Shall We Haggle in Pennies at the Speed of Light or in Nickels in the Dark? How Minimum Price Variation Regulates High Frequency Trading and Dark Liquidity

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Motivation

 Recent concerns with the U.S. system of market structure have focused on proposed reforms to tick size regulation (i.e., the price at which stocks are traded):

April 2010 Request for SEC Rulemaking by BATS Exchange, Inc., NASDAQ OMX Group, Inc., and NYSE Euronext, Inc

- <u>Concern</u>: Displayed quote is "artificially wide" for certain lower priced, liquid securities, causing a detrimental impact to the public price discovery process.
- <u>Recommendation</u>: Permit quoting in ½ cent (\$0.005) increments for securities trading between \$1.00 and \$20.00 per share.

Section 106 of the Jumpstart Our Business and Start-ups Act of 2012 + SEC Advisory Committee on Small and Emerging Businesses (2013)

- <u>Concern</u>: Transition from fractional to penny-based pricing of securities in 2000 destroyed the profitability of market-making, harming market support for smaller issuers.
- <u>Recommendation</u>: Increase the minimum price variation (MPV) from \$0.01 to \$0.05 or even \$0.1 for securities having low liquidity.



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Research Question and Hypotheses

- Central Research Question:
 - What would be the consequences on market structure of either (a) increasing tick sizes to more than a penny or (b) decreasing tick sizes further to permit subpenny quoting?
- Hypotheses:
 - Increasing tick sizes should result in:
 - More BD internalization and dark trading but less High Frequency Trading (HFT) on public (i.e., exchange/ECN) order books.
 - Wider quoted spreads
 - Greater inside depth
 - Decreasing tick sizes should result in:
 - Less BD internalization and dark trading but more HFT on public order books
 - Narrower quoted spreads
 - Less inside depth





Research Design

- Regression Discontinuity Framework:
 - We exploit the fact that while Rule 612 of Reg NMS requires an MPV of \$0.01 for orders, subpenny orders are permitted for orders priced less than \$1.00 per share (the "Subpenny Rule").



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Data

- NYSE Trade and Quote Data for 2011 (~7,083 securities)
- Focus on quotations/trades in securities that had at least one trade below \$2.00 per share in 2011
 - 974 securities issued by 962 firms
 - Generated ~ 271 million trades and 3 billion updates of exchanges' BBOs
 - Financial/accounting data pulled from CapitalIQ



Sample Firms vs. CRSP Firms

• Table 2: Sample Description and Sample Selection Comparison

	Sample	Firms	Non-Samp	le Firms	All CRSP	Firms
Variable	N	%	Ν	%	Ν	%
Industrial Classification:						
Agriculture, Forestry, And Fishing	4	0.4%	15	0.2%	19	0.3%
Mining	75	7.8%	278	4.6%	353	5.0%
Construction	10	1.0%	39	0.6%	49	0.7%
Manufacturing	435	45.4%	1,498	24.8%	1,933	27.6%
Transportation, Communications,						
Electric, Gas, And Sanitary Services	63	6.6%	429	7.1%	492	7.0%
Wholesale Trade	20	2.1%	107	1.8%	127	1.8%
Retail Trade	33	3.4%	223	3.7%	256	3.7%
Finance, Insurance, And Real Estate	162	16.9%	2,802	46.3%	2,964	42.3%
Services	156	16.3%	639	10.6%	795	11.3%
Public Administration	1	0.1%	16	0.3%	17	0.2%
	959	100%	6,046	100%	7,005	100%
Total Non-Financial	797		3,244		4,041	
Foreign. Incorporation	159	20.0%	605	18.6%	764	18.9%
Involuntary Delistings:	99	10.3%	63	(1.0%)	162	2.3%



