An Empirical Analysis of Market Segmentation on U.S. Equities Markets

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DISCLAIMER

We thank NASDAQ OMX for providing the data for this research. The data employed in this research are equivalent to the TAQ data publicly available through databases such as WRDS. The views expressed herein are not intended to represent the views of NASDAQ OMX, its employees, or directors. The authors are solely responsible for the content, which is provided for informational and educational purposes only. Nothing contained herein should be construed as investment advice, either on behalf of a particular security or an overall investment strategy.

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PREAMBLE

How do you tell whether any particular practice, regulation, or structural change is beneficial to the market?
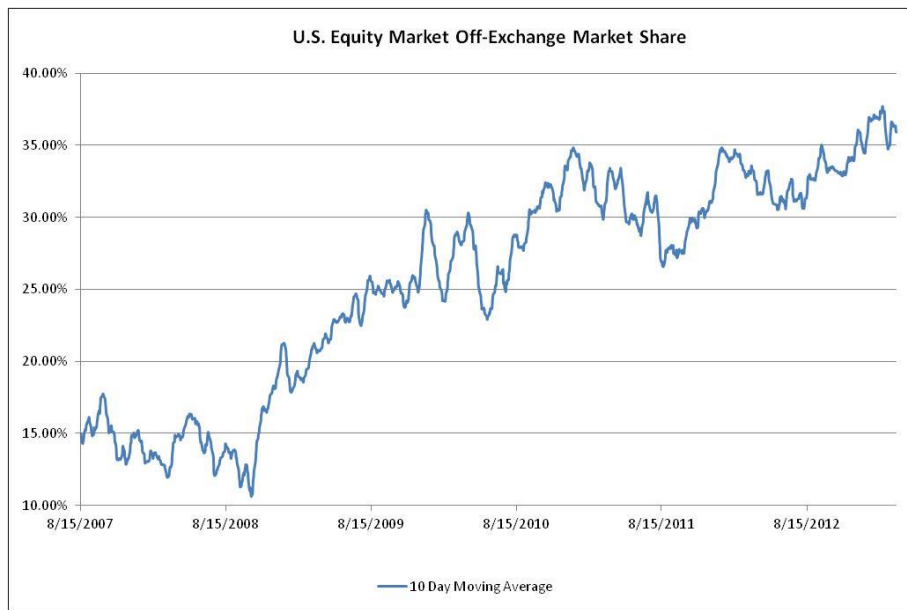
For example, the consensus is that in recent years,

- Competition among exchanges has increased,
- "Dark" market share has increased,
- High frequency trading has increased, and
- The bid ask spread has decreased.

Yet evaluating which of these trends, if any, is responsible for the decline in spreads, or even whether declining spreads mean that overall trading costs for all stocks are lower, remains a matter of faith as much as science.

Trading remains a complex multi-dimensional strategic interaction where identifying causality, or even correlation, is extremely challenging.
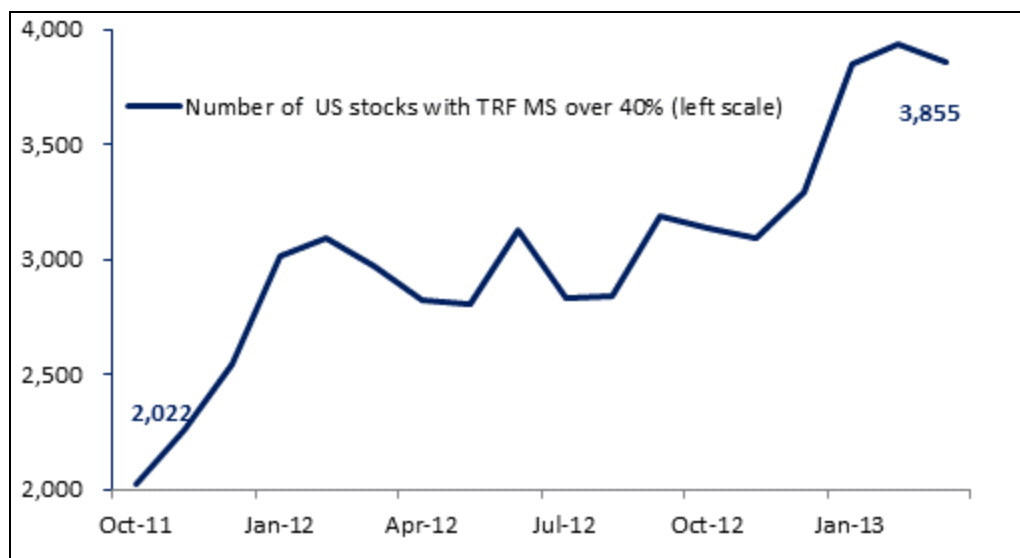
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PREAMBLE: NON-EXCHANGE TRADING GROWTH

U.S. Equity Market Off-Exchange Market Share

Number of Securities with over 40% OTC Market Share

OTC-share of trading has increased in the last five years, from 15% of total trading to over 35%.

Since September 2012, OTC levels have exceeded 35% on 64 (out of 140) days.

Number of Securities: The number of securities with >40% "OTC" share has more than doubled in the past year to over 49% of total stocks.

Source: CTA, UTP. Direct Edge and BATS ECN trading volumes removed from OTC/TRF totals.

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WHAT WE FIND
IN A NUTSHELL

Sample: 116 stocks listed on NYSE and NASDAQ

Sample period: Jan – March 2011

After controlling for market information asymmetry, we find that trading in dark markets :

Increases transaction costs;

> A 10% increase in dark market share will lead to 4.4% increase in transaction costs market wide.

> This is equivalent to $23 billion per year on the US markets

Reduces market price efficiency

The execution of large orders on dark markets does not harm market quality

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WHAT ARE WE TALKING ABOUT?
FRAGMENTATION, SEGMENTATION, AND TRANSPARENCY

By design, the U.S. equity markets are now a rich ecosystem of trading platforms with different participants, polices, and practices.

The platforms making up this ecosystem are becoming increasingly tailored toward different segments of market participants.

Choice is a good thing.

Look at how a market ecosystem characterized by choice deals with the core problems of asymmetric information and adverse selection.

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HOW TO DEAL WITH ASYMMETRIC INFORMATION AND ADVERSE SELECTION?
WHAT'S OLD IS NEW

Assume we divide the world in two, exchange markets (exchanges) and dark pool venues (dark pools).

Exchange markets display prices, are open to all participants, and offer standardized rules and practices including a standardized tick.

Dark pool venues do not display prices, restrict access, and offer more flexibility in rules and practices including relief from the standardized tick.

We think about the exchange model dealing with asymmetric information and adverse selection by setting the width and depth of the spread but historical practice included many other methods such as "the look", "fading the quote", and "pre-positioning" among others.

We don't know everything dark pool venues do to deal with asymmetric information and adverse selection but we do know about payment-for-order-flow, counterparty screening and toxicity ratings, IOIs, and other practices which are designed to address these problems.

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WHAT IS THE ISSUE WITH SEGMENTATION?
WHAT'S THE HARM?

One selling point of dark trading is that an order should at least try for a dark match knowing that any execution price will have to be at least as good as is shown on lit markets.

