Liquidity in U.S. Treasury spot and futures markets

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Abstract

We estimate various measures of market liquidity for U.S. Treasury spot and futures markets for 1993. We find that, for both spot and futures markets, trading is concentrated in the nearby expiration/on-the-run instrument and in specific maturities---longer maturities for the futures, and shorter maturities for the spot. The median realized bid-ask spread is uniformly lower for the futures market than in the spot market.

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1. Introduction

The Treasury market transacts the debt of the U.S. government. The size of the market corresponds roughly to the outstanding U.S. federal debt, the majority of which consists of marketable securities – Treasury bills, notes, and bonds. Treasury bills have maturities of one year or less, while notes and bonds have maturities of more than one year. Once Treasury securities are issued, they trade in the secondary market, where dealers trade for customers or their own accounts by quoting bids and offers. In addition, investors can also buy and sell Treasury futures, which are standardised contracts traded on organised exchanges. Since Treasury futures can be used to lock in an interest rate at a future date, they allow investors to hedge interest rate risk and speculate on the future direction of interest rates.

The Treasury spot and futures markets are intimately linked. The existence of the spot market gives investors a reason to transact in futures. On the other hand, the ability to use futures to protect against interest rate uncertainty allows investors to make larger transactions in the spot market than otherwise, helping to lower interest rates on Government debt. Also, since futures contracts are used to speculate on interest rate movements, the futures prices are informative about the level of interest rates expected to prevail in the future.

The strength of the spot-futures linkage depends on the cost of transacting in these two markets. If the cost of transacting in futures markets is high, then investors may be reluctant to commit funds to the spot market. If the spot market has high transactions costs, this may inhibit transactions in that market, and, ultimately, in the futures markets as well. Transactions costs include both direct costs, such as brokerage fees, and indirect costs, such as the illiquidity of the market. Here, liquidity refers to the ability of investors to make sizable transactions rapidly and at low cost. In this paper, we compute the liquidity costs of the spot and futures markets over a common period for various types of Treasury instruments.

Spot trading in U.S. Treasury securities mostly occurs in a multiple dealer, over-the-counter market. Trading takes place around-the-clock during the week, although 95% of it occurs during New York trading hours (roughly 7.30 a.m. to 5.00 p.m., New York time). The predominant market makers are the 32 primary government securities dealers – financial firms with which the Federal Reserve Bank of New York interacts directly in the course of its open market operations. As shown in Figure 1, the dealers traded an average of US$120 billion of securities per day in 1993: US$66 billion with customers, and US$54 billion with other dealers. The core of the spot market, and the source of our data, is the interdealer broker market, which accounts for over 90% of trading between dealers. Interdealer brokers collect and post dealer quotes and execute trades between dealers, thereby facilitating information flows in the market while providing anonymity to the trading dealers.

The majority of exchange-traded futures contracts are listed in the Chicago futures exchanges: the Chicago Board of Trade (CBOT) and the Chicago Mercantile Exchange (CME). The 13-week and 52-week Treasury bill futures are traded on the CME, while the Treasury note and bond contracts are traded on the CBOT. Almost all trading occurs manually in the pit from 7.20 a.m. to 2.00 p.m. Chicago time, although after-hours electronic trading volume has been growing.

Trading occurs on the floor of a pit by means of the so-called open outcry method. Floor traders negotiate prices by shouting out orders to other floor traders, indicating quantity and trade direction through hand signals. Other floor traders bid on the orders, also using hand signals. Once filled, an order is recorded separately by both parties to a trade. At the end of the day, the clearinghouse settles trades and ensures that there is no discrepancy in the matched trade information.

The remainder of the paper is organised as follows. In section 2, we describe our data and methodology. Section 3 characterises trading activity in the spot and futures markets. Section 4 reports estimates of bid-ask spreads for the two markets, and section 5 concludes.

2. Methodology and data

We analyse high-frequency tick-by-tick trading data from both the U.S. Treasury spot and futures markets. Our period of analysis is 1993 – the most recent year for which we have data for both markets. We compute the following liquidity measures: trading volume, number of trades, trade size, number of dealers/floor traders, and various measures of the bid-ask spread (quoted, effective, realised). Because of differences in the institutional features of the spot and futures markets, as well as in the spot and futures data, the measures are not always comparable. We indicate which measures are comparable and which are not. Wherever possible, we compute these liquidity measures for the most active and the less active instruments separately.

