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Asset Pricing with Liquidity Risk: A Replication and Out-of-Sample Tests with the Recent US and the Japanese Market Data

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ABSTRACT

Acharya and Pedersen (2005, hereafter AP) develop the liquidity-adjusted CAPM (LCAPM) that assets with higher illiquidity costs, higher liquidity risk, and higher market risk have higher average rates of return. Our paper conducts an independent replication and two out-of-sample tests with three datasets (US 1964 to 1999, US 2000 to 2016, and Japan 1978 to 2012), six versions of the LCAPM, and eight test portfolios. We first consider the "one-variable LCAPM test" for the intercept, the illiquidity cost effect, and the net liquidity risk effect. We then consider the "two-variable LCAPM test" that further requires that the market risk premium and the net liquidity risk premium are identical as implied by the AP theory. The LCAPM satisfies the one-variable test in 36.0% of regressions and the two-variable test in 5.2% of regressions conducted using the US data. This result is qualitatively similar across US samples and is consistent with the

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findings of an independent study by Holden and Nam (2018). The LCAPM does not satisfy either of the two tests in the Japanese market.

Keywords: Liquidity, Asset pricing, Replication, Out-of-sample test

JEL Codes: G0, G1, G12, N20

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1 Introduction

Research Question. Acharya and Pedersen (2005, "AP" hereafter) study the effect of liquidity risk (the fluctuation of liquidity over time) on the asset's expected return and develop the liquidity-adjusted CAPM equation ("one-variable LCAPM" hereafter)

$$E(r_t^i - r_t^f) = \kappa E_t c_t^i + \lambda^{net} \beta^{net,i} \qquad \text{(One-Variable LCAPM)}$$

where r_t^i is asset i's the rate of gross return, r_t^f is the risk-free rate, κ is the illiquidity cost premium, c_t^i is asset i's illiquidity costs, λ^{net} is the liquidity risk premium, and $\beta^{net,i} = \beta^{1,i} + \beta^{2,i} - \beta^{3,i} - \beta^{4,i}$ is a "liquidity-adjusted net beta", in which the CAPM beta $\beta^{1,i}$ is adjusted by three liquidity betas representing different forms of liquidity risks:

- $\beta^{2,i}$ measures the covariance between security i's illiquidity and the market illiquidity (the "commonality-in-liquidity" effect).
- $\beta^{3,i}$ measures return exposures to the market-wide illiquidity (the "return sensitivity to the market illiquidity" effect).
- $\beta^{4,i}$ measures the covariance between security i's illiquidity and the market return (the "fight-to-liquidity" effect).

In words, the AP LCAPM says that an asset's excess rate of return is determined by the illiquidity cost effect, the market risk effect, and the liquidity risk effect, and that the market risk premium and the liquidity risk premium are identical.[1]

AP test the cross-sectional predictions of the LCAPM as follows. First, AP use the US 1964 to 1999 New York Stock Exchange (NYSE) and the American Stock Exchange data and form the following eight test portfolios:

- **Test Portfolio 1**: 25 value-weighted illiquidity portfolios and an equally-weighted market portfolio.
- **Test Portfolio 2**: 25 σ (illiquidity) portfolios and an equally-weighted market portfolio.
- **Test Portfolio 3**: 25 equally-weighted illiquidity portfolios and an equally-weighted market portfolio.
- **Test Portfolio 4**: 25 value-weighted illiquidity portfolios and a value-weighted market portfolio.

[1]The difference between previous Amihud and Mendelson (1996) and AP can be summarized as follows. Amihud and Mendelson (1996) study the pricing of the illiquidity costs as "characteristic" and AP study the pricing of illiquidity "risk." We thank Yakov Amihud for clarifications on this issue. Amihud *et al.* (2015) examine the illiquidity cost effect (but not the liquidity risk effect) in stock markets across 45 countries including Japan.

Earlier literature on liquidity includes Demsetz (1968), Bagehot (1971), Garman (1976), Stoll (1978), and Roll (1984). Amihud *et al.* (2005), Foucault *et al.* (2014), and Vayanos and Wang (2012) provide surveys of the literature.

- **Test Portfolio 5**: 25 value-weighted size portfolios and an equally-weighted market portfolio.
- **Test Portfolio 6**: 25 B/M-by-size portfolios and an equally-weighted market portfolio.
- **Test Portfolio 7**: 25 illiquidity portfolios and an equally-weighted market portfolio with size and B/M controls.
- **Test Portfolio 8**: 25 B/M-by-size portfolios and an equally-weighted market portfolio with size and B/M controls.

Second, for each test portfolio, AP estimate the original one-variable LCAPM and a more general "two-variable LCAPM" (not implied by the AP theoretical model itself) that allows different risk premia among the market beta and the liquidity-adjusted betas:

$$E(r_t^i - r_t^f) = \text{Intercept} + \kappa E_t c_t^i + \lambda^1 \beta^{1,i} + \lambda^{net} \beta^{net,i} \qquad \text{(Two-Variable LCAPM)}$$

Specifically, AP estimate the following six versions of the LCAPM on each test portfolio:

- **Model 1**: The one-variable LCAPM with a calibrated κ (set to be equal to the average turnover).
- **Model 2**: The one-variable LCAPM without any restrictions on κ.
- **Model 3**: The CAPM.
- **Model 4:** The two-variable LCAPM with a calibrated κ (set to be equal to the average turnover).
- **Model 5**: The two-variable LCAPM without any restrictions on κ.
- **Model 6**: The two-variable LCAPM with $\kappa = 0$.

Then, AP report that "the LCAPM fares better than the standard CAPM in terms of R^2 for cross-sectional returns and p-values in specification tests, even though both models employ exactly one degree of freedom. The model has a good fit for portfolios sorted on liquidity, liquidity variation, and size, but the model cannot explain the cross-sectional returns associated with the book-to-market effect" (p. 376).

AP's idea that investors are concerned with the fluctuation of liquidity over time is economically intuitive and AP have been influential.[2] But the AP results have not been systematically replicated. Furthermore, they have not been updated

[2]Follow-up works include Lee (2011) who studies the LCAPM in integrated international financial markets using a different Fama and MacBeth (1973) approach. The novelty of this paper is a replication, update, and out-of-sample tests following the original methodologyof AP.

using the recent data. Then, the research questions of our paper are:

(1) Can the results reported by the AP LCAPM be independently replicated?

(2) Does the LCAPM hold in the recent US data?

(3) Do they hold for markets outside the US?

Test Criteria. Given the above research question, we need to develop the criteria to test the AP LCAPM.[3]

Our first interest is the "quantitative replication" that the estimated coefficients must be equal to the original AP estimates (with possible small differences). But the AP paper does not provide full details of the estimation procedure. Therefore, it is objectively not possible to determine the exact estimation procedure employed by AP from the paper.[4] Under such circumstances, it is not feasible to adopt the "quantitative replication" criterion to evaluate a replication attempt of AP.

Then, our second interest is the "one-variable LCAPM test" (also called the "one-variable test" hereafter) that examines the above one-variable LCAPM and requires all of the following tests 1 to 3 to be satisfied:

- **Test 1**: The one-variable LCAPM intercept is zero. In other words, the model can price excess returns.
- **Test 2:** The one-variable LCAPM illiquidity cost premium is positive and significant ($\kappa > 0$). In other words, assets with the higher expected illiquidity offer higher average rates of return.
- **Test 3:** The one-variable LCAPM net liquidity risk premium is positive and significant ($\lambda^{net} > 0$). In other words, assets with higher illiquidity risk offer higher average rates of return.

But this one-variable test does not provide a very sharp separation between the Amihud and Mendelson (1996) model and the AP LCAPM because the mere fact that the one-variable LCAPM net liquidity risk premium is positive ($\lambda^{net} > 0$)

For the Japanese market, Li *et al.* (2014) previously consider the AP Model 1 to 4 and report that "Acharya and Pedersen find some supportive evidence that their LCAPM is superior to the standard CAPM using data from the NYSE. However, our results are not supportive of this claim" (p. 25.). Their finding that AP LCAPM does not qualitatively hold in the Japanese market is consistent with the findings of the paper. The novelty of our paper is that our paper estimates all AP LCAPM models both for the US and the Japanese markets, makes comparisons, and derive the conclusion that the two-variable LCAPM with the liquidity risk premium higher than the market risk premium can potentially be a better fit for illiquid Japanese markets.

[3] We are grateful to Ivo Welch (the editor) and Craig Holden for extensive discussions on this issue.

[4] We thank Viral Acharya for correspondence regarding this issue.

cannot distinguish whether liquidity risks are truly priced, or it is rather that the market risk is priced and that liquidity risks are irrelevant for pricing.[5]

Thus, our third interest is in the "two-variable LCAPM test" (also called the "two-variable test" hereafter) that examines the above two-variable LCAPM and requires that all of the following tests 4 to 7 to be satisfied:

- **Test 4**: The two-variable LCAPM intercept is zero.
- **Test 5**: The two-variable LCAPM illiquidity cost premium is positive ($\kappa > 0$).
- **Test 6**: The two-variable LCAPM net liquidity risk premium is positive ($\lambda^{net} > 0$).
- **Test 7**: The two-variable LCAPM market risk premium beyond the net liquidity risk premium is zero ($\lambda^1 = 0$): the market risk premium and the liquidity risk premium are identical.[6]

This "two-variable test" corresponds to the "strict criterion" of Holden and Nam (2018). This criterion is consistent with the condition that "all estimated coefficients need to have significant effects in the same direction as in the original study" considered in Gelman and Stern (2006).

Test Design. Using these criteria, we test the AP LCAPM as follows. First, we consider the following three datasets:

- **US 1964 to 1999**. This is the original time period considered in AP.
- **US 2000 to 2016**. We estimate the AP LCAPM with a more recent period.
- **Japan 1978 to 2012**. We then test whether the AP LCAPM holds in the Japanese market data.[7]

Second, for each dataset, we form the above Test Portfolios 1 to 8 and then estimate Models 1 to 6 on each test portfolio. Thus, for each dataset, we have $8 \times 6 = 48$ regressions. Alternatively, for each of Models 1 to 6, we have four datasets (three datasets plus the original AP results) and eight test portfolios. Thus, each of Models 1 to 6 has $4 \times 8 = 32$ regressions.

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[5]We are grateful to a referee for this argument.

[6]Test 7 allows us to test the hypothesis that the market risk premium is the same with the liquidity risk premium because

$$E(r_t^i - r_t^f) = \kappa E_t c_t^i + (\lambda^{net} - \lambda^1)\beta^{1,i} + \lambda^{net}\beta^{2,i} - \lambda^{net}\beta^{3,i} - \lambda^{net}\beta^{4,i}.$$

[7]This paper studies the Japanese market using the Nikkei Financial Database, based on the original data at Nikkei, available during the period of 1978 to 2012, that provides a comprehensive coverage of Japanese markets. For example, the database has 1,737 firms, on average, and a minimum of 1,403 firms for each year during the sample period. In contrast, for example, Asness *et al.* (2013) consider 471 firms, on average, and a minimum of 148 firms for each year during the sample period (p. 934). Kazumori (2017) provides further discussions of the Nikkei Financial Database. The Nikkei Financial Database is not currently available for researchers after 2012.

Third, we conduct the one-variable LCAPM test using Models 1 and 2. Thus, we conduct the one-variable test on two models (Model 1 and 2), 4 datasets, and Test Portfolios 1 to 8 for each dataset, in total for $2 \times 4 \times 8 = 64$ regressions. We then conduct the two-variable LCAPM test using three models (Models 4, 5, and 6). That is, we conduct the two-variable LCAPM test for $3 \times 4 \times 8 = 96$ regressions.