Sample Firms vs. CRSP Firms

Table 2: Sample Description and Sample Selection Comparison

	Sampl	le Firms	Non-Samp	le Firms	All CR	SP Firms
	Mean		Mean		Mean	
Variable	[Median]	(SE)	[Median]	(SE)	[Median]	(SE)
Market Cap (\$ millions)	916.91	(390.75)	108,688.60	(42,467.84)	93,162.28	(36,352.25)
	[65.36]		[481.40]		[349.82]	
Total Assets	3,300.12	(1185.83)	448,210.10	(119,637.70)	375,846.10	(100,200.20)
	[89.51]		[818.32]		[609.63]	
ROE	-0.63	(0.13)	0.14	(0.05)	0.01	(0.05)
	[-0.15]		[0.09]		[0.08]	
ROA	-0.09	(0.01)	0.03	(0.00)	0.01	(0.00)
	[-0.03]		[0.03]		[0.03]	
Sales Growth	2.08	(0.88)	6.22	(5.75)	5.60	(4.89)
	[0.08]		[0.10]		[0.10]	
Leverage	0.31	(0.04)	0.26	(0.01)	0.27	(0.01)
	[0.17]		[0.19]		[0.19]	
Public Float	0.68	(0.01)	0.79	(0.00)	0.77	(0.00)
	[0.73]		[0.87]		[0.84]	
Volatility	0.68	(0.01)	0.34	(0.00)	0.39	(0.00)
	[0.62]		[0.32]		[0.35]	
Daily Trading Volume	0.64	(0.13)	1.67	(0.13)	1.52	(0.11)
	[0.08]		[0.15]		[0.14]	
Tobins q	2.13	(0.13)	2.68	(0.58)	2.59	(0.48)
	[1.22]		[1.22]		[1.22]	
Market-to-Book	1.59	(0.77)	3.09	(2.03)	2.84	(1.70)
	[1.20]		[1.48]		[1.44]	

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Examination of Treatment Effect: Incidence of Subpenny Orders Above & Below \$1.00/Share







Examination of Treatment Effect: Incidence of Subpenny Orders Above & Below \$1.00/Share







2011 Trading of Sample Securities by Venue:

Exchange	Number of trades	% of Total 2011 Trades
American Stock Exchange	1,794,016	2.08%
Boston Stock Exchange	3,416,200	3.96%
National (Cincinnati) Stock Exchange	2,265,754	2.62%
FINRA Trade Reporting Facility	25,300,000	29.30%
Direct Edge A Stock Exchange	5,146,107	5.96%
Direct Edge X Stock Exchange	7,633,681	8.84%
Chicago Stock Exchange	118,645	0.14%
New York Stock Exchange	2,053,069	2.38%
NYSE Arca SM	10,800,000	12.51%
NASDAQ Stock Exchange	10,600,000	12.27%
NASDAQ OMX Stock Exchange	4,072,291	4.72%
CBOE Stock Exchange	56,768	0.07%
NASDAQ OMX PSX Stock Exchange	610,878	0.71%
BATS Y-Exchange	3,241,613	3.75%
BATS Exchange	9,247,740	10.71%
Total	86,356,762	100.00%





Incidence of FINRA/TRF Trades Above & Below \$1.00/Share







2011 Trading Volume Above & Below \$1.00/Share







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Measuring HFT: Rate of Updating of Exchanges' Best Bid/Ask

symbol	date	time	bid	ofr	bidsiz	ofrsiz	mode	ex	Undates
STEM	1-Jun-11	10:56:41	0.6541	0.6551	5	25	12	Р	nor socond:
STEM	1-Jun-11	10:56:42	0.6541	0.6551	5	21	12	Р	
STEM	1-Jun-11	10:56:42	0.655	0.6551	196	26	12	Т	10:56:41 →1
STEM	1-Jun-11	10:56:44	0.655	0.6551	196	24	12	Т	10.56.12 ->2
STEM	1-Jun-11	10:56:45	0.655	0.6551	196	14	12	Т	10.30.42 72
STEM	1-Jun-11	10:56:45	0.65	0.6551	21	15	12	Κ	10:56:43 →0
STEM	1-Jun-11	10:56:45	0.65	0.6551	2	15	12	Ζ	10.56.11 -1
STEM	1-Jun-11	10:56:45	0.655	0.6551	158	14	12	Т	10.30.44 /1
STEM	1-Jun-11	10:56:45	0.6541	0.6551	5	11	12	Р	10:56:45 →5
STEM	1-Jun-11	10:56:50	0.6541	0.659	5	2	12	С	10.56.46 ->0
STEM	1-Jun-11	10:56:50	0.655	0.6551	158	1	12	Т	10.30.40 70
STEM	1-Jun-11	10:56:50	0.65	0.6593	21	1	12	Κ	10:56:47 →0
STEM	1-Jun-11	10:56:50	0.65	0.66	2	3	12	Ζ	10.56.49 ->0
STEM	1-Jun-11	10:56:50	0.655	0.6551	102	1	12	Т	10.30.40 70
STEM	1-Jun-11	10:56:50	0.65	0.67	2	3	12	Ζ	10:56:49 →0
STEM	1-Jun-11	10:56:50	0.655	0.67	2	3	12	Ζ	10,50,50
STEM	1-Jun-11	10:56:50	0.6541	0.66	5	11	12	Р	10:50:50 79
STEM	1-Jun-11	10:56:50	0.6541	0.66	5	8	12	Р	



