The Effect of Payment for Order Flow on Broker Order Routing

Saketh Aleti
Advisor: Professor Bruce Mizrach

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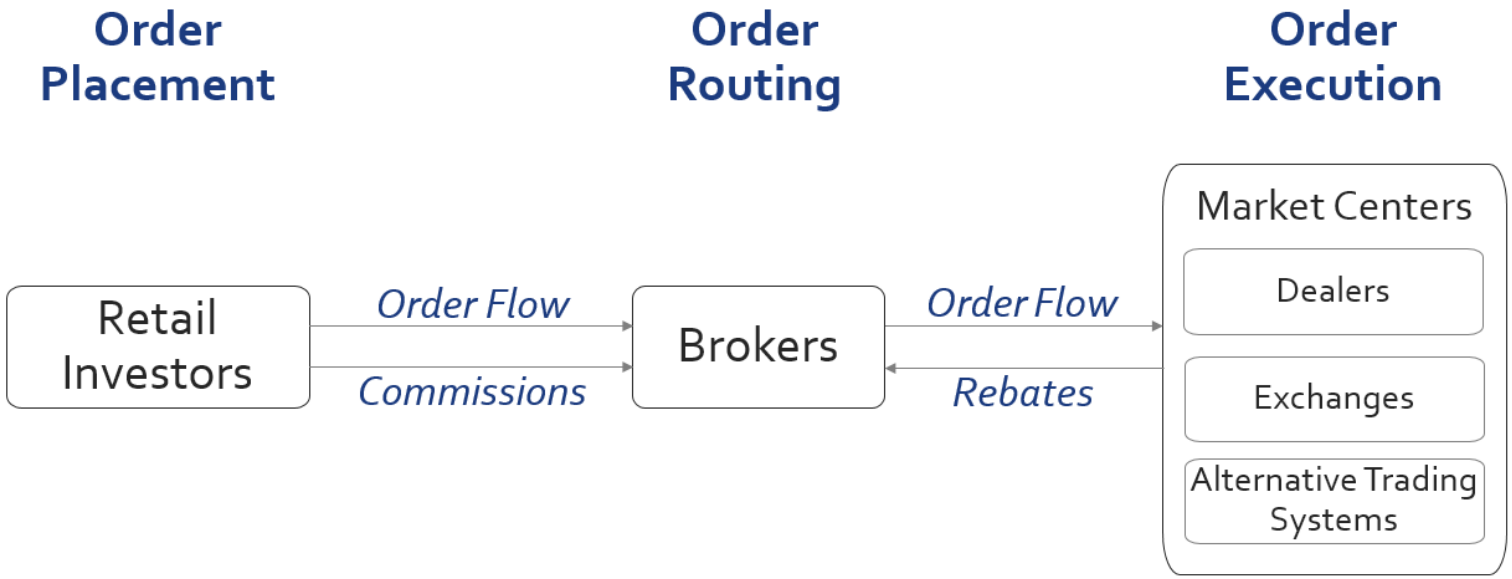
Research Question

How does payment for order flow affect broker order routing?



- Payment for Order Flow (POF)
  - Rebates given to brokers by market centers for order flow
  - Usually a bit less than $0.03 per 100 shares

Motivation and Approach

- Does retail investor welfare suffer from the presence of POF?
- SEC renounces negative statements about POF's effect on order routing (Exchange Act of 1934 - Rule 11Ac1-5)
- Basic idea: Study differences between POF brokers and Non-POF brokers
  - Suppose a market center improves its execution speeds
  - Non-POF brokers would reroute $\Delta\%$ of their orders to them
  - POF brokers would reroute less than $\Delta\%$, because they also consider rebates

Hypothesis

- Brokers who accept POF are less reactive to changes in execution quality than brokers who do not
  - Execution quality: price improvement and execution speed
  - Theory $\Longrightarrow$ brokers cannot simultaneously consider rebates as an objective while maximizing execution quality [1]
  - Empirics $\Longrightarrow$ broker order routing for *limit* orders was negatively impacted by payment for order flow [2]

[1] Dennert (1993), Duta and Madhavan (1997), Parlour and Rajan (2001), Cimon (2016), Maglaras, Moallemi, and Zheng (2015)