Main Findings of Our Paper. Our findings are summarized as follows. First, we find, as in AP, severe multicollinearity among the liquidity costs, the market beta, and the liquidity betas. AP note "illiquid stocks—that is, stocks with high average illiquidity—tend to have a high volatility of stock returns, a low turnover", and "a stock, which is illiquid in absolute terms (c_i), also tends to have a lot of commonality in liquidity with the market ($\beta^{2,i}$), a lot of return sensitivity to market liquidity ($\beta^{3,i}$), and a lot of liquidity sensitivity to market returns ($\beta^{4,i}$)" (p. 391). For example, AP find that a correlation between β^2 and β^4 at a portfolio level is −0.941. We find qualitatively similar severe multicollinearity results for our replication, the recent US data, and the Japanese data. In the above example, the replication study has a correlation −0.992, the recent US data have the correlation −0.983, and the Japanese data have the correlation −0.968 between $\beta^{2,p}$ and $\beta^{4,p}$ at a portfolio level.[8]

Second, due to the above multicollinearity problem, the AP LCAPM satisfies the above one-variable test for 36.0% (23) of 64 Models 1 and 2 regressions from AP05, the replication, the recent US data, and the recent Japanese data. For the US data, AP satisfy the one-variable test for 8 of the 16 Models 1 and 2 regressions.[9] The Replication satisfies the test for 7 out of 16 regressions. The recent US data satisfy the test for 8 out of 16 regressions. But none of the LCAPM regression on the Japanese data satisfy the one-variable test. In total, 23 out of 64 regressions (36.0%) satisfy the one-variable test.[10]

Third, the AP LCAPM performs even worse for the two-variable test. The AP LCAPM satisfies the test only for 5.2% (5) of 96 regressions from AP05, the replication, the recent US data, and the recent Japanese data. For the US data, AP satisfy the two-variable test for 1 out of the 24 Models 4 to 6 regressions. The replication satisfies the test for 3 out of the 24 regressions. The recent US data satisfies the test for 1 out of the 24 regressions. But none of the LCAPM

[8] Holden and Nam (2018) also find similar severe multicollinearity problems.

[9] To check, Panel A says that AP says the one-variable LCAPM test holds for 4 out of 8 Model 1 regressions. Panel B says that AP says that one-variable LCAPM test holds for 4 out of 8 Model 2 regressions.

[10] This result is consistent with Holden and Nam (2018) Table 4 Panels A and B. Furthermore, the above estimates are conservative since we include the results of AP in the calculation. Moreover, the above calculations do not include AP "Model 7" and "Model 8" that the AP LCAPM has further difficulties (AP write: "we see that the multicollinearities are severe, and, hence, statistical identification of the separate effects of the different liquidity risks is difficult. Of course, we must also entertain that possibilities that not all of these risk factors are empirically relevant" on p. 396.)

regression on the Japanese data satisfy the two-variable test. So in total, 5 out of 96 regressions (5.2%) satisfy the two-variable test.[11]

In summary, from the above results (and also from Holden and Nam (2018)), although we observe improvements in a fit of the AP LCAPM over the CAPM in terms of R^2, one has to conclude that the LCAPM does not satisfy either of the one-variable LCAPM test and the two-variable LCAPM test. Although the AP idea of the liquidity risk that investors are concerned with the fluctuation of liquidity over time is very economically intuitive, severe collinearity relations among the illiquidity costs, the market risk, the liquidity risks, and the size make the coefficient estimates statistically unstable and difficult to interpret.[12]

The Organization of the Paper. Section 2 summarizes data and the sample selection method. Section 3 documents the baseline test result. Section 4 discusses the results from robustness checks. Section 5 presents additional test results with size-based portfolios. Section 6 presents results when one controls the size and book-to-market effects. Section 7 concludes.

2 Data and Sample Selection

2.1 US Market Data

We follow the procedure described in AP as closely as possible. We use dseall, dsf, mse, msf, funda, and ccmxpf_linktable files from CRSP both for the original data period and for more recent data. We use the book-to-market ratio from COMPUSTAT and the US 30-day T-bill data from the Kenneth French database as the risk-free rate.

Measuring Liquidity. AP calculate the Amihud illiquidity ("illiq" in Amihud (2002)). Illiq reflects the relative price change induced by a given dollar volume. Then, as a metric for a dollar cost per dollar invested, AP consider a normalized illiquidity defined as $c_t^i = \min(0.25 + 0.30 ILLIQ_t^i P_{t-1}^M, 30.00)$ for stock i and for month t where P_{t-1}^M is the ratio of the capitalization of the market portfolio at the end of month $t-1$ and the capitalization of the market portfolio at the end of July 1962. AP then form the market portfolio for each month t during this sample period based on stocks with the beginning-of-month price between \$5 and \$1,000, and with at least 15 days of the return and the volume data in that month. AP

[11] This result is also consistent with Holden and Nam (2018) Table 4 Panel B.

[12] Levi and Welch (2017) find that size proxies well for betas and beta estimation biases. It would be an interesting question to further explore the relation between size and liquidity betas. Additionally, we find that the two-variable LCAPM can potentially explain the Japanese market behavior better than the one-variable LCAPM. In the Japanese market, trading volumes are lower than the US market, thus the trading costs are higher. That is, investors need to be concerned with the illiquidity costs in the Japanese market more than in the US market. Thus, the CAPM that is based on the no-arbitrage condition does not hold in the Japanese market (t-stat -1.477 at Table 4A, for example), consistent with Daniel *et al.* (2003). Also, the one-variable LCAPM does not explain the Japanese market data well.

	Frequency that the tests hold				
	T1 (intercept insignificant)	**T2 (illiq cost effect > 0)**	**T3 (net liq risk premium > 0)**		**One-variable LCAPM test**
Panel A: Model 1					
AP	7 out of 8	(assumed = 1)	5 out of 8		4 out of 8
Replication	5 out of 8	(assumed = 1)	3 out of 8		3 out of 8
Recent US	6 out of 8	(assumed = 1)	7 out of 8		5 out of 8
Japan	6 out of 8	(assumed = 1)	0 out of 8		0 out of 8
All 32 Regressions	24 out of 32		15 out of 32		12 out of 32
	Frequency that the tests hold				
	T1 (intercept insignificant)	**T2 (illiq cost effect > 0)**	**T3 (net liq risk premium > 0)**		**One-variable LCAPM test**
Panel B: Model 2					
AP	7 out of 8	6 out of 8	6 out of 8		4 out of 8
Replication	5 out of 8	7 out of 8	4 out of 8		4 out of 8
Recent US	7 out of 8	3 out of 8	6 out of 8		3 out of 8
Japan	6 out of 8	5 out of 8	0 out of 8		0 out of 8
All 32 Regressions	25 out of 32	21 out of 32	16 out of 32		11 out of 32
	Frequency that the hypotheses are true				
	T4 (intercept insignificant)	**T5 (illiq cost effect >0)**	**T6 (net liq risk premium > 0)**	**T7 (market premium = liq premium)**	**Two-variable LCAPM test**
Panel C: Model 4					
AP	7 out of 8	(assumed = 1)	4 out of 8	6 out of 8	1 out of 8
Replication	6 out of 8	(assumed = 1)	3 out of 8	6 out of 8	1 out of 8
Recent US	7 out of 8	(assumed = 1)	0 out of 8	8 out of 8	0 out of 8
Japan	7 out of 8	(assumed = 1)	5 out of 8	3 out of 8	0 out of 8
All 32 Regressions	27 out of 32		12 out of 32	23 out of 32	2 out of 32
	Frequency that the tests hold				
	T4 (intercept insignificant)	**T5 (illiq cost effect >0)**	**T6 (net liq risk premium > 0)**	**T7 (market premium = liq premium)**	**Two-variable LCAPM test**
Panel D: Model 5					
AP	8 out of 8	1 out of 8	5 out of 8	3 out of 8	0 out of 8
Replication	6 out of 8	1 out of 8	5 out of 8	3 out of 8	0 out of 8
Recent US	6 out of 8	0 out of 8	0 out of 8	8 out of 8	0 out of 8
Japan	8 out of 8	2 out of 8	4 out of 8	4 out of 8	0 out of 8
All 32 Regressions	28 out of 32	4 out of 32	14 out of 32	18 out of 32	0 out of 32

Table A: Acharya and Pedersen (2005) Replication Scorecard.

Panel E: Model 6					
AP	7 out of 8	(not included)	7 out of 8	1 out of 8	0 out of 8
Replication	6 out of 8	(not included)	7 out of 8	3 out of 8	2 out of 8
Recent US	7 out of 8	(not included)	4 out of 8	6 out of 8	1 out of 8
Japan	7 out of 8	(not included)	7 out of 8	0 out of 8	0 out of 8
All 32 Regressions	27 out of 32		25 out of 32	10 out of 32	3 out of 32

Table A: *Continued.*

Description: This table summarizes our test results of the AP LCAPM five variations (Model 1, 2, 4, 5, and 6)[13] on three datasets (US 1964 to 1999, US 2000 to 2016, and Japan 1978 to 2012) each with eight test portfolios.

We illustrate the construction of panels using an example of Panel A that records the results for Model 1. For each dataset, since we use eight test portfolios for each dataset, we have eight Model 1 regressions.

First, for each dataset, for each test, we record the number of regressions that each test holds out of eight regressions from that dataset.[14] For example, for AP and for Test 1, since AP report that Model 1 satisfies Test 1 for 7 out of 8 regressions, we record "7 out of 8" for an entry of the "AP/T1."[15]

Second, we record, for each test, the total number of regressions that satisfy the test aggregating the results from the four datasets. For example, for Test 1, AP has 7 out of 8 regressions, the replication has 5 out of 8 regressions, the recent US data have 6 out of 8 regressions, and the Japanese data have 6 out of 8 regressions that satisfy Test 1. Thus we record "24 out of 32" for an entry of "All 32 Regressions/T1."

We then construct Panels B to E following the same procedure. We estimate Model 2 for Panel B and Model 4 to 6 for Panels C to E.

Interpretation: Panel A shows that the LCAPM satisfies the one-variable test with the restricted illiquidity cost coefficient for 37.5% (12) of 32 regressions. Panel B shows that the LCAPM satisfies the unrestricted one-variable test for 34.4% (11) of 32 regressions. In total, the LCAPM satisfies the one-variable test for 35.9% (23) of 64 regressions.

Panel C shows the two-variable LCAPM test with the restricted illiquidity cost coefficient holds for 6.25% (2) of 32 regressions. Panel D finds that none of the 32 regressions satisfy the unconstrained two-variable test. Panel E finds that 9.38% (3) out of 32 regressions satisfy the two-variable test that omits the illiquidity cost effect. In total, the LCAPM satisfies the two-variable test only for 5.21% (5) of 96 regressions.

form 25 illiquidity portfolios for each year y by sorting stocks with the price, at the beginning of the year, between \$5 and \$1,000, and the return and the volume data in year $y-1$ for at least 100 days. The US out-of-sample test considers the period between January 1, 2000, and December 31, 2016.

2.2 The Japanese Market Data

We then apply the AP methodology to the Japanese markets.

[13] Model 3 is the CAPM thus omitted from the table.

[14] We report when the hypotheses are true at the 10% level of significance. For two-tail (one-tail) tests of 25 observations, the 10% critical value of the t-statistic is 1.708 (1.316).

