



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.

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, Boudouck and Whitelaw, 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 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, Vayanos, 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 analysis suggests that these off/on-the-run liquidity differentials are affected by uncertainty about speculators’ endowments in the on-the-run securities, consistent with our model. In particular, we find that in the days immediately following Treasury “new bond” auction dates—when on-the-run endowment uncertainty is arguably the highest—off/on-the-run bid–ask spread differentials are smaller, often significantly so, even after controlling for relative duration, convexity, repo specialness, and supply effects. Accordingly, we also show that off/on-the-run liquidity differentials are positively related to the competitive yield range (high minus low divided by average auction bid yield), a more direct proxy for auction-driven endowment uncertainty.

Further investigation reveals that the magnitude and dynamics of those liquidity differentials are also crucially related to the informational role of trading in the U.S. Treasury market, again consistent with our model. In particular, we find that off/on-the-run spread differentials are positively related to perceived, marketwide uncertainty surrounding U.S. monetary policy—measured by Eurodollar implied volatility—and to the degree of information heterogeneity about U.S. macroeconomic fundamentals among market participants—measured by the standard deviation of professional forecasts of macroeconomic news releases (as in Pasquariello and Vega, 2007)—albeit more weakly so. Correspondingly, we show that the availability of macroeconomic news lowers off/on-the-run bid–ask spread differentials, the more so when those signals are less noisy and/or when speculators’ private information is more heterogeneous.

We proceed as follows. In Section 2, we construct a stylized model of trading to guide our empirical analysis. In Section 3, we describe the data. In Section 4, we present the empirical results. We conclude in Section 5.

Section snippets

A model of the on-the-run liquidity phenomenon

The objective of our study is to propose and test a novel explanation of the on-the-run liquidity phenomenon in the *secondary* U.S. Treasury bond market—one based on both endowment uncertainty from the *primary* market for government bonds and adverse selection from post-auction trading. The primary market is where the U.S. Treasury sells securities, in “astonishing” quantity (**\$3.42** trillion in calendar year 2003, according to Garbade and Ingber, 2005), to the public: retail and institutional...

Data description

We test the implications of the model presented in the previous section in a comprehensive sample of U.S. Treasury bond market transaction-level data and U.S. macroeconomic announcements....

Empirical analysis

The model of Section 2 generates several implications for the on-the-run liquidity phenomenon in bond markets that we now test in this section. To that purpose, we need to compute off/on-the-run liquidity differentials that are compatible with those in the model for each of the bills and notes in our sample. This is a challenging task. In the context of our model, and consistent with Kyle (1985), market liquidity for a traded asset i is defined as the marginal impact of an unexpected trade on...

Conclusions

The existence of a negative liquidity differential between on-the-run and off-the-run securities is a pervasive and not fully understood feature of both domestic and international fixed income markets. The main goal of this paper is to deepen our understanding of the links between this important aspect of the on-the-run phenomenon, news about fundamentals, and strategic trading conditional on investors' dispersion of beliefs and public signals' noise.

To that end, we develop a parsimonious model ...

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...Bond maturity is also an important factor to distinguish investor preference. Longer maturity bonds have wider spreads than shorter maturity bonds as shorter term benchmarks are more liquid (Pasquariello and Vega, 2009; O'Sullivan and Papavassiliou, 2020). O'Sullivan and Papavassiliou (2020) show that liquidity for the 30-year bond may improve during crisis periods whereas it deteriorates for bonds of shorter maturities showing that shorter maturity bonds are more vulnerable to liquidity squeezes due to lower selling pressure....

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