The prices of the lit markets are set by market makers' quotes and investors' orders. Investors often price orders based on the market so market makers drive prices.

Quotes are based on the average profitability of a trade.

The orders which initially do better in the dark are those least costly to trade against, this changes the average profitability of quotes. This drives a cycle of deteriorating lit benchmark prices creating more incentives to try and do better by trading dark.

Market making also moves to dark trading, as evidenced by the fact many dark venues have a traded spread.

Obviously, lit trades will do worse. The research question is whether orders trading dark also do worse because they are priced based on the lit markets' prices.

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LITERATURE SKETCH
NOT THE END OF THE STORY. NO CONSENSUS ON SEGMENTATION AND MARKET QUALITY

- Adverse Relationship
  - CFA Institute (2012)*
  - Zhu (2012)*
  - Weaver (2011)
  - Degryse, de Jong, and van Kervel (2011)
  - Easley, Kiefer, and O'Hara (1996)
- Neutral Relationship
  - Larrymore and Murphy (2009)
  - Chung, Chuwonganant, and McCormick (2006)*
- Favorable Relationship
  - O'Hara and Ye (2011)*
  - Buti, Rindi, and Werner (2010a, 2010b)
  - Gresse (2006)

* Indicates NASDAQ OMX provided data

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DATA SUMMARY
OUR CORE DATA IS FROM THE PUBLIC DOMAIN

TAQ equivalent Trade and Quote Data

1. Stratified sample of 116 Securities, 57 NASDAQ and 59 NYSE

    1. HFT sample stocks less four stocks which were delisted by end of sample period.

2. Sample period 1/3/11 to 3/31/11

3. Data is from the Tape Plans and is scrubbed as follows:

    1. Quotes with one sided quotes and with spreads lt 0.00 or gt $2.00 deleted

    2. Only regular way trades 9:30:30 to 16:00:00

    3. Winsorize trades outside the NBBO to be at the same side of the NBBO

4. Trade and quote matching

    1. Exchange venues contemporaneous match

    2. Dark pool venues trades matched with quotes 40ms prior.

    3. Lee & Ready for buy/sell initiation

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DATA SUMMARY STATS

Table 1. Sample Descriptive Statistics

The sample consists of trades from 116 stocks occurring between January 3 2011 and March 31 2011. Reported are cross-sectional values averages across the 116 stocks. *Market cap.* is the stock's market capitalization on January 3 2011 in billions. All remaining variables are daily averages. *Quoted spread* is the time-weighted average difference between the bid and ask prices in dollars. *Price* is the average trade price in dollars. *Volume* is the average number of shares traded in millions. *Ntrades* is the average number of transactions in thousands. *Trade size* is the average daily trade size in number of shares. *Market share* is the venue volume (i.e. NMS volume or non-NMS volume) of shares traded divided by the total volume of shares traded, expressed as a percentage. Stocks are sorted into terciles based on market capitalization, and Panels B to D report these statistics for each tercile group.

	NMS					Non-NMS				
	Mean	**Stddev**	**Q1**	**Median**	**Q3**	**Mean**	**Stddev**	**Q1**	**Median**	**Q3**
Panel A: Full sample										
Market cap.	20.72	44.95	0.644	2.256	20.77					
Quoted spread	0.038	0.071	0.011	0.020	0.035					
Price	46.44	70.04	16.26	30.79	54.35	46.44	70.04	16.26	30.80	54.35
Volume	3.132	7.123	0.144	0.339	2.668	1.426	3.747	0.056	0.116	1.104
Ntrades	13.57	21.10	1.068	2.833	18.06	3.903	7.793	0.239	0.505	3.734
Trade size	153.4	59.5	123.9	134.0	151.6	256.1	77.88	208.1	235.2	280.5
Market share	73.80	5.231	70.78	73.91	77.04	26.20	5.231	22.96	26.09	29.22

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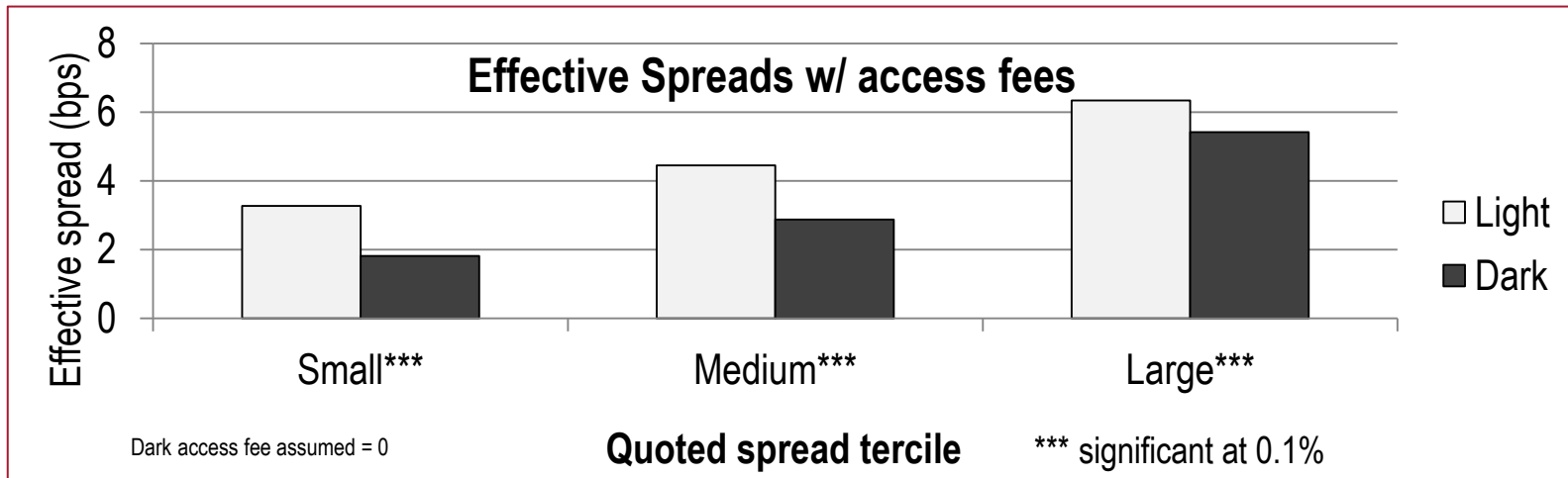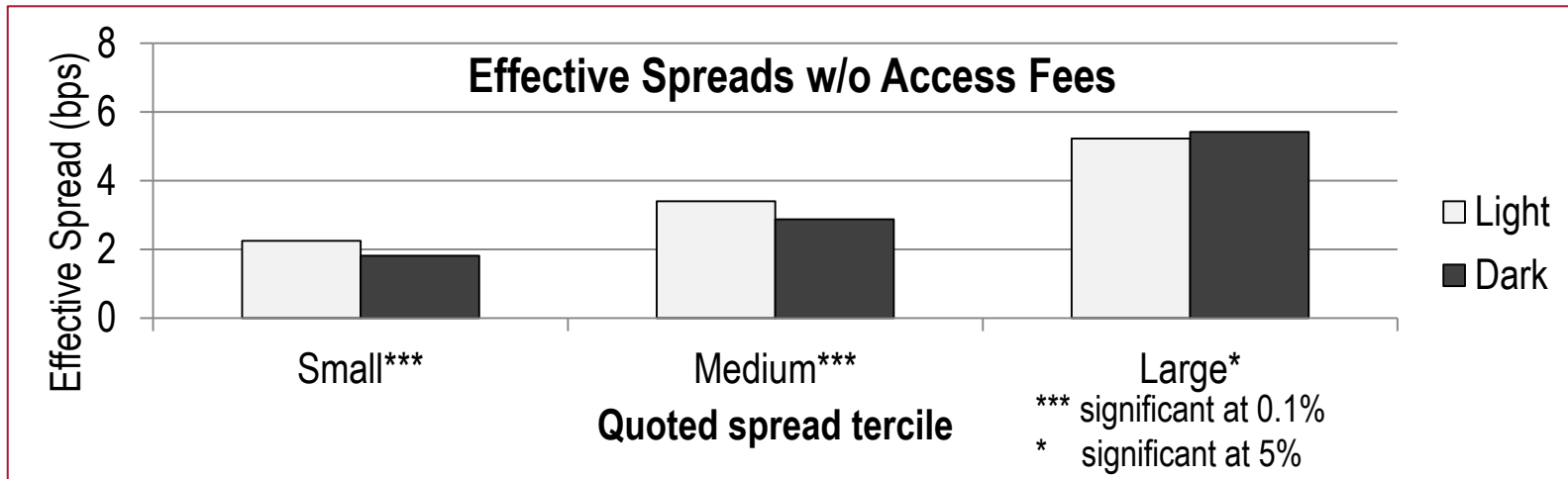
DATA ANALYSIS
DOES THIS STRATIFIED SAMPLE LOOK LIKE WHAT WE'D EXPECT FROM A LARGER SAMPLE?