[15] "T1" is the abbreviation for "Test 1" for this table.

Data. The Japanese data are from the Nikkei Financial Database (daily). We consider all common stocks from the first section and the second section of the Tokyo Stock Exchange (TSE) and the Osaka Stock Exchange (OSE) that have 15 or more trading days in that month. We employ the daily return, the volume, and the accounting data from the Nikkei Financial Database until December 31, 2011, that is, the whole period that the data are available.

The Market Portfolio. The market portfolio for Japanese stocks is formed from the common stocks in the first section and the second section of the TSE/OSE that have 15 or more days of trading and a price from JPY 100 to JPY 100,000. For the Japanese market, we replace the USD volume (in millions) with the JPY volume (in hundreds of millions).

Measuring Liquidity. For each year y, we consider stocks that have a price, at the beginning of the year, between JPY 1,000 and JPY 10 million and that have a valid return and a valid volume data in year $y-1$ for at least 100 days.[16] We compute the annual illiquidity for each eligible stock as the average of daily illiquidity over the entire year $y-1$. The eligible stocks are then sorted into 25 portfolios based on their year $y-1$ illiquidity. To apply a uniform standard for the two markets, for a calculation of the normalized illiquidity of stock i at time t, we employ the formula used for the US data: $c_t^i = \min(0.25 + 0.30\overline{ILLIQ}_t^i P_{t-1}^M, 30.00)$. We define P_{t-1}^M to be the ratio of the capitalization of the market portfolio at the end of the month $t-1$ to the market portfolio at the end of February 1977. We also apply a factor, initially set as 1/3, to ensure that the Japanese illiquidity measures have about the same average as the US illiquidity measures. We then calculate liquidity betas following the method used in AP. We use the overnight collateralized REPO rate as a proxy for the risk-free rate in the Japanese market.[17]

Portfolio Formation. In Japan, the fiscal year usually ends in March, in contrast to the US The yearly portfolios for SMB (Size) and HML (Value) factors are rebalanced at the end of September. Since these Nikkei tables are updated daily, we use earnings, cash flow, dividends, and book equity data from the end of September. Book values are the shareholders' equity.

2.3 *Illiquidity Portfolio Characteristics (Tables 1, 2, and 3 that correspond to the AP Tables 1, 2, and 3)*

This subsection examines properties of the market beta β^1 and liquidity betas β^2, β^3, and β^4. We proceed according to AP. Table 1 reports the properties of the value-weighted illiquidity portfolios. Table 2 reports correlations among liquidity

[16] We choose this criterion to ensure the stability of the estimation results. Asness *et al.* (2013) also "restrict our sample to a much more liquid universe to provide reasonable and conservative estimates" (p. 934.). We tested various thresholds and the results are qualitatively similar.

[17] This data is available in BOJ (the Bank of Japan) *Finance and Economics Statistics Monthly.* We have also tried alternative proxies.

	β^{1p} (.100)	β^{2p} (.100)	β^{3p} (.100)	β^{4p} (.100)	$E(c^p)$ (%)	$\sigma(\Delta c^p)$ (%)	$E(r^{e,p})$ (%)	trn (%)	Size (bl)	BM
AP										
1st (Liquid)	55.10	0	−0.80	0	0.25	0	0.48	3.25	12.5	0.53
5th	74.67	0	−1.24	−0.07	0.27	0.01	0.6	4.17	1.2	0.71
9th	81.93	0.01	−1.37	−0.18	0.32	0.02	0.71	3.82	0.48	0.73
13th	85.29	0.01	−1.47	−0.4	0.43	0.05	0.77	3.47	0.24	0.77
17th	87.89	0.04	−1.59	−0.98	0.71	0.13	0.8	2.96	0.13	0.88
21st	92.73	0.09	−1.69	−2.10	1.61	0.34	1.13	2.97	0.06	0.99
25th (Least)	84.54	0.42	−1.69	−4.52	8.83	1.46	1.10	2.6	0.02	1.15
Replication										
1st (Liquid)	60.99	0.00	−0.71	0.04	0.26	0.05	0.48	3.34	14.09	0.59
5th	79.99	0.00	−1.02	−0.09	0.29	0.08	0.60	4.47	1.43	0.75
9th	86.33	0.01	−1.13	−0.32	0.35	0.12	0.63	4.09	0.58	0.79
13th	90.79	0.01	−1.25	−0.49	0.43	0.08	0.73	3.95	0.27	0.83
17th	93.47	0.03	−1.35	−1.11	0.72	0.20	0.85	3.45	0.14	0.91
21st	95.36	0.07	−1.43	−2.18	1.58	0.38	0.94	3.05	0.07	1.00
25th (Least)	88.09	0.20	−1.43	−5.84	6.22	1.12	0.94	2.99	0.02	1.31
Recent US										
1st (Liquid)	62.64	0.00	−0.22	−0.04	0.26	0.04	0.21	94.48	11.08	0.47
5th	82.73	0.00	−0.50	0.08	0.27	0.09	0.71	8.41	19.83	0.57
9th	91.73	0.00	−0.62	−0.02	0.27	0.10	0.94	3.46	19.74	0.62
13th	102.82	0.01	−0.60	−0.26	0.28	0.14	0.98	1.88	18.74	0.65
17th	108.97	0.01	−0.79	−0.23	0.35	0.14	0.92	1.08	14.35	0.78
21st	105.80	0.01	−0.68	−0.28	0.68	0.17	0.73	0.45	11.18	0.91
25th (Least)	59.43	0.34	−0.44	−8.02	10.72	1.81	0.90	0.10	3.67	1.90

Table 1: Properties of Illiquidity Portfolio.

	β^{1p} (.100)	β^{2p} (.100)	β^{3p} (.100)	β^{4p} (.100)	$E(c^p)$ (%)	$\sigma(\Delta c^p)$ (%)	$E(r^{e,p})$ (%)	trn (%)	Size (bl)	BM
Japan										
1st (Liquid)	77.50	0.00	−0.86	0.00	0.25	0.00	0.02	27.91	5.28	0.38
5th	81.98	0.00	−0.73	−0.04	0.27	0.01	0.30	4.75	4.97	0.43
9th	86.17	0.00	−0.86	−0.13	0.30	0.03	0.31	2.21	4.28	0.50
13th	85.46	0.01	−0.87	−0.36	0.37	0.06	0.29	1.38	3.52	0.54
17th	82.25	0.02	−0.84	−0.62	0.54	0.21	0.26	0.76	3.15	0.61
21st	83.01	0.05	−0.92	−1.58	0.91	0.25	0.78	0.44	2.60	0.66
25th (Least)	70.57	0.32	−0.83	−6.00	4.00	1.38	1.04	0.17	1.82	0.73

Table 1: *Continued*.

Description: Table 1 corresponds to the AP Table 1. We develop the table as follows. For each dataset, we form 25 illiquidity portfolios for each year y by sorting eligible stocks based on their past year $y-1$ average illiquidity.[18] Then, for each data and for each portfolio, we calculate the market beta ($\beta^{1,p}$) and the liquidity betas ($\beta^{2,p}, \beta^{3,p}$, and $\beta^{4,p}$), computed using all monthly return and illiquidity observations; $E(c^p)$, the average illiquidity; $\sigma(\Delta c^p)$, the standard deviation of a portfolio's illiquidity innovation; $E(r^{e,p})$, the average excess return; trn, the turnover (trn); size, the market capitalization; BM, the book-to-market computed for each portfolio as time-series averages of the respective monthly characteristics. We then report the results the 1st, 5th, 9th, 13th, 17th, 21st, and 25th portfolios for each dataset. See the AP Table 1 for details.[19]

Interpretation: AP report that stocks with higher past illiquidity will have higher and more volatile illiquidity costs, higher liquidity betas (in absolute terms), and lower market capitalizations and the higher book-to-market. The replication, recent US data, and the Japanese data also exhibit qualitatively similar colinear patterns.

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[18]That is, this is a sorting based on *past* illiquidity. See AP p.387 for details.

[19]AP also report $\sigma(r^p)$, the average of the standard deviation of daily returns for the portfolio's constituent shocks computed each month. But $\sigma(r^p)$ is not further discussed in AP. Thus, we omit this statistic from the table to save space.

	$\beta^{1,p}$	$\beta^{2,p}$	$\beta^{3,p}$	$\beta^{4,p}$
AP				
$\beta^{1,p}$	1.000	0.441	−0.972	−0.628
$\beta^{2,p}$		1.000	−0.573	−0.941
$\beta^{3,p}$			1.000	0.726
$\beta^{4,p}$				1.000
Replication				
$\beta^{1,p}$	1.000	0.472	−0.952	−0.516
$\beta^{2,p}$		1.000	−0.685	−0.992
$\beta^{3,p}$			1.000	0.720
$\beta^{4,p}$				1.000
Recent US Data				
$\beta^{1,p}$	1.000	−0.515	−0.850	0.503
$\beta^{2,p}$		1.000	0.174	−0.983
$\beta^{3,p}$			1.000	−0.162
$\beta^{4,p}$				1.000
Japan				
$\beta^{1,p}$	1.000	−0.645	−0.038	0.665
$\beta^{2,p}$		1.000	−0.178	−0.968
$\beta^{3,p}$			1.000	0.268
$\beta^{4,p}$				1.000

Table 2: Beta Correlations for Illiquidity Portfolios and for Individual Stocks.

Description: Table 2 corresponds to the AP Table 2. It reports correlations among liquidity betas $\beta^{1,p}$, $\beta^{2,p}$, $\beta^{3,p}$, and $\beta^{4,p}$ for the 25 value-weighted illiquidity portfolios formed each year. Table 3 corresponds to the AP Table 3. It reports correlations for common shares. The four betas are computed for each stock using all monthly return and illiquidity observations for the stock and the market portfolio. The correlations are computed annually for all eligible stocks in a year and then averaged over the sample period.

Interpretation: AP report severe multicollinearity among the market beta and liquidity betas both at the portfolio level and also at the individual stock level. The replication, the recent US data, and the Japanese data also find severe multicollinearity among the market beta and liquidity betas.

betas at the portfolio level. Table 3 reports the correlations at an individual stock level.[20]

AP. AP report severe collinearities among liquidity betas, illiquidity costs, and other variables. First, when AP sort stocks according to their past illiquidity, portfolios' current illiquidity is monotonically increasing in past illiquidity. Second, illiquid stocks have higher standard deviations of liquidity innovation, lower turnovers, and smaller market capitalizations. Third, illiquid stocks have higher liquidity betas (that is, higher commonality in liquidity with market liquidity,

[20]In this section, following AP, we report portfolio properties and correlations up to the second decimal place.

	$\beta^{1,i}$	$\beta^{2,i}$	$\beta^{3,i}$	$\beta^{4,i}$
AP				
$\beta^{1,i}$	1.000	0.020	−0.685	−0.164
$\beta^{2,i}$		1.000	−0.072	−0.270
$\beta^{3,i}$			1.000	0.192
$\beta^{4,i}$				1.000
Replication				
$\beta^{1,i}$	1.000	0.114	−0.595	−0.124
$\beta^{2,i}$		1.000	−0.235	−0.585
$\beta^{3,i}$			1.000	0.139
$\beta^{4,i}$				1.000
Recent US Data				
$\beta^{1,i}$	1.000	−0.062	−0.370	0.022
$\beta^{2,i}$		1.000	−0.034	−0.346
$\beta^{3,i}$			1.000	0.020
$\beta^{4,i}$				1.000
Japan				
$\beta^{1,i}$	1.000	−0.004	−0.506	−0.108
$\beta^{2,i}$		1.000	−0.232	−0.681
$\beta^{3,i}$			1.000	0.161
$\beta^{4,i}$				1.000

Table 3: Beta Correlations for Illiquidity Portfolios and for Individual Stocks.

