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The on-the-run *liquidity* phenomenon ☆

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ABSTRACT

We test the implications of a model of multi-asset speculative trading in which *liquidity* differentials between on-the-run and off-the-run U.S. Treasury bonds ensue from endowment shocks in the presence of two realistic market frictions—information heterogeneity and imperfect competition among informed traders—and a public signal. Our evidence suggests that (i) off/on-the-run liquidity differentials are economically and statistically significant, even after controlling for several of the bonds' intrinsic characteristics (such as duration, convexity, repo rates, or term premiums), and (ii) off/on-the-run liquidity differentials are smaller immediately following bond auction dates, and larger when the uncertainty surrounding the ensuing auction allocations is high, when the dispersion of beliefs across informed traders is high, and when macroeconomic announcements are noisy, consistent with our model.

1. Introduction

The *on-the-run phenomenon* refers to the stylized fact that, in fixed income markets, securities with nearly identical cash flows trade at different yields and with different liquidity. In particular, most recently issued (i.e., *on-the-run*, *new*, or *benchmark*) government bonds of a certain maturity are generally more expensive and liquid than previously issued (i.e., *off-the-run* or *old*) bonds maturing on similar dates.

Ample evidence of this phenomenon has been reported both in the U.S. Treasury market (e.g., Amihud and Mendelson, 1991; Kamara, 1994; Furfine and Remolona, 2002; Krishnamurthy, 2002; Strebulaev, 2002; Fleming, 2003; Goldreich, Hanke and Nath, 2005) and in other countries (e.g., for Japan, Mason, 1987; Boudouck and Whitelaw, 1991, 1993). Accordingly, several explanations have also been provided by practitioners and academics. The most popular one attributes off/on-the-run yield differentials to liquidity—the extent to which an asset can be traded cheaply, quickly, and with limited price impact. The liquidity premium hypothesis of Amihud and Mendelson (1986) states that since investors value liquidity, more liquid securities should trade at a premium over otherwise similar, yet less liquid ones. Most existing literature concentrates on testing this prediction. Early studies find support for it (e.g., Amihud and Mendelson, 1991; Warga, 1992; Kamara, 1994). More recent research suggests that off/on-the-run yield differentials may be explained by such considerations as differing tax

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treatments (Strebulaev, 2002), specialness in the repo markets (i.e., the cost of shorting, as in Duffie, 1996; Krishnamurthy, 2002), search costs (Vayanos and Weill, 2008), or the value of future liquidity (Goldreich, Hanke and Nath, 2005).

In spite of this debate on the extent of off/on-the-run yield differentials and the relative importance of liquidity as an explanatory factor (the on-the-run *price* phenomenon), there is little or no disagreement in the literature that off/on-the-run liquidity differentials (the on-the-run *liquidity* phenomenon) are both economically and statistically significant (e.g., Amihud and Mendelson, 1991; Strebulaev, 2002). Nonetheless, we are aware of no theoretical and empirical study of the determinants of those liquidity differentials.[1] Performing such an analysis is the objective of this paper.[2] To that purpose, we develop a parsimonious model of multi-asset trading. The model—in the spirit of Kyle (1985), Foster and Viswanathan (1996), and Pasquariello and Vega (2007)—builds upon two realistic market frictions: information heterogeneity and imperfect competition among informed traders (henceforth, speculators). In this basic setting, speculators trade strategically based on their private signals. This leads uninformed market-makers (MMs) to worsen equilibrium market liquidity. More diverse information among speculators makes their trading activity more cautious and MMs more vulnerable to adverse selection. This leads to even lower equilibrium market liquidity. Pasquariello and Vega (2007) find strong empirical support for these implications of the model in the U.S. Treasury market.[3]