[2] Battalio, Shkilko, and Van Ness (2016), Battalio, Corwin, and Jennings (2016)

Data

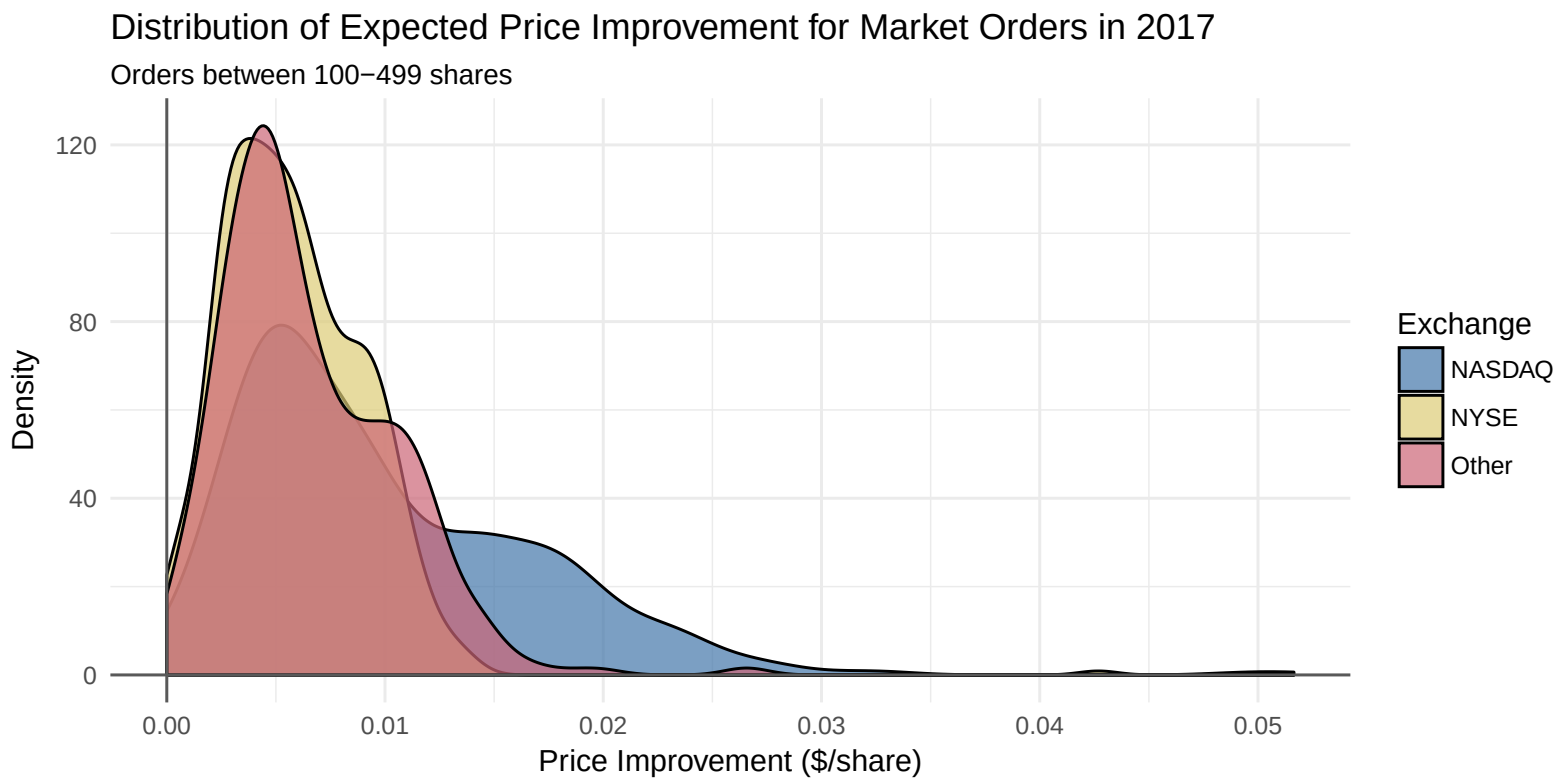
606 Disclosures

- Broker reports of order routing data
- **Market share**: % of orders routed to a market center
- *Most* of the time, brokers disclose the influence of POF

