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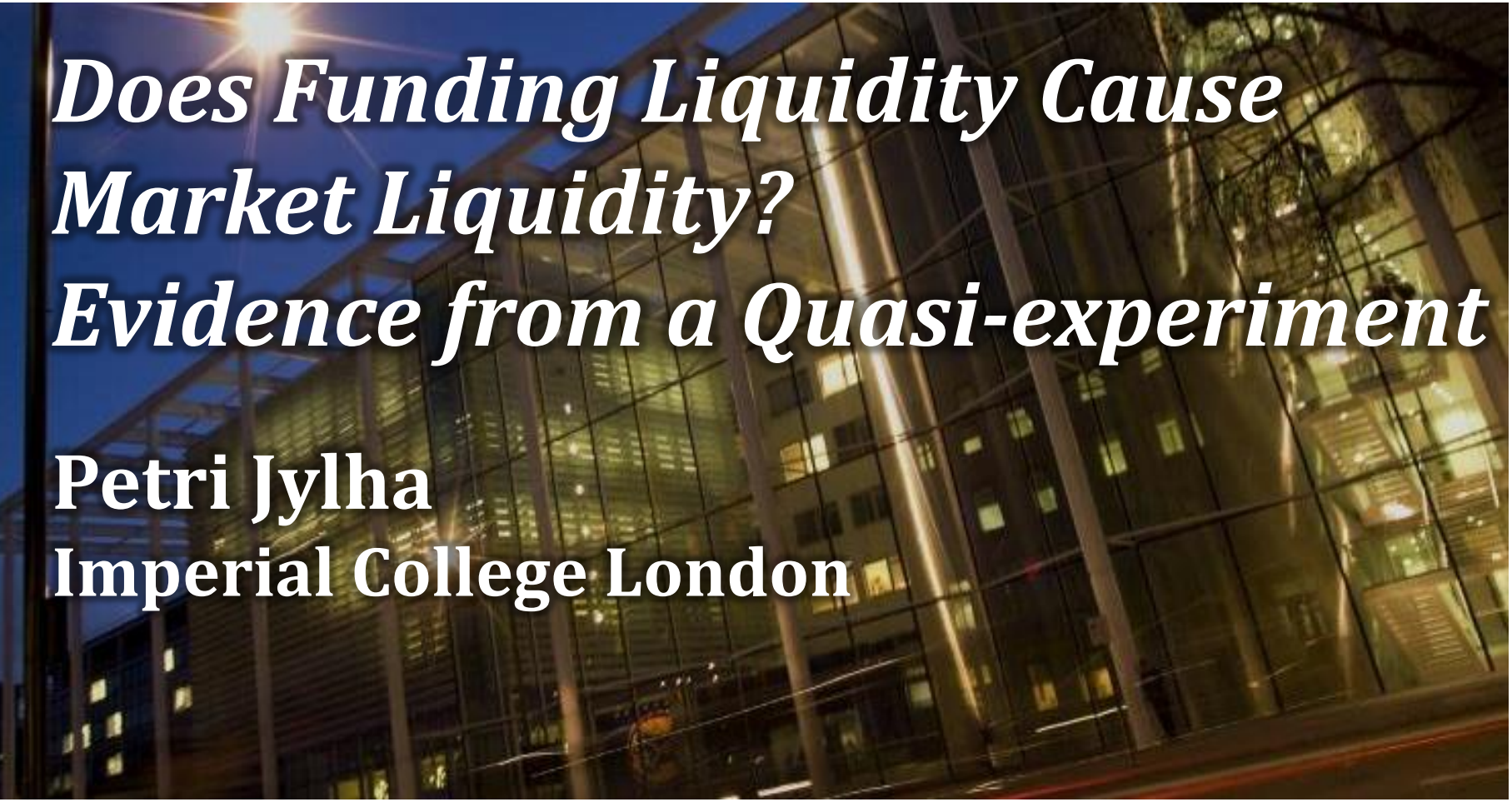

Does Funding Liquidity Cause Market Liquidity? Evidence from a Quasi-experiment

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Agenda

- Does funding liquidity cause market liquidity?
  - YES!