We use this setting to identify a novel mechanism explaining the on-the-run liquidity phenomenon. Specifically, we explore the role of government auctions in discriminating among two asset types of identical terminal payoff, off-the-run and on-the-run bonds, since by definition the latter are those most recently auctioned to sophisticated traders. In addition, the individual allocations these traders receive from the auction process are unknown to market participants. We capture these features of government bond markets by further assuming that each speculator receives an uninformative, privately observed endowment shock in the on-the-run asset and cares about the interim as well as the liquidation value of his portfolio. In this amended setting, we show that equilibrium market liquidity in the on-the-run asset is greater than in the off-the-run asset, the more so the greater the uncertainty about endowment shocks. Intuitively, speculators trade strategically in the on-the-run asset based not only on their private signals (as in the off-the-run asset) but also on their endowment shocks. The latter ameliorates adverse selection in on-the-run trading and induces the MMs to make the on-the-run market more liquid than the off-the-run market.

As interestingly, the resulting equilibrium off/on-the run liquidity differential is sensitive to the information environment in which trading takes place. In particular, we show that such differential is generally lower the more correlated speculators' private fundamental information is. More homogeneous private signals attenuate speculators' incentives to trade cautiously in both markets; yet they alleviate adverse selection the most where it is most severe (i.e., in the off-the-run market). Consistently, we also show that, ceteris paribus, the equilibrium off/on-the-run liquidity differential is decreased by the availability of public fundamental news—a trade-free source of information about assets' payoffs reducing the adverse selection risk for the MMs—the more so the greater is that signal's precision.

The contribution of the model is twofold. Other papers have studied the properties of a financial market in which strategic traders receive privately observable endowment shocks, most notably Vayanos (1999, 2001), and Bhattacharyya and Nanda (2008). Yet, to our knowledge, our model is the first to relate off/on-the-run liquidity differentials to auction-driven endowment shocks.[4] Furthermore, our model is the first to generate explicit and empirically testable implications on the impact of both the heterogeneity of private signals and the presence and quality of public signals on the nature of that relationship.

Our empirical results strongly support the main implications of our model. We start by providing additional evidence of the on-the-run liquidity phenomenon in the U.S. Treasury market.[5] We show that daily averages of intraday bid–ask spread differentials between the second most recently auctioned (i.e., *just* off-the-run) three-month, six-month, and one-year Treasury bills, and two-year, five-year, and 10-year Treasury notes and the corresponding on-the-run securities are positive, economically significant—averaging more than half of the corresponding mean off-the-run spread—and cannot be explained by differences in such fundamental characteristics of the underlying securities as modified duration, convexity, repo differentials, and term premiums. Our

[1] Amihud and Mendelson (1991) and Vayanos and Weill (2008) report anecdotal evidence that off-the-run bonds are in smaller effective supply, hence less liquid, because they become locked away in institutional investors' portfolios. Barclay, Hendershott and Kotz (2006) show that the market share of electronic trading platforms drops significantly when Treasury securities go off-the-run. Those platforms were not available during most of our sample period.

[2] A related literature studies price discrepancies among substantially identical securities or portfolios (e.g., Lee, Schleifer, and Thaler, 1990, 1991; Daves and Ehrhardt, 1993; Bodurtha, Kim, and Lee, 1995; Froot and Dabora, 1999; Grinblatt and Longstaff, 2000). Many of these papers use liquidity differentials to explain observed mispricings, yet none examines directly the determinants of those differentials.

[3] Consistently, Sadka and Scherbina (2007) find a positive relationship between analyst disagreement and both the permanent price impact of trades and the effective percentage bid–ask spread in the U.S. equity market.

[4] Nyborg and Strebulaev (2004) explore the strategic behavior of bidders with exogenous, pre-auction long/short endowment shocks in multiunit uniform and discriminatory auctions when short squeezing can occur in the secondary market. See also Nyborg and Strebulaev (2001).

[5] Amihud and Mendelson (1991) find that the difference between the relative bid–ask yield spread of U.S. Treasury notes and bills with matched maturities of less than six months is about 2.25%. Strebulaev (2002) finds similarly large absolute bid–ask yield spread differentials when comparing U.S. Treasury notes with different initial maturity but maturing on the same day.