These mortgages have very different prepayment characteristics than typical MBS and TBA prices may be a poor benchmark for them.

The next two columns report similar regressions with 0 – 15 year SPs. SPs with these maturities are deliverable to fulfill 15-year TBA trades. Trading costs do not change significantly with TBA transparency for these SPs.

B. MBS Trading Costs with Active vs Inactive Dealers

There are theoretical reasons to expect trading costs to differ for investors trading with active and inactive 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 active core dealers and trade with narrower spreads. 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 three reasons why we might expect the introduction of post-trade transparency to affect active and inactive dealers differently. First, active 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. Less active 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 inactive dealers when they can learn from reported trades. Second, large 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 (2014)). With increased transparency, small, high-cost dealers may have to reduce the amount they charge to trade to bring costs into line with more active dealers.

To study the different trading costs of large and small dealers, we modify regression (3) as follows:

$$\begin{aligned}\Delta P_{td} = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot \left(ln\left({}^{Size_t}/_{1,000,000} \right) + ln\left({}^{Size_{t-1}}/_{1,000,000} \right) \right) \\ + \alpha_3 \Delta Q_t \cdot TBA\ PostTrdTrans_t + \alpha_4 \Delta Q_t \cdot Ln(DlrVol)_d \\ + \alpha_5 \Delta Q_t \cdot Ln(DlrVol)_d \cdot TBA\ PostTrdTrans_t + \Sigma\beta_i\ Ret_{i,t} + \varepsilon_t,\end{aligned} \tag{4}$$

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_5 coefficient on $\Delta Q_t \cdot Ln(DlrVol)_d \cdot TBA\ PostTrdTrans_t$ measures the change in the round-trip cost charged by dealer d in response to percentage changes in the trading activeness.

Panel A of Table IV reports results of various specifications of regression (4) for 30-year and 15-year TBA trades, in columns (1) – (3) and columns (4) – (6), respectively. We observe from columns (1) and (4) that the coefficient on ΔQ x Dealer Volume is significantly negative prior to post-trade transparency, implying that small or less active dealers charge higher round-trip costs to customers, on average. This contrasts with findings by Li and Schürhoff (2014) that central dealers in the municipal market charge greater trading costs. 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 the higher risk they face from informed trading. It is also consistent with the idea that small, high-cost market makers were able to survive by exploiting the ignorance of investors about prices before post-trade transparency.

Columns (2) and (5) report results of the regression (4) for the TBA trades after November 12, 2012. We observe that less active dealers charge *higher* round-trip costs to customers before the TBA transparency reporting, but charge *lower* round-trip costs after the TBA transparency reporting. The significantly positive coefficients on ΔQ x Dealer Volume x TBA PostTrdTrans, reported in columns (3) and (6) for the full regression (4), further confirm that the round-trip cost charged by less active dealers *declined* significantly relative to the round-trip cost charged by more active dealers, when TBA transparency is increased through post-trade reporting. This contrasts with the finding of Li and Schürhoff (2014) 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.

On the one hand, this evidence could imply that small dealers benefit more than larger dealers from the TBA post-trade reporting, perhaps because their informational disadvantages are diminished with the increased transparency. As a result, the round-trip trading cost they charge *declines* relative to more active dealers. On the other hand, if small dealers are also dealers with high costs, the decline in trading costs for small dealers relative to large ones is consistent with predictions by Duffie, Dworczak, and Zhu (2016). In an opaque market without a benchmark price, high costs dealers can earn positive profits. When a benchmark is introduced, trading shifts away from high-cost dealers to low cost dealers.

The relative impact of post-trade transparency for active and inactive dealers could plausibly be very different for SP trades than TBA trades. The most active dealers concentrate their trading in the large, liquid TBA market, while the least active dealers trade primarily SPs. In the six months prior to our sample period, SP trades accounted for 15.2% of the trades of the ten most active dealers, and 95.3% of the trades of the 443 least active dealers. Small inactive dealers may be less informed about the prices of TBA trades that are used as benchmarks for SP trades, but may be better informed about SP prices.

Panel B of Table IV reports results of various specifications of regression (4) for TBA-eligible specified pools with time to maturities of 16-30 years in columns (1) – (3) and 0-15 years in columns (4) – (6). In all regressions the coefficients on ΔQ x Ln(DlrVol) are significantly positive. That is, small dealers charge lower round-trip costs to customers on average for SP trades in contrast to the higher round-trip costs charged by small dealers for TBA trades. Yet, similar to the results for TBA trades in Panel A, Panel B shows that the round-trip cost charged by small dealers for TBA-eligible specified pools *declined* significantly relative to the round-trip cost charged by large dealers after the TBA transparency reporting. Specifically, the coefficient on ΔQ x Ln(DlrVol) increases from 0.237 for trades before November 12, 2012 to 0.284 for trades after November 12, 2012. The positive coefficient on ΔQ x Ln(DlrVol) x TBA PostTrdTrans reported in column (4), equal to 0.049 with a t-stat of 2.009, confirms this significant *decrease* of the round-trip costs charged by small dealers relative to those charged by large dealers for trading specified pools after the TBA transparency reporting. Similar results are seen for 0 – 15 year SPs. The coefficient on ΔQ × Ln(DlrVol) increases from 0.173 before post-trade transparency to 0.199 afterwards. This difference is not statistically significant, however,

The largest dealers tend to specialize in TBA trading, while smaller ones mostly trade specified pools. So, it is not entirely surprising that large dealers would charge more for SP trades. Nor is it surprising that the trading costs difference would rise with transparency for TBA trades. Large dealers already know a lot about TBA prices from their own trading activities. It is the smaller dealers that gain valuable information from TBA post-trade reporting as TBA prices provide a useful benchmark for pricing SPs.

C. Dealer Trading Profits

Dealers who trade frequently are likely to be better informed about market conditions than less active dealers. This informational advantage is likely to be diminished by an increase in transparency. Our data allows us to look directly at the impact of TBA transparency on the trading profits of active versus inactive dealers.

The round-trip profits earned by active versus inactive dealers, are, of course related to the costs of trading with active and inactive dealers. Unlike estimates of trading costs, the estimates of round-trip trading profits include interdealer trades. This allows us to look more closely at the effects of transparency on different market participants. MBS investors, who were the least informed about trade prices before post-trade transparency should gain from trade reporting. Active dealers who were already well informed are likely to lose their competitive advantage as a result of post-trade reporting. Inactive dealers, who may be less informed about TBA prices than active dealers but more informed than investors, are likely to do better on their interdealer trades but worse on their trades with investors.

We define a round-trip as two or three trades of the same MBS by the same dealer in which total buy volume exactly offsets total sell volume. For each trade in our sample period, we first see if there is a single offsetting trade in which the dealer reverses his position. If there is more than one single offsetting trade we select the one that occurs closest in time to the initial trade. We define this pair of trades as a roundtrip. Neither trade is used as part of another roundtrip for the dealer. If there is no single trade that offsets the initial trade, we search for two other trades, which, when combined with the initial trade, add up to zero net volume. To make the search manageable, we limit the second trade in the roundtrip to the first 500 trades (by all dealers) in that MBS after the initial trade and limit the third trade to the first 500 trades after the second trade. When a round-trip consists of three trades, none of the three trades are used in additional round-trips. We calculate the percentage profit on the round-trip as the total amount received by selling MBS minus the total amount paid for the MBS, divided by the average of the total amount paid and the total amount received.

