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Competitive inventory management in Treasury markets

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ABSTRACT

We decompose US Treasury bid-ask spreads into inventory, adverse selection and order processing costs by using the fact that inventory trades have different effects on spreads than do proprietary trades. We exploit this asymmetry and develop a technique to identify the three components of the spread in order to test three hypotheses: dealers make larger changes to inventory (1) following macroeconomic announcements (2) at the start and toward the end of the New York trading hours, and (3) when transaction sizes are relatively large. We test these predictions using GovPX data for on-the-run 2-year and 10-year Treasury Notes. All three predictions are supported. We also assess how primary dealers react to the Federal Reserve's open market operations (OMOs). Our findings reveal interesting intraday patterns in the inventory component for both securities.

1. Introduction

The market microstructure literature provides us with a general framework for decomposing the dealer's bid-ask spread into adverse selection, inventory, and order processing costs.[1] It is typically assumed that rational market makers incorporate all three costs in spreads.[2] For the Treasury market, a strong case may be made ex ante for a large inventory component. This around-the-clock market is characterized by high-value trades that tend to cluster around the beginning and end of New York trading hours. Moreover, at any given time, many dealers in this market may be driven as much by self-preservation as by profiting from the spread. For instance, the market-making profits for primary dealers of US Treasuries are relatively minor compared to their profits or losses from taking on proprietary positions (Sundaresan, 1997).[3] This might imply strong motives to reverse trades that are nonproprietary in nature. In fact, the motive to make the market may be mostly incidental; these dealers are afforded preferential treatment by the Federal Reserve Board in primary issues of Treasuries, but in turn are expected to serve as providers of liquidity in the secondary market (also see GAO, 1987). Since dealers making the secondary market for Treasuries may be uniquely motivated to control their inventories closely, these markets provide an excellent venue to examine the nature of the inventory component of the spread.

We decompose US Treasury bid-ask spreads into inventory, adverse selection and order processing costs by using the fact that inventory trades have different effects on spreads than do proprietary trades. We exploit this asymmetry and develop a technique to identify the three components of the spread in order to test three hypotheses: the largest adjustments in the inventory component are made (1) following macroeconomic news announcements; (2) towards the start and end of New York trading hours; and (3) when transaction sizes are large. We test our three hypotheses using on-the-run 2-year and 10-year notes, employing intraday transaction data pertaining to inter-dealer trading. All three

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[1] The effective spread is typically defined as the absolute difference of the transacted price and the midpoint of the bid and ask prices or $|P_t - \frac{1}{2}(A_t + B_t)| = |P_t - m_t|$, where A_t and B_t are the ask and bid prices, respectively, and m_t is the mid-point of the quoted prices.

[2] We note that the cost of trading (and liquidity) is a multi-faceted phenomenon. While the bid-ask spread is often considered a good proxy for costs and liquidity, it is well-known that other competing proxies have been employed. For instance, Hasbrouck (2004) employs signed order flow.

[3] Following the terminology in Sundaresan (1997), we identify transactions where dealers take positions as principals as proprietary, and distinguish these transactions from other transactions (nonproprietary) where dealers undertake transactions for another party.

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hypotheses are supported. Further, our framework permits us to assess how primary dealers react to the Federal Reserve's open market operations (OMOs). Our findings reveal interesting intraday patterns in the inventory component for both securities.

We allow for an adverse selection component in our decomposition because Treasury dealers may face information asymmetries, albeit in the less conventional sense. First, the bid or ask quote that a dealer submits to inter-dealer brokers is held firm for two minutes unless it is transacted upon, or a new and more favorable post occurs. The firmness of the quotes leaves the dealer vulnerable for a period of time during which market conditions may change.[4] Additionally, dealers establish relatively large proprietary positions in Treasuries. Dealers commonly leverage their long positions via the repo market, and establish significant short positions to hedge against their positions in mortgage-backed securities (Sundaresan, 1997). Knowledge of large forthcoming transactions may allow these dealers to better predict the short-term evolution of prices, affording them a degree of market power (Cornell, 1993; Huang and Stoll, 1997).

Fleming (1997) provides the first detailed intraday analysis of the Treasury markets. He finds that trading volume and price volatility are highly concentrated during New York trading hours and less so during London and Tokyo trading hours. He concludes that Treasury markets, although in operation around-the-clock, tend to behave like US equity markets with limited trading hours.

Our study adds to the growing literature that examines the behavior of spreads in Treasury markets. Pasquariello and Vega (2007) focus on the determinants of liquidity and price differentials between on-the-run and off-the-run US Treasury bonds. They note that mean spread differentials between off-the-run and on-the-run bonds are economically and statistically significant, even after controlling for other bond characteristics. Brandt and Kavajecz (2004) show that changes in the yield curve in Treasury markets may be related to the aggregation of heterogeneous private information. Green (2004) finds a significant increase in the informational role of trading following economic announcements. The focus of our study is on the inventory component of the spread.[5]

2. Spread dynamics

Dealers transact in the Treasury market for multiple reasons. First, a dealer may simply be providing liquidity with transactions representing short term-positions. Second, a dealer may be representing a client or offsetting a position undertaken with a client. In these two cases, the dealer's motivations are nonproprietary. On the other hand, a dealer's motivations may be proprietary, in which case changes in the position are more likely to be long-term. It follows naturally that transactions relating to short-run inventory-control arise for nonproprietary motives, and proprietary and nonproprietary transactions can be expected to have disparate effects on bid-ask dynamics.