Agenda

- Motivation of research question
- Research methodology
- Empirical results
- Conclusions

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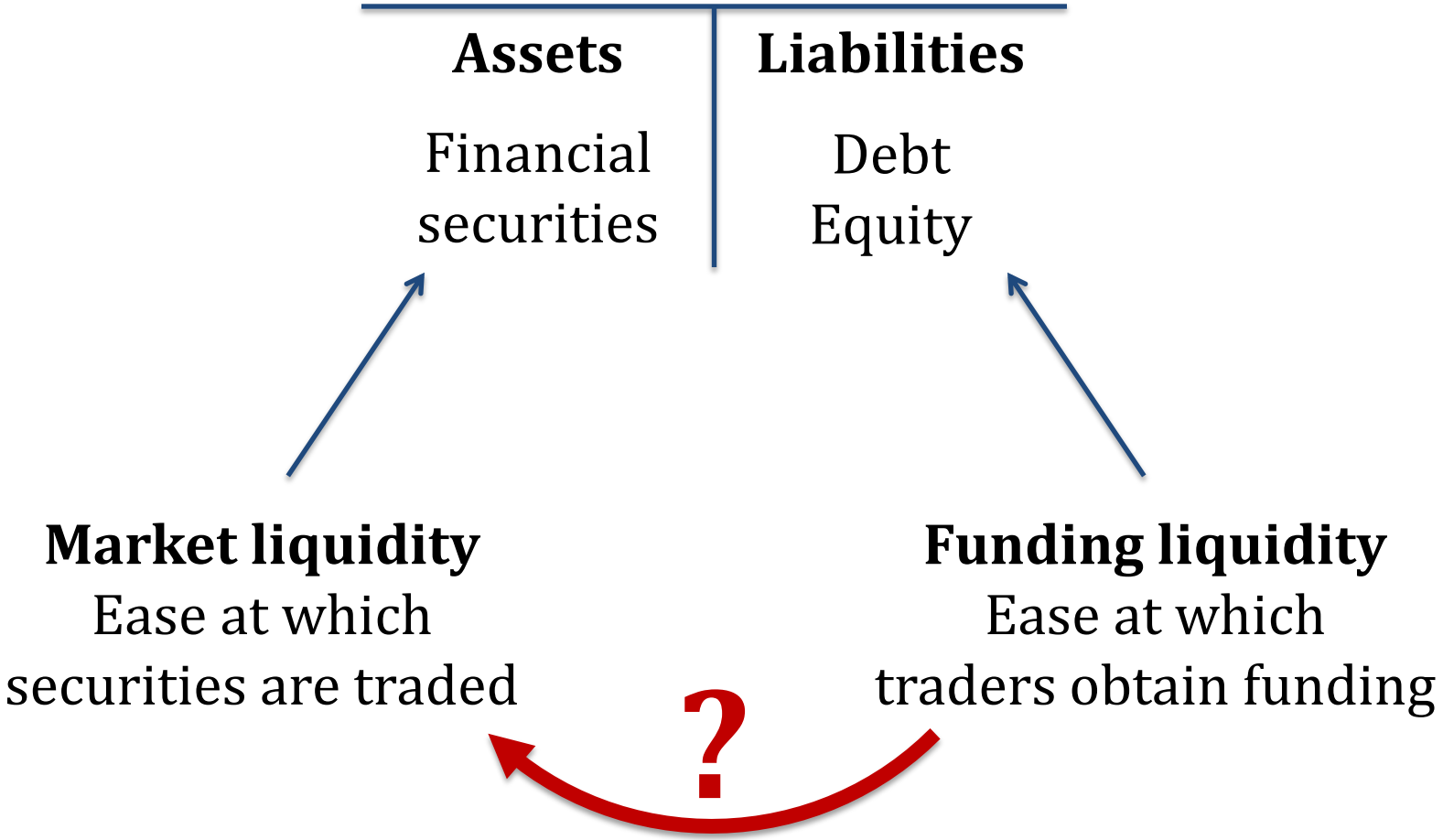
Funding liquidity and market liquidity