Description: Table 2 corresponds to the AP Table 2. It reports correlations among liquidity betas $\beta^{1,p}$, $\beta^{2,p}$, $\beta^{3,p}$, and $\beta^{4,p}$ for the 25 value-weighted illiquidity portfolios formed each year. Table 3 corresponds to the AP Table 3. It reports correlations for common shares. The four betas are computed for each stock using all monthly return and illiquidity observations for the stock and the market portfolio. The correlations are computed annually for all eligible stocks in a year and then averaged over the sample period.

Interpretation: AP report severe multicollinearity among the market beta and liquidity betas both at the portfolio level and also at the individual stock level. The replication, the recent US data, and the Japanese data also find severe multicollinearity among the market beta and liquidity betas.

high return sensitivity to market liquidity, and high liquidity sensitivity to market returns). Fourth, there are severe multicollinearities (such as −0.97 and −0.94) among liquidity betas.[21]

Replication. The replication also finds severe collinearities. Portfolios sorted on past illiquidity have monotonically increasing current illiquidity (from 0.26 to 6.22). Illiquid stocks have higher standard deviations of liquidity innovation (0.05 to 1.12) and smaller market capitalizations (14.09 to 0.02). Illiquid stocks have higher liquidity betas $\beta^{2,p}$ (0.00 to 0.20), $\beta^{3,p}$ (−0.71 to −1.43), and $\beta^{4,p}$

[21] For AP, $\beta^{1,p}$ and $\beta^{3,p}$ have correlation −0.97 and $\beta^{2,p}$ and $\beta^{4,p}$ have correlation −0.94.

(0.04 to −5.84). Replication betas also have severe multicollinearities (−0.95 and −0.99).[22]

Recent US. We also find severe collinearities in the recent US data. Portfolios sorted on past illiquidity have monotonically increasing current illiquidity (from 0.26 to 10.72). Illiquid stocks have higher standard deviations of liquidity innovation (0.04 to 1.81), lower turnovers (from 11.08 to 3.67%), and smaller market capitalizations (94.48 to 0.10). Illiquid stocks have larger liquidity betas. Liquidity betas also have severe multicollinearity (−0.85 and −0.98).[23]

Japan. The Japanese market data also find severe collinearity among liquidity betas and illiquidity costs. Sorting according to past illiquidity measures yields monotonically increasing average illiquidity (0.25 to 4.00). Illiquid stocks tend to have higher standard deviations of liquidity innovation (0.00 to 1.38), lower turnovers (5.28 to 1.82%), and smaller market capitalizations (27.91 to 0.17). Illiquid stocks have higher liquidity betas. The Japanese liquidity betas also have severe multicollinearity (−0.65 and −0.97).[24]

3 The Baseline Liquidity-Sorted Test Portfolios

AP test the LCAPM by running cross-sectional regressions on test portfolios using a GMM framework that takes into account the pre-estimation of betas. Following AP, we first consider the baseline Test Portfolio 1 (liquidity-sorted portfolios) and Test Portfolio 2 (σ (illiquidity)-sorted portfolios). In this section, we say that "the LCAPM satisfies the one-variable test" if Model 2 satisfies the one-variable test because Model 2 does not impose any restrictions on the illiquidity cost premium. Similarly, we say that "the LCAPM satisfies the two-variable test" if Model 5 satisfies the two-variable test for the same reason.

3.1 Test Portfolio 1: Value-Weighted Liquidity-Sorted Portfolios and an Equally-Weighted Market Portfolio (Table 4A that Corresponds to the AP Table 4 Panel A)

The LCAPM satisfies the one-variable test but not the two-variable test.

AP. The LCAPM satisfies the one-variable test. Nevertheless, it does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat −0.806) and (2) the market risk effect is negative (−13.233) and significant (t-stat −1.969) beyond the net liquidity risk effect.

Replication. As in AP, the LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because of the same reasons with AP.

[22] For replication, $\beta^{1,p}$ and $\beta^{3,p}$ have correlation −0.95 and $\beta^{2,p}$ and $\beta^{4,p}$ have correlation −0.99.

[23] For the recent US data, $\beta^{1,p}$ and $\beta^{3,p}$ have correlation −0.85 and $\beta^{2,p}$ and $\beta^{4,p}$ have correlation −0.98.

[24] For the Japanese data, $\beta^{1,p}$ and $\beta^{2,p}$ have correlation −0.65 and $\beta^{2,p}$ and $\beta^{4,p}$ have correlation −0.97.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
AP						
1	−0.556	0.034		1.512	0.732	Yes
	(−1.450)	(-)		(2.806)	(0.732)	
2	−0.512	0.042		1.449	0.825	Yes
	(−1.482)	(2.210)		(2.532)	(0.809)	
3	−0.788		1.891		0.653	
	(−1.910)		(3.198)		(0.638)	
4	−0.333	0.034	−3.181	4.334	0.843	No
	(−0.913)	(-)	(−0.998)	(1.102)	(0.836)	
5	0.005	−0.032	−13.233	13.767	0.878	No
	(0.013)	(−0.806)	(−1.969)	(2.080)	(0.861)	
6	−0.160		−8.322	9.164	0.870	No
	(−0.447)		(−2.681)	(3.016)	(0.858)	
Replication						
1	−0.449	0.034		1.272	0.760	Yes
	(−0.938)			(1.968)	(0.750)	
2	−0.421	0.081		1.218	0.835	Yes
	(−1.049)	(2.040)		(2.176)	(0.820)	
3	−0.661		1.592		0.651	
	(−1.339)		(2.306)		(0.636)	
4	−0.330	0.034	−1.377	2.477	0.775	No
	(−0.874)		(−0.479)	(0.849)	(0.754)	
5	0.105	−0.085	−15.306	15.701	0.908	No
	(0.255)	(−0.986)	(−2.115)	(2.236)	(0.895)	
6	−0.225		−4.656	5.589	0.866	Yes
	(−0.594)		(−1.637)	(1.934)	(0.854)	
Recent US						
1	−0.280	0.034		1.114	0.588	Yes
	(−0.921)			(2.378)	(0.570)	
2	−0.366	0.049		1.188	0.584	Yes
	(−0.913)	(1.885)		(2.279)	(0.546)	
3	0.110		0.744		0.300	
	(0.394)		(1.705)		(0.270)	
4	−0.358	0.034	−1.449	2.627	0.603	No
	(−0.923)		(−0.409)	(0.692)	(0.567)	
5	−0.430	0.084	7.985	−6.688	0.617	No
	(−1.048)	(0.921)	(0.767)	(−0.644)	(0.562)	
6	−0.318		−5.583	6.700	0.604	Yes
	(−0.820)		(−1.583)	(1.771)	(0.568)	

Table 4A: LCAPM with Illiquidity Portfolios.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
Japan						
1	0.837	0.050		−0.501	0.018	No
	(1.113)			(−0.587)	(−0.025)	
2	−0.059	0.367		0.406	0.615	No
	(−0.084)	(2.138)		(0.528)	(0.580)	
3	1.488		−1.260		0.130	
	(1.985)		(−1.477)		(0.092)	
4	−0.621	0.050	−11.614	12.599	0.560	No
	(−0.868)		(−2.050)	(2.098)	(0.520)	
5	−0.939	−0.987	−52.432	53.649	0.685	No
	(−1.288)	(−1.971)	(−3.326)	(3.349)	(0.640)	
6	−0.636		−14.386	15.370	0.680	No
	(−0.889)		(−2.545)	(2.566)	(0.650)	

Table 4A: *Continued.*

Description: Table 4A corresponds to the AP Table 4 Panel A. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.

Second, for each dataset, we generate 25 *value-weighted illiquidity portfolios* with *an equally-weighted market portfolio*. Then, we record the estimated coefficients for each of the six LCAPM models. Specifically, "Model 1" is a one-variable LCAPM equation with κ calibrated to be the average monthly turnover across all samples. "Model 2" is the LCAPM with κ as a free parameter. "Model 3" is the CAPM. "Model 4" is a two-variable LCAPM with calibrated κ. "Model 5" is the two-variable LCAPM with κ as a free parameter. "Model 6" is a two-variable LCAPM with $\kappa = 0$. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.

Third, we conduct the LCAPM tests. For Model 1 and 2, we conduct the one-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes" at the " Test" column. We do not conduct any test for Model 3 that is the CAPM that does not involve any liquidity costs nor liquidity risks. For Model 4, 5, and 6, we conduct the two-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the market risk coefficient is statistically insignificant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes."

Interpretation: AP satisfy the one-variable test for 2 out of 2 regressions but do not satisfy the two-variable test. The results from the replication and the recent data satisfy the one-variable test but the two-variable test only when the liquidity cost effect is not included in the regression. This finding is consistent with the one in Holden and Nam (2018). The LCAPM does not satisfy neither of the two tests for the Japanese data.

Recent US. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.921) and (2) the net liquidity risk effect is also not significant (t-stat −0.644).

Japan. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is not significant (t-stat 0.528). The LCAPM does not satisfy the two-variable test because the market risk effect is negative (−52.432) and statistically significant (t-stat −3.326) beyond the liquidity risk effect.

3.2 Test Portfolio 2: σ (Illiquidity) Portfolios and an Equally-Weighted Market Portfolio (Table 4B that Corresponds to the AP Table 4 Panel B)

Results from the Test Portfolio 2 are consistent with the results from the Test Portfolio 1.

AP. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.158) and (2) the market risk effect is negative (−11.013) and significant (t-stat −2.080) beyond the net liquidity risk effect, as in the case with Test Portfolio 1.

Replication. As in AP, the LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because of the same reasons with AP.

Recent US. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.695) and (2) the net liquidity risk effect is not significant (t-stat −0.005).

Japan. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is not significant (t-stat −0.072). The LCAPM does not satisfy the two-variable test either because (1) the illiquidity cost effect is not significant (t-stat −0.012) and (2) the net liquidity risk effect is not significant (t-stat 1.655).

4 Robustness Check 1: Different Weighting Methods

To check the robustness of the result, AP consider different specifications and portfolios. First, AP consider robustness to the choice between the value-weighting method and the equal-weighting method of portfolios.

4.1 Test Portfolio 3: Equally-Weighted Illiquidity Portfolios and an Equally-Weighted Market Portfolio (Table 5A that Corresponds to the AP Table 5 Panel A)

Results obtained using the Test Portfolio 3 are consistent with the results from the results obtained from Test Portfolios 1 to 2.