Our spot market data cover trading in the interdealer broker market over 250 trading days in 1993. The source of the data is GovPX, Inc., a joint venture set up by the primary dealers and interdealer brokers in 1991 to improve the public's access to U.S. Treasury prices. GovPX consolidates and posts data from five of the six interdealer brokers, accounting for roughly two-thirds of the interdealer broker market. The posted data include the best bid and offer quotes and the size of each trade. The quotes are firm, as they are obtained directly from the broker screens. The data are transmitted real-time through several on-line vendors. As our data cover the interdealer broker market, we have no information on trades involving investors who are not dealers and we have no information on trades done directly between dealers (without a broker).

Data for the futures markets is from the Commodity Futures Trading Commission (CFTC), and cover 253 trading days in 1993. The data contain all transactions in the 30-year Treasury bonds, and the 2, 5, and 10-year Treasury notes, on the CBOT; and the 13-week Treasury bill on the CME. A futures floor trader may be involved in four types of trades: for his own personal account, on behalf of customers, for another member present on the exchange floor, or for a clearing member's house account. In this paper, we focus on the first two types of trading: trading for a floor trader's own account and for outside customers. These two types of trading constitute the majority of trading activity in the pits.

3. Trading activity in the spot and futures markets

A. Trading activity in the spot market

Figure 1 shows that most U.S. Treasury spot trading takes place in a relatively small number of securities. Sixty-two percent (62%) of interdealer trading in 1993, or US$34 billion per day, was in on-the-run securities – the most recently issued securities of a given maturity. An additional 26% of trading, or US$14 billion per day, was in off-the-run securities – issued securities that are no longer on-the-run. Finally, 11% of trading, or US$6 billion per day, was in when-issued securities – securities announced for auction but not yet issued.

Trading volume in the interdealer spot market is presented in Table 1 by security sector (cash-management bill, 13-week bill, etc.) and by security life-stage (when-issued, on-the-run, and off-the-run). As noted, our spot market data source does not cover all of the interdealer market because it omits one of the six interdealer brokers and because it does not include dealer-to-dealer trades done without a broker. We therefore scale the numbers from our data source up so that our total volume matches total interdealer volume calculated from the Federal Reserve Bulletin. This scaling results in figures which are biased down somewhat for the longer-term securities and biased up somewhat for the shorter-term securities.[1]

[1] The figures are biased in such a manner as the excluded broker is regarded as being stronger in the longer term issues than the other interdealer brokers.

The on-the-run 5-year U.S. Treasury note is the most actively traded security in the interdealer spot market with an average daily volume of US$8.7 billion. Issue sizes for the 5-year note in 1993 were about US$11.0 billion, implying a daily turnover rate in the interdealer market of 79%. The 5-year note is followed in trading volume by the 2-year note and the 10-year note with daily volumes of US$6.2 billion and $5.4 billion, respectively. The least actively traded issues with daily volumes in the US$1.6–1.7 billion range are the occasionally-issued cash-management bill, the 7-year note (last issued in 1993) and the 30-year bond.

Trading is weighted towards the shorter-term securities for the off-the-run issues. Off-the-run 13-week bills account for more trading volume than any other sector with an average daily volume of US$3.6 billion. The 13-week bill sector is also the only one in which off-the-run volume exceeds on-the-run volume. Since off-the-run volumes are for entire sectors of off-the-run securities, however, the average volume of individual off-the-run securities is much less than that of the on-the-run issues. The 13-week bill is followed by the 2-year note and the 5-year note with daily volumes of US$3.1 billion and US$2.3 billion, respectively. The least off-the-run trading occurs in the 4-year note and 20-year bond sectors, both sectors in which the Treasury no longer issues securities. The 30-year bond is the least actively traded sector among those in which the Treasury still issues securities, with daily volume of just US$169 million.

The when-issued security with the most trading volume is the 2-year note, with average daily volume of US$4.8 billion. It is followed by the 5-year note and 3-year note, with daily volumes of US$4.4 billion and US$4.3 billion, respectively. The 3-year note actually has higher average daily volume as a when-issued security than as an on-the-run security, as does the 7-year note and the 52-week bill. The 30-year bond is the least active when-issued sector, with average daily volume of US$561 million.

The number of trades per day and mean daily trade size are presented in Table 2 for the on-the-run securities. The number of trades is scaled up by the same factor as trading volume in Table 1 so that the figures more closely approximate total interdealer activity. The table shows that the 5-year note, the most active security by dollar volume, is also the most frequently traded security in the spot market, with an average of 1,019 trades per day. It is followed closely by the 10-year note, with 945 trades per day, and then by the 2-year note, with 492 trades per day. The bills are the least frequently traded securities with daily averages of 42, 69, 70, and 144 trades for the cash-management, 13-week, 26-week, and 52-week bills, respectively.