- Effective spreads

- Price Improvement

- Adverse Selection

- Realized Spread

- Hasbrouck Information Shares

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RESULTS: EFFECTIVE SPREADS
½ SPREAD CONVENTION

$$Effective\ spread_t = q_t \frac{(p_t - m_t)}{m_t} + \frac{fee}{m_t}$$

Effective Spreads w/o Access Fees

Effective Spread (bps)

Small***   Medium***   Large*

Quoted spread tercile

Light
Dark

*** significant at 0.1%
*   significant at 5%

Effective Spreads w/ access fees

Effective spread (bps)

Small***   Medium***   Large***

Dark access fee assumed = 0   Quoted spread tercile   *** significant at 0.1%

Light
Dark

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RESULTS: PRICE IMPROVEMENT DISTRIBUTION

Level	Price improvement (cents)	Lit		Dark	
		Mean	**Median**	**Mean**	**Median**
Panel A: Full sample					
1	0	83.61	86.32	50.48	49.58
2	$0 < x \leq 0.10$	0.00	0.00	11.73	11.45
3	$0.10 < x \leq 0.20$	0.00	0.00	2.68	2.29
4	$0.20 < x \leq 0.30$	0.00	0.00	2.83	2.78
5	$0.30 < x \leq 0.40$	0.00	0.00	1.18	1.00
6	$0.40 < x < 0.50$	0.00	0.00	0.51	0.37
7	0.5	1.66	1.43	12.38	11.65
8	$0.50 < x < 0.60$	0.00	0.00	0.13	0.08
9	$0.60 \leq x < 0.70$	0.00	0.00	0.36	0.27
10	$0.70 \leq x < 0.80$	0.00	0.00	0.45	0.46
11	$0.80 \leq x < 0.90$	0.00	0.00	0.45	0.39
12	$0.90 \leq x < 1.00$	0.00	0.00	0.16	0.12
13	$1.00 \leq x$	14.73	12.14	16.64	17.49

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RESULTS: ADVERSE SELECTION

$$Adverse\ selection_t = q_t \frac{(m_{t+30} - m_t)}{m_t}$$

Adverse Selection – 30 seconds

Adverse selection (bps)

Quoted spread tercile

Small   Medium   Large

☐ Lit
■ Dark

All differences significant at 0.1%

Adverse Selection – 5 minutes

Adverse selection (bps)

Quoted spread tercile

Small   Medium   Large

☐ Lit
■ Dark

All differences significant at 0.1%

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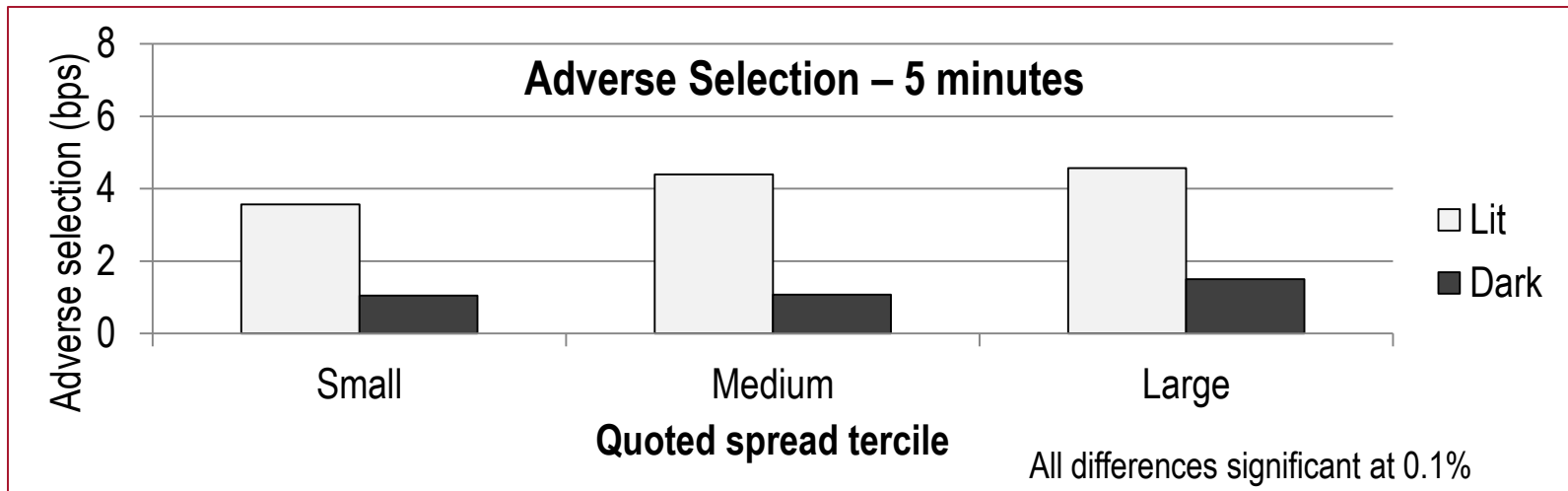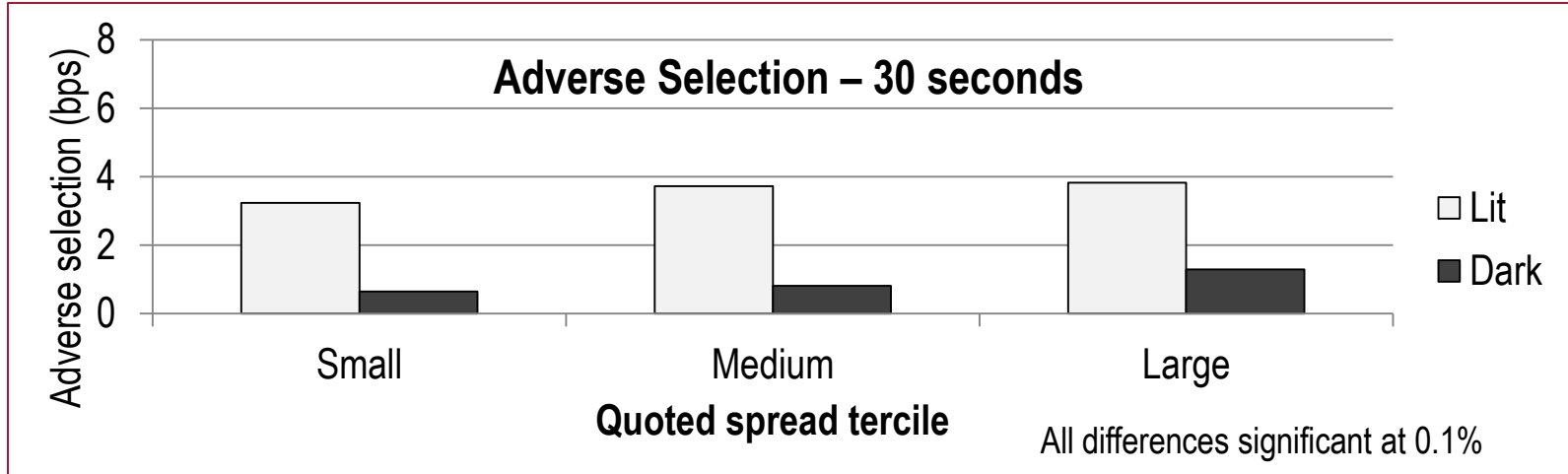
RESULTS: REALIZED SPREADS AFTER REBATE
½ SPREAD CONVENTION