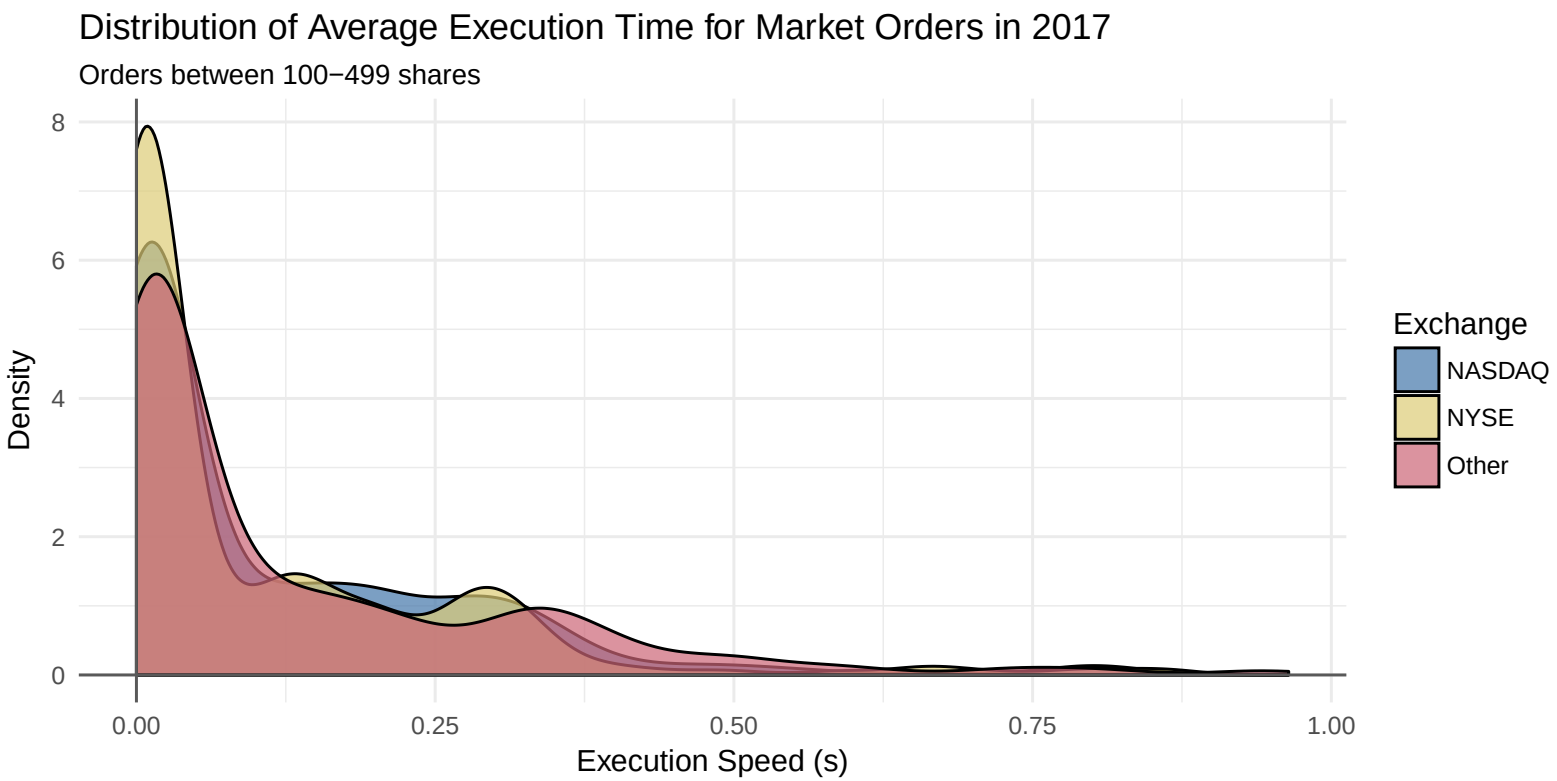
605 Disclosures

- Market Center reports of execution statistics
- **Execution quality** by stock, order type, and size