Average daily trade size decreases nearly monotonically with security maturity. Treasury bills, which trade in sizes of at least US$5 million, have average trade sizes ranging from US$36 million for cash-management bills to US$20 million for 52-week bills. Treasury notes and bonds, which trade in sizes of at least US$1 million, have average trade sizes ranging from US$12 million for the 2-year note to US$4.7 million for the 7-year note and 30-year bond.

B. Trading activity in the futures markets

At any time, four different expiration months are listed for a particular futures contract: March, June, September, and December. Typically, only the ***nearby*** contract – i.e. the contract for which the expiration month is closest to the trading date – records significant volume.[2] Figure 2 shows that volume in the nearby contracts was US$41 billion in 1993 and made up 90% of the total trading volume in Treasury futures. This is an aspect of the "concentration of liquidity" which is a feature of the futures markets. We shall have more to say on this feature later.

[2] For our calculations, we define the nearby contract as the expiration with the maximum volume on a particular day. This is consistent with market practice, since traders typically switch to the next expiration month a few days before the current contract month expires.

Trading volume is highly concentrated in the futures markets (Table 3). There are two aspects to this concentration: by maturity, and by expiration. The vast majority of futures market trading volume is in longer maturity instruments, especially the contract for the 30-year bond. Activity is also highly concentrated in the nearby expiration, with the exception of the 13-week bill, where substantial activity exists even for the distant expirations. Interestingly, it appears that the ***more*** active the nearby contract, the ***less*** active the distant contracts. The share of the distant contracts in total volume declines monotonically from 37.35% for the 13-week bill to just 5.57% for the 30-year bond.

Table 4 reports the daily number of trades, trade size and the number of floor traders in the futures markets. These numbers are calculated from the CFTC data, unlike the trading volume data of Table 3, which are from DRI and Datastream. Since the CFTC data reports both sides of a trade, the number of trades, and hence trading volume (which is not reported), is roughly twice that in the DRI and Datastream data.

Panel A of Table 4 reports numbers for trades made on floor traders' own accounts, while Panel B describes trades made by floor traders on behalf of customers. For both panels, the number of trades and the number of floor traders tends to increase with contract maturity, and drop off sharply for the distant expirations, as with trading volume. The exception is the 13-week bill. In addition, the trade size generally decreases with maturity for all contracts.

Customer trading activity (number of trades and floor traders) is about equal to dealer trading activity in the 13-week bill and the 2-year note futures. However, for all other contracts, customer trading activity is substantially less than dealer activity, with the proportion declining with maturity. For the 30-year bonds, for example, the number of customer trades is about a third of dealer trades on a daily basis. Relative to trades for dealers' own accounts, trade sizes tend to be larger for customers, and the number of floor traders executing customer trades on a day tends to be smaller.

C. Trading activity comparison

For both spot and futures markets, trading is concentrated in the nearby expiration/on-the-run instrument. However, in the futures markets, liquidity appears to be even more concentrated in the nearby contract, as compared to the spot markets. The spot market appears to be more active for the shorter maturity contracts, while the futures market is more active for longer maturity contracts. For both markets, trade size decreases with maturity.

4. Bid-ask spreads in spot and futures markets

A. Bid-ask spread measures

Our bid-ask spread measure that is common to both markets is the realised spread, since we only have transactions data for the futures market. The realised bid-ask spread is calculated as the difference between the daily volume-weighted buy price and the daily volume-weighted sell price. As the realised spread compares buy and sell prices across different times of the day, it is necessarily more noisy than other spread measures that are based on dealer quotes. However, the realised spread accounts for traders' ability to time their transactions across a trading day and to buy low and sell high. The realised spread is proportionalised by dividing by the midpoint between the mean buy and sell prices.

For the futures markets, we separately calculate realised bid-ask spreads corresponding to the two types of trades, for floor traders' own account and for customers. For a floor trader, the (negative of the) bid-ask spread is his realised average trading revenue per contract. For a customer, the bid-ask spread is his average realised trading cost per contract. Suppose that, when trading for their own accounts, floor traders as a group have c trades with outside customers and o trades with other floor traders. Trades between floor traders constitute an income transfer, and so the aggregate bid-ask

spread for these trades is zero. Hence, the average bid-ask spread for floor traders' own accounts is equal to the spread on trades with outside customers, weighted by the ratio $c/(c+o)$.