$$Realized\ spread_t = q_t \frac{(p_t - m_{t+30})}{m_t} + \frac{rebate}{m_t}$$

Realized Spreads – 30 seconds

Y-axis: Realized Spreads (bps); values -1, 1, 3, 5, 7
X-axis: Small, Medium, Large — Quoted spread tercile
Legend: Lit, Dark
All differences significant at 0.1%

Realized Spreads – 5 minutes

Y-axis: Realized Spreads (bps); values -1, 1, 3, 5, 7
X-axis: Small, Medium, Large — Quoted spread tercile
Legend: Lit, Dark
All differences significant at 0.1%

16   Dark rebate assumed = 0

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RESULTS: LAST SALE INFORMATION CONTRIBUTION TO MARKET PRICE
HASBROUCK (1995) 1 MINUTE SAMPLING INTERVAL

$$\Delta p_{1,t} = \alpha_1 + \Sigma\beta_{1,t-s}\Delta P_{1,t-s} + \Sigma\beta_{2,t-s}\Delta P_{2,t-s} + b_1\left(P_{1,t-1} - P_{2,t-1}\right) + \Delta\varepsilon_{1,t}$$
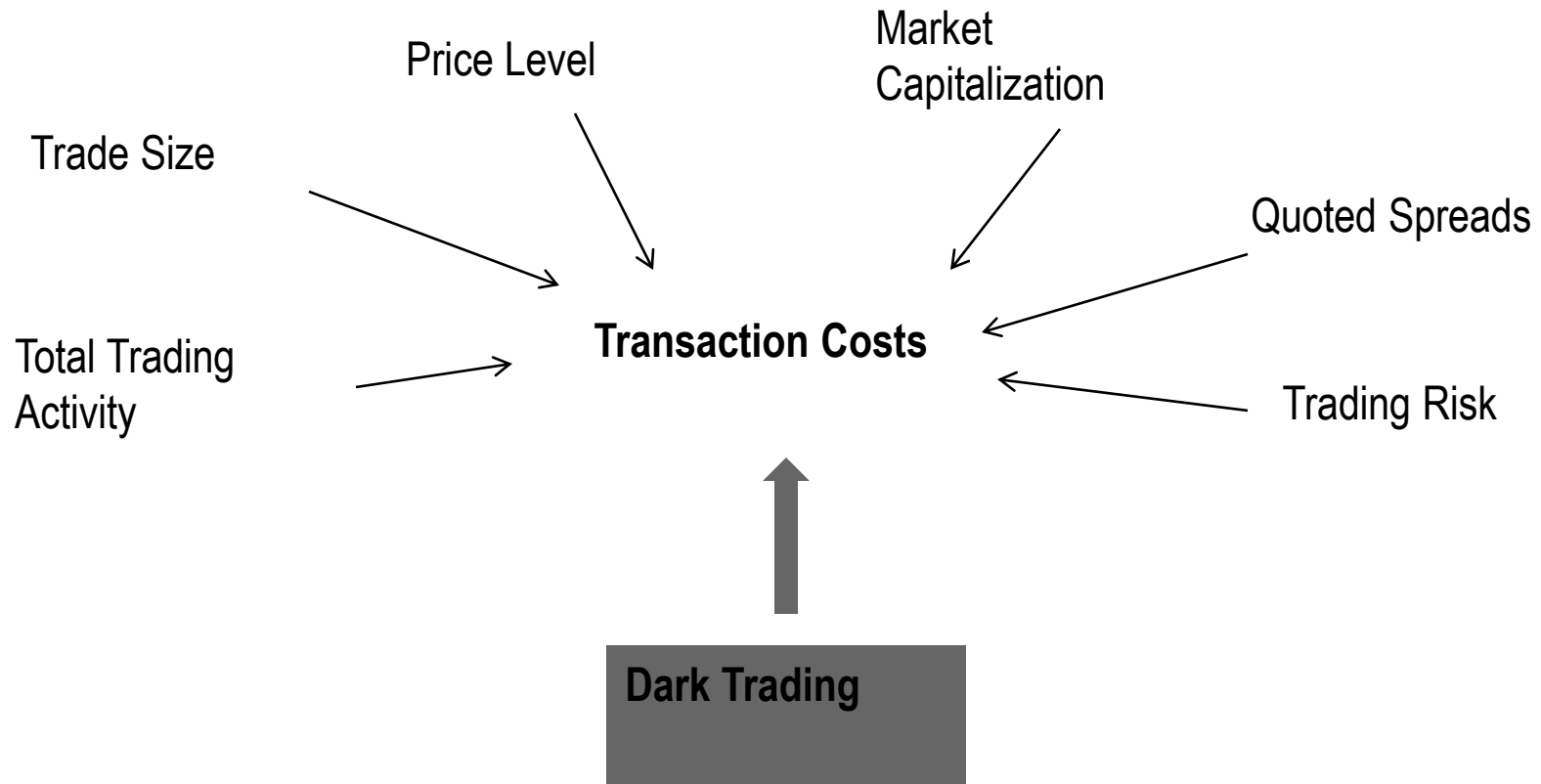
$$\Delta p_{2,t} = \alpha_2 + \Sigma\beta_{1,t-s}\Delta P_{1,t-s} + \Sigma\beta_{2,t-s}\Delta P_{2,t-s} + b_2\left(P_{1,t-1} - P_{2,t-1}\right) + \Delta\varepsilon_{2,t}$$

