Funding liquidity, market liquidity and TED spread: A two-regime model

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ABSTRACT
We study the effect of market liquidity on equity-collateralized funding, accounting for endogeneity. Theory suggests market liquidity can affect funding liquidity in stabilizing and destabilizing manners. Using a new proxy for equity-collateralized funding liquidity of S&P 500 stocks over the period of July 2006–May 2011, we show that we can separate the two regimes using the yield spread of Eurodollars over T-bills (TED spread) and that a regime switch occurs near a TED spread of 48 basis points.

1. Introduction
Secondary markets are considered liquid if an investor can quickly execute a significant quantity at a price near fundamental value. Such market liquidity is of great importance: it allows investors to enter and exit trading positions, rebalance portfolios, and smooth consumption. For market makers and other traders to provide liquidity in secondary markets, however, they may need to raise capital from financiers in the primary market. This capital is often borrowed against collateral. We refer to the willingness of financiers to provide such loans as funding liquidity. Intuitively, when market makers and traders post more valuable securities as collateral, financiers are more willing to lend out funds. Thus the market value of the assets serving as collateral plays a pivotal role in the smooth functioning of capital markets. Moreover, these collateral values might well depend on their market prices, on the uncertainty of those prices (i.e. volatilities), and also on their market liquidities. Therefore, asset market liquidity affects funding liquidity and vice versa. This paper empirically studies the effect of asset market liquidity on financier behavior and shows how the level of credit risk in the interbank money market changes this effect.

Despite a longstanding interest in the determinants of market liquidity initiated by Stoll (1978), Amihud and Mendelson (1980), Kyle (1985), Glosten and Milgrom (1985), and others, the role of limited market-maker capital in asset market liquidity has been relatively uninvestigated. Even less is known about how asset market liquidity ultimately feeds back into the supply of funds. Recent theoretical work by Gromb and Vayanos (2002, 2010) and Brunnermeier and Pedersen (2009) suggests limits to arbitrage via linkages.
between collateral values and funding can lead to vicious cycles of decreasing funding and market liquidity. However, Gromb and Vayanos (2010) and Brunnermeier and Pedersen (2009) also predict virtuous cycles of mutually increasing funding and market liquidity. Unfortunately, data limitations have impeded efforts to confirm and explore these two regimes empirically.

Directly assessing the cost of equity-collateralized funding would require data from the equity repurchase ("repo") market. Unfortunately, such data are not readily available. To measure capital constraints in the secured lending market Mancini-Griﬀoli and Ranaldo (2011) draw on earlier work by Goffey et al. (2009) and Gorton and Metrick (2010) in using the spread between "Agency Mortgage Backed Securities" and "General Collateral" repo rates. Adrian et al. (2012) describe the institutional features of the secured lending market and the data challenges involved in monitoring lending conditions and systemic risk in repo and securitized lending markets.

In this paper, we introduce and test a new measure of funding liquidity, or rather funding illiquidity, in equity markets. We proxy for the aggregate funding illiquidity of S&P 500 stocks on a given day using a volume-weighted average of their stock loan rates. However, not all stock loan rates are informative about the cost of borrowing against equity collateral, i.e. the funding liquidity of equities. In particular, in the stock lending market, only those price movements that can be attributed to changes in the demand for shorting stock are informative about a stocks' collateral value and its funding liquidity. As shown by Cohen et al. (2007), an outward shift in the demand curve for shorting a stock leads to a significant negative abnormal return in the following month. This naturally implies that such an outward shift of the demand curve signals a stock is poorer quality or riskier collateral going forward, i.e. its funding liquidity decreased. Consequently, in order to construct the time series of the aggregate funding illiquidity of S&P 500 stocks as a weighted average of stock loan rates, we identify demand shifts in the stock lending market by using data on both prices and volumes of stock on loan using the procedure proposed by Cohen et al. (2007). This identification strategy allows us to cleanly eliminate changes in stock loan rates that are driven by supply shocks to lendable stocks, instead of demand shocks, and that are therefore uninformative about the funding illiquidity of equities. The ability to focus sharply on demand shifts in the stock lending market allows us to make powerful inference about the time series of equity-collateralized funding conditions, in spite the lack of publicly available data on the equity repo market.

