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An index-based measure of liquidity

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ABSTRACT

The liquidity shocks of '08–'09 revealed that measures of liquidity risk being used in most financial institutions turned out to be woefully inadequate. The construction of long-short portfolios based on liquidity proxies introduces errors such as extraneous risk factors and hedging error. We develop a new measure for liquidity risk using exchange-traded funds (ETFs) that attempts to minimize this error. We form a theoretically-supported measure that is long ETFs and short the underlying components of that ETF, i.e., long and short a similar set of underlying securities with the same weights. Pricing discrepancies between the long and short positions are driven by liquidity differences between the ETF and its underlying components. Constructing liquidity risk factors in a number of markets, we undertake several tests to validate our new liquidity metric. The results show that our illiquidity measure is strongly related to other measures of illiquidity, explains bond index returns, and reveals a systematic illiquidity component across fixed-income markets.

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1. Introduction

The two years beginning in August 2007 demonstrated to the world the enormous destructive effects that global financial shocks can have, not only on the financial markets and institutions but on the real economy. It has become widely acknowledged that a substantial part of these shocks were a series of liquidity events that occurred in a contagion-like manner in a number of financial markets, beginning with the credit markets, and had a substantial negative impact on the balance sheets of most financial institutions. As a result, many financial institutions during this period (including banks, insurance companies, hedge funds, endowments, and pension funds) discovered to their detriment just how sensitive their balance sheets were to liquidity risk.[2] While liquidity risk has become a topic of greater interest for academics and practitioners in the last few years, one of the most difficult aspects of this risk is its measurement—it is a latent risk factor and so it is not possible to directly observe it. Most measures of liquidity risk that have been developed are confounded by the fact that they mix liquidity risk with varying amounts of other risk factors, i.e., it is difficult to know whether one has really captured pure liquidity risk. As a result, even those investors who were utilizing measures of liquidity risk in their risk management processes prior to the financial crisis discovered that their measures did not adequately capture the true level of liquidity risk in their balance sheets.

In this paper, we develop a new measure of liquidity risk which attempts to isolate liquidity risk from all other risk factors. We do so by constructing a portfolio that is long and short an identical set of securities, weighted in an identical manner. One set of securities is constructed by investing in an exchange traded fund (ETF), while the other set of securities is constructed by investing in the exact same securities that are in the ETF, with the exact same portfolio weights. The difference between the prices of the two securities may be attributed to liquidity differences. We devote much of the paper to demonstrating that the measure we derive by this method does indeed capture liquidity. Subsequently with our liquidity measure, we also run tests to check for the pricing of liquidity risk as well as test the extent of the liquidity exposure that one class of financial institutions with purportedly high liquidity levels of liquidity exposure, hedge funds, have on their balance sheets.

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[2] One of the most widely used quotes during this time period was provided by the "sage of Omaha," Warren Buffet, who said "You only find out who is swimming naked when the tide goes out" (Chairman's Letter, 2001 Berkshire Hathaway Annual Report). One interpretation of this quote is that one can only tell how much and what types of risk a firm is really carrying in its balance sheet when the downside of that risk manifests itself. In hindsight, it appears that many financial institutions had substantial liquidity risk in their balance sheets and the crisis of '07–'09 caused the "tide to go out" and make it clear which ones had the largest quantities of this risk.

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1.1. Background

Liquidity is a fundamental need of all investors at some point in time. The need for liquidity can be equated to the need for immediacy in doing a transaction, whether buying or selling. Liquidity risk is essentially the risk that an investor may need transaction immediacy at a particularly convenient or inconvenient time in the markets, i.e., when the price of transaction immediacy is particularly low or high, respectively.

Not all investors face the same degree of liquidity risk. Investors with long-dated liabilities, for example, face less risk of suddenly needing transaction immediacy in the short-term. Investors like these, who face little risk of requiring sudden liquidity, should then be able to collect a premium for providing liquidity to those investors who do.

Many financial institutions utilize this concept and structure their balance sheets to essentially provide these liquidity services (and thereby bear liquidity risk) to other investors in return for a premium—a liquidity premium. Consider for example a convertible arbitrage hedge fund. Convertible arbitrage involves a hedging strategy of forming portfolios that are long corporate bonds and short equities in such a way as to be market neutral. While this long-short position may reduce market risk, this strategy in fact increases the proportion of liquidity risk in the portfolio and magnifies (with leverage) the quantity of liquidity risk. The liquidity risk in the strategy comes from the fact that corporate bonds are typically several orders of magnitude more illiquid than equities. Hence the long and short positions are mismatched on the dimension of liquidity risk. This liquidity mismatch in the portfolio gives rise to a long exposure to liquidity risk, which cannot be hedged. Therefore, convertible arbitrage funds – and in fact, virtually all funds with long-short positions where the long and short positions are not carefully matched on liquidity risk – end up bearing considerable liquidity risk in their portfolios.[3] If this liquidity risk is priced, i.e., if there is a liquidity premium, then at least a part of the performance of convertible arbitrage funds is due to compensation for bearing this liquidity risk in the portfolio.[4]

