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A new method for estimating liquidity risk: Insights from a liquidity-adjusted CAPM framework

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ABSTRACT

This paper proposes a new non-parametric method for estimating model-free, time-varying liquidity betas which builds on realized covariance and volatility theory. Working under a liquidity-adjusted CAPM framework we provide evidence that liquidity risk is a factor priced in the Greek stock market, mainly arising from the covariation of individual liquidity with local market liquidity, however, the level of liquidity seems to be an irrelevant variable in asset pricing. Our findings provide support to the notion that liquidity shocks transmitted across securities can cause market-wide effects and can have important implications for portfolio diversification strategies.

1. Introduction

Liquidity is important since its level and variability have implications for portfolio diversification strategies and investment performance. Asset prices are not only affected by systematic risk, as measured by the standard market beta, but also by liquidity risk. Liquidity risk can be defined as the type of risk associated with the inability to buy or sell assets at the market price at the desired time. Liquidity affects asset returns as a characteristic (Amihud and Mendelson, 1986; Brennan and Subrahmanyam,

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1996; Amihud, 2002) or as a risk factor (Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005; Martinez et al., 2005; Sadka, 2006; Liu, 2006; Watanabe and Watanabe, 2008). Therefore, liquidity appears to be a proper candidate for a priced state variable.

The studies by Acharya and Pedersen (2005) and Pastor and Stambaugh (2003) suggest that liquidity risk is a factor priced in the market. Besides the evidence from the US market, insights about the importance of liquidity as a risk factor in other developed markets are limited (Liang and Wei, 2012; Lee, 2011). Also, research on emerging markets where liquidity effects may be particularly strong, is almost absent (notable examples are the studies by Bekaert et al., 2007 who analyze daily and monthly data on 19 emerging equity markets, and Rouwenhorst, 1999 who studies the cross-sectional relation between asset returns and liquidity measured by turnover in 20 emerging markets). With the exception of Acharya and Pedersen's (2005) seminal study and Lee's (2011) more recent work, the vast majority of previous studies do not deal with multiple forms of liquidity risk and their effect on asset prices.

The aim of the present study is twofold. In particular, as a first step, a new method for estimating model-free liquidity betas from a recent and detailed high-frequency data set is proposed which builds on realized covariance and volatility theory. The main difficulty in testing the risk-return relation is that both the conditional expected return and the conditional variance of the market are not directly observable. To deal with this problem, many studies rely on parametric and semi-parametric procedures (ARCH or stochastic volatility models) to model the conditional mean and variance. In the present study the *ex post* return variability is measured by using a non-parametric estimator, namely quadratic variation or integrated variance, that is unbiased for the conditional variance and also unaffected by any specific assumptions about the stochastic process generating returns. The integrated variance is latent, but it can be estimated in a consistent manner using the realized variance.

Using this non-parametric approach, the measurement error that arises as a result of employing a proxy for the latent conditional variance in estimating the risk-return relation is mitigated, thanks to the use of high-frequency data.[2] Since liquidity betas are estimated as a time-varying process without any specific assumptions about the dynamics of their determination, their temporal dimension allows to assess how sensitivity to liquidity risk varies over time. Therefore, within this setting the estimation of liquidity betas becomes more efficient compared to standard methods utilizing liquidity measures derived from lower frequency data sets, as in Acharya and Pedersen (2005).[3] Also, the estimation of conditional liquidity betas is more realistic than their unconditional version estimated by Acharya and Pedersen (2005), who assume that conditional covariances of innovations in liquidity and returns are constant.

Second, we analyze for the first time in the literature whether the Greek high-frequency stock returns are associated cross-sectionally with betas estimated relative to various liquidity risk factors. That is, we ask whether liquidity risk is priced and whether it can play a significant role in asset pricing. Along these lines, we also provide fresh evidence for the relationship between liquidity as a characteristic and asset returns. Both issues are still an open question, especially for small and less liquid markets with several unique features which often exhibit larger variations in their liquidity (Vaihekoski, 2009).[4]

[2] Even the use of high-frequency data can deviate from 100% efficiency. Andersen et al. (2005) comment: "The consistency of the realized volatility for the true (latent) integrated volatility relies on the assumption of an ever increasing number of finer sampled high-frequency returns which approach zero. However, in empirical applications market microstructure frictions impose a limit on the number of return observations per unit time interval that can be productively employed. Therefore, realized volatility is subject to a finite-sample measurement error vis-à-vis the integrated volatility".

[3] It is common knowledge in the literature that measures of liquidity calculated from daily data are more coarse and less accurate than liquidity measures derived from microstructure data (see Amihud, 2002).

[4] Smaller markets like Greece tend to have lower liquidity than larger markets. During capital market liberalizations and institutional reforms that promote competition, such as those that took place in the Greek capital market during the period 2003–2006, liquidity significantly increases and transaction costs decrease in the form of narrower spreads (Bollen et al., 2004). This is a unique feature of smaller and less liquid markets like Greece which exhibit large liquidity variations especially during periods of liberalization processes.