AP. The LCAPM satisfies the one-variable test but not the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.318) and (2) the

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	Test
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
AP						
1	−0.528	0.035		1.471	0.865	Yes
	(−1.419)	(-)		(2.817)	(0.865)	
2	−0.363	0.062		1.243	0.886	Yes
	(−1.070)	(2.433)		(2.240)	(0.875)	
3	−0.827		1.923		0.726	
	(−2.027)		(3.322)		(0.714)	
4	−0.014	0.035	−7.113	7.772	0.917	No
	(−0.037)		(−1.939)	(2.615)	(0.914)	
5	0.094	0.007	−11.013	11.467	0.924	No
	(0.235)	(0.158)	(−2.080)	(2.480)	(0.917)	
6	0.119		−11.914	12.320	0.924	No
	(0.305)		(−2.413)	(2.608)	(0.917)	
Replication						
1	−0.394	0.035		1.197	0.787	Yes
	(−0.855)			(1.931)	(0.778)	
2	−0.359	0.086		1.134	0.862	Yes
	(−0.874)	(1.967)		(1.955)	(0.849)	
3	−0.700		1.621		0.742	
	(−1.401)		(2.343)		(0.731)	
4	−0.168	0.035	−2.441	3.321	0.812	No
	(−0.397)		(−0.696)	(0.996)	(0.795)	
5	0.129	−0.047	−13.883	14.252	0.913	No
	(0.292)	(−0.535)	(−1.922)	(2.045)	(0.901)	
6	−0.081		−5.687	6.423	0.891	Yes
	(−0.191)		(−1.631)	(1.938)	(0.881)	
Recent US						
1	−0.377	0.035		1.223	0.689	Yes
	(−1.242)			(2.590)	(0.676)	
2	−0.490	0.055		1.317	0.716	Yes
	(−1.261)	(1.715)		(2.572)	(0.690)	
3	−0.011		0.882		0.394	
	(−0.038)		(1.968)		(0.367)	
4	−0.497	0.035	−2.570	3.888	0.724	No
	(−1.302)		(−0.598)	(0.859)	(0.699)	
5	−0.464	0.066	1.349	−0.063	0.729	No
	(−1.182)	(0.695)	(0.118)	(−0.005)	(0.690)	
6	−0.459		−6.987	8.245	0.727	Yes
	(−1.205)		(−1.625)	(1.822)	(0.702)	

Table 4B: LCAPM with σ (Illiquidity) Portfolios.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
Japan						
1	1.219	0.050		−0.968	0.068	No
	(1.595)			(−1.092)	(0.028)	
2	0.323	0.403		−0.066	0.404	No
	(0.404)	(2.094)		(−0.072)	(0.350)	
3	1.654		−1.473		0.179	
	(2.248)		(−1.735)		(0.144)	
4	−0.126	0.050	−10.805	11.205	0.366	No
	(−0.153)		(−1.614)	(1.551)	(0.308)	
5	−0.856	−0.006	−27.238	28.313	0.576	No
	(−0.926)	(−0.012)	(−1.621)	(1.655)	(0.515)	
6	−0.163		−13.704	14.128	0.511	No
	(−0.198)		(−2.051)	(1.960)	(0.467)	

Table 4B: *Continued.*

Description: Table 4B corresponds to the AP Table 4 Panel B. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.

Second, for each dataset, we generate 25 *value-weighted* σ (*illiquidity*) *portfolios* with *an equally-weighted market portfolio*. Then, we record the estimated coefficients for each of the six LCAPM models. Specifically, "Model 1" is a one-variable LCAPM equation with κ calibrated to be the average monthly turnover across all samples. "Model 2" is the LCAPM with κ as a free parameter. "Model 3" is the CAPM. "Model 4" is a two-variable LCAPM with calibrated κ. "Model 5" is the two-variable LCAPM with κ as a free parameter. "Model 6" is a two-variable LCAPM with $\kappa = 0$. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.

Third, we conduct the LCAPM tests. For Model 1 and 2, we conduct the one-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes" at the " Test" column. We do not conduct any test for Model 3 that is the CAPM that does not involve any liquidity costs nor liquidity risks. For Model 4, 5, and 6, we conduct the two-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the market risk coefficient is statistically insignificant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes."

Interpretation: AP satisfy the one-variable test for 2 out of 2 regressions but do not satisfy the two-variable test. The results from the replication and the recent data satisfy the one-variable test but the two-variable test only when the liquidity cost effect is not included in the regression. The LCAPM does not satisfy neither of the two tests for the Japanese data. The results are consistent with the findings from Table 4A.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	Test
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
AP						
1	−0.391	0.046		1.115	0.825	Yes
	(−0.889)	(-)		(1.997)	(0.825)	
2	−0.299	0.062		0.996	0.846	Yes
	(−0.737)	(3.878)		(4.848)	(0.832)	
3	−0.530		1.374		0.350	
	(−1.082)		(2.085)		(0.322)	
4	−0.088	0.046	−2.699	3.395	0.879	Yes
	(−0.249)	(-)	(−1.441)	(1.782)	(0.873)	
5	0.105	0.008	−6.392	6.800	0.901	No
	(0.296)	(0.318)	(−2.238)	(2.427)	(0.886)	
6	0.143		−7.115	7.467	0.900	No
	(0.397)		(−3.623)	(3.871)	(0.891)	
Replication						
1	−0.121	0.046		0.712	0.477	No
	(−0.227)			(1.093)	(0.454)	
2	−0.027	0.110		0.557	0.879	No
	(−0.061)	(3.779)		(1.006)	(0.867)	
3	−0.131		0.840		0.166	
	(−0.265)		(1.286)		(0.129)	
4	0.156	0.046	−2.186	2.534	0.706	No
	(0.395)		(−1.099)	(1.195)	(0.679)	
5	0.298	0.011	−5.615	5.761	0.919	No
	(0.753)	(0.399)	(−1.975)	(1.990)	(0.907)	
6	0.309		−5.773	5.916	0.919	No
	(0.775)		(−2.983)	(2.859)	(0.911)	
Recent US						
1	−0.380	0.046		1.117	0.677	Yes
	(−1.320)			(2.617)	(0.663)	
2	−0.130	0.029		0.901	0.530	No
	(−0.276)	(1.354)		(1.610)	(0.487)	
3	0.302		0.526		0.283	
	(1.139)		(1.337)		(0.252)	
4	−0.175	0.046	3.618	−2.685	0.724	No
	(−0.404)		(0.754)	(−0.518)	(0.699)	
5	−0.180	0.022	−1.498	2.455	0.534	No
	(−0.379)	(0.785)	(−0.286)	(0.455)	(0.467)	
6	−0.056		−5.179	6.031	0.481	No
	(−0.131)		(−1.093)	(1.175)	(0.434)	

Table 5A: LCAPM with Equally-Weighted Portfolios and an Equally-Weighted Market Portfolio.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
Japan						
1	1.034	0.050		−0.699	0.024	No
	(1.448)			(−0.939)	(−0.018)	
2	−0.372	0.377		0.629	0.717	No
	(−0.470)	(2.688)		(0.754)	(0.691)	
3	2.008		−1.734		0.190	
	(2.851)		(−2.435)		(0.155)	
4	−0.759	0.050	−10.000	10.959	0.650	No
	(−0.905)		(−2.462)	(2.374)	(0.619)	
5	−0.826	−0.547	−33.695	34.641	0.745	No
	(−0.998)	(−1.395)	(−3.129)	(3.127)	(0.708)	
6	−0.757		−12.394	13.335	0.745	No
	(−0.903)		(−3.055)	(2.893)	(0.721)	

Table 5A: *Continued.*

Description: Table 5A corresponds to the AP Table 5 Panel A. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.

Second, for each dataset, we generate 25 *equally-weighted liquidity portfolios* with *an equally-weighted market portfolio*. Then, we record the estimated coefficients for each of the six LCAPM models. Specifically, “Model 1” is a one-variable LCAPM equation with κ calibrated to be the average monthly turnover across all samples. “Model 2” is the LCAPM with κ as a free parameter. “Model 3” is the CAPM. “Model 4” is a two-variable LCAPM with calibrated κ. “Model 5” is the two-variable LCAPM with κ as a free parameter. “Model 6” is a two-variable LCAPM with $\kappa = 0$. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.

Third, we conduct the LCAPM tests. For Model 1 and 2, we conduct the one-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the net liquidity risk coefficient is positive and statistically significant, we record “Yes” at the “ Test” column. We do not conduct any test for Model 3 that is the CAPM that does not involve any liquidity costs nor liquidity risks. For Model 4, 5, and 6, we conduct the two-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the market risk coefficient is statistically insignificant, and the net liquidity risk coefficient is positive and statistically significant, we record “Yes.”

Interpretation: AP satisfy the one-variable test but satisfy the two-variable test only when the illiquidity cost premium is restricted to be 1. The replication LCAPM, the LCAPM on the recent US data, and the LCAPM on the Japanese data do not satisfy either of the one-variable test and the two-variable test.

market risk effect is negative (−6.392) and significant (t-stat −2.238) beyond the net liquidity risk effect.

Replication. The LCAPM does not satisfy the one-variable test because the illiquidity cost effect is not significant (t-stat 1.006). It does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.399) and (2) the market risk effect is negative (−5.615) and significant (t-stat −1.975) beyond the net liquidity risk effect.

Recent US. The LCAPM does not satisfy the one-variable test because the liquidity cost effect is not significant (t-stat 1.354). It does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.785) and (2) the net liquidity risk effect is also not significant (t-stat 0.455).

Japan. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is insignificant (t-stat 0.754). Nor it does satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat −1.395) and (2) the market risk effect is negative (−33.695) and significant (t-stat −3.129).

4.2 Test Portfolio 4: Value-Weighted Illiquidity Portfolios and a Value-Weighted Market Portfolio (Table 5B that Corresponds to the AP Table 5 Panel B)

The results from the Test Portfolio 4 are also consistent with the previous results obtained from the Test Portfolios 1 to 3.

AP. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (0.902) and (2) the market risk effect is negative (−16.226) and significant (t-stat −2.978) beyond the net liquidity risk effect.

Replication. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test for the same reason as in AP.

Recent US. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.501) and (2) the net liquidity risk effect is also not significant (t-stat 0.092).

Japan. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is insignificant (t-stat −0.899). Nor it does satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat −1.590) and (2) the market risk effect is negative (−54.631) and significant (t-stat −2.680) beyond the net liquidity risk effect.

5 Robustness Check 2: Size-Based Test Portfolios

As a further robustness check, AP re-estimate the LCAPM with the Test Portfolio 5 (size-based portfolios) and the Test Portfolio 6 (5 book-to-market quantiles $*$ 5 size quantiles).