The Treasury market is characterized by a centralized quoting system in which only the best bid- and ask prices are advertised by interdealer brokers. The posted quotes are blind so that it is not possible to observe the quotes or order-flows of individual dealers on a continuous basis. The posted bid- and ask prices are the best quotes of a few dozen primary dealers. These observed quotes remain firm for two minutes from their initiation. Further, the mixing of proprietary and nonproprietary quotes in these markets implies dealers' inventory positions are not mean-reverting in the (very) short-run.

Consider first the effects of inventory control by a dealer (Dealer A) following a non-proprietary transaction initiated in the inter-dealer market. For simplicity, assume Dealer A is the originator of the best bid and ask quotes. Following a "hit" (dealer purchase, at the bid), Dealer A lowers the quotes in an effort to induce a take (dealer sale, at the ask), thereby reducing the inventory of newly acquired securities. It can be expected that the larger the size of the initial trade and the greater the uncertainty in the market, the more immediate will be this action by Dealer A to reverse the trade, and larger the compromise on pricing. As long as there is no new information in the market, it is unlikely that Dealer A's lower bid price will be reflected in the updated quotes. On the other hand, Dealer A's lower ask price has a higher probability of being the best ask. If Dealer A's quote is indeed the best ask, A's inventory adjustment will result in a lower spread broadcast by the inter-dealer brokers. Similar arguments can be made following a "take" at the ask. Dealer A raises the quotes in an effort to induce a hit. Again, if there is no new information in the market, it is unlikely that Dealer A's raised ask price will be reflected in the updated quotes. On the other hand, Dealer A's raised bid price has a higher probability of being the best bid and will result in a lower spread broadcast by the inter-dealer brokers.

For nonproprietary trades illustrated above, the convergence in the spread can be expected to persist until the offsetting transaction is completed. Exceptions to this may occur if Dealer A's nonproprietary bid or ask size is large enough to be regarded as informative. Anonymity in the secondary trading of Treasuries may result in dealers obtaining a degree of temporary market power, allowing them to predict the short-term evolution of prices. This market power may be important enough to amount to private information (Huang and Stoll (1997)). In such cases, inventory control regimes may be very short-lived.

Next, consider the effects of a proprietary trade. Given that this is a multi-dealer market, if the trade occurs directly between two proprietary dealers (not via inter-dealer brokers), the transaction should have no effect on the ensuing best bid and ask quotes since these dealers have no motive for short-term trade reversals. In these instances the dealers are acting more like "owners" than as "dealers". If dealers transact via the inter-dealer brokers, the trades are likely to occur at the best bid or ask prices. Once again, following these transactions, neither trader has an incentive to provide revised quotes since there is no motive for short-term trade reversals. As long as these trades are not perceived as informative, and there is enough depth – namely just one dealer on each trade side who can step in at the prior bid and ask – the quotes will not change following these transactions.

2.1. Inventory regime formulations

Since dealers compete to make the market, following a trade and absent new information, inventory control will result in convergence between the bid and ask quotes, with quotes remaining constrained within this narrower "hidden" spread until an offset-

[4] Umlauf (1991) notes that price/quantity pairs, whether they are held in queue or posted on the broker's video screen, expire 2 min after they are submitted. If a posted quote expires without a transaction or a better quote, the broker replaces the order with the next most favorable price in the queue. Posting times are not provided on broker screens, so that it is not obvious to the non-posting dealers as to when the quotes will expire.

[5] Several other studies, though less closely related, examine important aspects of the Treasury market. Mizrach and Neely (forthcoming) provide insights into the microstructure of the US Treasury securities market. Barclay et al. (2006) and Huang et al. (2002) examine the price impact of trades in the Treasury market. Simon (1994) considers the effects of issue size on yields and finds that larger issues lead to higher yields. Other studies focus on the effects of macroeconomic announcements on Treasury prices. Balduzzi et al. (2001) employ intraday Treasury data to examine the effects of macroeconomic announcements on volume, prices and spreads. In a similar vein, de Goeij and Marquering (2006) analyze the effects of macroeconomic announcements and monetary policy events on the US Treasury market. Mizrach and Neely (2008) calculate spot/futures information shares in the Treasury markets and examine their relation with macroeconomic announcements and relative liquidity measures. Other related papers also include Gómez-Valle and Martínez-Rodríguez (2008); Kraft and Munk (2007) and Junker et al. (2006).