The initial trade in the roundtrip must occur within the sample period in order to be included. To insure that we are not omitting difficult trades that take time to offset from the post-transparency period, we allow the other trades in the roundtrip to take place as long as one month after the end of the sample period. To estimate the impact of transparency on dealer round-trip profits, we estimate the following regression

$$PctProfit_i = \alpha_0 + \alpha_1 LnDlrVol_i + \alpha_2 D_{PostTrdTrans,i} + +\alpha_3 LgSize_i + \alpha_4 Brokered_i + \alpha_5 DaysHeld_i + +\alpha_6 NumTrd_i + \varepsilon_i \quad (5)$$

where $PctProfit_i$ is the percentage profit for the dealer on roundtrip i, $LnDlrVol_i$ is the natural logarithm of the number of TBA trades that the dealer completed in the six months prior to the sample period, $D_{PostTrdTrans}$ is one if the initial trade took place after TBA post-trade reporting became required, LgSize is the natural logarithm of the par value of the MBS in the roundtrip, $Brokered_i$ takes a value of one if the first and last trades in roundtrip i took place less than five minutes apart, $DaysHeld_i$ is the natural log of one plus the number of days between the first and last trade in the round trip and $NumTrd_i$ is either two or three, depending on the number of trades in roundtrip i.

Results for TBA trades are reported in Panel A of Table V. The first three columns provide regression estimates for dealer profits on all TBA positions. In the first column, we report results when only two of the explanatory variables are used: the dummy post-trade transparency and the natural log of the number of TBA trades that the dealer engaged in in the six months prior to the sample period. The coefficient on the Ln(DlrVol) is -0.0067 with a robust t-statistic of -8.83. More active dealers earn small percentage profits on round-trip TBA trades. The coefficient on post-trade transparency is -0.3106 with a robust t-statistic of -141.4. Dealer profits fell significantly with post-trade transparency. The regression indicates that average dealer profits on TBA trades were positive before post-trade transparency, and negative afterwards.[3] In the next regression we include the interaction between the post-trade transparency dummy and the log of the number of dealer trades in the six months before the sample period. The coefficient on this interaction is -0.0466, with a t-statistic of -31.07. The mean log of the number of trades in this regression is 10.4, meaning that for a typical dealer, profits fell on net with post-trade transparency. The mean log of the number of transactions in the six months before the sample period is 10.4, and the standard deviation is 1.32 for the TBA roundtrips. So, a one standard deviation increase in the log of the number of trades by the dealer implies an additional six basis point decrease in the round-trip trading profits.

It makes sense that post-trade transparency decreased the TBA trading profits of active dealers more than it decreased the TBA trading profits of less active dealers. Frequent trading gave active dealers an information advantage over less active dealers, as well as over investors, but that advantage declined with post-trade transparency.

It is possible that the characteristics of TBA trades changed with post-trade transparency. They could, for example, have become larger. Or, they could be more likely to be brokered. In a brokered (or prearranged, or riskless principal) trade, the dealer finds a buyer for a selling customer and does not risk any capital. Trading costs on brokered trades are cheaper than on trades where a dealer takes risk.

To ensure that changes in post-trade transparency are responsible for changes in dealer profits, we rerun the dealer profit regression with the additional explanatory variables. Results are reported in the

[3] Some caution is required in interpreting these results to mean that dealers lose money in TBA trades. It is likely to be a profitable round-trip if, for example, a dealer buy in the TBA markets, takes delivery, and sells in the SP market, but that round-trip would not be among the TBA round-trips in Table V.

next column. They reveal that dealer round-trip trading profits are significantly lower for brokered trades, decline with the number of days needed to unwind the position, and are lower if the round-trip consists of three trades rather than two. The inclusion of these extra variables, however, has almost no impact on the coefficient or t-statistic for the dummy variable for post-trade transparency, on Ln(DlrVol), or on the interaction of the two. Our main result still holds – trading profits declined more for trades with active dealers than inactive ones.

In the rest of Panel A, we estimate the dealer TBA profit regressions separately for round trips that were both opened and closed with interdealer trades, and for round-trips in which the position was both opened and closed with a trade with a customer. When the position is opened and closed with interdealer trades, the coefficient on the interaction between post-trade transparency and Ln(DlrVol) is -0.0437 with a t-statistic of -18.76. Interdealer trades are a zero sum game. One dealer's profit is another dealer's loss. With the introduction of post-trade transparency, active dealers' profits decrease. The informational advantages that active dealers have over less active dealers decrease with post-trade reporting.

The last three columns of Panel A present the results of the dealer profit regressions when all of the trades in the roundtrip are between dealers and customers. Here the results are different. Now, in each regression, the coefficient on the interaction between post-trade transparency and Ln(DlrVol) positive and significant. Active dealers' profits drop less with post-trade transparency than inactive dealers' profits. This result also makes sense. Both more and less active dealers have information advantages over customers. Duffie, Dworczak, and Zhu (2014) suggest that inactive dealers have higher costs and charge customers more to trade. With post-trade transparency, their ability to charge more than active dealers is taken away. Hence the profits active dealers make from trades with customers declined less than the profits of inactive dealers when post-trade transparency was introduced.

There is another potential reason why the profits that dealers earn trading with customers declined more for inactive dealers than active ones. The customers of the two types of dealers may be different. More sophisticated and knowledgeable customers may trade more with active dealers, while the clientele for less active dealers may be less knowledgeable customers. If this is true, post-trade transparency will prove especially informative and valuable for the customers of less active dealers. The trading profits from customer trades of less active dealers could then be expected to decline relative to the trading profits from customer trades of more active dealers.

Panel B presents similar dealer round-trip trading profit regressions for TBA-eligible specified pool trades. Unlike TBA trades, there was no change in post-trade reporting for SP trades during our sample period. So, it is not surprising that our results are very different for SP trading profits. Dealer profits on TBA trades fell sharply with post-trade transparency. For SP trades, there is no evidence that profits fell with the introduction of post-trade transparency. For interdealer TBA trades, trading profits of active dealers fell relative to trading profits of inactive dealers with post trade transparency. For interdealer SP trades, trading profits of active dealers actually increase relative to trading profits of inactive dealers. These findings suggest that the decline in active dealer profits in interdealer TBA trades was a result of the change in TBA transparency, and not factors that affected both the TBA and SP market.

D. Dealer Profits Intermediation Chains

In the mortgage-backed securities market, a dealer trade with a customer may be followed by several interdealer trades before one of the succeeding dealers makes an offsetting trade with a customer. An intermediation chain can be thought of as passing a position from a dealer who trades with an investor through intermediating dealers to another dealer who knows of an investor who wants to take the other side of the trade. End dealers in the chain can be thought of as dealers who interact with investors and know their needs, while intermediating dealers may know other dealers and their trading needs and therefore specialize in interdealer trades.

Table VI provides a description of intermediation chains. For both TBA and SP trades, it is far more common for a single dealer to buy from and sell to investors than for multiple dealers to intermediate. Nevertheless, chains of three to seven dealers are common. Intermediation by several dealers is more common, as a percentage of round-trips, for SP trades than TBA trades.