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
AP						
1	−1.938	0.034		2.495	0.486	No
	(−1.203)	(-)		(1.627)	(0.486)	
2	−2.059	0.081		2.556	0.642	No
	(−1.755)	(2.755)		(2.107)	(0.609)	
3	0.700		0.062		0.000	
	(0.272)		(0.025)		(−0.043)	
4	−1.536	0.034	−6.070	8.099	0.754	No
	(−2.033)	(-)	(−1.540)	(2.040)	(0.743)	
5	−0.583	−0.076	−16.226	17.333	0.841	No
	(−0.718)	(−0.902)	(−2.978)	(3.543)	(0.819)	
6	−1.241		−9.210	10.954	0.800	No
	(−1.271)		(−2.733)	(3.183)	(0.781)	
Replication						
1	−1.583	0.034		2.132	0.331	Yes
	(−1.635)			(2.028)	(0.302)	
2	−1.462	0.144		1.948	0.683	Yes
	(−1.538)	(2.671)		(1.933)	(0.654)	
3	0.459		0.247		0.003	
	(0.763)		(0.376)		(−0.040)	
4	−1.307	0.034	−3.914	5.726	0.634	Yes
	(−1.538)		(−1.409)	(1.714)	(0.601)	
5	−0.417	−0.136	−17.365	18.320	0.890	No
	(−0.525)	(−1.440)	(−2.732)	(2.786)	(0.874)	
6	−1.130		−6.279	7.921	0.780	No
	(−1.327)		(−2.278)	(2.384)	(0.760)	
Recent US						
1	−0.289	0.034		0.959	0.350	Yes
	(−0.720)			(1.941)	(0.322)	
2	−0.908	0.071		1.483	0.393	Yes
	(−1.635)	(2.331)		(2.379)	(0.338)	
3	0.400		0.366		0.067	
	(1.105)		(0.840)		(0.026)	
4	−0.630	0.034	−2.479	3.733	0.393	No
	(−1.342)		(−0.912)	(1.218)	(0.338)	
5	−1.029	0.068	0.534	1.049	0.409	No
	(−1.794)	(0.501)	(0.048)	(0.092)	(0.325)	
6	−0.543		−5.675	6.861	0.337	No
	(−1.161)		(−2.098)	(2.246)	(0.277)	

Table 5B: LCAPM with Value-Weighted Portfolios and a Value-Weighted Market Portfolio.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	Test
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
Japan						
1	1.105	0.051		−0.896	0.393	No
	(1.874)			(−1.406)	(0.367)	
2	0.786	0.268		−0.598	0.626	No
	(1.239)	(1.567)		(−0.899)	(0.592)	
3	1.259		−1.063		0.472	
	(2.250)		(−1.780)		(0.449)	
4	0.580	0.051	−8.579	8.264	0.508	No
	(0.889)		(−1.420)	(1.290)	(0.463)	
5	0.399	−0.908	−54.631	54.730	0.635	No
	(0.591)	(−1.590)	(−2.680)	(2.634)	(0.583)	
6	0.536		−12.433	12.176	0.635	No
	(0.824)		(−2.069)	(1.910)	(0.602)	

Table 5B: *Continued*.

Description: Table 5B corresponds to the AP Table 5 Panel B. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.

Second, for each dataset, we generate 25 *value-weighted liquidity portfolios* with *a value-weighted market portfolio*. Then, we record the estimated coefficients for each of the six LCAPM models. Specifically, "Model 1" is a one-variable LCAPM equation with κ calibrated to be the average monthly turnover across all samples. "Model 2" is the LCAPM with κ as a free parameter. "Model 3" is the CAPM. "Model 4" is a two-variable LCAPM with calibrated κ. "Model 5" is the two-variable LCAPM with κ as a free parameter. "Model 6" is a two-variable LCAPM with $\kappa = 0$. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.

Third, we conduct the LCAPM tests. For Model 1 and 2, we conduct the one-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes" at the "Test" column. We do not conduct any test for Model 3 that is the CAPM that does not involve any liquidity costs nor liquidity risks. For Model 4, 5, and 6, we conduct the two-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the market risk coefficient is statistically insignificant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes."

Interpretation: AP do not satisfy either of the one-variable test and the two-variable test. But the LCAPM for the replication and for the recent US data satisfy the one-variable test but not the two-variable test. The LCAPM does not satisfy any of the two tests for the Japanese data.

5.1 Test Portfolio 5: Size-Based Portfolios and an Equal-Weighted Market Portfolio (Table 6A that Corresponds to the AP Table 6 Panel A)

The LCAPM satisfies neither the one-variable nor the two-variable test except for two cases from AP.

AP. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 1.180) and (2) the net liquidity risk effect is also not significant (t-stat 0.266).

Replication. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is insignificant (t-stat 1.274). It does not satisfy the two-variable test for the same reason with AP.

Recent US. The LCAPM does not satisfy the one-variable test because the illiquidity cost effect is insignificant (t-stat −0.000). It does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.242) and (2) the net liquidity risk is not significant (t-stat −0.203).

Japan. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is not significant (t-stat 0.539). Nor it does satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.182) and (2) the net liquidity risk effect is also not significant (t-stat 0.833).

5.2 Test Portfolio 6: B/M-by-Size Portfolios and an Equal-Weighted Market Portfolio (Table 6B that Corresponds to the AP Table 6 Panel B)

Results with the Test Portfolio 6 satisfy neither the one-variable test nor the two-variable test.

AP. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is not significant (t-stat 0.377). It does not satisfy the two-variable test either because (1) the net liquidity risk effect is negative and not positive (−17.458) and significant (t-stat −2.265) and (2) the market risk effect is positive (18.229) and significant (t-stat 2.344) beyond the net liquidity risk effect.

Replication. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is not significant (t-stat −1.053). It does not satisfy the two-variable test because (1) the intercept term is significant (t-stat 2.536) and (2) the net illiquidity risk effect is not significant (t-stat −1.295).

Recent US. The LCAPM does not satisfy the one-variable test because the illiquidity cost effect is not significant (t-stat 0.580). It does not satisfy the two-variable test either because (1) the illiquidity cost effect is not significant (t-stat −0.344) and (2) the net liquidity risk effect is also not significant (t-stat 0.624).

Japan. The LCAPM does not satisfy the one-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.028) and (2) the net liquidity risk effect is also not significant (t-stat 0.022). Nor it does satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 0.448) and (2) the net liquidity risk effect is also not significant (t-stat −0.160).

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	Test
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
AP						
1	−0.087	0.047		0.865	0.910	Yes
	(−0.274)	(-)		(1.864)	(0.910)	
2	−0.059	0.056		0.823	0.912	Yes
	(−0.201)	(2.139)		(1.768)	(0.904)	
3	−0.265		1.144		0.757	
	(−0.789)		(2.270)		(0.747)	
4	−0.043	0.047	−0.770	1.562	0.912	No
	(−0.151)	(-)	(−0.323)	(0.685)	(0.908)	
5	−0.055	0.054	−0.168	0.984	0.912	No
	(−0.186)	(1.180)	(−0.050)	(0.266)	(0.900)	
6	0.032		−4.633	5.278	0.902	No
	(0.112)		(−1.899)	(2.104)	(0.893)	
Replication						
1	0.051	0.047		0.634	0.702	No
	(0.130)			(1.184)	(0.689)	
2	0.039	0.137		0.611	0.851	No
	(0.116)	(2.935)		(1.274)	(0.838)	
3	−0.115		0.886		0.569	
	(−0.288)		(1.560)		(0.550)	
4	0.059	0.047	−0.124	0.746	0.702	No
	(0.184)		(−0.056)	(0.322)	(0.675)	
5	0.052	0.093	0.004	0.609	0.860	No
	(0.159)	(1.047)	(0.001)	(0.122)	(0.840)	
6	0.145		−3.953	4.433	0.827	No
	(0.450)		(−1.817)	(1.952)	(0.812)	
Recent US						
1	−0.559	0.047		1.359	0.745	No
	(−1.742)			(2.984)	(0.734)	
2	−0.335	0.000		1.167	0.748	No
	(−0.804)	(−0.000)		(2.222)	(0.725)	
3	−0.213		1.070		0.719	
	(−0.726)		(2.503)		(0.707)	
4	−0.385	0.047	4.751	−3.507	0.833	No
	(−0.962)		(1.170)	(−0.806)	(0.818)	
5	−0.337	0.015	3.138	−1.949	0.754	No
	(−0.858)	(0.242)	(0.331)	(−0.203)	(0.719)	
6	−0.310		−1.045	2.185	0.745	No
	(−0.777)		(−0.257)	(0.502)	(0.722)	

Table 6A: LCAPM with Size Portfolios.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
Japan						
1	−0.768	0.050		1.243	0.257	No
	(−0.917)			(1.286)	(0.225)	
2	−0.184	0.258		0.491	0.649	No
	(−0.227)	(1.848)		(0.539)	(0.618)	
3	−0.819		1.369		0.220	
	(−0.925)		(1.317)		(0.186)	
4	0.027	0.050	−7.063	7.285	0.483	No
	(0.034)		(−1.795)	(1.894)	(0.436)	
5	−0.008	0.062	−7.783	8.055	0.670	No
	(−0.010)	(0.182)	(−0.798)	(0.833)	(0.623)	
6	0.041		−9.075	9.274	0.667	No
	(0.051)		(−2.304)	(2.409)	(0.636)	

Table 6A: *Continued.*

Description: Table 6A corresponds to the AP Table 6 Panel A. We develop the table as follows. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.

Second, for each dataset, we generate 25 *value-weighted size portfolios* with *an equally-weighted market portfolio*. Then, we record the estimated coefficients for each of the six LCAPM models. Specifically, "Model 1" is a one-variable LCAPM equation with κ calibrated to be the average monthly turnover across all samples. "Model 2" is the LCAPM with κ as a free parameter. "Model 3" is the CAPM. "Model 4" is a two-variable LCAPM with calibrated κ. "Model 5" is the two-variable LCAPM with κ as a free parameter. "Model 6" is a two-variable LCAPM with $\kappa = 0$. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.
Third, we conduct the LCAPM tests. For Model 1 and 2, we conduct the one-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes" at the " Test" column. We do not conduct any test for Model 3 that is the CAPM that does not involve any liquidity costs nor liquidity risks. For Model 4, 5, and 6, we conduct the two-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the market risk coefficient is statistically insignificant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes."

Interpretation: AP satisfy the one-variable test but not the two-variable test. But the replication, the LCAPM on the recent US data, and the LCAPM on the Japanese data do not satisfy neither of the two tests.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	Test
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
AP						
1	0.200	0.045		0.582	0.406	No
	(0.680)	(-)		(1.197)	(0.406)	
2	0.453	0.167		0.182	0.541	No
	(1.657)	(3.452)		(0.377)	(0.499)	
3	0.109		0.748		0.262	
	(0.348)		(1.406)		(0.229)	
4	0.529	0.045	−8.289	8.275	0.502	No
	(1.665)	(-)	(−2.013)	(2.198)	(0.481)	
5	0.187	0.387	18.229	−17.458	0.571	No
	(0.626)	(3.061)	(2.344)	(−2.265)	(0.510)	
6	0.574		−11.787	11.671	0.483	No
	(1.959)		(−3.102)	(2.902)	(0.436)	
Replication						
1	0.763	0.045		−0.119	0.005	No
	(2.460)			(−0.247)	(−0.038)	
2	0.915	0.367		−0.474	0.313	No
	(3.216)	(4.026)		(−1.053)	(0.251)	
3	0.751		−0.063		0.001	
	(2.369)		(−0.125)		(−0.042)	
4	1.167	0.045	−9.373	8.580	0.152	No
	(4.304)		(−2.555)	(2.376)	(0.075)	
5	0.745	0.364	8.321	−8.470	0.342	No
	(2.536)	(2.535)	(1.234)	(−1.295)	(0.248)	
6	1.250		−13.093	12.160	0.248	No
	(4.615)		(−3.620)	(3.415)	(0.179)	
Recent US						
1	−0.496	0.045		1.314	0.801	Yes
	(−1.272)			(2.461)	(0.793)	
2	−0.511	0.027		1.349	0.828	No
	(−1.351)	(0.580)		(2.633)	(0.812)	
3	−0.514		1.384		0.797	
	(−1.344)		(2.585)		(0.788)	
4	−0.533	0.045	2.587	−1.207	0.814	No
	(−1.499)		(0.473)	(−0.215)	(0.797)	
5	−0.465	−0.028	−4.313	5.600	0.828	No
	(−1.275)	(−0.344)	(−0.479)	(0.624)	(0.804)	
6	−0.472		−2.754	4.050	0.827	No
	(−1.332)		(−0.508)	(0.726)	(0.811)	

Table 6B: LCAPM with B/M-by-size Portfolios.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$		
Japan						
1	0.003	0.050		0.356	0.013	No
	(0.003)			(0.301)	(−0.030)	
2	0.232	0.026		0.026	0.192	No
	(0.195)	(0.028)		(0.022)	(0.119)	
3	0.151		0.232		0.006	
	(0.139)		(0.195)		(−0.037)	
4	0.837	0.050	−26.439	25.486	0.168	No
	(0.684)		(−2.179)	(2.103)	(0.093)	
5	0.436	2.919	7.828	−8.728	0.208	No
	(0.215)	(0.448)	(0.142)	(−0.160)	(0.095)	
6	0.838		−28.075	27.120	0.208	No
	(0.685)		(−2.315)	(2.239)	(0.136)	

Table 6B: *Continued*.