Similarly, a customer may trade with another customer, or a floor trader trading for his own account. Since the spread for trades between customers is zero, the average bid-ask spread for customers is also the spread on trades between customers and floor traders, ***but*** weighted by the ratio $o/(c+o)$. Since, typically, $c<o$ (see Table 4), the average spread for customer trades is expected to be larger than those for trades on floor traders' own accounts.

If floor traders differ widely in their trading skills and their ability to generate trading revenues, then an alternative measure of realised spreads for floor traders' own account trades may be appropriate. This alternative measure of realised spreads, which involves calculating spreads for each floor trader for each day he is active and then averaging across all floor traders active for the day, is not reported since it is less comparable to the realised spreads in the spot market.[3]

For the spot market, spreads are calculated only for dealers as our spot market data only cover the interdealer broker market. As every dealer purchase in this market is offset by a dealer sale, the mean and median realised spread for all dealers together must be zero. However, our spot market data indicate which party initiated a transaction and we calculate the realised spread from this trader's perspective. For comparability with the notes and bonds, Treasury bill quotes are converted into a comparable price basis for this and the other spread measures.[4]

We report two additional bid-ask spread measures for the spot market. One is the quoted spread, defined as the difference between the bid and the offer quotes. Our quotes, from the interdealer broker market, are not typically from a single dealer but are rather the best bid and the best offer quotes posted at any of the five brokers as provided by any of the participating dealers. To produce a proportional spread measure the spread is divided by the midpoint of the bid and offer quotes. For comparability with other measures, we calculate the mean spread for each day and then report statistics based on these daily means.

Our other spread measure is the effective spread. The effective spread measures the actual price paid as compared to the quoted price in the market, and is typically calculated to account for negotiated price improvement. While there is no price negotiation in the interdealer broker market, the effective spread may still differ from the quoted spread if trades are not executed independent of the quoted spread (e.g. if trades are conducted when the spread tends to be narrower). We calculate the effective spread as the difference between the buy price and the offer price for purchases and the difference between the sell price and the bid price for sales.[5] As with the quoted spread, the effective spread is divided by the midpoint of the bid and offer quotes to produce a proportional spread measure. We calculate the mean spread for each day combining the differences for the buys and sells and then report statistics based on these daily means.

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[3] In cases where a floor trader is active on only one side of the market we assume that the floor trader's end-of-day inventory is marked-to-market at the closing or settlement price.

[4] Treasury bill prices are converted into a comparable price assuming a fixed maturity of 90, 180, and 360 days for the on-the-run 13-week, 26-week, and 52-week bills, respectively.

[5] Large trades in the interdealer broker market are often "worked" such that the trade size is negotiated between dealers beyond the quantity initially offered. This results in a several second lag between the time a trade is initiated and the time the total volume of a trade is reported. As we get our trade price information from the same line as total trade size, our price information is often delayed by several seconds. In calculating the effective spread, we use the second to last set of quotes before the trade occurred instead of the last set of quotes to account for the fact that quotes may be updated before all of the trade information is transmitted. Nevertheless, this trade price/quote asynchrony may still result in effective spread measures which are somewhat biased down.

B. Bid-ask spreads in the spot market

Bid-ask spreads in the U.S. Treasury spot market are not constrained by regulation to defined minimum tick sizes. Treasury notes and bonds are quoted and traded in 32nds of a point, where one point equals one percent of par, but the 32nds are frequently split into halves and quarters, and occasionally into eighths, allowing price delineation to 1/256th of a point. Treasury bills are quoted on a discount basis in decimal terms with the basis points split into halves and quarters allowing price delineation to 1/400th of a percent.

Table 5 reports our three bid-ask spread measures for each of the on-the-run securities for the spot market. The quoted spread increases nearly monotonically with security maturity. Median spreads on Treasury bills range from 0.1 hundredths of 1% for the 13-week bill to 0.5 hundredths of 1% for the 52-week bill. Under bill quoting conventions, such spreads are roughly equal to one half of one basis point for each of the bills. Median Treasury note and bond spreads range from 0.9 hundredths of 1% for the 2-year note to 4.9 hundredths of 1% for the 30-year bond. Under note and bond quoting conventions, such spreads are roughly equal to 1/128th of a point and 3/64ths of a point, respectively. The only exception to the rule of the quoted spread increasing with maturity is the 7-year note, for which issuance ceased in 1993.