With the introduction of post-trade transparency, dealers in a chain are better able to see what their predecessors paid (or received) in their trades. As a result, it is possible that dealer markups will become more uniform over the chain. To test this, we run the following regression

$$PctProfit_{id} = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 End\ Dealer_{id} + \alpha_3 D_{PostTradeTrans} \cdot End\ Dealer_{id} + \alpha_4 Trd\ Size_{id} + \Sigma\beta_{id}\ Ret_{id} + \varepsilon_{id} \quad (8)$$

where $D_{PostTradeTrans}$ equals one if the two consecutive trades executed by dealer d on the round-trip chain i occurred after November 12, 2012, $End\ Dealer_{id}$ is a dummy variable that equals one if dealer d is either the first or the last dealer in round-trip chain i, $Trd\ Size_{id}$ is the sum of the natural logs of the trade sizes of the two consecutive trades executed by dealer d in round-trip chain i, and ΣRet_{id} are the 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.

Regression estimates are reported in Table VII. The first two columns report results for dealer percentage profits in TBA trade chains. In the first regression, the coefficient on $D_{PostTradeTrans}$ is -0.099 with a t-statistic of -22.51, indicating that a dealer in a chain of transactions made smaller profits following the introduction of post-trade transparency. The coefficient on the dummy variable for End

Dealer is positive and significant. Dealers at the beginning and end of chains earn greater profits on their trades than dealers who intermediate between dealers. This is consistent with the findings in Li and Schürhoff (2014) for corporate bond trades. The regression shown in the next column includes the interaction $D_{PostTradeTrans} \cdot End\ Dealer_{id}$. The coefficient on this variable is -0.080 with a t-statistic of -5.39. This regression shows that end dealers do make larger profits on trades, but only before the introduction of post-trade transparency. Afterwards, end dealers and others in the chain earn almost identical profits.

The next two columns of the table show regression results for chains of TBA-eligible SPs. Profits for end dealers are actually lower than profits for intermediating dealers for TBA-eligible SPs. The coefficient on $D_{PostTradeTrans} \cdot End\ Dealer_{id}$ indicates that post-trade transparency does not result in a significant change in profits of end-dealers versus intermediating dealers. The last two columns provide regression estimates for chains of TBA-ineligible SP trades. There are a relatively small number of observations in these regressions. Neither $End\ Dealer_{id}$ nor $D_{PostTradeTrans} \cdot End\ Dealer_{id}$ is significantly different from zero.

It is possible that profits for end dealers change relative to profits for intermediating dealers following post-trade transparency because the dealers in these positions in the chain change. We test whether end dealers in a chain are more likely to be active dealers, and whether the likelihood changes with post-trade transparency by estimating the following regression

$$Activeness_{id} = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 End\ Dealer_{id} + \alpha_3 D_{PostTradeTrans} \cdot End\ Dealer_{id} + \varepsilon_{id} \quad (9)$$

where $Activeness_{id}$ is the natural log of the total number of trades of dealer d six months before the sample period.

Results when the natural log of trading volume is used as the measure of dealer activeness is shown in last four rows of Table VII. The first two columns show results for chains of TBA trades. In both regressions, the coefficient on $D_{PostTradeTrans}$ is negative and significant. Following post-trade transparency, chains of TBA trades are more likely to contain less active dealers. The coefficient on $End\ Dealer_{id}$ is also negative and highly significant. Dealers who deal with customers tend to be less active, while dealers who intermediate between tend to be more active. The second regression also includes the interaction term $D_{PostTradeTrans} \cdot End\ Dealer_{id}$. The coefficient on this interaction is 0.292 with a robust t-statistic of 4.84. With post-trade transparency, active dealers in trade chains are more likely to trade with investors.

The last two columns present regression results for TBA-eligible SP trade chains. For both, end dealers are likely to be less active. The coefficient on $D_{PostTradeTrans}$ is negative and significant in the second-to-last regression, indicating that less active dealers made up more of the trade chains after post-trade transparency. In the last regression, when the interaction term $D_{PostTradeTrans}$ x $End\ Dealer_{id}$ is included, the coefficients on both $D_{PostTradeTrans}$ and its interaction with $End\ Dealer_{id}$ are both insignificant. In neither case though, is there any indication that the relation between dealer activity and likelihood of being at the ends of the chain is altered by post-trade transparency.

To summarize, for chains of TBA trades, profits were larger for dealers trading with investors than for dealers intermediating between dealers prior to post-trade transparency. Afterwards, when trades and trade prices can be observed, profits even out. End dealer's profits are not significantly different from intermediating dealers. This is not because less sophisticated dealers traded more with dealers following post-trade transparency. The opposite is true – more active dealers were a larger proportion of end dealers after the introduction of post-trade transparency.

Support for the idea that the introduction of post-trade transparency altered the distribution of profits over trading chains comes from our SP regressions. The distribution of profits did not change significantly for SPs.

V. TBA Price Transparency and Bilateral Trading Structure

Price transparency can affect the bilateral trading structure of over-the-counter markets. In this section, we study the effect of TBA transparency through the lens of changes in interdealer trading following the introduction of TBA post-trade transparency. We consider two aspects of the bilateral trading structure, the number of trading counterparties for a dealer and the likelihood of trading with the same dealer on consecutive days.

A. The Number of Trading Counterparties

With more transparent prices, small dealers are likely to rely less on relationships with large dealers, and spread trades among a larger number of counterparties instead.[4] 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:

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

Panel A of Table VIII 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.

[4] Li and Shurhoff (2016) and Di-Maggio, Kermani, and Song (2017) document that small or peripheral dealers maintain persistent trading relationships with large dealers, in the sense that most of their trades are executed with a limited number of large dealers.

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 an inactive dealer, following the introduction of TBA transparency reporting, is larger than that of an active 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, $D_{PostTradeTrans} \times LogNDDTrade_{td}$, 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.

The second and third columns of Panel A of Table VIII 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 an inactive dealer increases relative to the number for an active dealer both for buying and selling trades.

The fourth and fifth columns of Panel A of Table VIII 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, more positive and 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 an inactive dealer relative to an active dealer is greater for large trades than for small trades.

To summarize, the results in Panel A of Table VIII indicate that dealers allocated the same number of interdealer trades across more dealers after the introduction of post-trade transparency than before. All else equal, the increase in the number of counterparties was 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.

Panel B of Table VIII reports the results of regression (6) using interdealer SP trades. That is, N_{td} is equal to the total number of interdealer SP trading counterparties on day t for dealer d, and $Ln(DlrVol)_d$ is equal to the natural log of the rank of dealer-d among all dealers by the total SP trading volume six months before our sample period.

The first column in Panel B of Table VIII considers the number of interdealer trading counterparties for all SP trades. The coefficient on $\mathrm{D}_{\mathrm{PostTrdTrans}}$ is negative but statistically insignificant. The coefficient on $\mathrm{D}_{\mathrm{PostTrdTrans}} \times \mathrm{LogNDDTrade}_{\mathrm{td}}$ is -0.017 and, again, statistically insignificant. When all types of SP trades are considered, post-trade transparency appears to have no impact on the number of dealer counterparties. Like the results for TBA trading counterparties in Panel A, the regression coefficient on $Ln(DlrVol)_d$ is positive and significant. Hence, in SP markets overall, larger dealers tend to have more trading counterparties.

The difference between these results and the results for the number of counterparties for TBA trades is striking. If some factor affected trading in agency MBS in general during our sample period, we might expect the number of counterparties for TBA trades and SP trades to change in the same way. Instead, we find that dealers use more counterparties for TBA trades, but no evidence that dealers use more counterparties for SP trades. This is what we would expect if the increase in counterparties was a result of the introduction of post-trade transparency for TBA trades only.

