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Transaction costs, liquidity risk, and the CCAPM ☆

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ABSTRACT

In this paper, we make a liquidity adjustment to the consumption-based capital asset pricing model (CCAPM) and show that the liquidity-adjusted CCAPM is a generalized model of Acharya and Pedersen (2005). Using different proxies for transaction costs such as the effective trading costs measure of Hasbrouck (2009) and the bid-ask spread estimates of Corwin and Schultz (2012), we find that the liquidity-adjusted CCAPM explains a larger fraction of the cross-sectional return variations.

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1. Introduction

Recent studies in asset pricing suggest that liquidity plays an important role in investors' consumption and investment decisions.[1] Following these leads, we extend the traditional CCAPM (Rubinstein, 1976; Lucas, 1978; Breeden, 1979) by incorporating the liquidity effect, in the spirit of Acharya and Pedersen (2005). We show that expected stock return is determined by both consumption risk and liquidity risk with the latter being defined as the covariance between transaction costs and consumption growth. The liquidity-adjusted CCAPM, contingent on the transaction costs proxies and test portfolios, adds up to 79% additional explanatory power to the cross-sectional variation of expected returns.

Specifically, using different proxies for transaction costs such as the effective trading costs of Hasbrouck (2009) and the high-low-price-based bid-ask spread estimates of Corwin and Schultz (2012), we show that our liquidity-adjusted CCAPM provides a better fit for the cross-sectional expected returns across various liquidity-based portfolios, while the traditional CCAPM fails to capture the liquidity effect.[2] Our model also accounts for a larger fraction of the variations in expected returns across size and book-to-market portfolios than the CCAPM. Lewellen et al. (2010) demonstrate that it is necessary for asset pricing tests to include other sets of portfolios (e.g., industry portfolios) to break down the strong factor structure of size and book-to-market portfolios. We show that the liquidity-adjusted CCAPM is robust to the inclusion of industry portfolios.

Recent studies also highlight the importance of the ultimate or long-run consumption risk (Parker and Julliard, 2005), durable consumption (Yogo, 2006), and the fourth-quarter consumption

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[1] For instance, Parker and Julliard (2005) suggest that concerns of liquidity are perhaps imperative components neglected by consumption risk alone. Liu (2010) argues that liquidity risk originates from consumption and solvency constraints with latter being also demonstrated by Chien and Lustig (2010) and Pastor and Stambaugh (2003). Næs et al. (2011) find that stock market liquidity can predict consumption growth. Lynch and Tan (2011) show that transaction costs can generate a first-order effect when they add return predictability, wealth shocks, and state-dependent costs to the traditional consuming and investing problems. Further, Lagos (2010) develops a model with search frictions and shows the importance of the liquidity premium in explaining the equity premium puzzle.

[2] Acharya and Pedersen (2005) show that the CAPM (Sharpe, 1964; Lintner, 1965) fails to capture liquidity costs and liquidity risks. Liu (2006) and Liu (2010) find that both the CAPM and the Fama-French (1993) three-factor model have difficulty in capturing the liquidity effect. A few recent studies examine the explanatory power of the traditional CCAPM to the variation of expected return across portfolios sorted by different liquidity proxies. For instance, Kang and Li (2011) use the long-run consumption risk framework of Hansen et al. (2008) to explain liquidity premium.

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(Jagannathan and Wang, 2007) in explaining the variations of expected returns. We show that applying the long-run, total (durable and nondurable), and fourth-to-fourth quarter consumption growth measures to our liquidity-adjusted model explains a larger fraction of the variation in cross-sectional expected returns than the CCAPM.

Lettau and Ludvigson (2001) and Petkova and Zhang (2005) show that value stocks have higher risk exposure than growth stocks in bad times. We find that the patterns of estimated liquidity betas conditional on the economic states provide a liquidity-risk based explanation for the countercyclical value premium. Specifically, we show that value stocks have higher liquidity risk in bad times than in good times, while growth stocks have lower liquidity risk in good times than in bad times.

Overall, our results suggest that investors do care about the sensitivity of transaction costs to the aggregate consumption growth, and hence demand high return for securities with high exposure to liquidity risk. By tying transaction costs with consumption growth, we provide new evidence to the recent literature that highlights the importance of liquidity risk in asset pricing (e.g., Chordia et al., 2000; Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005; Liu, 2006; Sadka, 2006; Bekaert et al., 2007). While these studies appear to make liquidity adjustment to the CAPM or the Fama–French three-factor model and show that models with this adjustment improve the models' fit, the focus of our paper is on the liquidity adjustment to the consumption-based pricing models, an area that has attracted little attention in the literature.

