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Liquidity costs, idiosyncratic volatility and expected stock returns

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ABSTRACT

This paper considers liquidity as an explanation for the positive association between expected idiosyncratic volatility (IV) and expected stock returns. Liquidity costs may affect the stock returns, through bid-ask bounce and other microstructure-induced noise, which will affect the estimation of IV. We use a novel method (developed by Weaver, 1991) to eliminate microstructure influences from stock closing price-based returns and then estimate IV. We show that there is a premium for IV in value-weighted portfolios, but this premium is less strong after correcting returns for microstructure bias. We further show that this premium is driven by liquidity in the prior month after correcting returns for microstructure noise. The pricing results from equally-weighted portfolios indicate that IV does not predict returns either before or after controlling for liquidity costs. These findings are robust after controlling for common risk factors as well as analysing double-sorted portfolios based on IV and liquidity.

1. Introduction

The pricing ability of idiosyncratic volatility (IV) in asset returns has been at the centre of several studies in the recent asset pricing literature. Portfolio theory suggests that IV is diversified away. The capital asset pricing model (CAPM) predicts that only systematic market risk is priced because all investors hold the market portfolio in equilibrium and so IV is diversified away. However, in reality, investors do not fully diversify their portfolios.[1] There are theories that suggest IV should be priced if investors require compensation for bearing this undiversified risk. For example, Levy (1978) shows that given the assumption of under-diversification IV affects asset prices. Merton (1987) also provides theoretical evidence that there is a positive relation between IV and expected returns when investors do not fully diversify their portfolios.

The empirical results on the existence of the relationship between IV and the cross section of expected stock returns are not consistent either. There are two strands of empirical literature on the pricing of IV. The first strand is based on the *expected volatility* where a long time-series (of monthly return data) is employed to estimate IV (Brockman & Schutte, 2007; Chichernea, Ferguson, & Kassa, 2015; Chua, Goh, & Zhang, 2007; Fu, 2009; Malkiel & Xu, 2006; Spiegel & Wang, 2005; Tinic & West, 1986). These studies have reported a positive relationship between IV and expected returns. The second strand is based on the *realized volatility* estimated using a shorter time-series window (of daily return data) to estimate IV. The studies based on realised volatility have reported a negative (Ang, Hodrick, Xing, & Zhang, 2006, 2009 Cotter, O'Sullivan, & Rossi, 2015) or insignificant relationship between IV and expected returns (Bali & Cakici, 2008; Boyer, Mitton, & Vorkink, 2010).

Resolving this inconsistency on the role of IV in stock returns is important and has recently generated a rapidly growing literature. Bali and Cakici (2008) provide evidence that shows the *negative* association between expected returns and lagged IV of Ang et al. (2006, 2009) is driven by small firms. Huang, Liu, Rhee, and Zhang (2010) and Han and Lesmond (2011) demonstrate that this negative relationship is driven by return reversals and liquidity. Huang et al. (2010) further show that the *positive* relation between expected IV and returns is robust after controlling for return reversals. Cotter et al. (2015) find that idiosyncratic volatility is significantly negatively priced in stock returns only in down-markets.

We contribute to this developing literature by providing further evidence to resolve the apparent inconsistency in the association of IV and expected returns. In the spirit of Han and Lesmond (2011) we concentrate on the measurement of IV and show that liquidity costs can explain the positive relationship between expected IV and expected returns reported in several papers.

Spiegel and Wang (2005) investigate the negative correlation between liquidity and IV, and examine whether one variable might be responsible for the premium documented for the other. They show

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[1] For several reasons investors may not hold perfectly diversified portfolios. Goetzmann and Kumar (2008) show that, based on a sample of more than 62,000 household investors in the period of 1991–1996, more than 25% of the investor portfolios contain only one stock, over half of the investor portfolios contain no more than three stocks, and less than 10% of the investor portfolios contain more than 10 stocks.

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that while there is a premium for each of them, the effect of IV is much stronger and that IV dominates liquidity in explaining the variation of cross-sectional average returns. This result is in line with the work of Constantinides (1986) who shows that the effect of liquidity costs may be confounded with that of risk.

Liquidity explanations for the documented IV premium have been considered and rejected in several studies (Ang et al., 2006, 2009; Chua et al., 2007; Fu, 2009; Huang et al., 2010). In all these studies, a liquidity variable has been included in the cross-sectional tests or has been used in double-sorted portfolios to account for the liquidity effect.

In this paper, we take into account liquidity costs and re-examine the existence and significance of the relationship between expected IV and expected returns. We focus on the estimation of IV before investigating liquidity level as a possible explanation for the volatility premium documented in the literature. Han and Lesmond (2011) theoretically show that the bid-ask microstructure effect on asset returns yields an inflated estimate of IV. We use a new method to eliminate the microstructure effects of bid-ask bounce and other transient errors in closing price-based returns before estimating expected IV.[2] Then we examine directly if liquidity affects the pricing ability of IV in asset pricing tests.