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Theory

- Gromb & Vayanos (2002, JFE) and Brunnermeier & Pedersen (2009, RFS)
- Funding constraints (insufficient funding liquidity) prevent traders from providing full liquidity to financial markets
- Improvement in funding liquidity → increase in traders' positions → improvement in market liquidity
- Causal effect of funding liquidity on market liquidity

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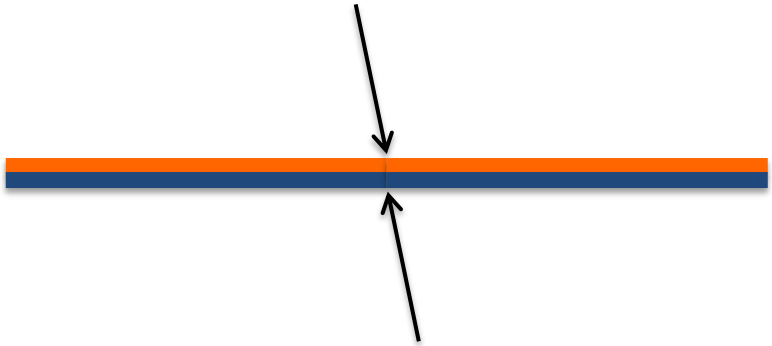
Theory Illustration

No funding constraints
Perferct funding liquidity

1) ”Buy 1m NL shares”

Royal Dutch Shell
€25 = £18



2) Liquidity provider
buys 1m UK shares @ £18 and
sells 1m NL shares @ €25

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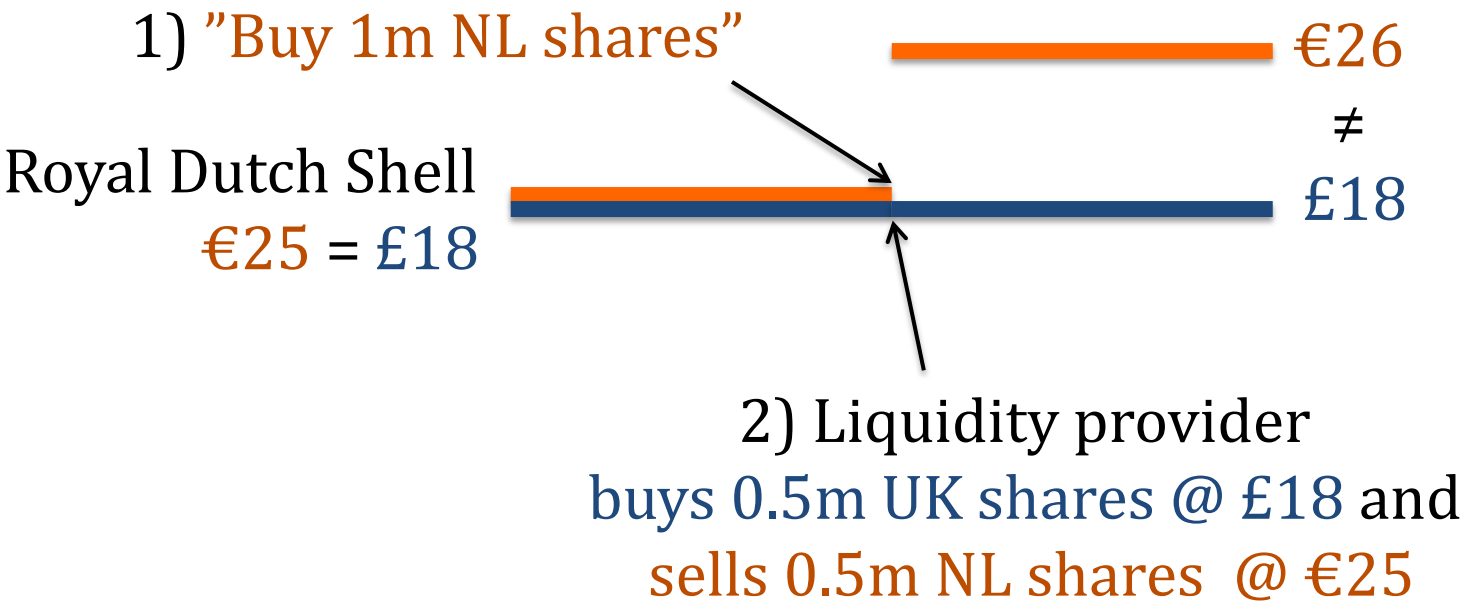
Theory Illustration