Descriptive Statistics - Price Improvement



Descriptive Statistics - Execution Speed



Methodology

- $Y_{i,j,k,t} = \alpha_{i,j} + X_{j,k,t} \cdot \beta + (D_i \cdot X_{j,k,t}) \cdot \gamma + \varepsilon_{i,j,t}$
  - $Y_{i,j,k,t}$ = % of Orders Routed by Broker i to Market Center j
  - X = Execution Quality
  - D_i = Indicator for POF
- Parametric Approach with Tobit and OLS
- Semiparametric Approach with SLS (Ichimura, 1993)
  - $Y_{i,j,k,t} = f(X_{j,k,t} \cdot \beta) + v_{i,j,t}$
  - Gaussian kernel

Table: Tobit Regression Results

	Dependent variable: Market Share			
	(1)	(2)	(3)	(4)
Percent of Shares Price Improved	-0.0536		-0.0461	
	(0.129)		(0.131)	
Percent of Shares Price Improved × D_i	-0.497**		-0.503**	
	(0.191)		(0.192)	
Avg Price Improvement	14.25***		14.18***	
	(2.895)		(2.875)	
Avg Price Improvement × D_i	-6.677		-7.200	
	(4.279)		(4.256)	
Expected Price Improvement		14.75***		14.62***
		(3.206)		(3.190)
Expected Price Improvement × D_i		-13.55**		-13.98**
		(4.600)		(4.578)
Avg Execution Time for Price-Improved	-0.117**	-0.116**		
	(0.0400)	(0.0402)		
Avg Execution Time for Price-Improved × D_i	0.0982*	0.102*		
	(0.0411)	(0.0413)		
Avg Execution Time for All Shares			-0.0586**	-0.0581**
			(0.0195)	(0.0198)
Avg Execution Time for All Shares × D_i			0.0514*	0.0531**
			(0.0202)	(0.0205)
Observations	2982	2982	2982	2982
Wald Test	96.801***	38.828***	91.954***	35.462***

Parametric Results

- All signs on interaction term coefficients favored Non-POF brokers
  - All except average price improvement were significant
  - Differences in routing towards execution speed were fairly small
- Highlighted coefficients imply moderate welfare impacts
  - Market center improves its PrImp_ExpAmt by $0.01 per share
  - Some broker routes 100 million shares in volume per week
  - Counterfactual broker receiving POF would miss out on $7 million in price improvement per year
  - Similar exercise with a 3% increase in PrImp_Pct finds a loss in $1.3 million per year

Table: SLS Regression Results (POF Brokers)

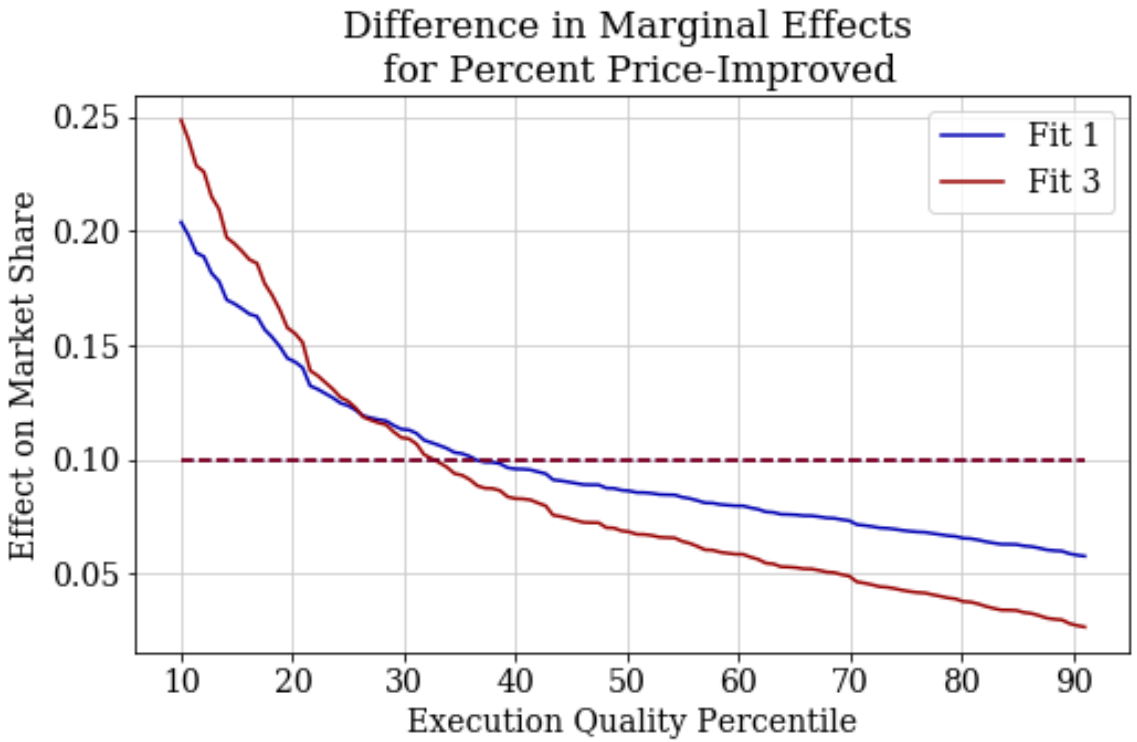
	Dependent variable:			
	(1)	(2)	(3)	(4)
Panel A: POF Brokers				
Percent of Shares Price Improved	1		1	
Avg Price Improvement	1.020**		1.061**	
	(0.393)		(0.375)	
Expected Price Improvement		1		1
Avg Execution Time for Price-Improved	0.000771	-0.00995***		
	(0.00170)	(0.00187)		
Avg Execution Time for All Shares			0.000962	-0.00114***
			(0.00167)	(0.000153)
Observations	1,494	1,494	1,494	1,494
RMSE	0.30458	0.30916	0.30466	0.30937