In the remaining columns of Panel B, we present regression results using sell trades, buy trades, trades of more than $1 million, trades of less than $1 million, trades of TBA-eligible SPs and trades of

TBA-ineligible SPs. There is some evidence that number of counterparties dealers used increased at an faster rate with the number if interdealer trades after post-trade transparency. In general though, post-trade transparency had little or no impact on the number of counterparties that dealers used for SP trades.

B. *The Likelihood of Continued Trading with the Same Counterparties*

On each day t, we find all pairs of dealers that traded with each other at least once. We set Trd_{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 two dealers, and the interaction between the two variables. That is

$$\begin{aligned}\text{Log}[I_{tp}/(1-I_{tp})] \quad &= \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 Larger\ Dealer\ LnVol_p + \\ &\qquad \alpha_3 D_{PostTradeTrans} \times Larger\ Dealer\ LnVol_p + \varepsilon_{tp}\ (7).\end{aligned}$$

Results for TBA trades are shown in Panel A of Table IX. 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, the only explanatory variable is 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 an active dealer than an inactive 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 less active 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 the largest dealers.

The last two columns of Panel A show regression estimates when dealer rank based on trading activity in the six months prior to the sample period is used as a measure of dealer activity rather than the dealers' trading volume over the same period. Results are similar but weaker than those obtained with trading volume.

Panel B of Table IX reports results of logit regressions for SPs that are TBA-eligible. In each case, the coefficient on $D_{PostTrdTrans}$ is negative when that is the only explanatory variable. A dealer is less likely to trade SPs with a dealer two days in a row after post-trade transparency than before. In each case, the coefficient on volume for the larger dealer is negative. Dealers are less likely to trade with another dealer two days in a row if the counterparty is an active dealer. This seems counterintuitive, but the most active dealers trade mainly in the TBA market and are less active in SP trading. The third column in each panel provides the regression results when $D_{PostTrdTrans}$, the volume of the active dealer, the interaction of the two, and a fixed effect for the less active dealer are all included in the regression. The coefficient on $D_{PostTrdTrans}$ is now statistically insignificant. The coefficient on the interaction between $D_{PostTrdTrans}$ and the active dealer volume is negative for TBA-eligible SPs, but of marginal significance. There is little evidence that post-trade transparency affected the number of SP counterparties differently for active and inactive dealers.

VI. Conclusions

FINRA began to require dealers to report TBA trades of mortgage-backed securities as of November 13, 2012. Prior to that date, dealers were only required to report trades at the end of the day. The introduction of post-trade transparency did provide useful information to the market. We find that the dispersion of prices of near identical TBA trades falls sharply with post-trade reporting.

The market participants who were likely to have known the least about market prices and conditions appear to have benefited the most from the additional transparency. Institutional investors, who are likely to know less about market conditions than dealers, benefit from post-trade transparency by paying significantly lower trading costs. Inactive dealers, who trade less frequently than active dealers, are likely to know less about recent prices than active dealers but more than investors. We show that inactive dealers make less on their trades with investors after the introduction of post-trade transparency, but do better on their interdealer trades with active dealers.

Greater competition for interdealer trades may be one reason inactive dealers do better on their interdealer trades following the introduction of post-trade transparency. We find that, after adjusting for the number of trades, the number of counterparties for interdealer trades for a given dealer increases with post-trade transparency. Relationships between dealers become less important with post-trade reporting.

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Table I

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.

Panel A. The distribution of trading variables for the whole period, pre-transparency, and post-transparency

	Entire Sample Period			Pre-Transparency			Post Transparency		
	Mean	25th Per.	75th Per.	Mean	25th Per.	75th Per.	Mean	25th Per.	75th Per.
Number Dealers	129.5	124	137	129.2	125	136	129.7	124	139
Volume ($Millions)	230,710	156,297	307,304	256,639	176,946	356,725	208,142	146,649	263,512
Daily Number Trades	7,852	6,655	9,474	8,225	6,673	9,835	7,528	6,580	8,997
Number TBA	5,023	4,120	6,291	5,518	4,214	6,840	4,592	3,407	5,518
Number SP	2,829	2,422	3,280	2,707	2,298	3,086	2,936	2,436	3,457
Number Interdealer	3,224	2,748	3,889	3,489	2,946	4,087	2,993	2,597	3,582
Number Customer	4,629	3,846	5,580	4,736	3,878	5,704	4,535	3,785	5,438
Number Large	6,009	4,976	7,232	6,508	5,085	7,905	5,575	4,691	6,674
Number Small	1,843	1,545	2,185	1,717	1,511	1,880	1,952	1,730	2,301

Panel B. T-tests for differences in means across subperiods.

	Mean Before 11/13/2012	Mean After 11/13/2012	Difference	T-statistic for Difference
Number of Dealers	129.2	129.7	-0.4697	-0.18
Daily Number of Trades	8,225	7,528	697	1.55
Percent Trades that are TBA	66.67%	59.96%	6.71%	5.18
Percent Trades that are Interdealer	42.40%	39.47%	2.93%	3.73
Percent Trades that are Large	78.71%	72.78%	5.94%	6.02

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

Dealers	Total Trades	Mean Percent TBA	Mean Percent SP
1-10	1,192,967	84.8%	15.2%
11-30	469,446	76.5%	23.5%
31-50	178,642	49.3%	50.7%
51-100	156,351	27.1%	72.9%
101-543	49,891	4.7%	95.3%

Table II.

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 number 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 regression:

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

For SPs we include a dummy variable for TBA eligibility and an interaction between TBA eligibility and post-trade transparency. The regression we run for SP trade clusters is

$$\sigma_i = \alpha_1 + \alpha_2 D_{PostTradeTrans} + \alpha_3 D_{TBA\ Elig.} + \alpha_4 D_{PostTradeTrans} \times D_{TBA\ Elig.}$$

$$+\alpha_5 \sigma_{Index} + \alpha_6 D_{PostTradeTrans} \times \sigma_{Index} + \varepsilon_i$$

Panel A. Dispersion of Prices in Clusters of TBA Trades

Trade Size	Trade Type	Intercept	$D_{PostTrdTrans}$	σ_{Index}	σ_{Index} x $D_{PostTrdTrans}$	Obs.	R^2
≥ $1 mill	Interdealer	0.0526***	-0.0108***			29,626	0.0049
		(80.04)	(-12.07)				
≥ $1 mill	Dealer - Customer	0.0701***	-0.0142***			28,736	0.0031
		(60.51)	(-9.46)				
< $1 mill	Interdealer	0.0485***	0.0055			1,930	0.0007
		(22.99)	(1.20)				
< $1 mill	Dealer - Customer	0.0621***	-0.0108**			2,067	0.0031
		(23.73)	(-2.54)				
≥ $1 mill	Interdealer	0.0420***	-0.0105***	0.1134***		29,626	0.0333
		(58.64)	(-11.98)	(20.36)			
≥ $1 mill	Dealer - Customer	0.0592***	-0.0149***	0.1272***		28,736	0.0164
		(46.74)	(-9.93)	(15.96)			
< $1 mill	Interdealer	0.0398***	0.0050	0.1303***		1,930	0.0204
		(18.74)	(1.10)	(6.01)			
< $1 mill	Dealer - Customer	0.0484***	-0.0120***	0.1658***		2,067	0.0444
		(16.72)	(-2.91)	(6.48)			
≥ $1 mill	Interdealer	0.0353***	0.0017	0.1838***	-0.1313***	29,626	0.0428
		(39.99)	(1.47)	(20.18)	(-12.73)		
≥ $1 mill	Dealer - Customer	0.0522***	-0.0021	0.2087***	-0.1460***	28,736	0.0207
		(34.05)	(-1.08)	(14.99)	(-9.26)		
< $1 mill	Interdealer	0.0317***	0.0187***	0.2508***	-0.2002***	1,930	0.0315
		(14.89)	(3.43)	(8.10)	(-5.26)		
< $1 mill	Dealer - Customer	0.0408***	0.0013	0.2585***	-0.1561***	2,067	0.0532
		(14.34)	(0.32)	(7.87)	(-3.53)		