Fisher (1966), Blume and Stambaugh (1983) and Black (1986) show that observed stock prices can be regarded as the sum of unobservable efficient prices and noise attributable to microstructure effects. Blume and Stambaugh (1983) extend the work of Fisher (1966) and show that due to Jenson's inequality microstructure noise induces upward bias in observed stock returns. The microstructure-induced noise in returns increases the variation of returns (Asparouhova, Bessembinder, & Kalcheva, 2010) which results in an inflated IV estimate. Therefore, ranking stocks and constructing testing portfolios based on biased return estimates might be misleading. Since the microstructure-induced bias is cumulative (Fisher, Weaver, & Webb, 2010), it can potentially affect portfolio returns and, hence, their relative performance. Moreover, as Asparouhova et al. (2010) point out, the upward bias in returns in the standard regression-based tests in asset pricing induces noisy slope estimates and inflated premia for explanatory variables that are cross-sectionally correlated with the amount of noise in prices. Since there is a non-zero correlation between biased returns and empirical estimates of volatility, we anticipate that the noise associated with microstructure influences might be the reason for the premium reported for IV in the recent literature.

We use a methodological correction developed by Weaver (1991) and implemented by Fisher et al. (2010) to correct the returns that are used to estimate IV and to compute the average returns of test portfolios. Then, using the corrected returns, we examine if liquidity can explain the premium attributed to IV.

Fisher et al.'s (2010) method applies to equally-weighted portfolios and asymptotically eliminates all random transient errors in portfolio returns. Based on this method, dividing a current two-period average portfolio gross return (one plus the observed return) by prior one-period average portfolio gross return results in an unbiased estimate of the current true one-period gross return. The bias is removed because the average bias in observed returns is attributable to pricing errors at the beginning of the holding period (e.g., Blume & Stambaugh, 1983). In this method, the returns in the denominator and numerator include the beginning of the period, therefore the bias will cancel out, leaving asymptotically unbiased estimates of true arithmetic returns.

We follow Malkiel and Xu (2006) and estimate individual stock expected IV using the portfolio membership approach suggested by Fama and French (1992) to estimate betas. In particular, we construct equally-weighted rebalanced portfolios, and estimate idiosyncratic volatilities for the portfolios based on the Fama–French three-factor model before and after correcting the underlying returns for microstructure influences. Then, we assign the portfolio volatility estimates to each of the constituent stocks for every month and test the pricing ability of IV using value-weighted and equally-weighted portfolios.

The pricing results of the value-weighted portfolios, before controlling directly for the liquidity level, show that there is a premium for IV before and after correcting returns for microstructure noise. However, this premium is less prevalent, and the positive association between IV and returns is attenuated after correcting for microstructure bias in estimation of IV. The positive association between expected IV and returns are consistent with several prior studies (Brockman & Schutte, 2007; Chua et al., 2007; Fu, 2009; Huang et al., 2010; Malkiel & Xu, 2006; Tinic & West, 1986) that report a positive premium for IV in value-weighted portfolios.

We further show that this premium is driven by illiquidity in the prior month after correcting returns for microstructure noise. The significant alpha for the zero-investment portfolio with respect to the Carhart (1997) four-factor and Fama and French (1993) three-factors disappears when we include the illiquidity level at the time of portfolio construction in the time series regression. The slope for the illiquidity level is positive and statistically significant at conventional levels, a result which is consistent with the positive premium for illiquidity documented in the literature. This finding holds when we control for the illiquidity level by double-sorting stocks based on illiquidity and IV.

This finding is consistent with that of Han and Lesmond (2011) who use quote midpoint-based returns, which may reflect true returns, instead of closing price-based returns to estimate IV and test its pricing ability. They demonstrate that the negative relation between expected returns and realised IV of Ang et al. (2006, 2009) is driven by liquidity. Their results indicate that although the pricing ability of IV is stronger when IV is estimated using closing returns, it is still significant when quote midpoint returns are used. However, quote midpoint returns are not a good proxy for true returns since liquidity providers set quote prices in a way that moves the midpoints from the true value of the asset in order to be compensated for liquidity costs risks (Ho & Stoll, 1980). We use closing price-based returns, rather than proxies for true returns, to explain positive association between expected IV and returns.

We also examine the pricing ability of IV in equally-weighted portfolios and find that IV cannot predict returns, regardless of the liquidity effect, before or after correcting for microstructure noise. This is consistent with Bali and Cakici (2008) and Huang et al. (2010) who find that IV does not have pricing power on equally-weighted portfolios. However, our correction for bid-ask bounce and other microstructure noise attenuates the magnitude of the statistically insignificant premium for IV in equally-weighted returns.

While our paper falls into the part of the literature that tries to explain the inconsistent results for the IV premium, it is different from studies that provide explanations for a negative association between returns and realised IV. We contribute to the literature in several ways. First, our results confirm that liquidity costs can explain the positive association between expected returns and expected IV documented in the literature for value-weighted portfolios. Second, we employ a novel method to correct closing price-based returns for bid-ask bounce and other microstructure-induced noise which make it possible to utilise closing price-based returns to estimate IV and conduct asset pricing tests. Third, our study provides an alternative way to control for liquidity costs in empirical studies; correcting the returns for bid-ask bounce before estimating any variable measured based on returns. This is particularly important in studies that use IV as a control variable in their empirical tests. Fourth, we confirm results of earlier studies that there is no premium for IV in equally-weighted portfolios and that the weighting scheme impacts the pricing ability of IV. Fifth, our finding that there is no premium for IV in equally-weighted portfolios as well as value-weighted portfolios, after controlling for liquidity

[2] As Asparouhova et al. (2010) point out the bias due to microstructure noise is relevant to both monthly and higher frequency (e.g. daily) data because the absolute bias is independent of the return measurement interval.

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