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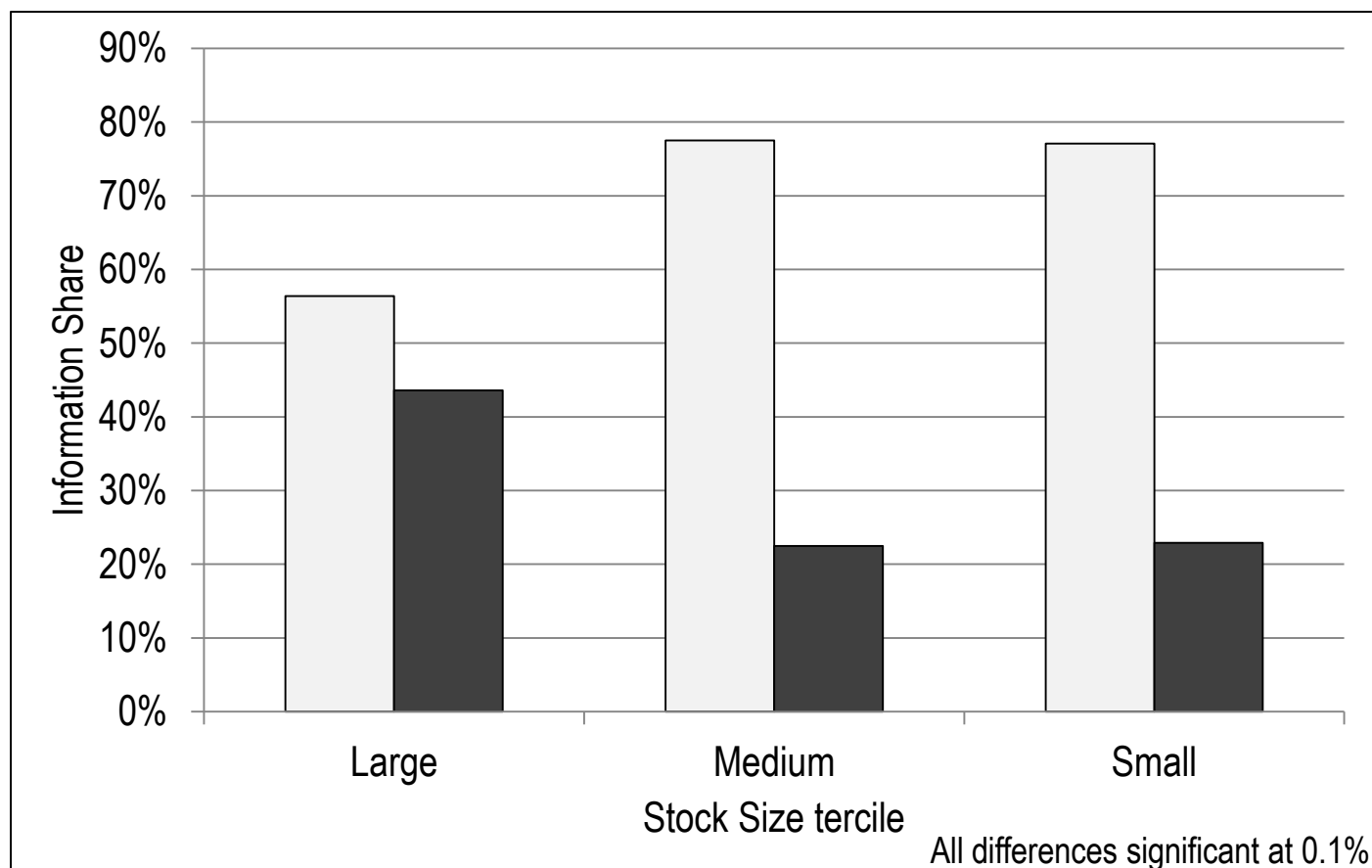
THE 116 STOCK SAMPLE BEHAVES AS EXPECTED
NOW MODEL THE TRADING DECISION AND THE EFFECTIVE SPREAD

Trade Size

Price Level

Market Capitalization

Quoted Spreads

Total Trading Activity

Transaction Costs

Trading Risk

Dark Trading

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FORMAL MODEL
HECKMAN TWO STAGE MODEL TO ADDRESS SELECTION BIAS FOLLOWING BESSEMBINDER (2003) AND O'HARA AND YE (2011)

Stage 1: $Dark\_Pool\_value\_ratio = \phi(Z_{it}\gamma + \mu_{it})$

Stage 2: $Eff_{spread_{it}} = Dark\_Pool\_value\_ratio_{it}\beta_1 + X_{it}\beta_2 + \theta\hat{\lambda}_{it} + \varepsilon_{it}$

where $\phi(\cdot)$ is the standard normal cumulative distribution function.

Controls following existing literature:

$Mcap_i$ is the market capitalization measured at the beginning of the sample period

$Price_{it}$ is daily the value weighted average trade price

$Trade\_size\_ratio_{it}$ is calculated as the ratio of the average trade size on day t and the average trade size for the whole sample period for each sample stock.
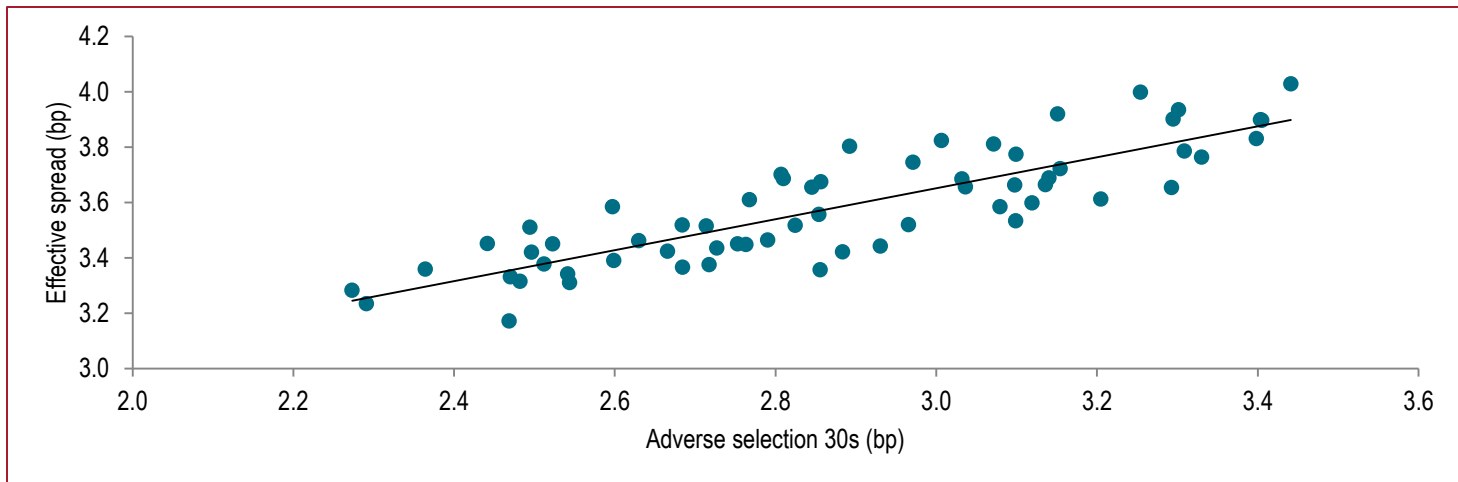
$Total\_value_{it}$ is the daily dollar turnover.