Table: SLS Regression Results (Non-POF Brokers)

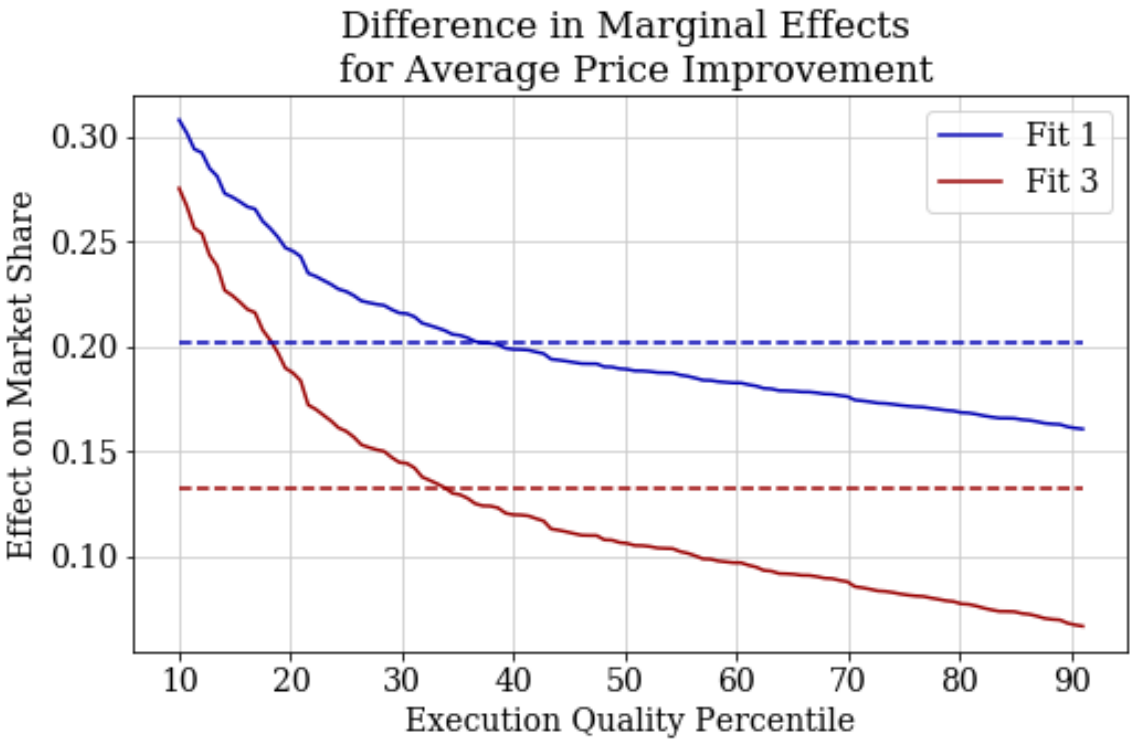
	Dependent variable:			
	(1)	(2)	(3)	(4)
Panel B: Non-POF Brokers				
Percent of Shares Price Improved	1		1	
Avg Price Improvement	-0.249		0.711	
	(0.365)		(0.524)	
Expected Price Improvement		1		1
Avg Execution Time for Price-Improved	-0.143***	-0.0462***		
	(0.00447)	(0.00479)		
Avg Execution Time for All Shares			-0.00674***	-0.0307***
			(0.000693)	(0.00537)
Observations	1,488	1,488	1,488	1,488
RMSE	0.24503	0.24399	0.24503	0.24264