Median effective spreads are less than quoted spreads for every security and median realised spreads are less than effective spreads for every security except one (the 5-year note). As with the quoted spreads, effective and realised spreads increase nearly monotonically with security maturity. Median effective spreads range from 0.02 hundredths of a percent for the 13-week bill to 2.7 hundredths of a percent for the 30-year bond. Median realised spreads for the 13-week bill are actually slightly negative, at –0.03 hundredths of a percent, while 30-year bond spreads are 1.9 hundredths of a percent.

C. Realised spreads in the futures markets

Table 6 reports the distribution of spreads for the futures markets. Panel A reports spreads for trades on floor traders' own accounts. For both nearby and distant contracts, the magnitude of the spreads is small for all contracts. The minimum price change, or tick, mandated by the exchange is US$12.50 for the 13-week bill, US$15.625 for the 2-year contract and US$31.25 for the remaining contracts. In all cases, the median (and mean) spread is less than the minimum tick, with the sole exception of the distant contracts for the 30-year bond, where the mean spread is slightly larger than the minimum tick.

For the nearby contracts, the median spreads are very similar for all maturities, except for the 13-week bill, ranging from US$3.42 to US$3.69. The median spread for the 13-week bill, at $7.56, is more than double that of the other maturities. Not surprisingly, the median spreads are generally higher for the distant contracts. The exception is the 13-week bill, where the distant expirations are fairly active (see Table 4). The median spread for the distant expirations of the 2-year note is also small, but the mean spread is much higher. Consistent with the patterns observed for trading activity, the more active the nearby contract, the larger the increase in mean and median spreads for the distant contracts, relative to the nearby contract. For example, the 10-year note and 30-year bonds have the most active nearby contracts and the highest increase in spreads for the distant contracts.

The proportional spreads (the realised spread divided by the average transactions price for the day) generally follow a pattern similar to the realised spreads. For the nearby contracts, the median proportional spread is lowest for the 2-year note. They are higher for the distant expirations, with the size of the increase being greatest for the 10-year note and the 30-year bond.

Panel B of Table 6 reports spreads on customer trades. As explained in section A, we expect customer spreads to be larger in magnitude than dealer spreads, because of the high proportion of interdealer trading. This is the case for median spreads for ***all*** maturities, with the sole exception of the 13-week bill.

Unlike dealer spreads, median customer spreads are not similar for the various maturities, but are the highest for the 2-year note and the 30-year bond. Similar to dealer spreads, mean and median spreads

increase sharply for the distant expirations in the 10-year note and the 30-year bond. It is worth noting again that the above comparisons change if we compute dealer spreads on a floor trader basis.

D. Bid-ask spread comparison

The median proportional realised spreads are uniformly lower in the futures markets than in the spot market, with the exception of the 13-week bill. However, it cannot necessarily be inferred at this point that trading costs are lower in the futures markets than the spot market. Trade size, for example, was shown to be higher in the spot market and is not controlled for in this comparison.

5. Conclusion

In this paper we compute the liquidity costs of the spot and futures markets over a common period for various types of Treasury instruments. We compare the following liquidity measures for the U.S. Treasury spot and futures markets: trading volume, number of trades, trade size, number of dealers/floor traders, and various measures of the bid-ask spread (quoted, effective, and realised).

For both spot and futures markets, trading is concentrated in the nearby expiration/on-the-run instrument. The spot market appears to be more active for the shorter maturity contracts, while the futures market is more active for longer maturity contracts. Also, the concentration of activity is more prominent in the futures markets since liquidity appears to be even more concentrated in the nearby contract, as compared to the spot markets.

For the futures market, the median realised bid-ask spread is higher for customer trades than dealer trades, consistent with the predominance of inter-dealer trading in this market. Only realised bid-ask spreads are comparable between the spot and futures markets, since our futures data do not contain dealer quotes. The median values of the realised spreads are uniformly lower in the futures markets, with the exception of the 13-week bill. These results do not mean that liquidity costs in the futures markets is lower than in the spot markets, since we have not controlled for differences in the two markets, such as trade size and volatility. More formal tests are needed before we can draw conclusions about the relative liquidity costs in the two markets.

