The Liquidity-Adjusted Capital Asset Pricing Model: A Meta-Analysis

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Acharya & Pedersen (2005)

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Asset pricing with liquidity risk☆

Viral V. Acharya[a,b], Lasse Heje Pedersen[b,c,d,*]

The Capital Asset Pricing Model (CAPM)

$$\left[E(R_i) - R_f\right] = \beta_i\left[E(R_m) - R_f\right]$$

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Expected return for security *i* above the risk-free rate

The Capital Asset Pricing Model (CAPM)

$$\left[E(R_i) - R_f\right] = \beta_i \left[E(R_m) - R_f\right]$$

Expected return for "the market" above the risk-free rate.

The Capital Asset Pricing Model (CAPM)

$$\left[E(R_i) - R_f\right] = \beta_i\left[E(R_m) - R_f\right]$$

Security *i*'s sensitivity to market movements

Estimating the CAPM

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$$(R_i - R_f) = \lambda\beta_i$$

$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

Estimating the CAPM

$$(R_i - R_f) = \lambda \beta_i$$

"Market price of risk"

The Liquidity Adjusted CAPM (L-CAPM)

$$[E(R_i) - R_f] = E(c_i) + (\beta_i^1 + \beta_i^2 - \beta_i^3 - \beta_i^4)\left[E(R_m) - R_f - C_m\right]$$

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$$\beta_i^2 = \frac{Cov(c_i, C_m)}{Var(R_m - R_f - C_m)}$$

→ **"Commonality in liquidity with the market liquidity"**

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→ **"Return sensitivity to market liquidity"**

The Liquidity Adjusted CAPM (L-CAPM)

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$$\beta_i^4 = \frac{Cov(c_i, R_m)}{Var(R_m - R_f - C_m)}$$

→ **"Liquidity sensitivity to market returns"**

Estimating the L-CAPM

$$\left(R_i - R_f\right) = \alpha + \kappa E(c_i) + \lambda^1 \beta_i^1 + \lambda^2 \beta_i^2 - \lambda^3 \beta_i^3 - \lambda^4 \beta_i^4$$

Testable Hypotheses

$$\left(R_i - R_f\right) = \alpha + \kappa E(c_i) + \lambda^1 \beta_i^1 + \lambda^2 \beta_i^2 - \lambda^3 \beta_i^3 - \lambda^4 \beta_i^4$$

1) $\lambda^1 > 0;$ 2) $\lambda^2 > 0;$ 3) $\lambda^3 > 0;$ 4) $\lambda^4 > 0;$

5) $\lambda^2 = \lambda^3 = \lambda^4;$

6) $\lambda^1 = \lambda^2 = \lambda^3 = \lambda^4$

PROBLEM: Collinearity in the betas

"The collinearity of measures of liquidity risk…makes it hard to empirically distinguish the separate effects of illiquidity and the individual liquidity betas." (Acharya & Pedersen, page 392)

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SOLUTION → Meta-Analysis

Data

24 Studies; 41 Model specifications, 4385 Estimates

Model Code	All Model Specifications Dependent variable: $r_i - r_f$
1	$\lambda_0 + \lambda_{all}\hat{\beta}_{all}$
2	$\lambda_0 + k^f E[C_i] + \lambda_{all}\hat{\beta}_{all}$
3	$\lambda_0 + kE[C_i] + \lambda_{all}\hat{\beta}_{all}$
4	$\lambda_0 + kE[C_i] + \lambda_1\hat{\beta}_1 + \lambda_{all*}\hat{\beta}_{all*}$
5	$\lambda_0 + \lambda_1\hat{\beta}_1 + \lambda_{all*}\hat{\beta}_{all*}$
6	$\lambda_0 + k^f E[C_i] + \lambda_1\hat{\beta}_1 + \lambda_{all*}\hat{\beta}_{all*}$
7	$\lambda_0 + kE[C_i] + \lambda_1\hat{\beta}_1 + \lambda_{liq}\hat{\beta}_{liq}$
8	$\lambda_0 + kE[C_i] + \lambda_{liq}\hat{\beta}_{liq}$
9	$\lambda_0 + \lambda_{liq}\hat{\beta}_{liq}$
10	$\lambda_0 + k^f E[C_i] + \lambda_{liq}\hat{\beta}_{liq}$
11	$\lambda_0 + \lambda_1\hat{\beta}_1 + \lambda_{liq}\hat{\beta}_{liq}$
12	$\lambda_0 + kE[C_i] + \lambda_1\hat{\beta}_1 + \lambda_2\hat{\beta}_2 + \lambda_3\hat{\beta}_3 + \lambda_4\hat{\beta}_4$
…	…

$$H_0: \lambda^1 = \lambda^2 = \lambda^3 = \lambda^4$$

Model Specification	Studies	Observations
$\lambda_0 + \lambda_1 \hat{\beta}_1 + \lambda_2 \hat{\beta}_2 - \lambda_3 \hat{\beta}_3 - \lambda_4 \hat{\beta}_4$	4	14
$\lambda_0 + k^f E[C_i] + \lambda_1 \hat{\beta}_1 + \lambda_2 \hat{\beta}_2 - \lambda_3 \hat{\beta}_3 - \lambda_4 \hat{\beta}_4$	5	41
$\lambda_0 + kE[C_i] + \lambda_1 \hat{\beta}_1 + \lambda_2 \hat{\beta}_2 - \lambda_3 \hat{\beta}_3 - \lambda_4 \hat{\beta}_4$	15	102
$k^f E[C_i] + \lambda_1 \hat{\beta}_1 + \lambda_2 \hat{\beta}_2 - \lambda_3 \hat{\beta}_3 - \lambda_4 \hat{\beta}_4$	1	14

$$H_0: \lambda^1 = \lambda^2 = \lambda^3 = \lambda^4$$

Original specification from primary study

$$\left(R_i - R_f\right) = \lambda_0 + \lambda^1\beta_i^1 + \lambda^2\beta_i^2 - \lambda^3\beta_i^3 - \lambda^4\beta_i^4$$

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This produces five estimates: $\boldsymbol{\hat{\lambda}^1, \hat{\lambda}^2, \hat{\lambda}^3, \hat{\lambda}^4}$, plus $\boldsymbol{\hat{\lambda}_0}$

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$$\lambda_s = \alpha_1 D\lambda_s^1 + \alpha_2 D\lambda_s^2 + \alpha_3 D\lambda_s^3 + \alpha_4 D\lambda_s^4 + \alpha_5 Dconstant_s + \alpha_6 Dcost_s$$

$$H_0\colon \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4$$

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$+\alpha_5 DSE1 \times SE(\lambda_s^1) + \alpha_5 DSE2 \times SE(\lambda_s^2) + \alpha_5 DSE3 \times SE(\lambda_s^3) + \alpha_5 DSE4 \times SE(\lambda_s^4)$

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Results

Specification	$F(3, 17)$	$prob > F$	Observations
1	1.01	0.413	665
2	0.80	0.508	665

The End