

# Empirical Asset Pricing

You have 1.5 hours to complete the exam. The exam is open-book. Good luck!

1. Bige Kahraman and Heather Tookes have a recent working paper by the title "Leverage Constraints and Liquidity: What can we learn from margin trading?". Here is the abstract of the paper:

Do traders' leverage constraints drive equity market liquidity? We use the unique features of the margin trading system in India to test the hypothesis that there is a causal relationship between traders' leverage constraints (i.e., their ability to borrow to invest in risky assets) and a stock's market liquidity. In India, the list of stocks eligible for margin trading is revised every month, creating a series of quasi-experiments that provide traders of newly eligible and ineligible stocks with shocks to the availability of leverage. We employ a regression discontinuity design that exploits the threshold rules that determine a stock's margin trading eligibility. When we compare the liquidity of eligible and ineligible stocks that lie close to the eligibility threshold, we find that liquidity is higher when stocks become eligible for margin trading and that it decreases with ineligibility. Using available data on margin financing activity at the individual stock level, we try to uncover the mechanisms driving this main finding. We find evidence consistent with the idea that the liquidity enhancement that we observe stems from margin traders' contrarian strategies.

Here's another description of what the authors do:

The paper is an empirical examination of the impact of leverage constraints on market liquidity. The authors exploit a unique feature of the Indian stock exchanges that allows stocks to be traded on margin only if a measure of their liquidity in a given period ('the impact cost') passes a pre-specified threshold. This rule splits the universe of stocks into two groups, only one of which is eligible for margin trading. The authors use this quasi-experiment within a regression discontinuity (RD) design. If some conditions are respected, this approach is suitable to estimate the causal impact of leverage constraints on liquidity. The authors find that stocks that become eligible for margin trading experience modest improvements in liquidity. Also, the authors show that stocks within the same eligibility group display co-movement in their liquidity level. They interpret this finding as evidence that changes in traders' leverage affect the dynamics of liquidity.

- (a) Refer to Brunnermeier and Pedersen (2009) and explain why we expect that stocks with different margin requirements should experience different liquidity (Hint: start from the budget constraint in their paper, equation (4))
- (b) Cite and briefly describe two papers that test the prediction that a tightening of arbitrageurs' capital causes lower liquidity. Specifically discuss the identification of these two papers and comment on the 'exogeneity' of the explanatory variable.

- (c) In the Indian stock market, stocks become eligible for margin trading if at the end of the month their average liquidity (as measured by price impact) over the past six months has passed a pre-specified threshold. So, every month there are two groups of stocks: Group 1, which contains stocks that are eligible for margin trading, and Group 2, which contains stocks that are ineligible for margin trading. Kahraman and Tookes in their main tests regress stock liquidity on a dummy for membership of Group 1.using the entire universe of stocks

$$Liquidity_{it} = \alpha_i + \beta * Group1_t + \gamma * X_t + \varepsilon_{it}$$

where Liquidity is either the bid-ask spread or the Amihud (2002) ratio (labeled ILLIQ), and X is a set of controls. Here are the main results:

VARIABLES	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread
Group1	-0.0012*** (0.0001)	-0.0071*** (0.0009)	-0.0004*** (0.0001)	-0.0003*** (0.0001)	-0.0037*** (0.0008)
lag_std_dret			0.0725*** (0.0033)	0.0690*** (0.0038)	0.0607*** (0.0039)
lag_mret			-0.0002 (0.0002)	-0.0000 (0.0002)	-0.0004* (0.0002)
lag_logvolume			-0.0005*** (0.0000)	-0.0004*** (0.0000)	-0.0002*** (0.0000)
lag_Spread			0.2343*** (0.0081)	0.2353*** (0.0091)	0.2217*** (0.0088)
lag_ILLIQ			0.0007*** (0.0002)	0.0007*** (0.0002)	-0.0002 (0.0003)
lag_logmcap				-0.0005*** (0.0001)	-0.0002** (0.0001)
Constant	0.0176*** (0.0003)	0.0157*** (0.0006)	0.0193*** (0.0005)	0.0277*** (0.0016)	0.0180*** (0.0019)
Observations	89,631	89,631	88,095	72,211	72,211
R-squared	0.231	0.260	0.303	0.307	0.312
Stock FE	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes
Polynomials	No	Yes	No	No	Yes
Controls	No	No	Yes	Yes	Yes