Table 1

Daily trading volume in the U.S. Treasury spot market by sector

Sector	On-the-run[1]	Off-the-run	When-issued[2]
Cash-management bill	1,608 (1,460)	n.a.	582 (579)
13-week bill	2,040 (1,104)	3,588 (1,776)	1,090 (981)
26-week bill	1,777 (945)	1,554 (815)	1,319 (1,119)
52-week bill	2,935 (1,547)	884 (651)	3,083 (2,836)
2-year note	6,219 (2,658)	3,116 (1,249)	4,804 (4,062)
3-year note	3,302 (1,278)	704 (399)	4,327 (3,451)
4-year note	n.a.	112 (101)	n.a.
5-year note	8,682 (3,253)	2,261 (1,002)	4,418 (3,370)
7-year note	1,621 (817)	799 (374)	1,874 (1,704)
10-year note	5,444 (1,833)	1,091 (496)	1,701 (1,990)
20-year bond	n.a.	71 (93)	n.a.
30-year bond	1,677 (855)	169 (192)	561 (748)

[1] The on-the-run figures are estimated only for days in which the securities traded on-the-run. This is less than the full year for the cash-management bill and the 7-year note.

[2] The when-issued figures are estimated only for days in which the securities traded when-issued. This is less than the full year for every security.

Note*:* Means and standard deviations of daily interdealer trading volume in the U.S. Treasury spot market are reported by sector for 1993. Trading volume is reported in millions of U.S. dollars. Figures are estimated using data from GovPX, Inc.

Table 2

Daily number of trades and trade size in the U.S. Treasury spot market

Sector	Number of trades[1]	Trade size
Cash-management bill	42 (28)	36.38 (20.77)
13-week bill	69 (26)	28.75 (8.43)
26-week bill	70 (30)	24.95 (6.42)
52-week bill	144 (65)	19.83 (3.35)
2-year note	492 (178)	12.46 (1.81)
3-year note	377 (120)	8.63 (1.34)
5-year note	1,019 (321)	8.40 1.08
7-year note	339 (139)	4.69 (0.72)
10-year note	945 (266)	5.70 (0.68)
30-year bond	356 (168)	4.71 (0.78)

[1] The figures are estimated only for days in which the securities traded on-the-run. This is less than the full year for the cash-management bill and the 7-year note.

Note: Means and standard deviations of the mean daily number of trades and the mean daily trade size among interdealers are reported by sector for 1993 for the on-the-run issues. Trade size is reported in millions of U.S. dollars. Figures are estimated using data from GovPX, Inc.

Table 3

Daily trading volume in U.S. Treasury futures markets by sector

Sector	Nearby contract	Distant contracts
13-week bill	2,508 (1,429)	1,495 (1,157)
2-year note	329 (229)	91 (160)
5-year note	2,761 (1,162)	451 (686)
10-year note	5,745 (2,245)	801 (981)
30-year bond	29,647 (10,436)	1,747 (1,977)

Note*:* Means and standard deviations of daily trading volume in U.S. Treasury futures markets are reported by sector for 1993. Trading volume is reported in millions of U.S. dollars. Figures are estimated using data from DRI and Datastream.

Table 4

Daily number of trades, floor traders, and trade size in U.S. Treasury futures markets

Sector	Number of trades		Trade size (in million US$)		Number of floor traders	
	Nearby contract	Distant contracts	Nearby contract	Distant contract	Nearby contract	Distant contract
Panel A: Trades for floor traders' own account						
13-week bill	168 (87)	136 (84)	10.33 (3.86)	8.28 (3.48)	11 (3)	10 (2)
2-year note	89 (51)	16 (16)	10.82 (8.19)	11.89 (10.38)	12 (3)	5 (3)
5-year note	1,351 (461)	46 (64)	15.62 (2.70)	18.43 (10.38)	57 (9)	12 (10)
10-year note	3,155 (1,002)	146 (166)	13.71 (2.23)	13.03 (7.49)	100 (11)	25 (17)
30-year bond	30,085 (8,702)	692 (591)	9.63 (1.24)	6.13 (2.95)	502 (48)	41 (17)
Panel B: Trades for customers						
13-week bill	202 (108)	134 (93)	10.98 (3.93)	8.00 (3.75)	10 (3)	9 (3)
2-year note	70 (42)	14 (13)	17.90 (16.23)	18.25 (18.32)	5 (2)	3 (2)
5-year note	790 (282)	51 (65)	21.01 (3.41)	21.42 (14.27)	26 (4)	9 (7)
10-year note	1,619 (511)	89 (105)	18.12 (2.86)	16.66 (10.55)	46 (7)	14 (10)
30-year bond	9,774 (2,958)	424 (456)	16.46 (1.94)	7.98 (3.97)	217 (17)	24 (13)

Note*:* Means and standard deviations of the daily number of trades, the daily trade size and the number of floor traders in the Treasury securities are reported for 1993. Trade size is reported in millions of U.S. dollars. Futures data are from the Commodity Futures Trading Commission.