While transaction costs are not taken into account by the traditional CCAPM, they are the subject currently generating much research interests. Amihud and Mendelson (1986) introduce liquidity costs into the present value of stocks and show that liquidity costs are positively related to expected returns. Jacoby et al. (2000) develop a static liquidity-adjusted CAPM using net returns (i.e., returns after bid-ask spread adjustment) and show that market risk and liquidity are related. Lo et al. (2004), using an equilibrium model with heterogeneous agents, show that transaction costs can significantly affect asset prices. Acharya and Pedersen (2005) study how investors maximize expected utility with time-varying liquidity costs and show the evidence that liquidity risk affects stock returns. Recently, studies show that transaction costs can generate liquidity premium that is in the same order as the costs with time-varying investment opportunity sets (Jang et al., 2007) and with predictable returns, wealth shocks, and state-dependent transaction costs (Lynch and Tan, 2011).[3] Buss and Dumas (2013) highlight that transaction costs are as important as cash flows. Gârleanu and Pedersen (2013) show the impact of transaction costs on investors' optimal dynamic portfolio policies.

Our model is a generalized version of Acharya and Pedersen (2005) and suggests a novel source of liquidity risk which is the covariance between transaction costs and consumption growth. We show that the three channels of liquidity risk of Acharya and Pedersen (2005) can be captured by the covariance between transaction costs and consumption growth. We extend the literature that highlights the pricing of various systematic risks associated with consumption (e.g., Lettau and Ludvigson, 2001; Bansal and Yaron, 2004; Parker and Julliard, 2005; Yogo, 2006; Jagannathan and Wang, 2007; Savov, 2011; Boguth and Kuehn, 2013) by showing the positive relation between stock returns and the sensitivity of transaction costs to consumption growth.

One study relates to ours is Márquez et al. (2014) where the authors build a liquidity-adjusted stochastic discount factor. The differences between their model and ours are, however, that they assume a market illiquidity shock to consumption while we focus on transaction costs following Acharya and Pedersen (2005). Further, they measure liquidity risk as the covariance between returns and liquidity factor, while we measure liquidity risk as the covariance between transaction costs and aggregate consumption growth.

The economic meaning on incorporating the sensitivity of transaction costs to consumption growth to the CCAPM is straight-forward. When the economy is haunted by uncertainties, impacting consumption and squeezing liquidity, individual investors may unwillingly switch from their securities to cash to smooth out consumption; institutional investors may reluctantly exchange their holdings for cash to fulfill their obligations. Under these circumstances, securities whose transaction costs are less sensitive to consumption fluctuations comfort investors from states of low consumption. On the contrary, securities whose transaction costs are highly sensitive to consumption fluctuations impair investors' abilities to cushion the deterioration in consumption. As a result, investors would be more reluctant to hold high liquidity-risk (the sensitivity of transaction costs to consumption growth) securities unless they offer high expected returns.

The remainder of the paper proceeds as follows. Section 2 derives the liquidity-adjusted CCAPM. Section 3 describes the data. Section 4 presents the cross-sectional regression results. Section 5 carries out the robustness tests. Section 6 concludes the paper.

2. The model

In this section, we begin our setting up based on a representative consumer's multiperiod consumption and investment decision model of Samuelson (1969) and Merton (1969). We incorporate transaction costs, the key ingredient of this article, into the traditional CCAPM to develop our liquidity-adjusted CCAPM.

2.1. Transaction costs and budget constraints

The representative consumer maximizes a serial of expected utility functions with respect to consumption and a terminal bequest function, and chooses to invest in n risky assets and a risk-free asset. The decision interval is a discrete time period and each period is of unit length. In our study, we follow Acharya and Pedersen (2005) by assuming a time-vary transaction cost, which implies that the representative consumer faces uncertainty with the future costs of trading. We later show that shocks of transaction costs are countercyclical, consistent with Acharya and Pedersen (2005) and Lynch and Tan (2011). Specifically, the return of risky asset i after netting out transaction costs is,

$$R^n_{i,t+1} = \frac{D_{i,t+1} + P_{i,t+1} - TC_{i,t+1}}{P_{i,t}} = R_{i,t+1} - tc_{i,t+1}, \tag{1}$$

where $P_{i,t+1}$ is the ex-dividend stock i's price, $D_{i,t+1}$ is the dividend, $TC_{i,t+1}$ is the per-share cost of selling stock i,[4] $R_{i,t+1}$ is the return before transactions costs, $R^n_{i,t+1}$ is the net return, and $tc_{i,t+1}$ is the relative time-varying transaction costs. In the spirit of Acharya and Pedersen (2005), investors can buy stock i at $P_{i,t+1}$ but have to sell it at $P_{i,t+1} - TC_{i,t+1}$. This assumption allows us to study the effect of liquidity risk.

Given the above assumption, we incorporate the effect of transaction costs to the budget constraints. Let the representative consumer's time t portfolio weight of the risky asset i be $\omega_{i,t}$ $(i = 1, 2, \ldots, n)$, the weight of the risk-free asset is then $1 - \sum_{i=1}^{n} \omega_{i,t}$. Since the representative consumer is exposed to the

[3] Early studies such as Constantinides (1986) and Vayanos (1998) show that transaction costs only have a second-order effect in the model with the constant transaction costs.

[4] Following Acharya and Pedersen (2005), $D_{i,t+1}$ and $TC_{i,t+1}$ are first-order autoregressive processes.

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