For the second stage regression, X_{it} includes $Price_{it}$, $Trade\_size\_ratio_{it}$ and $Total\_value_{it}$.

Except for *dark pool_value_ratio_{it}* and *Trade_size_ratio_{it}*, all variables are log transformed.

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WHAT'S MISSING FROM THE PRIOR MODELS
SPREADS AND & DARK TRADING BOTH RELATED TO TRADING RISK

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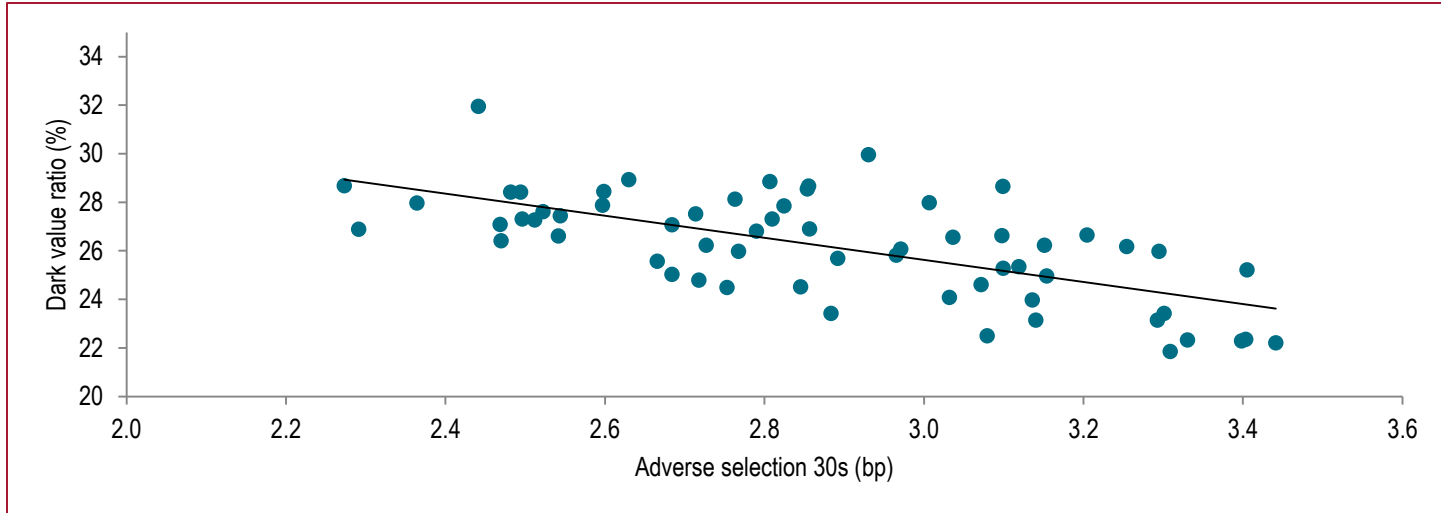
SPREADS AND THE LOCUS OF TRADES
IMPORTANCE OF CONTROLLING FOR THE STATE OF MARKET

For the same stock, the location of a trade seems to be related to the state of the spread prior to the trade. Simply put, is liquidity cheap or expensive, both for today overall and right now?
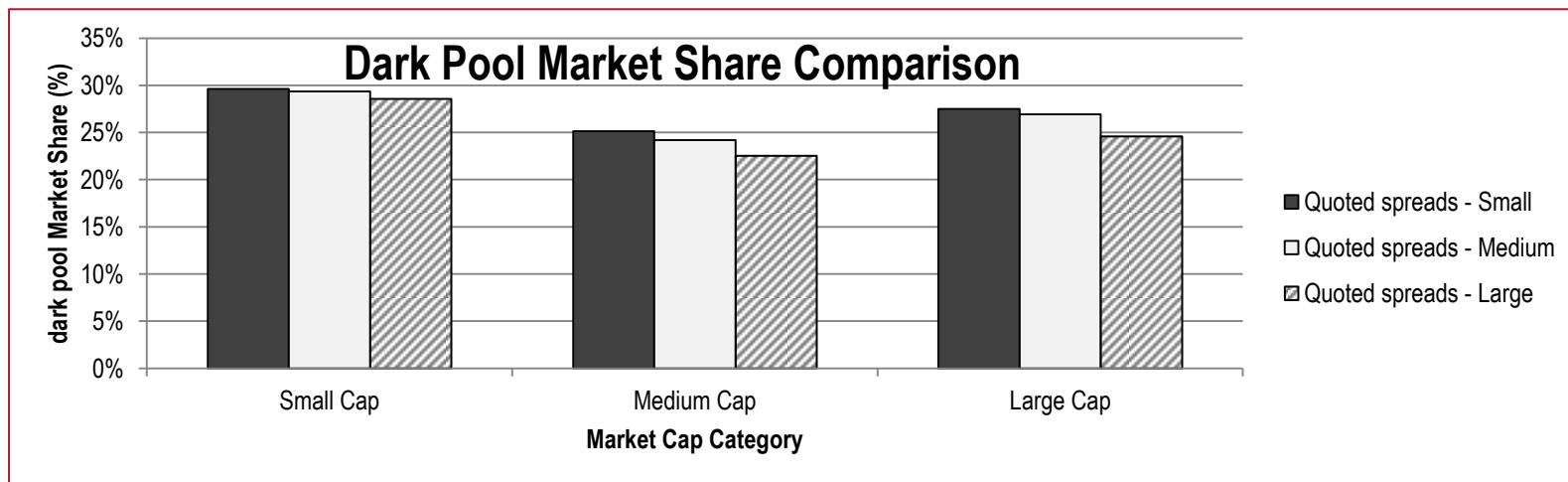
To address this we both

1) partition all trades in a stock into terciles depending on the state of the quoted spread on the day of the trade (shown below), and

2) control for the price impact of a trade having occurred (not shown).

Dark Pool Market Share Comparison

Legend:
- Quoted spreads - Small
- Quoted spreads - Medium
- Quoted spreads - Large

X-axis: Market Cap Category (Small Cap, Medium Cap, Large Cap)
Y-axis: dark pool Market Share (%)

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FORMALLY: ADD INFORMATIONAL CONTROLS
MODEL SHORT TERM AND LONG TERM FACTORS

The dependent variable is *dark pool_value_ratio*, which is calculated as the proportion of total trading value on dark pool venues.