Table 5

Bid-ask spreads in the U.S. Treasury spot market

Sector	Statistic	Quoted spread	Effective spread	Realised spread
13-week bill	Median	0.10	0.02	–0.03
	mean	0.11	0.02	–0.02
	standard deviation	(0.04)	(0.03)	(0.14)
26-week bill	median	0.24	0.07	0.01
	mean	0.26	0.08	0.01
	standard deviation	(0.09)	(0.07)	(0.25)
52-week bill	median	0.53	0.26	0.11
	mean	0.57	0.28	0.18
	standard deviation	(0.16)	(0.12)	(0.48)
2-year note	median	0.88	0.44	0.41
	mean	0.92	0.46	0.47
	standard deviation	(0.21)	(0.16)	(0.88)
3-year note	median	1.50	0.80	0.23
	mean	1.55	0.83	0.23
	standard deviation	(0.34)	(0.23)	(1.41)
5-year note	median	1.56	1.00	1.03
	mean	1.59	1.01	1.14
	standard deviation	(0.27)	(0.20)	(1.54)
7-year note	median	3.42	2.06	0.63
	mean	3.51	2.10	0.83
	standard deviation	(0.69)	(0.44)	(3.30)
10-year note	median	2.66	1.67	1.43
	mean	2.69	1.68	1.51
	standard deviation	(0.44)	(0.29)	(2.45)
30-year bond	median	4.89	2.73	1.89
	mean	5.03	2.93	2.07
	standard deviation	(1.03)	(0.87)	(6.69)

Note*:* Medians, means, and standard deviations of mean daily bid-ask spreads are reported by sector for 1993 for the on-the-run issues. Quoted and effective bid-ask spreads are measured in proportion to the bid-ask midpoint and realised spreads are measured in proportion to the mean of the volume-weighted buy and sell prices. All spreads are reported in hundredths of one percent. Data are from GovPX, Inc.

Table 6

Bid-ask spreads for U.S. Treasury futures markets

Sector	Realised spread (in dollars)		Proportional realised spread (in hundredths of per cent)	
	Nearby contract	Distant contracts	Nearby contract	Distant contracts
Panel A: Spreads for trades on floor traders' own account				
13-week bill				
median	–7.56	–7.70	–0.31	–0.32
mean	–9.20	–8.91	–0.38	–0.37
standard deviation	12.52	13.22	0.52	0.55
observations	253	253	253	53
2-year note				
median	–3.42	–3.65	0.16	–0.17
mean	–2.69	–8.70	–0.13	–0.41
standard deviation	(35.78)	(90.64)	(1.68)	(4.26)
observations	253	121	253	121
5-year note				
median	–3.66	–11.81	–0.33	–1.07
mean	–3.84	–14.92	–0.35	–1.35
standard deviation	(10.28)	(86.32)	(0.92)	(7.81)
observations	253	206	253	206
10-year note				
median	–3.61	–8.58	0.28	–0.76
mean	–3.10	–14.85	0.27	–1.36
standard deviation	(8.48)	(94.20)	(0.75)	(8.49)
observations	253	243	253	243
30-year bond				
median	–3.69	–24.41	–0.33	–2.21
mean	–3.77	–32.08	–0.33	–2.81
standard deviation	(157.64)	(92.87)	(0.31)	(8.09)
observations	253	253	253	253

Table 6 (contd.)

Bid-ask spreads for U.S. Treasury futures markets

Sector	Realised spread (in dollars)		Proportional realised spread (in hundredths of per cent)	
	Nearby contract	Distant contracts	Nearby contract	Distant contracts
Panel B: Spreads for customer trades				
13-week bill				
median	6.23	7.88	0.30	0.30
mean	7.85	9.90	0.30	0.40
standard deviation	12.92	16.85	0.53	0.70
observations	253	253	253	253
2-year note				
median	8.90	4.18	0.40	0.20
mean	9.10	8.48	0.40	0.40
standard deviation	(37.63)	(81.66)	(1.77)	(3.83)
observations	253	116	253	116
5-year note				
median	5.80	8.77	0.50	0.80
mean	6.86	21.54	0.60	2.00
standard deviation	(15.32)	(84.85)	(1.38)	(7.68)
observations	253	210	253	210
10-year note				
median	7.03	14.63	0.60	0.13
mean	7.81	19.18	0.70	0.17
standard deviation	(18.83)	(117.20)	(1.67)	(10.48)
observations	253	246	253	246
30-year bond				
median	11.96	31.08	1.10	2.80
mean	12.59	39.95	1.10	3.50
standard deviation	(11.01)	(129.34)	(0.97)	(11.35)
observations	53	253	253	253

Note: Medians, means, and standard deviations of daily realised bid-ask spreads (in dollars) and proportional realised spreads (in hundredths of one percent) in the Treasury futures are reported for 1993. The daily realised spread is the difference between the volume-weighted average buy price and the volume-weighted average sale price for the day. The daily proportional realised bid-ask spread is measured as the ratio of the realised bid-ask spread to the volume-weighted average transactions price for the day.

