



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

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# Acharya & Pedersen (2005)

## 4700+ Google Scholar citations



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### Asset pricing with liquidity risk <sup>☆</sup>

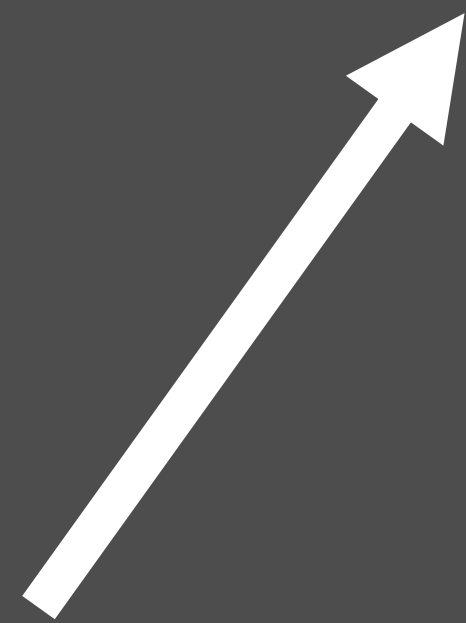
Viral V. Acharya<sup>a,b</sup>, Lasse Heje Pedersen<sup>b,c,d,\*</sup>

# The Capital Asset Pricing Model (CAPM)

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

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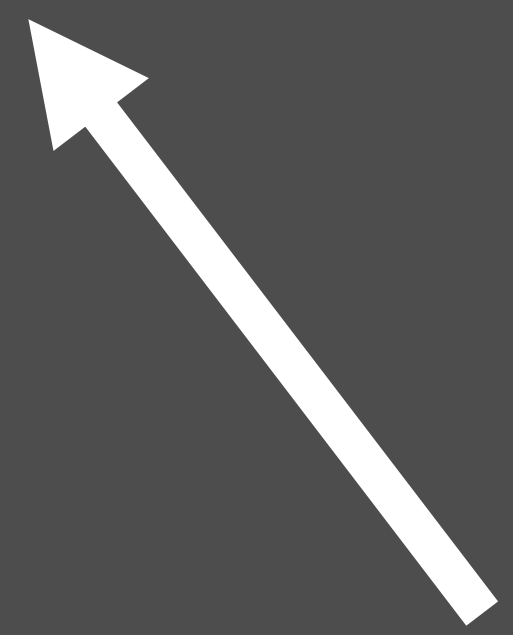
$$[E(R_i) - R_f] = \beta_i [E(R_m) - R_f]$$



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

# The Capital Asset Pricing Model (CAPM)

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



Expected return for  
“the market” above  
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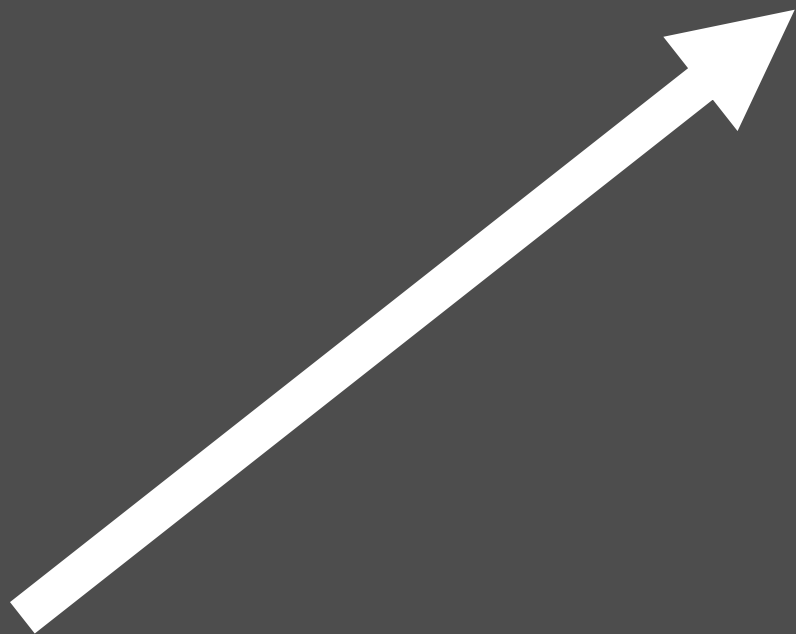
Security  $i$ 's  
sensitivity to  
market movements



# Estimating the CAPM

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

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




## Estimating the CAPM

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

“Market price of risk”



## The Liquidity Adjusted CAPM (L-CAPM)

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

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



“Commonality in liquidity with the market liquidity”

## The Liquidity Adjusted CAPM (L-CAPM)

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“Return sensitivity  
to market liquidity”

# The Liquidity Adjusted CAPM (L-CAPM)

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“Liquidity sensitivity to market returns”



## Estimating the L-CAPM

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

## Testable Hypotheses

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

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)**

## **PROBLEM: Collinearity in the betas**

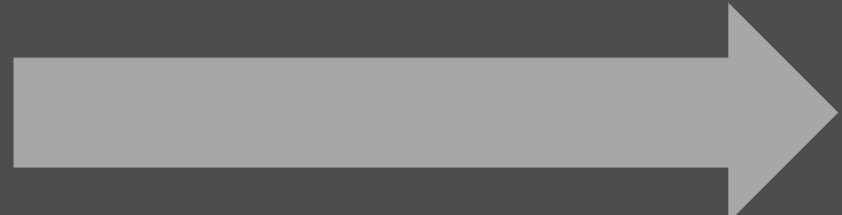
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**Tests of the theory: Confirmed=4 , Disconfirm=1, Mixed=19**

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**Tests of the theory: Confirmed=4 , Disconfirm=1, Mixed=19**

**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**

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



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

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$$\lambda_s = \alpha_1 D \lambda_s^1 + \alpha_2 D \lambda_s^2 + \alpha_3 D \lambda_s^3 + \alpha_4 D \lambda_s^4 + \alpha_5 D \text{constant}_s + \alpha_6 D \text{cost}_s$$

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

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# Results

<b>Specification</b>	<b><math>F(3, 17)</math></b>	<b><math>prob &gt; F</math></b>	<b>Observations</b>
1	1.01	0.413	665
2	0.80	0.508	665

**The End**