Some funding constraints
Imperferct funding liquidity



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Testing theories

- Causal effect of funding liquidity on market liquidity
- Difficult to test
  - Measuring funding liquidity difficult
  - Correlation ≠ causation
  - Common determinant
  - Direction of causality
- Solution
  - Find exogenous funding liquidity shock
  - Measure market liquidity effect of this funding liquidity shock

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Funding liquidity shock

- Approval of ”portfolio margining” of listed index options by SEC on July 14, 2005
- Significant reduction of margin requirement (improvement in funding liquidity) for index options
- No effect on margin requirement for (single-name) equity options

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Margining of written options
Strategy-based margin

- Individual written option
  - Call: $C_t + 0.15 \times S_t + \max(S_t - K, 0)$
  - Put: $P_t + 0.15 \times S_t + \max(K - S_t, 0)$
- Pre-determined strategies (straddle, box spread, collar, . . .)
  - Some combination of components (e.g. maximum)
  - Similar formula
- Problem
  - OTM options especially expensive to write
  - Limited number of pre-determined strategies
  - High margin requirement for complex low-risk portfolios
  - Ignores mechanical correlations

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Margining of written options
Portfolio margin

- Based on portfolio scenario analysis
- Shock underlying asset
  - -8%,…,+6% for index underlying
  - -15%,…,+15% for stock underlying
- Calculate total portfolio P&L for each scenario
- Margin requirement = maximum portfolio loss
- For index option portfolios, portfolio margin is on average 28% of strategy-based margin
- Significant improvement in funding liquidity
- Fully icorporates mechanical correlations

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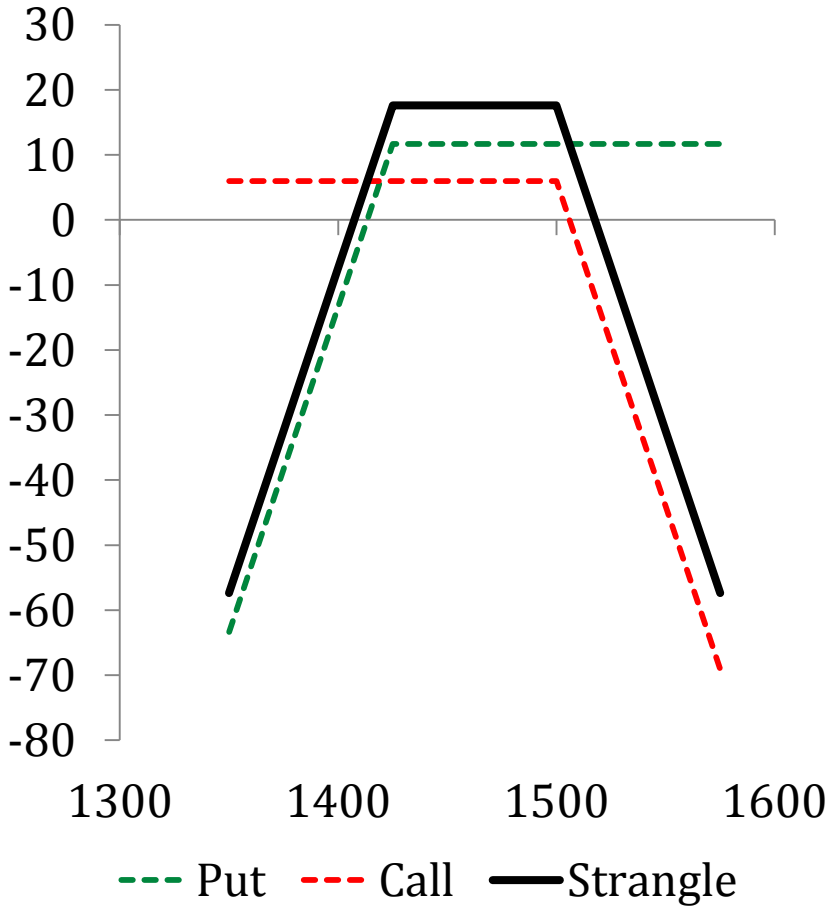
Margin example
Short strangle