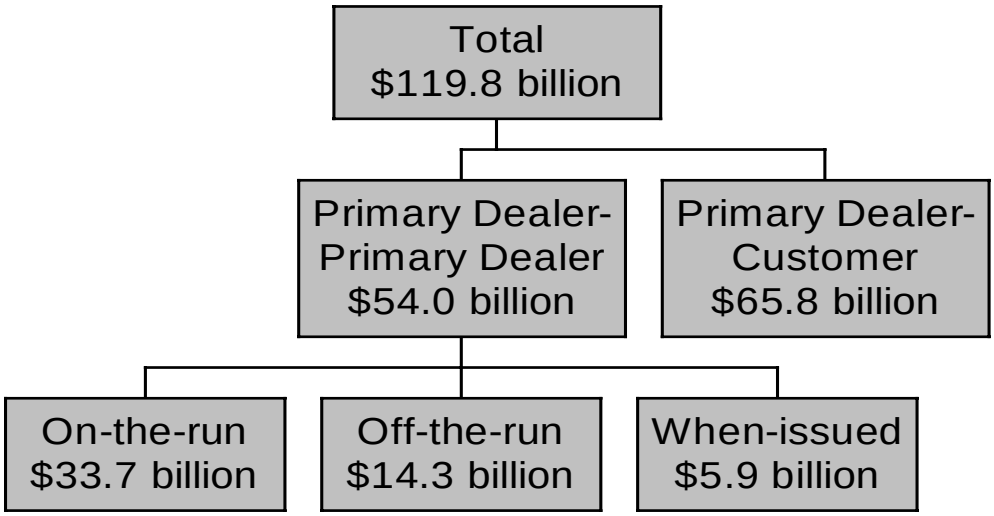

Figure 1. **Daily Trading Volume in U.S. Treasury Spot Market, 1993**
The exhibit shows the mean daily volume of secondary trading in the U.S. Treasury spot market for 1993. Figures are calculated using data from the Federal Reserve Bulletin and GovPX, Inc. and are reported on a one-way basis (i.e., each trade is counted only once).

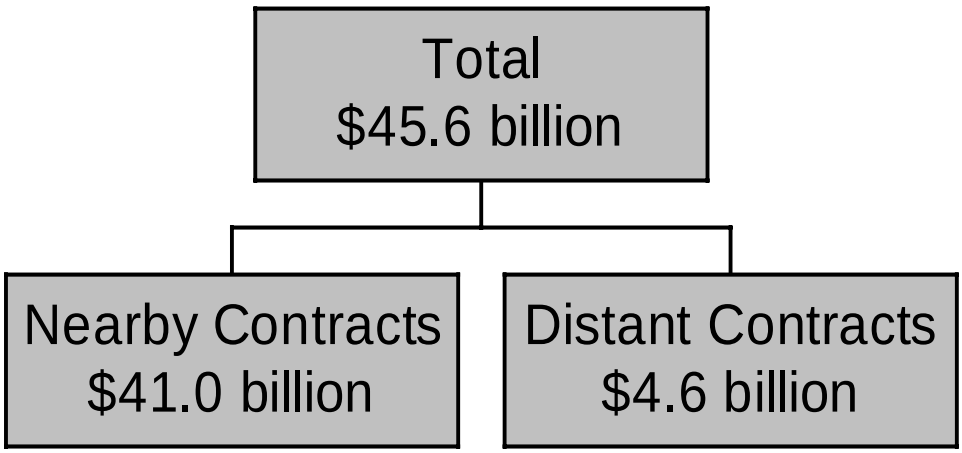

Figure 2. **Daily Trading Volume in U.S. Treasury Futures Markets, 1993**
The exhibit shows the mean daily volume of trading in U.S. Treasury futures markets for 1993. Figures are calculated using data from DRI and Datastream and are reported on a one-way basis (i.e., each trade is counted only once).