Panel B. Dispersion of Trade Prices in Clusters of TBA Trades that Occurred Within 45 Minutes and Clusters that Occurred Over Time Intervals Greater than 45 Minutes

Trade Size	Trade Type	Time Lag	Intercept	$D_{PostTrdTrans}$	Obs.	R^2
≥ $1 mill	Interdealer	< 45 min	0.0260***	-0.0030***	42,597	0.0007
			(71.73)	(-5.63)		
≥ $1 mill	Interdealer	≥ 45 Min	0.0626***	-0.0125***	23,559	0.0059
			(85.76)	(-11.85)		
< $1 mill	Interdealer	< 45 min	0.0271***	0.0108**	1,555	0.0020
			(7.01)	(2.01)		
< $1 mill	Interdealer	≥ 45 Min	0.0636***	-0.0074**	1,190	0.0030
			(25.78)	(-2.13)		
≥ $1 mill	Dealer - Customer	< 45 min	0.0371***	-0.0034***	26,341	0.0003
			(43.97)	(-2.88)		
≥ $1 mill	Dealer - Customer	≥ 45 Min	0.0833***	-0.0192***	24,194	0.0052
			(68.76)	(-11.33)		
< $1 mill	Dealer - Customer	< 45 min	0.0335***	-0.0039	1,805	0.0006
			(17.51)	(-1.47)		
< $1 mill	Dealer - Customer	≥ 45 Min	0.0719***	-0.0135***	1,769	0.0037
			(20.41)	(-2.75)		

Panel C. Dispersion of Prices in Clusters of SP Trades

Trade Size	Trade Type	Intercept	TBA Eligible	$D_{PostTrdTrans}$	TBA Elig. x $D_{PostTrdTrans}$	σ_{Index}	σ_{Index} x $D_{PostTrdTrans}$	Obs.	R^2
				Panel C: SP Trades					
≥ $1 mill	Interdealer	0.1571***	-0.0374***	0.0149	-0.0395***			8,147	0.0108
		(18.90)	(-3.82)	(1.25)	(-2.85)				
≥ $1 mill	Dealer - Customer	0.0791***	-0.0043	0.0194	-0.0088			1,287	0.0018
		(5.29)	(-0.25)	(0.86)	(-0.36)				
< $1 mill	Interdealer	0.4150***	0.0239	0.0815*	0.0380			6,309	0.0062
		(12.31)	(0.64)	(1.85)	(0.78)				
< $1 mill	Dealer - Customer	0.0973***	0.0701**	0.0145	0.0473			1,275	0.0083
		(5.24)	(2.11)	(0.45)	(0.091)				
≥ $1 mill	Interdealer	0.1509***	-0.0383***	0.0155	-0.0402***	0.2081***		8,147	0.0126
		(18.01)	(-3.90)	(1.30)	(-2.90)	(3.93)			
≥ $1 mill	Dealer - Customer	0.0678***	-0.0044	0.0141	-0.0091	0.3679***		1,287	0.0193
		(4.42)	(-0.26)	(0.62)	(-0.37)	(4.25)			
< $1 mill	Interdealer	0.3778***	0.0285	0.0769**	0.0296	1.1268***		6,309	0.0193
		(13.90)	(0.94)	(2.09)	(0.71)	(7.84)			
< $1 mill	Dealer - Customer	0.0295	0.0986***	0.0284	0.0154	1.3875***		1,275	0.0447
		(1.15)	(2.85)	(0.84)	(0.30)	(3.97)			
≥ $1 mill	Interdealer	0.1495***	-0.0385***	0.0179	-0.0397***	0.2546***	-0.0839	8,147	0.0127
		(17.72)	(-3.92)	(1.48)	(-2.86)	(3.26)	(-0.79)		
≥ $1 mill	Dealer - Customer	0.0651***	-0.0044	0.0190	-0.0090	0.4546***	-0.1362	1,287	0.0198
		(3.98)	(-0.26)	(0.79)	(-0.36)	(2.62)	(-0.69)		
< $1 mill	Interdealer	0.3667***	0.0299	0.0915**	0.0285	1.4607***	-0.4310	6,309	0.0196
		(13.05)	(0.098)	(2.40)	(0.068)	(5.66)	(-1.42)		
< $1 mill	Dealer - Customer	0.0290	0.0987	0.0291	0.0152	1.3968***	-0.0165	1,275	0.0447
		(1.23)	(0.72)	(0.72)	(0.29)	(4.61)	(-0.03)		

Table III

MBS Trading Costs Before and After TBA Transparency Reporting

We regress the percentage change in prices between two consecutive trades 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, on the interaction between ΔQ and TBA 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 a dummy variable for TBA eligible SPs, 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:

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

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, 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.

Panel A: TBA Trades

	30-year		15-year	
Explanatory Variables	(1)	(2)	(3)	(4)
ΔQ	0.040***	0.044***	0.053***	0.062***
	(14.874)	(14.014)	(10.724)	(10.479)
ΔQ x Trade Size	-0.006***	-0.006***	-0.007***	-0.007***
	(-12.108)	(-12.114)	(-8.505)	(-8.581)
ΔQ x TBA PostTrdTrans.		-0.006**		-0.019***
		(-2.237)		(-3.714)
MBS Index	58.266***	58.292***	68.098***	68.020***
	(3.072)	(3.074)	(3.805)	(3.802)
Treasury Index	7.418	7.402	-2.699	-2.712
	(0.721)	(0.719)	(-0.318)	(-0.320)
Corporate Bond Index (IG)	-2.168	-2.157	11.971	12.063
	(-0.240)	(-0.239)	(1.120)	(1.129)
Corporate Bond Index (HY)	-0.539	-0.543	-9.699***	-9.739***
	(-0.137)	(-0.138)	(-2.621)	(-2.631)
S&P 500 Index	-2.943*	-2.943*	1.898	1.926
	(-1.688)	(-1.688)	(0.878)	(0.892)
Constant	0.001	0.001	0.002*	0.002*
	(0.949)	(0.950)	(1.941)	(1.947)
Obs	140,648	140,648	32,370	32,370
R^2	0.048	0.048	0.119	0.120

Panel B: Specified Pool Trades.