In addition, we establish an instrumental variables identiﬁcation strategy that, for the ﬁrst time, allows us to capture the endogeneity between market liquidity and funding liquidity. While our objective is to estimate the effect of market liquidity on funding liquidity, a causal relationship operating in the opposite direction is likely also present. We rely on two natural instruments to isolate the exogenous variation in market liquidity: (i) a variable capturing the trend in average time between trades, allowing us to exploit the well-established correlation between trading activity and market liquidity as in George and Longstaff (1993), and (ii) the change in yields for short-term AAA-rated corporate bonds versus change in Treasury bill rates. The latter spread is typically used to capture liquidity-driven action within the bond market independent of credit-risk as in Chen et al. (2005) and Almeida and Philippon (2007). Moreover, as financiers’ desire to supply liquidity is typically a function of the collateral asset’s fundamental volatility and credit risk, we control for S&P 500 market volatility by adding the VIX as a control variable and for credit risk using the TED spread. To account for the possibility that funding liquidity could feed back into asset market volatility, we add lagged volatility and TED spread to serve as internal instruments as explored in with Bloom et al. (2007). We show these instruments have strong explanatory power for asset market liquidity, volatility and credit risk.

Finally, we put forward a two-regime estimation procedure to distinguish between the stabilizing and destabilizing financier behavior featured in the aforementioned theoretical literature. On the one hand, when a ﬁnancier believes a fall in market liquidity is temporary and could recover shortly, he might charge lower rates in response to decreased market liquidity of the stock collateral. This behavior has a stabilizing effect on market liquidity. On the other hand, ﬁnanciers may destabilize market liquidity by increasing rates in periods of reduced market liquidity, forcing traders to unwind positions at unfavorable prices in order to meet the higher interest payments on their loans. Our analysis is the ﬁrst to account for these two regimes. We distinguish between these two distinct regimes via Brunnermeier and Pedersen’s (2009) proposition that a ﬂight to quality, in the form of aggregate desire to move from investments of lower to higher credit quality, would be part of the spiral effect of a destabilizing reduction in market liquidity.

Episodes of ﬂight to quality are usually detected using credit spreads. As noted by Brunnermeier (2009), many market observers historically focused on the TED spread, deﬁned as the difference in yields between US Eurodollar deposits (effectively three-month USD LIBOR) and US Treasury bills. Thus, by construction, this spread captures the difference in yields between unsecured top-rated interbank and government “riskless” credits.1 In times of uncertainty, banks increase the interest rates on unsecured loans, driving up LIBOR. A ﬂight to quality would then manifest itself as a widening of the TED spread which, as per Brunnermeier and Pedersen (2009), would suggest a destabilizing spiral between the liquidity of the equity market and the liquidity of the margin loan market. That a ﬂight to quality is part of such a destabilizing spiral is crucial: it allows us to investigate the transition between stabilizing and destabilizing regimes based on the TED spread. We emphasize that our approach of using the TED spread as an explanatory variable for equity-collateralized funding liquidity is not inconsistent with recent articles such as Brunnermeier (2009) using the TED spread as a proxy for funding illiquidity. In fact, we predict a strong positive relationship between the TED spread and funding illiquidity through the credit risk and ﬂight-to-quality channels.

For the purpose of exposition, we first explore simpler estimation strategies which fail to account for the endogeneity of market illiquidity and/or fail to distinguish between different regimes. We point out where those speciﬁcations disagree with economic intuition or the data. We then explore a two-regime, two-stage least squares estimation where the threshold for the transition between stabilizing and destabilizing states is estimated by the methods of Hansen (2000) and Caner and Hansen (2004), facilitating statistical inference on the estimated threshold. Our results provide direct evidence of the existence of two liquidity regimes.

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1 These banks were once AAA-rated credits; however, that is no longer the case.
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