Description: Table 6B corresponds to the AP Table 6 Panel B. We develop the table as follows. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.
Second, for each dataset, we generate 25 *value-weighted B/M-by-size portfolios* with *an equally-weighted market portfolio*. Then, we record the estimated coefficients for each of the six LCAPM models. Specifically, "Model 1" is a one-variable LCAPM equation with κ calibrated to be the average monthly turnover across all samples. "Model 2" is the LCAPM with κ as a free parameter. "Model 3" is the CAPM. "Model 4" is a two-variable LCAPM with calibrated κ. "Model 5" is the two-variable LCAPM with κ as a free parameter. "Model 6" is a two-variable LCAPM with $\kappa = 0$. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.

Third, we conduct the LCAPM tests. For Model 1 and 2, we conduct the one-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes" at the " Test" column. We do not conduct any test for Model 3 that is the CAPM that does not involve any liquidity costs nor liquidity risks. For Model 4, 5, and 6, we conduct the two-variable test: if the intercept coefficient is statistically insignificant, the expected illiquidity cost coefficient is positive and statistically significant, and the market risk coefficient is statistically insignificant, and the net liquidity risk coefficient is positive and statistically significant, we record "Yes."

Interpretation: AP, the replication LCAPM, the LCAPM on the recent US data, and the LCAPM on the Japanese data do not satisfy either of the one-variable and the two-variable test except for one case.

6 Robustness Check 3: Controlling the Size Effect and the Book-to-Market Effect

In the final robustness check, AP consider

$$E(r_t^p - r_t^f) = \alpha + \kappa E(c_t^p) + \lambda^1 \beta^{1,p} + \lambda^{net} \beta^{net,p} + \lambda^5 \ln(\text{size}^p) + \lambda^6 \text{BM}^p$$

where $\ln(\text{size}^p)$ is the time-series average of the natural log of the ratio of the portfolio's market capitalization at the beginning of the month to the total market capitalization, and BM^p is the time-series average of the monthly average of the book-to-market of the portfolio.

6.1 Test Portfolio 7: Liquidity Portfolios and an Equal-Weighted Market Portfolio Controlling the Size Effect and the Book-to-Market Effects (Table 7A that Corresponds to the AP Table 7 Panel A)

When we control the size effect and the book-to-market effect, the LCAPM does not satisfy any of the above tests except for one case.

AP. The LCAPM does not satisfy the one-variable test because the illiquidity cost effect is not significant (t-stat 1.129). It does not satisfy the two-variable test either because (1) the illiquidity cost effect is not significant (t-stat −0.227) and (2) the illiquidity risk effect is not significant (t-stat 1.453).

Replication. The LCAPM satisfies the one-variable test. But it does not satisfy the two-variable test because the (1) the illiquidity cost effect is not significant (t-stat −0.224) and (2) the market risk effect is negative (−17.687) and significant (t-stat −2.444) beyond the net liquidity risk effect.

Recent US. The LCAPM does not satisfy the one-variable test because (1) the illiquidity cost effect is not significant (t-stat 1.298) and (2) the net liquidity risk effect is also not significant (t-stat 1.162). It does not satisfy the two-variable test either because (1) the illiquidity cost effect is not significant (t-stat 1.053) and (2) the net liquidity risk effect is also not significant (t-stat 0.179).

Japan. The LCAPM does not satisfy the one-variable test because the net liquidity risk effect is not significant (t-stat −0.003). Nor it does satisfy the two-variable test because the market risk effect is negative (−62.209) and significant (t-stat −3.746) beyond the net liquidity risk effect.

6.2 Test Portfolio 8: B/M-by-Size Portfolios and an Equal-Weighted Market Portfolio Controlling the Size Effect and the Book-to-Market Effects (Table 7B that Corresponds to the AP Table 7 Panel B)

Results obtained using the Test Portfolio 8 also show that the LCAPM tests do not hold when controlling the size effect and the book-to-market effect.

AP. The LCAPM does not satisfy the one-variable test because the illiquidity cost effect is not significant (t-stat 0.684). It does not satisfy the two-variable test

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	ln(size)	B/M	R^2	Test
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$				
AP								
1	−1.358	0.034		2.158	0.142	1.076	0.865	No
	(−1.843)	(-)		(2.114)	(1.247)	(1.871)	(0.852)	
2	−1.286	0.028		1.970	0.129	1.120	0.865	No
	(−1.501)	(1.129)		(1.869)	(0.950)	(2.215)	(0.838)	
3	−0.818		0.798		0.043	1.350	0.850	
	(−0.837)		(0.651)		(0.302)	(1.724)	(0.829)	
4	−1.273	0.034	−3.740	6.145	0.155	0.679	0.869	No
	(−1.459)	(-)	(−0.576)	(0.891)	(1.054)	(0.814)	(0.850)	
5	−0.441	−0.018	−12.278	13.565	0.068	0.159	0.882	No
	(−0.613)	(−0.227)	(−1.292)	(1.453)	(0.871)	(0.229)	(0.850)	
6	−0.730		−9.313	10.988	0.098	0.339	0.880	No
	(−0.939)		(−1.884)	(2.106)	(0.788)	(0.598)	(0.856)	
Replication								
1	1.055	0.034		−0.159	−0.150	−1.136	0.826	No
	(1.995)			(−0.180)	(−2.052)	(−5.075)	(0.801)	
2	0.021	0.147		1.740	−0.002	−1.232	0.879	Yes
	(0.040)	(3.576)		(2.098)	(−0.031)	(−5.538)	(0.854)	
3	1.693		−1.230		−0.221	−1.135	0.878	
	(3.521)		(−1.588)		(−3.464)	(−5.131)	(0.861)	
4	−0.262	0.034	−12.476	14.789	0.096	−1.217	0.850	No
	(−0.529)		(−3.766)	(4.126)	(1.359)	(−5.459)	(0.820)	
5	0.084	−0.020	−17.687	19.391	0.073	−1.166	0.931	No
	(0.154)	(−0.224)	(−2.444)	(2.755)	(1.041)	(−5.273)	(0.913)	
6	−0.149		−15.476	17.593	0.092	−1.205	0.911	No
	(−0.301)		(−4.679)	(4.915)	(1.315)	(−5.424)	(0.893)	
Recent US								
1	0.194	0.034		0.554	−0.079	−0.544	0.668	No
	(0.517)			(1.023)	(−1.429)	(−2.233)	(0.621)	
2	0.097	0.098		0.781	−0.062	−0.709	0.669	No
	(0.225)	(1.298)		(1.162)	(−1.000)	(−2.281)	(0.602)	
3	0.335		0.266		−0.101	−0.441	0.663	
	(0.923)		(0.523)		(−1.874)	(−1.810)	(0.615)	
4	−0.002	0.034	−10.618	11.613	−0.031	−0.745	0.669	No
	(−0.004)		(−1.580)	(1.636)	(−0.433)	(−2.851)	(0.602)	
5	−0.087	0.101	−0.498	1.620	−0.023	−0.694	0.695	No
	(−0.197)	(1.053)	(−0.056)	(0.179)	(−0.374)	(−2.275)	(0.614)	
6	0.023		−13.862	14.795	−0.031	−0.696	0.667	No
	(0.057)		(−2.062)	(2.082)	(−0.424)	(−2.677)	(0.600)	

Table 7A: Controlling for Size and Book-to-Market with Liquidity Portfolios.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	ln(size)	B/M	R^2	Test
Theory	$\alpha=0$	$\kappa>0$	$\lambda^{1,p}=0$	$\lambda^{net,p}>0$				
Japan								
1	1.484	0.050		−0.433	−0.256	−4.532	0.599	No
	(2.067)			(−0.600)	(−3.601)	(−5.096)	(0.542)	
2	1.212	0.395		−0.002	−0.181	−4.418	0.726	No
	(1.665)	(1.722)		(−0.003)	(−2.189)	(−4.925)	(0.672)	
3	1.902		−0.937		−0.262	−4.553	0.638	
	(2.684)		(−1.366)		(−3.699)	(−5.125)	(0.586)	
4	0.810	0.050	−13.447	13.998	−0.140	−4.283	0.651	No
	(1.118)		(−2.085)	(2.059)	(−1.666)	(−5.016)	(0.581)	
5	0.476	−1.048	−62.029	63.055	−0.052	−4.144	0.736	No
	(0.643)	(−2.054)	(−3.746)	(3.736)	(−0.615)	(−5.014)	(0.666)	
6	0.786		−16.595	17.171	−0.135	−4.280	0.735	No
	(1.085)		(−2.583)	(2.535)	(−1.614)	(−5.015)	(0.682)	

Table 7A: *Continued.*

Description: Table 7A corresponds to the AP Table 7 Panel A. We develop the table as follows. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.

Second, for each dataset, we generate 25 *value-weighted B/M-by-size portfolios* with *an equally-weighted market portfolio*. Then, we record the estimated coefficients for each of the six LCAPM models with size and book-to-market:

$$E(r_t^i - r_t^f) = \text{Intercept} + \kappa E_t c_t^i + \lambda\beta^{net,i} + \lambda^2 \ln(\text{size}^p) + \lambda^3 \text{BM}^p$$
$$E(r_t^i - r_t^f) = \text{Intercept} + \kappa E_t c_t^i + \lambda^1\beta^{1i} + \lambda^{net}\beta^{net,i} + \lambda^2 \ln(\text{size}^p) + \lambda^3 \text{BM}^p$$

Specifically, "Model 1" estimates an LCAPM equation with κ calibrated as the average monthly turnover across all samples. "Model 2" estimates the LCAPM with κ as a free parameter. "Model 3" is the CAPM. "Model 4" is a two-variable LCAPM with κ at its calibrated value. "Model 5" is the two-variable LCAPM with κ as a free parameter. "Model 6" is a two-variable LCAPM that κ is restricted to be 0. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.

Third, we conduct the LCAPM tests. For Model 1 and 2, if the model satisfies the one-variable test, we record "Yes" at the " Test" column. For Model 4, 5, and 6, if the model satisfies the two-variable test, we record "Yes" at the "Test" column., we record "Yes."