Explanatory Variables	16-30 Year		0 – 15 Year	
	(1) TBA Eligible	(2) All	(3) TBA Eligible	(4) All
ΔQ	0.655***	0.933***	0.551***	0.820***
	(39.839)	(26.444)	(22.186)	(6.575)
ΔQ x Trade Size	-0.164***	-0.162***	-0.134***	-0.106***
	(-54.614)	(-59.223)	(-22.904)	(-4.374)
ΔQ x TBA Eligible		-0.288***		-0.269**
		(-7.392)		(-2.128)
ΔQ x TBA PostTrdTrans.	-0.082***	0.064	0.019	-1.227
	(-3.470)	(1.418)	(0.552)	(-1.217)
ΔQ x TBA Eligible x TBA PostTrdTrans.		-0.138***		1.271
		(-2.716)		(1.228)
MBS Index	108.270***	101.837***	44.466***	32.242***
	(26.286)	(24.063)	(7.599)	(2.988)
Treasury Index	-29.451***	-28.051***	-11.524***	-1.239
	(-16.198)	(-16.199)	(-4.161)	(-0.098)
Corporate Bond Index (IG)	13.521***	12.440***	4.050	-1.974
	(6.710)	(5.799)	(1.500)	(-0.194)
Corporate Bond Index (HY)	-5.383***	-5.238***	-4.217***	-4.195***
	(-8.901)	(-8.719)	(-3.931)	(-3.812)
S&P 500 Index	-3.471***	-3.272***	0.098	0.936
	(-6.289)	(-6.133)	(0.109)	(0.860)
Constant	0.040***	0.041***	0.027**	0.071*
	(5.906)	(6.571)	(2.229)	(1.935)
Obs	83,186	94,355	29,138	31,280
R^2	0.156	0.150	0.091	0.009

Table IV.

MBS Trading Costs of Large vs Small 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 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 TBA Disclose), on the interaction term ΔQ x Ln(DlrVol) x TBA Disclose, 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:

$$\Delta P_{td} = \alpha_0 + \alpha_1 \Delta Q_t + \alpha_2 \Delta Q_t \cdot \left(ln \left({}^{Size_t}/_{1{,}000{,}000} \right) + ln \left({}^{Size_{t-1}}/_{1{,}000{,}000} \right) \right)$$
$$+ \alpha_3 \Delta Q_t \cdot TBA\ PostTrdTrans_t + \alpha_4 \Delta Q_t \cdot Dealer\ Volume_d + \alpha_5 \Delta Q_t \cdot Dealer\ Volume_d \cdot TBA\ PostTrdTrans_t + \Sigma \beta_i\ Ret_{i,t} + \varepsilon_t,$$

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.

Panel A: TBA Trades

	30-Year			15-Year		
	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory Variables	Before	After	All	Before	After	All
ΔQ	0.203***	-0.084**	0.208***	0.252***	-0.097**	0.256***
	(4.163)	(-1.965)	(4.283)	(3.804)	(-2.103)	(3.791)
ΔQ x Trade Size	-0.002***	-0.003***	-0.002***	-0.002**	-0.004***	-0.003***
	(-2.615)	(-3.368)	(-3.614)	(-2.368)	(-4.776)	(-4.970)
ΔQ x Ln(DlrVol)	-0.017***	0.009**	-0.018***	-0.021***	0.010**	-0.021***
	(-3.690)	(2.146)	(-3.877)	(-3.502)	(2.427)	(-3.434)
ΔQ x TBA PostTrdTrans.			-0.260***			-0.332***
			(-4.190)			(-4.117)
ΔQ x Ln(DlrVol) x TBA PostTrdTrans			0.023***			0.029***
			(4.039)			(3.977)
MBS Index	100.357***	46.839***	72.966***	74.046***	48.661***	63.968***
	(19.831)	(8.567)	(19.193)	(15.689)	(9.880)	(21.565)
Treasury Index	-7.926***	49.157***	18.242***	5.493**	22.034***	13.367***
	(-3.118)	(17.563)	(9.617)	(2.407)	(8.665)	(8.144)
Corporate Bond Index (IG)	15.858***	-31.833***	-3.528*	-0.074	-14.222***	-6.018***
	(6.296)	(-9.289)	(-1.730)	(-0.034)	(-4.981)	(-3.431)
Corporate Bond Index (HY)	-12.977***	-2.919***	-7.019***	-6.901***	-1.434	-4.404***
	(-10.950)	(-2.936)	(-8.884)	(-7.235)	(-1.535)	(-7.337)
S&P 500 Index	0.838	-4.140***	-1.250***	2.153***	-0.537	1.142***
	(1.431)	(-6.422)	(-2.946)	(3.629)	(-1.031)	(2.756)
Constant	0.854	-0.044	-0.247	0.648*	-0.753**	-0.508*
	(1.248)	(-1.046)	(.)	(1.929)	(-2.142)	(-1.673)
Observations	68,693	70,174	138,867	15,696	16,149	31,845
R-squared	0.398	0.271	0.329	0.704	0.576	0.656
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: TBA-Eligible Specified Pool Trades

Explanatory Variables	30-Year (1) Before	30-Year (2) After	30-Year (3) All	15-Year (4) Before	15-Year (5) After	15-Year (6) All
ΔQ	-1.469***	-1.928***	-1.462***	-1.195***	-1.351***	-1.201***
	(-8.139)	(-13.161)	(-8.065)	(-8.646)	(-10.773)	(-8.691)
ΔQ x Trade Size	-0.151***	-0.166***	-0.159***	-0.087***	-0.095***	-0.091***
	(-41.212)	(-55.865)	(-68.554)	(-12.690)	(-13.794)	(-18.631)
ΔQ x Ln(DlrVol)	0.237***	0.284***	0.235***	0.173***	0.199***	0.172***
	(12.432)	(18.088)	(12.257)	(10.949)	(13.698)	(10.837)
ΔQ x TBA PostTrdTrans.			-0.459**			-0.124
			(-1.980)			(-0.683)
ΔQ x Ln(DlrVol) x TBA PostTrdTrans			0.049**			0.025
			(2.009)			(1.207)
MBS Index	61.061***	90.195***	98.710***	45.807***	40.781***	51.209***
	(9.539)	(16.253)	(26.103)	(4.715)	(5.409)	(9.501)
Treasury Index	11.949***	-20.597***	-18.652***	1.851	-12.666***	-10.252***
	(3.817)	(-8.314)	(-11.277)	(0.356)	(-3.235)	(-3.847)
Corporate Bond Index (IG)	-17.466***	8.289***	6.602***	-11.612**	8.591**	2.202
	(-5.570)	(2.865)	(3.614)	(-2.439)	(2.208)	(0.849)
Corporate Bond Index (HY)	-0.382	-7.020***	-8.973***	3.836*	-2.811***	-2.077**
	(-0.283)	(-10.231)	(-16.641)	(1.694)	(-2.710)	(-2.470)
S&P 500 Index	0.061	-1.304*	-0.099	-3.445***	0.184	-1.012
	(0.087)	(-1.824)	(-0.199)	(-3.082)	(0.173)	(-1.335)
Constant	0.068***	-0.003	0.038***	0.017	0.054***	0.039***
	(7.697)	(-0.378)	(6.576)	(0.934)	(3.337)	(3.367)
Observations	25,395	33,544	58,939	7,399	10,429	17,828
R-squared	0.284	0.297	0.296	0.112	0.098	0.105

Table V
Dealer Profits in Round-Trip MBS Trades

A roundtrip is defined as a two or three trades in the same MBS by the same dealer in which the dealer's total buy volume equals the dealer's total sell volume. The percentage profit on the roundtrip is the volume-weighted sell price minus the volume weighted purchase price divided by the volume-weighted average of buy and sell prices. The following regression is run with percentage profit on round trips as the dependent variable.

$$PctProfit_i = \alpha_0 + \alpha_1 LnDlrTrades_i + \alpha_2 D_{PostTrdTrans,i} + +\alpha_3 LgSize_i + \alpha_4 Brokered_i + \alpha_5 DaysHeld_i + \alpha_6 NumTrd_i + \varepsilon_i$$

LnDlrVol$_i$ is the natural logarithm of the number of trades by the dealer in the six months before the sample period. $D_{PostTrdTrans}$ is a dummy variable that is one for trades that took place on or after 11/13/2012 when mandatory trade reporting was introduced, LgSize is the natural logarithm of the par value of the trade, Brokered takes a value of one if all trades in the round-trip took place less than five minutes apart, *DaysHeld* is the natural logarithm of one plus number of trading days between the first and last trade of the round-trip, and *NumTrd* is two or three, depending on the number of trades in the round-trip.