Stage 1: $Dark\_Pool\_value\_ratio_{it} = \phi(Z_{it}\gamma + \mu_{it})$

Stage 2: $Eff_{spread_{it}} = Dark\_Pool\_value\_ratio_{it}\beta_1 + X_{it}\beta_2 + \theta\hat{\lambda}_{it} + \varepsilon_{it}$

where $\phi(\cdot)$ is the standard normal cumulative distribution function.

Controls to address state of information in the market:

Adverse_Selection_Short _Term$_{it}$ is 30 second adverse selection costs, all trades, on each trading day for each stock.

Adverse_Selection_Long_Term$_{it}$ is 5 minute adverse selection costs, all trades, on each trading day for each stock.

Spread_Medium$_{it}$ and *Spread_Large$_{it}$* represent dummy variables for the two largest quoted spread terciles.

With these two controls we seek to capture the information state of the market on the day of the trade (*Adverse Selection*) and the information state of the market at the time of the trade (*Spread*)

We also control for "blocks", the largest 1% of the trades for each stock during the sample period.

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TABLE 5: DARK TRADING AND EFFECTIVE SPREADS
CONTROLLING FOR THE INFORMATIONAL ENVIRONMENT AND BLOCKS

Results for dark pool trading flip. Controlling for the information state matters.

	Model 1			Model 3		
	Coefficient	StdErr		Coefficient	StdErr	
Dark-Pool_value_ratio				2.4982	0.6775	***
Dark-Pool_block_ratio				-1.3426	0.1896	***
Lambda				0.5034	0.6225	
Adverse selection						
Short-term	-438.1893	30.1819	***	0.6036	0.0652	***
Long-term	45.1772	22.0857	*	0.1165	0.0284	***
$Spread_{Medium}$				0.1315	0.0396	***
$Spread_{Large}$				0.3363	0.0554	***
Price	-0.1809	0.0049	***	-0.4646	0.1765	**
Trade_size_ratio	9107.7994	293.3323	***	5.3891	0.8203	***
Total_value	0.1033	0.0023	***	-0.0658	0.0239	**
Mcap	-0.1622	0.0054	***			
Intercept	0.2277	0.0611	***	3.5207	1.2992	**
Adj-R	0.3326			0.8307		

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TABLE 5: DARK TRADING AND EFFECTIVE SPREADS
CONTROLLING FOR THE INFORMATIONAL ENVIRONMENT AND BLOCKS

Results for replacing signed Adverse Selection term with unsigned volatility.

	Model 1			Model 3		
	Coefficient	**StdErr**		**Coefficient**	**StdErr**	
Dark_value_ratio				2.0316	1.0389	**
Dark_block_ratio				-1.2808	0.3004	***
Lambda				2.3372	1.2206	**
Stock Volatility						
Short-term (30 sec.)	-282.4878	35.1770	***	0.2949	0.0450	***
Long-term (5 min)	-21.1596	11.7585	*	0.0227	0.0125	**
Spread$_{Medium}$				0.0815	0.0534	*
Spread$_{Large}$				0.1827	0.0943	**
Price	-0.1753	0.0048	***	-1.0058	0.2496	***
Trade_size_ratio	7541.7890	265.0794	***	9.6678	1.7764	***
Total_value	0.1180	0.0024	***	-0.0573	0.0432	*
Mcap	-0.1955	0.0058	***			
Intercept	0.5615	0.0669	***	2.6620	2.5605	
Adj-R^2	0.336			0.7466		

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DISAGGREGATING THE EFFECTS ON EXCHANGE AND DARK POOL MARKETS
LINK THE PROFESSIONAL AND INVESTOR MARKETS

Is a higher level of dark pool trading associated with higher average costs on exchange venues or all venues?

In other words, does price improvement on dark pools increase enough to offset wider spreads?

Or, do spreads widen on both markets as the exchange quotes sets prices for both and price improvement does not adjust correspondingly to an increase in exchange spreads?

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TABLE 6: SOURCE OF HIGHER AVERAGE COSTS
AGGREGATE EFFECT ON DARK POOL TRADE STATISTICALLY INSIGNIFICANT

	Lit			Dark		
	Coefficient	StdErr		Coefficient	StdErr	
Dark-Pool_value_ratio	3.1633	0.5571	***	0.7337	0.8746	
Dark-Pool_block_ratio	-1.2121	0.1848	***	-1.2997	0.2547	***
Lambda	0.1145	0.5731		1.1610	0.7612	
Adverse selection						
Short-term	0.5855	0.0632	***	0.6905	0.1093	***
Long-term	0.1204	0.0294	***	0.1064	0.0322	***
$Spread_{Medium}$	0.1153	0.0294	***	0.1791	0.0582	**
$Spread_{Large}$	0.3067	0.0508	***	0.4674	0.0822	***
Price	-0.4906	0.1809	**	-0.2659	0.2128	
Trade_size_ratio	4.7170	1.0125	***	6.9859	1.1347	***
Total_value	-0.0770	0.0269	**	-0.0710	0.0350	*
Intercept	4.3845	1.3051	***	2.2908	1.7308	
Adj-R	0.8586			0.7042		

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TABLE 7: ROLE OF MARKET CAP

FOR LARGE AND MID-CAP STOCKS EFFECT ON DARK POOL MARKET IS STATISTICALLY SIGNIFICANT.   SMALL CAPS ARE INDETERMINATE

Model 3: Dependent Variable = Effective Spread

	Lit			Dark		
	Coefficient	**StdErr**		**Coefficient**	**StdErr**	
Panel A: Large stocks						
Dark-Pool_value_ratio	1.8917	0.3108	***	1.5967	0.3666	***
Dark-Pool _block_ratio	-0.7358	0.1586	***	-0.5979	0.2008	**
Panel B: Medium stocks						
Dark-Pool _value_ratio	2.5121	0.5166	***	1.7025	0.6700	**
Dark-Pool _block_ratio	-0.7672	0.1523	***	-0.9108	0.2496	***
Panel C: Small stocks						
Dark-Pool _value_ratio	1.5878	0.6340	**	-2.5489	1.5425	
Dark-Pool _block_ratio	-0.9218	0.2899	**	-0.7089	0.4774	

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OTHER MARKET QUALITY MEASURES
PRICE EFFICIENCY

Use the Variance Ratio test for Price Efficiency, measure as absolute value of deviation from 1.

Follow O'Hara and Ye (2011) and calculate the variance ratio as:

$$Variance\_ratio = \left| 1 - \frac{\sigma^2_{short}}{\frac{1}{n}\sigma^2_{long}} \right|$$

Where σ_{short} and σ_{long} are variances of returns measured over short and long intervals, respectively and n is the ratio of the intervals.

For each stock and trading day, we calculate the variance of midpoint returns at 60-second, 600-second, 900-second and 1800-second intervals. The variance ratio is then calculated over four frequencies: 60/600, 60/1800, 300/900 and 300/1800.

We also perform the same analysis without absolute values.

The mean variance rations are between 1.26 and 1.56 depending on the intervals measured.