Interpretation: AP, the replication LCAPM, the LCAPM on the recent US data, and the LCAPM on the Japanese data do not satisfy either of the one-variable and the two-variable test except for one case.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	ln(size)	B/M	R^2	Test
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$				
AP								
1	0.310	0.045		−0.199	−0.084	0.251	0.924	No
	(1.040)	(-)		(−0.345)	(−1.415)	(2.892)	(0.917)	
2	0.317	0.035		−0.236	−0.091	0.250	0.925	No
	(1.206)	(0.684)		(−0.311)	(−1.176)	(2.905)	(0.910)	
3	0.365		−0.403		−0.119	0.246	0.920	
	(1.177)		(−0.516)		(−2.155)	(2.749)	(0.909)	
4	0.311	0.045	0.484	−0.696	−0.089	0.249	0.924	No
	(1.170)	(-)	(0.155)	(−0.262)	(−1.598)	(2.960)	(0.913)	
5	0.340	−0.003	−3.145	2.850	−0.087	0.259	0.925	No
	(1.083)	(−0.039)	(−0.894)	(0.846)	(−1.224)	(3.108)	(0.906)	
6	0.338		−2.930	2.639	−0.087	0.259	0.925	No
	(1.003)		(−1.366)	(0.613)	(−1.065)	(3.314)	(0.910)	
Replication								
1	0.642	0.045		−0.572	−0.065	0.280	0.791	No
	(2.166)			(−1.214)	(−1.292)	(2.308)	(0.761)	
2	0.879	0.079		−1.096	−0.136	0.257	0.835	No
	(2.687)	(1.152)		(−2.019)	(−2.239)	(2.172)	(0.802)	
3	0.743		−0.800		−0.096	0.257	0.831	
	(2.559)		(−1.782)		(−1.990)	(2.107)	(0.807)	
4	0.801	0.045	4.185	−5.113	−0.128	0.294	0.816	No
	(2.560)		(1.052)	(−1.241)	(−2.078)	(2.477)	(0.779)	
5	0.787	−0.007	3.478	−4.393	−0.128	0.307	0.841	No
	(2.354)	(−0.050)	(0.544)	(−0.697)	(−2.038)	(2.531)	(0.800)	
6	0.874		0.806	−1.872	−0.130	0.304	0.839	No
	(2.799)		(0.203)	(−0.456)	(−2.118)	(2.561)	(0.806)	
Recent US								
1	−0.686	0.045		1.639	0.018	0.024	0.805	No
	(−2.236)			(3.400)	(0.377)	(0.188)	(0.778)	
2	−0.705	0.073		1.692	0.026	0.021	0.853	No
	(−1.971)	(1.271)		(3.068)	(0.451)	(0.146)	(0.824)	
3	−0.471		1.190		−0.032	0.069	0.846	
	(−1.592)		(2.574)		(−0.669)	(0.527)	(0.824)	
4	−0.718	0.045	−2.979	4.726	0.038	0.012	0.825	No
	(−2.166)		(−0.458)	(0.705)	(0.752)	(0.081)	(0.789)	
5	−0.628	0.034	−2.623	4.202	0.022	0.025	0.854	No
	(−1.859)	(0.371)	(−0.261)	(0.423)	(0.359)	(0.169)	(0.815)	
6	−0.586		−6.050	7.549	0.016	0.025	0.849	No
	(−1.788)		(−0.930)	(1.126)	(0.320)	(0.172)	(0.819)	

Table 7B: Controlling for Size and Book-to-Market with B/M-by-Size Portfolios.

	Intercept	$E(c^p)$	$\beta^{1,p}$	$\beta^{net,p}$	**ln(size)**	**B/M**	R^2	**Test**
Theory	$\alpha = 0$	$\kappa > 0$	$\lambda^{1,p} = 0$	$\lambda^{net,p} > 0$				
Japan								
1	1.491	0.050		−1.482	−0.131	−0.541	0.665	No
	(1.406)			(−1.182)	(−0.976)	(−0.753)	(0.618)	
2	1.409	1.048		−1.111	−0.002	−0.697	0.688	No
	(0.996)	(0.731)		(−0.770)	(−0.010)	(−0.873)	(0.626)	
3	1.555		−1.616		−0.142	−0.545	0.677	
	(1.531)		(−1.362)		(−1.124)	(−0.782)	(0.631)	
4	2.747	0.050	−27.172	24.540	−0.084	−1.437	0.692	No
	(1.857)		(−1.700)	(1.544)	(−0.524)	(−1.620)	(0.630)	
5	−0.380	14.867	118.711	−119.847	0.090	−1.121	0.702	No
	(−0.112)	(1.163)	(1.074)	(−1.094)	(0.459)	(−1.034)	(0.624)	
6	2.752		−28.734	26.086	−0.087	−1.442	0.696	No
	(1.861)		(−1.800)	(1.643)	(−0.537)	(−1.627)	(0.635)	

Table 7B: *Continued.*

Description: Table 7B corresponds to the AP Table 7 Panel B. We develop the table as follows. We develop the table as follows. First, in the first and second row, we record independent variables of the regression and the AP theoretical predictions. The first variable is the intercept term. The AP prediction is that it is zero. The second variable is the expected illiquidity costs. The prediction is that it has a positive impact on the rate of returns. The third variable is the market beta. The prediction is that the market risk premium beyond the net liquidity risk premium is zero because the AP theory implies that the market risk premium and the liquidity risk premium are identical. The fourth variable is the net liquidity betas including the market beta. The prediction is that the net liquidity risk has a positive impact.

Second, for each dataset, we generate 25 *B/M-by-size liquidity portfolios* with *an equally-weighted market portfolio.* Then, we record the estimated coefficients for each of the six LCAPM models with size and book-to-market:

$$E(r_t^i - r_t^f) = \text{Intercept} + \kappa E_t c_t^i + \lambda \beta^{net,i} + \lambda^2 \ln(\text{size}^p) + \lambda^3 \text{BM}^p$$
$$E(r_t^i - r_t^f) = \text{Intercept} + \kappa E_t c_t^i + \lambda^1 \beta^{1i} + \lambda^{net} \beta^{net,i} + \lambda^2 \ln(\text{size}^p) + \lambda^3 \text{BM}^p$$

Specifically, "Model 1" estimates an LCAPM equation with κ calibrated as the average monthly turnover across all samples. "Model 2" estimates the LCAPM with κ as a free parameter. "Model 3" is the CAPM. "Model 4" is a two-variable LCAPM with κ at its calibrated value. "Model 5" is the two-variable LCAPM with κ as a free parameter. "Model 6" is a two-variable LCAPM that κ is restricted to be 0. We report t-statistics estimated using a GMM framework that takes into account the pre-estimation of the betas in the parenthesis. We report R^2 obtained in a single cross-sectional regression and the adjusted R^2 is reported in parentheses.
Third, we conduct the LCAPM tests. For Model 1 and 2, if the model satisfies the one-variable test, we record "Yes" at the " Test" column. For Model 4, 5, and 6, if the model satisfies the two-variable test, we record "Yes" at the "Test" column., we record "Yes."

Interpretation: AP, the replication LCAPM, the LCAPM on the recent US and the LCAPM on the Japanese data satisfy none of the one-variable and the two-variable test.

because (1) the illiquidity cost effect is not significant (t-stat −0.039) and (2) the net illiquidity risk effect is not significant (t-stat 0.846).

Replication. The LCAPM does not satisfy the one-variable test because, for one, the illiquidity cost effect is insignificant (t-stat 1.152). It does not satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat −0.050) and (2) the net illiquidity risk effect is also not significant (t-stat −0.697).

Recent US. The LCAPM does not satisfy the one-variable test nor the two-variable test for the same reasons as above.

Japan. The LCAPM does not satisfy the one-variable test because the illiquidity cost effect is not significant (t-stat 0.731). Nor it does satisfy the two-variable test because (1) the illiquidity cost effect is not significant (t-stat 1.163) and (2) the net liquidity effect is not significant (t-stat −1.094).

7 Conclusion

Acharya and Pedersen (2005) study the effect of liquidity risk on the cross-section of asset returns and develop the LCAPM formula with the four testable hypotheses that (1) the intercept term is zero, (2) the illiquidity costs have a positive effect, (3) the net liquidity risk also has a positive effect, and (4) the market risk premium is equal to the liquidity risk premium.

This paper tests the validity of the AP LCAPM for six models, eight test portfolios, and three different datasets (the 1964 to 1999 US data, the recent 2000-16 US data, and the 1978-2012 Japanese data). We find that the AP LCAPM satisfies the one-variable LCAPM test for 36.0% of 64 regressions and the two-variable LCAPM test for 5.2% of 96 regressions. These results are consistent with Holden and Nam (2018).

Although the idea of the liquidity risk that investors are concerned with the fluctuation of liquidity over time is very economically intuitive, when there are severe multicollinearity among the illiquidity costs, the market beta, and the liquidity betas, the estimation results are statistically unstable and hard to interpret.

References

Acharya, V. V. and L. H. Pedersen. 2005. "Asset Pricing with Liquidity Risk." *Journal of Financial Economics*. 77(2): 375–410.

Amihud, Y. 2002. "Illiquidity and Stock Returns: Cross-Section and Time-Series Effects." *Journal of Financial Markets*. 5(1): 31–56.

Amihud, Y., A. Hameed, W. Kang, and H. Zhang. 2015. "The Illiquidity Premium: International Evidence." *Journal of Financial Economics*. 117(2): 350–368.

Amihud, Y. and H. Mendelson. 1996. “Asset Pricing and the Bid-Ask Spread.” *Journal of Financial Economics*. 17(2): 223–249.

Amihud, Y., H. Mendelson, and L. H. Pedersen. 2005. “Liquidity and Asset Prices.” *Foundations and Trends in Finance, Now Publishers*. 1(4): 269–364. February.

Asness, C. S., T. J. Moskowitz, and L. H. Pedersen. 2013. “Value and Momentum Everywhere.” *The Journal of Finance*. 68(3): 929–985.

Bagehot, W. 1971. “The Only Game in Town.” *Financial Analyst Journal*. 27(2): 12–14.

Daniel, K., S. Titman, and K. C. J. Wei. 2003. “Explaining the Cross-Section of Stock Returns in Japan: Factors or Characteristics?” *Journal of Finance*. 56(2): 743–766.

Demsetz, H. 1968. “The Cost of Transacting.” *The Quarterly Journal of Economics*. 82(1): 33–53.

Fama, E. and J. D. MacBeth. 1973. “Risk, Return and Equilibrium: Empirical Tests.” *Journal of Political Economy*. 81(3): 607–636.

Foucault, T., M. Pagano, and A. Röell. 2014. *Market Liquidity: Theory, Evidence, and Policy*. UK: Oxford University Press.

Garman, M. B. 1976. “Market Microstructure.” *Journal of Financial Economics*. 3(3): 257–275.

Gelman, A. and H. Stern. 2006. “The Difference Between ‘Significant’ and ‘Not Significant’ is not Itself Statistically Significant.” *The American Statistician*: 328–331.

Holden, C. W. and J. Nam. 2018. “Do the LCAPM Predictions Hold? Replication and Extension Evidence.” *Critical Finance Review*. 8: 29–71.

Kazumori, E. 2017. “Asset Pricing with Liquidity Risk: A U.S.-Japan Comparison.” Working Paper.

Lee, K.-H. 2011. “The World Price of Liquidity Risk.” *Journal of Financial Economics*. 99(1): 136–161.

Levi, Y. and I. Welch. 2017. “Best Practice for Cost-of-Capital Estimates.” *Journal of Financial and Quantitative Analysis*. 52(2): 427–463.

Li, B., Q. Sun, and C. Wang. 2014. “Liquidity, Liquidity Risk and Stock Returns: Evidence from Japan.” *European Financial Management*: 126–151.

Roll, R. 1984. “A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market.” *The Journal of Finance*. 39(4): 1127–1139.

Stoll, H. R. 1978. “The Supply of Dealer Services in Securities Markets.” *Journal of Finance*. 33(4): 1133–1151.

Vayanos, D. and J. Wang. 2012. “Market Liquidity: Theory and Empirical Evidence.” In: *Handbook of the Economics of Finance in George Constantinides*. Edited by M. Harris and R. Stulz. Amsterdam: North Holland. Chapter 19.