A convertible arbitrage hedge fund is merely an example. Virtually all financial institutions have assets and liabilities and run liquidity mismatches between these assets and liabilities, either intentionally or unintentionally (because it is virtually impossible to precisely asset-liability match on the liquidity risk dimension)—in either case, the mismatch results in a liquidity premium.[5]

The approach we take in this paper for measuring liquidity risk utilizes precisely this same concept of mismatching the liquidity of assets and liabilities. We measure the level of liquidity risk by the difference in price between two assets which are otherwise similar except for the level of liquidity of each asset. Essentially, we calculate the value of a long-short portfolio where the long and short positions are identical but their prices are not because the long position is more liquid than the short—in the theoretical development that follows, we will show how these positions may be interpreted as call and put options on trading immediacy. Our methodology is very general and applies to any market in which an exchange-traded fund (ETF) is traded.

1.2. Existing literature

The academic papers that have been written to measure and analyze liquidity risk have used this same concept of mismatching asset and liability liquidity risk to create net liquidity risk on a balance sheet. The difficulty with liquidity risk is that it is a latent risk factor—it cannot be directly observed. Therefore, existing papers have used characteristics about securities to essentially instrument for liquidity risk, and then created long-short portfolios where the long and short positions are mismatched on these characteristics. This, in turn, gives rise to a portfolio with liquidity risk whose return can therefore be viewed as a liquidity premium—essentially a liquidity index. The problem, of course, is that because liquidity risk is not observable, especially situations of high liquidity risk, one is never sure whether the characteristics being used as instruments are also instrumenting for other risk factors. If they are, then the resulting long-short portfolio is a mix of liquidity risk and other risk factors.

While liquidity risk has received considerable attention recently in the academic literature, owing primarily to financial market disruptions in late Summer 2007 caused by liquidity problems in the mortgage securitization market, there had already been a growing literature addressing this issue well before the recent market turbulence. Many papers have investigated the importance of liquidity for explaining returns, using data from the equity markets. Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Brennan et al. (1998), Datar et al. (1998) and Chordia et al. (2002) have all found positive relationships between stock returns and overall liquidity as measured by spreads, depth, and volume. However, Chordia et al. (2001) find a negative relationship between liquidity and expected returns, while Hasbrouck and Seppi (2001) find no relationship. Ben-David et al. (2014) examine the relationship of ETF introduction on the volatility of the underlying equity, and find that the existence of ETFs raises volatility appreciably, and raises regulator concern that this may damage liquidity in the ETFs as well, see also Trainor (2010). Runs on ETFs may damage financial system stability (Ramaswamy, 2011). Finally, Huberman and Halka (2001) and Pastor and Stambaugh (2003) examined the question of whether liquidity risk is systematic. Both papers find substantial systematic components in liquidity risk. More recent work, for example from Acharya and Pedersen (2005), Sadka (2006), Korajczyk and Sadka (2008), Li et al. (2007) and Das and Hanouna (2010), seem to find more positive results for the pricing of liquidity risk, though in many cases the pricing is small.

The mixed results on liquidity pricing in the equity markets is likely the result of performing liquidity tests in a market where liquidity is typically pervasive and therefore, an unimportant characteristic. In fact, next to the Treasury market, the US equity market is the most liquid in the world. Work done in markets where the effects of illiquidity are pronounced, seems to indicate that liquidity risk is in fact priced. For example, Chacko (2009), utilizing holdings data instead of trading data, analyzes the question of whether liquidity risk is priced in the US corporate bond market.[6] Using data for the corporate bond market (excluding convertible corporate bonds), he finds strong evidence for a systematic liquidity risk factor. Longstaff et al. (2005), Ericsson and Renault (2006) and Chen et al. (2007) try to relate corporate bond liquidity to yield spreads as a way of ascertaining the pricing of liquidity risk—and all find some evidence that liquidity risk is priced.[7]

[3] Aragon (2007) studies hedge funds from the perspective of liquidity service provision.

[4] It is also interesting to note that any performance evaluation tests that fail to account for this liquidity risk/premium will mistakenly attribute the compensation for this liquidity risk as alpha.

[5] One effect of the prevalence of liquidity risk on the balance sheets of financial institutions and the interconnections of these institutions (the liabilities of many financial institutions are the assets of other financial institutions) is the widespread transmission of liquidity shocks around the world—such as the one we just experienced from mid-2007 thru 2009.

[6] See Goodhart and O'Hara (1997) and Edwards et al. (2007).

[7] Elton et al. (2001) and Huang and Huang (2003) on the other hand find evidence that the tax effects play a greater role than liquidity, while Campbell and Taksler (2003) find equity volatility to be more important than liquidity. Das and Hanouna (2009) find that equity liquidity is important even in explaining credit default swap spreads.

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