VARIABLES	(1) ILLIQ	(2) ILLIQ	(3) ILLIQ	(4) ILLIQ	(5) ILLIQ
Group1	-0.0188*** (0.0063)	-0.0859*** (0.0255)	-0.0029* (0.0016)	0.0012 (0.0020)	-0.0562*** (0.0205)
lag_std_dret			-0.2490* (0.1324)	-0.6214*** (0.1679)	-0.7308*** (0.1625)
lag_mret			0.0146** (0.0064)	0.0245*** (0.0080)	0.0121 (0.0079)
lag_logvolume			-0.0067*** (0.0009)	-0.0002 (0.0011)	0.0032*** (0.0012)
lag_spread			1.0931*** (0.2426)	0.9480*** (0.2765)	-0.2444 (0.2695)
lag_ILLIQ			0.7398*** (0.0089)	0.7461*** (0.0090)	0.5773*** (0.0141)
lag_logmcap				-0.0290*** (0.0031)	-0.0133*** (0.0024)
Constant	0.1502*** (0.0122)	0.1229*** (0.0237)	0.1499*** (0.0130)	0.6848*** (0.0610)	0.3314*** (0.0557)
Observations	89,606	89,606	88,074	72,194	72,194
R-squared	0.127	0.497	0.601	0.611	0.634
Stock FE	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes
Polynomials	No	Yes	No	No	Yes
Controls	No	No	Yes	Yes	Yes

Describe the results and comment their consistency with the hypothesis that is tested in the paper.

- (d) Comment on the exogeneity of the experiment that the authors use to identify the effect of interest. In particular, can you imagine a situation in which an unobservable variable co-determines allocation to Group 1 and the dependent variable?
- (e) In a second set of tests, the authors implement a Regression Discontinuity (RD) Design. That is, they restrict the sample to a narrow range of stocks around the cutoff for eligibility to Group 1 membership. For example, they consider 50 stocks to the left of the cutoff and 50 stocks to the right of the cutoff. The idea of RD is that, for this small set of stocks, the assignment to either group is mostly exogenous as it depends on random shocks to past liquidity that, on the margin, cause a stock to pass the threshold for membership. In this restricted sample of stocks, they run the same regressions as above. Comment on the reason that makes this identification more exogenous relative to the previous regressions.
- (f) Here are the results of RD (the controls are the same as in the previous tables,

columns (3) to (5))

VARIABLES	(1) Spread	(2) Spread	(3) Spread	(4) ILLIQ	(5) ILLIQ	(6) ILLIQ
Group1	-0.0004*** (0.0001)	-0.0003** (0.0001)	-0.0003** (0.0001)	-0.0049*** (0.0010)	-0.0021* (0.0012)	-0.0027*** (0.0010)

What are the main differences that you observe from the estimates in the previous regressions?

- (g) Can you think of a shortcoming of restricting the sample to such a small number of stocks around the cutoff? Do not focus on the power of the tests or the efficiency of the estimates. Rather, focus on the effects that you are measuring and whether they can be generalized.
- (h) Let us go back to the adherence of the research design to the predictions of the theory. Kahraman and Tookes show that stocks that are open for margin trading display higher liquidity. They conclude that investors that use leverage provide liquidity to these stocks. Is it something that is necessarily expected a priori? Can you think of and describe situations in which leveraged investors actually make stocks LESS liquid?

## 2. Let us talk about conditional Asset Pricing Models

- (a) Start from the stochastic discount factor pricing equation

$$E_t [(R_{t+1} + 1) M_{t+1}] = 1$$

Let the stochastic discount factor have a one-factor representation, with time-varying coefficients

$$M_{t+1} = a_t + b_t R_{f,t+1}$$

where  $R_{f,t+1}$  is the return on the factor. Assume that a risk-free rate exists, and show that time-variation in  $b_t$  is linked to time-variation in the risk premium on the factor.

- (b) Describe in formulas how you can move from a conditional asset pricing model to an unconditional one by assuming that the coefficients of the discount factor can be predicted using state variables.
- (c) What state variable do Lettau and Ludvigson (2001, Journal of Finance) use to predict the factor risk premium? How do they motivate this state variable?
- (d) Summarize the results of Lettau and Ludvigson (2001, Journal of Political Economy) relatively to the conditional version of CAPM and Consumption CAPM.
- (e) What is Lewellen and Nagel's (2005) criticism of the Conditional CAPM literature?