- Price of underlying $1451
- Write 1425-put @ $11.66 and 1500-call @ $5.96
- Margins
  - Separately: $19.15 (put) + $16.89 (call) = **$36.04**
  - Strategy-based: **$19.15**
  - Portfolio: **$6.70**
    - 35% of strategy-based margin



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Identification strategy

- Analyse option liquidity around portfolio margining approval
- Compare changes in index option liquidity to changes in equity option liquidity
- Equity options provide control (placebo) group to eliminate effect of market-wide liquidity changes

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Regression setup

$$Liq_{i,t} = \beta_0 + \beta_1 \times Index_i \times After_t + \beta_2 \times Index_i + \beta_3 \times After_t$$

- $Liq_{i,t}$: option liquidity measure for underlying i on day t
- $Index_i$: 1 for index options and 0 for equity options
- $After_t$: 1 after 14/7/2005 and 0 before

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Regression setup

$$Liq_{i,t} = \beta_0 + \beta_1 \times Index_i \times After_t + \beta_2 \times Index_i + \beta_3 \times After_t$$

Average level of liquidity

	Before	After	Difference
Equity	β_0	$\beta_0 + \beta_3$	β_3
Index	$\beta_0 + \beta_2$	$\beta_0 + \beta_1 + \beta_2 + \beta_3$	$\beta_1 + \beta_3$
Difference	β_2	$\beta_1 + \beta_2$	β_1

Coefficient of interest
Difference-in-difference

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To econometricians in audience

- Additional controls
  - Lagged implied volatility, lagged return of underlying, lagged squared return of underlying, last-day-of-trading (3rd Friday) dummy, time and underlying fixed effects
- Standard errors clustered by time
  - No two-way clustering as liquidity measures aggregated by underlying and day

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Data

- Daily option price data from OptionMetrics database
- Options traded on CBOE
- 5 index options (S&P 100 and 500, Dow Jones, Nasdaq 100, and Russell 2000)
- 30 most traded equity options
- 200-day estimation window around event
  - From 18/2/2005 to 2/12/2005

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Liquidity measures

- Trading volume
- Bid-ask spread → direct trading cost
- Price impact → indirect trading cost

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Effect on trading volume

- Contract volume ↑ 18 %
  - Effect comes mainly from OTM options
- Dollar volume ↑ 8 %
  - OTM options' dollar volume ↑ 20 %
- Contract volume increase > dollar volume increase
  - Trading moves towards cheaper options
  - Moneyness of traded options ↓
  - More trading in previously illiquid OTM options

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Effect on bid-ask spread

- Bid-ask spread ↓ 101bps
  - 12% of pre-event average (812bps)
  - Effect stronger for OTM options

- Significant reduction in direct trading costs

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Effect on price impact

- Price impact answers question ”How much option prices move from $1m of trading?”
- Price impact measures ↓ 22% - 33%
- Significant reduction in indirect trading costs

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Market efficiency

- Market liquidity improvement is nice, what about market efficiency?
- Difficult to measure changes in market efficiency over single event
- Solution: dispersion of option price implied volatility) changes for one underlying during one day
- Efficient markets: prices reflect fundamentals well → implied volatilities moe in tandem → dispersion low
- Inefficient markets: prices reflect fundamentals poorly → implied volatilities move by transitory supply/demand shocks → dispersion high

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Effect on market efficiency

- Dispersion of implied volatility change ↓
  → Market efficiency ↑
- Effect stronger for OTM options

- Significant improvement in market efficiency
  - Especially for previously illiquid OTM options

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Conclusion

- Funding liquidity improvement → market liquidity and market efficiency improvements
  - Especially for illiquid securities
- Causal evidence in support of theories of Gromb & Vayanos (2002) and Brunnermeier & Pedersen (2009)
- Take-aways
  - Theories work
  - Margin regulation changes can be used to study effects of funding liquidity
  - Margin requirements have dark side: higher margin requirement results in less liquid and less efficient markets