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TABLE 8: PRICE EFFICIENCY
PRICE LESS EFFICIENT WITH MORE DARK POOL VOLUME

	60/600		60/1800	
	Coefficient	**Stderr**	**Coefficient**	**Stderr**
Dark_value_ratio	**0.2348**	0.0980 **	**0.4232**	0.1987 *
Dark_block_ratio	**-0.1207**	0.0509 **	**-0.1811**	0.1207
Adverse selection				
Short-term	363.33	99.578 ***	794.41	269.44 **
Long-term	-487.07	53.149 ***	-1095.32	161.51 ***
$Spread_{Medium}$	0.0048	0.0138	-0.0056	0.0298
$Spread_{Large}$	0.0268	0.0155 *	0.0518	0.0334
Trade_size_ratio	6986	1238 ***	12814	2553 ***
Total_value	-0.0102	0.0026 ***	-0.0175	0.0051 ***
Intercept	0.6796	0.0938 ***	1.2450	0.1973 ***
Adj-R	0.0723		0.0480	

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ROBUSTNESS TESTS
## ENDOGENEITY AND BI-DIRECTIONAL CAUSALITY

We show that an increase in dark trading is associated with an increase in trading costs. However, the effect can be bi-directional.

A major objective is to isolate the cause and effect relationship between dark trading and trading costs.

One solution is to find another variable, called an Instrumental Variable (IV) related to dark trading but not trading costs.

We suggest the following variable:

$$Dark\_size\_ratio = \frac{Size_{Dark}}{Size_{Total}}$$
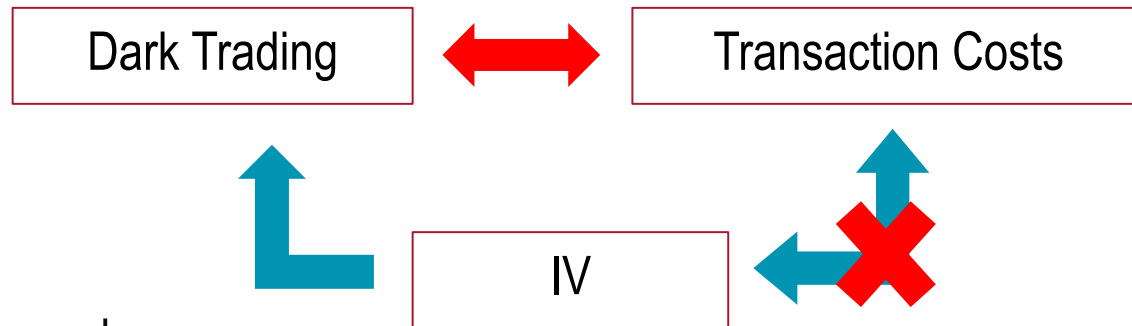
This is a valid IV, because
- It affects the level of dark trading, and
- It is not related to market average transaction costs.

TABLE 9: 2SLS WITH INSTRUMENTAL VARIABLE
2ND STAGE RESULTS, PREVIOUS FINDINGS HOLD

$$IV:\ Dark\_Pool\_size\_ratio = \frac{Size_{Dark}}{Size_{Total}}$$

	Coefficient	StdErr	
Dark_value_ratio (IV)	**3.9350**	**0.6677**	***
Dark_block_ratio	-2.0137	0.4451	***
Lambda	-0.0420	0.6214	
Adverse selection			
Short-term	0.5892	0.0664	***
Long-term	0.1181	0.0287	***
Spread$_{Medium}$	0.1314	0.0413	***
Spread$_{Large}$	0.3138	0.0602	***
Price	-0.5007	0.1884	**
Trade_size_ratio	5.6274	0.8717	***
Total_value	-0.0632	0.0259	**
Intercept	4.0919	1.3391	**
Adj-R	0.8277		

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ROBUSTNESS TESTS
HIGH FREQUENCY TRADING

The extent of dark pool trading and transactions costs could be co-dependent on the level of high frequency trading (HFT) in the market.

We can only identify HFT on NASDAQ, not on other markets.

But, using the information available from NASDAQ we can ask whether the inclusion of the level of HFT activity affects our results.

Controls to address level of HFT in the market:

Transactions of the 21 most active HFT firms on the NASDAQ market are identified.

HFT_{Make} (HFT_{Take}) is the ratio of the value of transactions in which an HFT provides (takes) liquidity and the total trading value on NASDAQ.

HFT_{All} is the ratio of, the sum of the value of transactions in which an HFT provides the liquidity and the value of transactions in which an HFT takes the liquidity, to the total trading value on NASDAQ.

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TABLE 10: ROBUSTNESS TEST
ADD HFT TO THE RHS OF THE MODEL IN TABLE 5

Including HFT impacts significance but not the overall result.

	Model 1			Model 2			Model 3		
	Coefficient	StdErr		Coefficient	StdErr		Coefficient	StdErr	
HFTd_{All}				-2.2746	0.5912	***			
HFTd_{Make}							-0.1601	0.6654	
HFTd_{Take}							-1.7635	0.3753	***
Dark-Pool_value_ratio	0.8070	0.4955	*	0.7723	0.4584	**	0.7585	0.4635	*
Dark-Pool_block_ratio	-1.8207	0.3872	***	-2.0315	0.3955	***	-1.9884	0.3792	***
Lambda	-5.2877	2.8103	**	-3.7453	2.8802	*	-3.8483	2.8627	*
Adverse selection									
Short-term	0.9477	0.1838	***	0.8773	0.1880	***	0.8844	0.1866	***
Long-term	0.0471	0.0233	**	0.0375	0.0234	*	0.0342	0.0235	*
Spread_{Medium}	0.2040	0.0419	***	0.2485	0.0432	***	0.2558	0.0419	***
Spread_{Large}	0.4741	0.0696	***	0.5533	0.0742	***	0.5747	0.0732	***
Price	0.3928	0.5023		0.1848	0.5196		0.3228	0.5545	
Trade_size_ratio	1.4756	0.4744	***	1.6476	0.4665	***	1.5887	0.4612	***
Total_value	-0.1796	0.0430	***	-0.1296	0.0445	***	-0.1528	0.0495	***
Intercept	8.4987	1.6204	***	7.4915	1.6005	***	7.8264	1.6093	***
Adj-R	0.75			0.76			0.77		

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CONCLUSION

WHAT ARE OUR OPTIONS FOR DARK TRADING?

- SIFMA/GFMA approach: Eliminate exchanges and allow competition between dealer systems. Concept is similar to NASDAQ circa 1990.

- Australian approach: Make dark markets operate like exchanges in most major respects including eliminating segmentation.

- Our suggestions (similar to Canadian Trade-At Rule):

  - Extend the Order-Protection (Trade Through) Rule so that all displayed liquidity at the best bid/offer must be satisfied before dark liquidity can trade at that price.

  - A common trade increment (tick) for both exchanges and OTC.

- Another approach: Do nothing or "start over" w.r.t. market structure.

- Finally, it must be said that the open, electronic limit order book may be a flawed model for trading by heterogeneous participants and consequently is inconsistent with the exchange model which should, in principle, cater to all types of participants.

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