Panel A. TBA trades.

	All Positions			Interdealer Trades Only			Customer Trades Only		
Intercept	0.2179***	-0.0233*	0.1252*	0.1331***	-0.0921***	-0.0901***	0.3280***	0.3971***	0.5222***
	(27.92)	(-1.93)	(1.86)	(11.52)	(-5.20)	(-4.55)	(11.04)	(8.65)	(11.05)
Post-Trade Trans.	-0.3106***	0.1735***	0.1710***	-0.2622***	0.1770***	0.1792***	-0.3681***	-0.5138***	-0.5225***
	(-141.4)	(11.31)	(11.14)	(-66.80)	(7.74)	(7.81)	(-77.03)	(-8.76)	(-8.94)
Ln(Dlr Vol)	-0.0067***	0.0165***	0.0193***	0.0004	0.0227***	0.0234***	-0.0147***	-0.0211***	-0.0175***
	(-8.83)	(14.03)	(14.26)	(0.35)	(12.64)	(11.89)	(-5.40)	(-4.99)	(-3.94)
Post-Trade Trans× Ln(Dlr Vol)		-0.0466***	-0.0463***		-0.0437***	-0.0439***		0.0135**	0.0143***
		(-31.07)	(-30.86)		(-18.76)	(-18.77)		(2.50)	(2.67)
Ln(trade Size)			0.0003			0.0031**			-0.0034***
			(0.51)			(2.58)			(-2.69)
Brokered			-0.0395***			-0.0085**			-0.0838***
			(-16.52)			(-2.29)			(-9.85)
Days Held			-0.0138***			0.0006			-0.0300***
			(-12.72)			(0.29)			(-13.82)
Number Trades			-0.0193***			-0.0164**			-0.0277***
			(-9.06)			(-4.09)			(-5.45)
Observations	197,677	197,677	197,674	51,478	51,478	51,478	52,691	52,691	52,690
R^2	0.0894	0.0929	0.0937	0.0763	0.0818	0.0821	0.0999	0.1000	0.1024

Panel B. TBA-eligible SP trades.

	All Positions			Interdealer Trades Only			Customer Trades Only		
Intercept	0.6254***	0.7112***	3.2503***	1.1238***	1.2942***	3.4897***	1.5812***	1.5907***	5.5177***
	(22.73)	(18.26)	(28.83)	(13.65)	(10.72)	(14.24)	(20.01)	(14.65)	(21.91)
Post-Trade Trans.	0.0408**	-0.1112**	-0.1190**	0.0994**	-0.2069	-0.2430	0.1444***	0.1273	0.0736
	(2.10)	(-2.25)	(-2.44)	(2.16)	(-1.35)	(-1.60)	(2.78)	(0.86)	(0.50)
Ln(Dlr Vol)	-0.0204***	-0.0327***	-0.0358***	-0.0622***	-0.0852***	-0.0740***	-0.0942***	-0.0954***	-0.0272**
	(-7.44)	(-7.58)	(-7.88)	(-7.85)	(-6.77)	(-6.19)	(-12.97)	(-9.01)	(-2.25)
Post-Trade Trans×		0.0227***	0.0232***		0.0424***	0.0354**		0.0022	0.0125
Ln(Dlr Vol)		(4.09)	(4.23)		(2.64)	(2.24)		(0.15)	(0.87)
Ln(trade Size)			-0.1722***			-0.2238***			-0.3158***
			(-39.03)			(-19.25)			(-29.93)
Brokered			-0.9165***			-0.8887***			-0.9490***
			(-39.67)			(-19.89)			(-18.38)
Days Held			0.0554***			-0.1107***			0.0840***
			(5.68)			(-6.40)			(4.05)
Number Trades			-0.5936***			-0.3534***			-1.1271***
			(-15.42)			(-5.56)			(-14.63)
Observations	81,273	81,273	81,265	21,466	21,466	21,466	18,412	18,412	18,412
R^2	0.0007	0.0008	0.0520	0.0032	0.0035	0.0345	0.0100	0.0100	0.0791

Table VI.

Summary of the Intermediation Chains

Trades of less than $10,000 face value are deleted. Non-split trading chains are those with the trade size unchanged along the chain, while split trading chains are those with the trade size unchanged except the last trade. The sample period is from 9/1/2012 to 1/31/2013.

Chain Type	TBA		SP	
	Non-Split	Split	Non-Split	Split
CDC	31762	20272	11431	2092
CDDC	856	218	1598	357
CDDDC	692	184	558	86
CDDDDC	99	27	106	14
CDDDDDC	202	54	11	2
CDDDDDDC	50	5	3	1
CDDDDDDDC	105	25		
Total	33766	20785	13707	2552

Table VII.

The Impact of Transparency on the Intermediation Chains

Columns (1) – (2) report regressions of the percentage profit of dealer d on the round-trip chain i ($PctProfit_{id}$), on a dummy variable that equals one if the two consecutive trades executed by dealer d on the round-trip chain i occurred after November 12, 2012 and zero before ($D_{PostTradeTrans}$), a dummy variable that equals one if dealer d is either the first or the last dealer on the round-trip chain i ($End\ Dealer_{id}$), the interaction term of these two dummy variables, the sum of the natural logs of the trade sizes of the two consecutive trades executed by dealer d on the round-trip chain i ($Trd\ Size_{id}$), and 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:

$$PctProfit_{id} = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 End\ Dealer_{id} + \alpha_3 D_{PostTradeTrans} \cdot End\ Dealer_{id} + \alpha_4 Trd\ Size_{id} + \Sigma\beta_{id}\ Ret_{id} + \varepsilon_{id}.$$

Columns (3) – (6) report regressions of measures of the activeness of dealer d on the round-trip chain i ($Activeness_{id}$), on a dummy variable that equals one if the two consecutive trades executed by dealer d on the round-trip chain i occurred after November 12, 2012 and zero before ($D_{PostTradeTrans}$), a dummy variable that equals one if dealer d is either the first or the last dealer on the round-trip chain i ($End\ Dealer_{id}$), the interaction term of these two dummy variables,

$$Activeness_{id} = \alpha_0 + \alpha_1 D_{PostTradeTrans} + \alpha_2 End\ Dealer_{id} + \alpha_3 D_{PostTradeTrans} \cdot End\ Dealer_{id} + \varepsilon_{id},$$

where we measure the dealer activeness both by the natural logs of the total trading volume of dealer d six months before November 12, 2012 ($LnDlrTrades_d$) and the natural log of dealer d's rank among all dealers by the total trading volume six months before November 12, 2012 ($LnDlrRank_d$). Trades from all MBS with the same coupon and maturity are included in the regressions, but 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.