Semiparametric Results

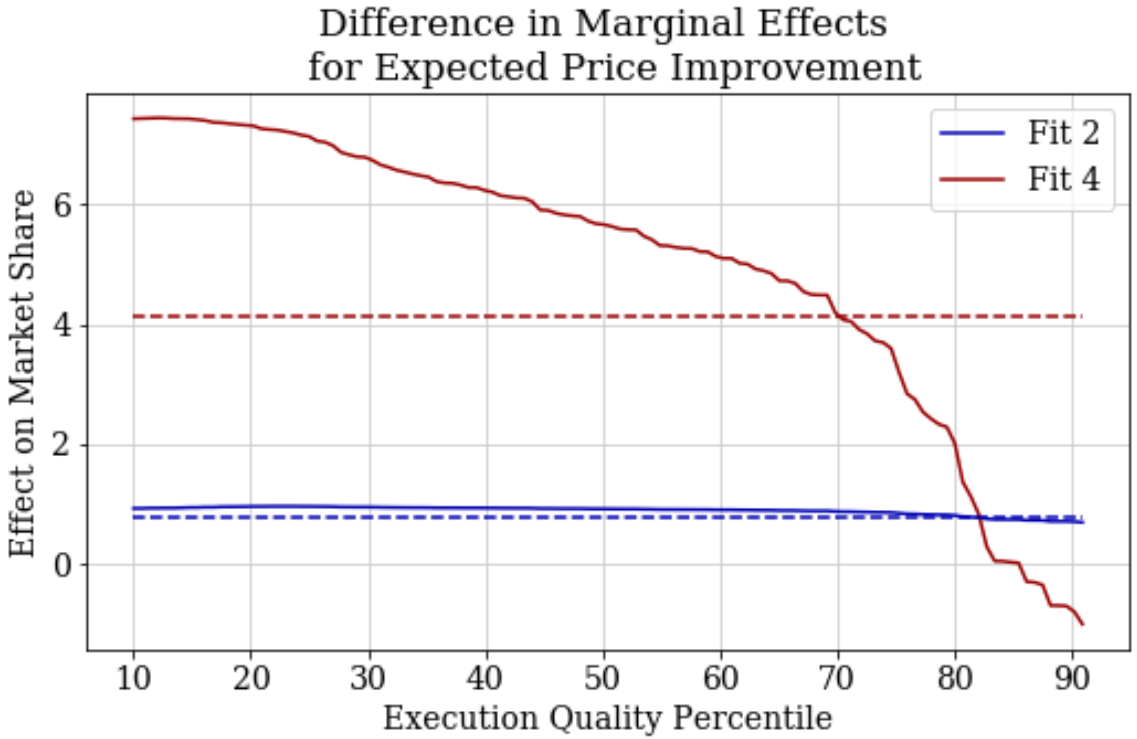
- Significance of coefficients
  - Average Price Improvement was significant for POF brokers but not Non-POF
  - Execution Speed was always significant for Non-POF brokers but only significant in half the regressions for POF brokers
  - Logical signs for significant coefficients