Rate of Updating of Exchanges' Best Bid/Ask: Average Above & Below \$1.00/Share







Rate of Updating of Exchanges' Best Bid/Ask: Incidence of Strategic Runs







Quoted Spreads Above & Below \$1.00/Share



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Inside Depth Above & Below \$1.00/Share







Robustness Check: Maker/Taker Fees at \$1.00



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Robustness Check: Maker/Taker Fees at \$1.00

 Fees and rebates as a percentage of a \$10,000 trade of a stock valued at either \$1.00 or \$0.99 in 2011:

		Panel A Access Fee Liquidit (% of \$10,000	Charged to y Taker 0 trade value)	Rebate Paid Prov (% of \$10,00	to Liquidity vider 0 trade value)
	Exchange:	Price=\$0.99	Price=\$1.00	Price=\$0.99	Price=\$1.00
	EDGA Exchange	0.00%	-0.06%	0.000%	0.05%
	NYSE Arca	-0.10%	-0.30%	0.000%	0.30%
	Nasdaq OMX BX	-0.10%	0.14%	0.000%	-0.18%
	BATS BZX	-0.10%	-0.29%	0.000%	0.29%
Ц	BATS BYX	-0.10%	0.02%	0.000%	-0.02%
	Nasdaq OMX PH	-0.20%	-0.25%	0.000%	0.24%
	NYSE	-0.23%	-0.23%	0.000%	0.15%
	NYSE Amex	-0.25%	-0.28%	0.000%	0.16%
	Nasdaq	-0.30%	-0.30%	0.009%	0.29%
	EDGX Exchange	-0.30%	-0.30%	0.003%	0.23%
╽ _┍ ╷	Chicago Stock Exchange	-0.30%	-0.30%	0.009%	0.25%
L	National Stock Exchange	-0.30%	-0.28%	0.025%	0.26%

Do exchanges that lower fees below the \$1 cut-off see an uptick in subdollar trading?



Trading Volume at the \$1.00 Cut-Off: 2010 vs. 2011







2010 Trading Volume for High Rebate Exchanges vs. FINRA



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Conclusions:

- Overall, analysis of the 2011 trading data confirms each of the predicted effects of changing the MPV:
 - Compared to trades/orders priced under \$1/share, trades/orders priced above \$1/share reveal:
 - More BD internalization and dark trading but less HFT on public order books.
 - Wider quoted spreads
 - Greater inside depth
 - Conversely, trades/orders below \$1.00 per share reveal:
 - Less BD internalization and dark trading but more HFT on public order books
 - Narrower quoted spreads
 - Less inside depth
 - Effects are robust to changes to maker/taker fees at \$1.00
 - 2010 data also reveals incentive for market manipulation where maker rebate>quoted spread.





Conclusions:

- At their most general level, these results suggest increasing tick sizes will do little to bring back market support and analyst coverage for smaller companies.
 - Beneficiaries of larger spreads in the current trading environment are primarily BD internalizers, dark pools, and (possibly) stock exchanges, none of which can be expected to subsidize research for smaller issuers.
 - Such a change will have real trading costs in the form of higher spreads and longer cues at the inside bid.
- Conversely, decreasing tick sizes will result in less dark trading but greater HFT within public order books.
 - Such a change will lower quoted spreads with lower depth at inside bid.
 - Any such change should be accompanied by formal limitations on the amount of maker rebates to ensure they do not exceed MPV.