	Percent Profits				Ln(Dealer Volume)			
	TBA Trades		TBA Eligible SPs		TBA Trades		TBA Eligible SPs	
$D_{PostTrdTrans}$	-0.099***	-0.025*	-0.082***	-0.300	-0.121***	-0.399***	-0.138***	-0.102
	(-22.505)	(-1.756)	(-4.784)	(-1.638)	(-12.895)	(-6.695)	(-7.030)	(-1.201)
End Dealer	0.035***	0.077***	-0.591***	-0.710***	-1.095***	-1.251***	-0.205***	-0.185**
	(3.259)	(5.362)	(-6.007)	(-4.134)	(-27.498)	(-25.644)	(-3.145)	(-2.479)
$D_{PostTrdTrans}$ x End Dealer		-0.080***		0.227		0.292***		-0.038
		(-5.386)		(1.239)		(4.840)		(-0.430)
Trade Size	-0.013***	-0.013***	-0.108***	-0.108***				
	(-23.240)	(-23.125)	(-48.186)	(-48.678)				
MBS Index	154.657***	154.338***	54.307***	54.584***				
	(125.347)	(125.068)	(4.189)	(4.208)				
Treasury Index	23.932***	24.121***	21.443***	21.362***				
	(56.543)	(56.735)	(3.403)	(3.387)				
Corporate Bond Index (IG)	30.457***	30.259***	-10.674	-10.610				
	(59.036)	(58.434)	(-1.556)	(-1.547)				
Corporate Bond Index (HY)	24.680***	24.709***	50.262***	50.199***				
	(93.759)	(93.854)	(11.418)	(11.390)				
S&P 500 Index	-1.160***	-1.150***	-0.676	-0.653				
	(-8.263)	(-8.194)	(-0.419)	(-0.405)				
Constant	0.168***	0.127***	1.181***	1.295***	11.491***	11.638***	9.120***	9.026***
	(14.328)	(8.673)	(11.680)	(7.552)	(283.036)	(237.405)	(65.427)	(48.079)
Observations	59,704	59,704	16,189	16,189	60,201	60,201	3,664	3,664
R-squared	0.554	0.555	0.205	0.206	0.090	0.090	0.077	0.077
Chain FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table VIII.

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 November 12, 2012 (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:

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

Panel A reports the regression results using interdealer TBA trades, while Panel B reports those using interdealer SP trades. In each panel, the regressions use all 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. In Panel B, the regressions use TBA-eligible SP trades in the sixth column and TBA-ineligible SP trades in the seventh 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.

Panel A: TBA Trades

Explanatory Variables	All	Sell	Buy	≥ \$1 mill	< \$1 mill
$D_{PostTrdTrans}$	0.114**	0.116*	0.101*	0.218***	0.085*
	(2.070)	(1.864)	(1.779)	(3.694)	(1.760)
Ln(DlrVolume)	0.031***	0.026***	0.050***	0.037***	0.053***
	(3.974)	(3.160)	(7.035)	(4.621)	(11.891)
$D_{PostTrdTrans}$ x Ln(DlrVol.)	-0.029***	-0.031***	-0.025***	-0.046***	-0.013**
	(-2.889)	(-3.046)	(-2.613)	(-4.403)	(-2.115)
LogNDDTrade	0.452***	0.442***	0.454***	0.431***	0.642***
	(44.606)	(43.993)	(47.211)	(42.381)	(74.443)
$D_{PostTrdTrans}$ x LogNDDTrade	0.048***	0.065***	0.047***	0.062***	0.033***
	(3.595)	(4.978)	(3.659)	(4.699)	(2.925)
Intercept	0.048	0.075	-0.164***	0.056	-0.413***
	(1.131)	(1.545)	(-3.895)	(1.245)	(-11.559)
Obs	6,956	6,135	6,241	6,551	4,126
R^2	0.792	0.761	0.804	0.782	0.812

Panel B: Specified Pool Trades

Explanatory Variables	All	Sell	Buy	≥ $1 mill	< $1 mill	TBA-eligible	TBA-ineligible
$D_{PostTrdTrans}$	-0.009	0.011	-0.011	0.007	0.017	-0.006	0.054
	(-0.193)	(0.233)	(-0.235)	(0.141)	(0.364)	(-0.121)	(0.965)
Ln(DlrVolume)	0.060***	0.079***	0.024***	0.042***	0.039***	0.063***	-0.015***
	(10.693)	(14.425)	(4.770)	(7.566)	(7.551)	(10.853)	(-2.955)
$D_{PostTrdTrans}$ x Ln(DlrVol.)	0.004	0.002	0.001	-0.005	0.002	0.005	-0.005
	(0.486)	(0.283)	(0.165)	(-0.720)	(0.277)	(0.612)	(-0.752)
LogNDDTrade	0.460***	0.365***	0.437***	0.512***	0.379***	0.433***	0.425***
	(52.877)	(38.012)	(49.066)	(48.901)	(43.064)	(48.419)	(37.854)
$D_{PostTrdTrans}$ x LogNDDTrade	-0.017	-0.023*	-0.009	0.034**	-0.030***	-0.022*	0.004
	(-1.447)	(-1.752)	(-0.710)	(2.486)	(-2.604)	(-1.880)	(0.261)
Intercept	-0.249***	-0.398***	-0.081**	-0.172***	-0.176***	-0.288***	0.207***
	(-7.630)	(-11.146)	(-2.566)	(-4.868)	(-5.051)	(-8.296)	(5.086)
Obs	9,442	7,272	7,543	7,140	6,581	8,708	4,664
R^2	0.657	0.524	0.597	0.667	0.569	0.636	0.486

Table IX.

Impact of Transparency on the Bilateral Trading Relations

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:

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

Panel A reports the regression results using interdealer TBA trades, Panel B reports those using interdealer TBA-eligible SP trades, and Panel C reports those using interdealer TBA-ineligible SP trades. 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.

Panel A: TBA Trades

Explanatory Variables	(1)	(2)	(3)	(4)	(5)
$D_{PostTrdTrans}$	-0.072***		-0.212***		-6.405***
	(-2.732)		(-4.010)		(-2.702)
Larger Dealer LnVol		0.150***	0.142***		
		(35.378)	(26.655)		
$D_{PostTrdTrans}$ x Larger Dealer LnVol			0.015**		
			(2.128)		
Larger Dealer Rank				0.061***	0.056***
				(24.277)	(17.221)
$D_{PostTrdTrans}$ x Larger Dealer Rank					0.012***
					(2.664)
Intercept	0.428***	-14.955***	-14.551***	-46.799	-43.601***
	(22.416)	(-2.525)	(-8.783)	(-0.07)	(-6.058)
Smaller Dealer FE	No	Yes	Yes	Yes	Yes
Obs	23,963	23,780	23,780	23,780	23,780
Pseudo R^2	0.0002	0.204	0.205	0.160	0.160

Panel B: TBA-Eligible SPs

Explanatory Variables	(1)	(2)	(3)	(4)	(5)
$D_{PostTrdTrans}$	-0.145***		0.009		3.232***
	(-3.970)		(0.117)		(2.754)
Larger Dealer Volume		-0.102***	-0.057		
		(-3.408)	(-1.421)		
$D_{PostTrdTrans}$ x Larger Dealer Volume			-0.087*		
			(-1.788)		
Larger Dealer Rank				-0.007***	-0.003*
				(-4.769)	(-1.712)
$D_{PostTrdTrans}$ x Larger Dealer Rank					-0.006***
					(-2.842)
Intercept	-0.514***	-1.028	-1.059	2.649*	0.702
	(-18.954)	(-0.890)	(-0.917)	(1.897)	(0.450)
Smaller Dealer FE	No	Yes	Yes	Yes	Yes
Obs	13,317	13,096	13,096	13,096	13,096
Pseudo R^2	0.0009	0.151	0.151	0.151	0.152