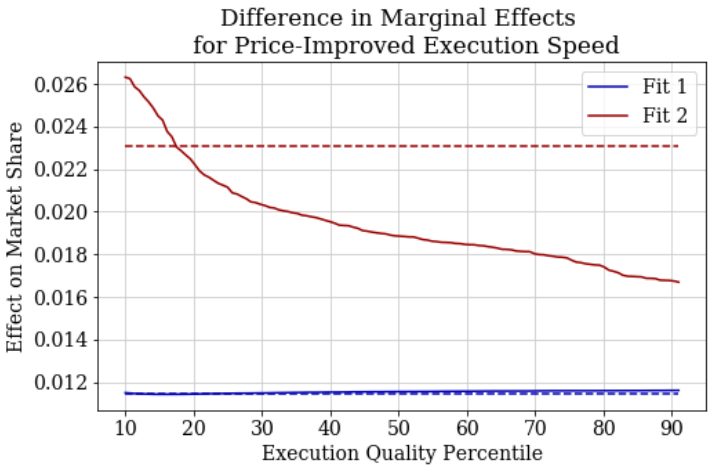
- Solid Lines = (Non-POF Broker ME) - (POF Broker ME)
- Dashed Lines = Difference in Average Marginal Effects

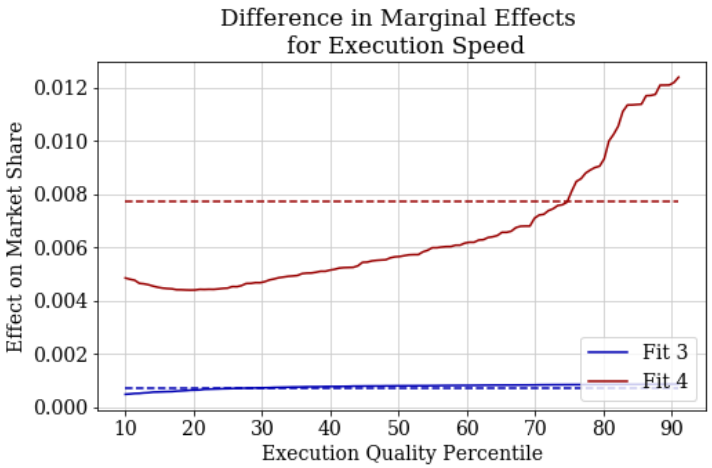


- As with percent of shares price-improved, Non-POF brokers relatively more responsive to bad market centers doing better



- Strongest support for the hypothesis
- Fit 1 was with PrImp_AvgT while Fit 3 was with All_AvgT





- Difference in marginal effects for execution speed were unexpectedly positive $\Longrightarrow$ POF brokers perform better
- Scale of effects too small to draw any conclusions

Semiparametric Results

- Marginal effects imply much smaller effects on welfare
  - Difference in average marginal effects for Expected Price Improvement was 4.14
  - Increase in PrImp_ExpAmt by \$0.01 $\Longrightarrow$ counterfactual broker receiving POF would miss out on \$2 million in price improvement per year
  - Difference in average marginal effects for Percent Price Improved was 0.10
  - 3% increase in PrImp_Pct $\Longrightarrow$ POF broker would miss out on \$0.26 million per year in price improvement

Conclusion

Regressions

- Parametric approach $\Longrightarrow$ significant welfare impacts
- Semiparametric approach $\Longrightarrow$ much smaller effects
- Robustness (OLS vs. Tobit vs. SLS)
  - Differences in responses to expected price improvement were meaningful
  - Weaker support for the average price improvement result
  - Significance of execution speeds but small magnitudes

Conclusion

Policy Implications

- Minor issue for individual retail investors
  - Suppose a retail investor's volume was 1000 shares/year
  - A POF broker would net \$1.36 *less* in price improvement than a Non-POF broker
  - Individuals should focus on minimizing commissions
- Major issue for SEC & FINRA
  - Welfare examples assumed 100 million weekly volume
  - Sum of broker trading volume likely more than 15 times larger

Conclusion

Future Research

- SEC Transaction Fee Pilot— *Does POF harm market quality?*
  - Puts stocks into three groups of POF restrictions: none, limited, unrestricted
  - Exchanges produce public data on execution quality
- Repeating this study— *Does POF harm broker routing?*
  - Using proprietary FINRA data
  - Would offer more granular results

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