

The Effect of Payment for Order Flow on Broker Order Routing

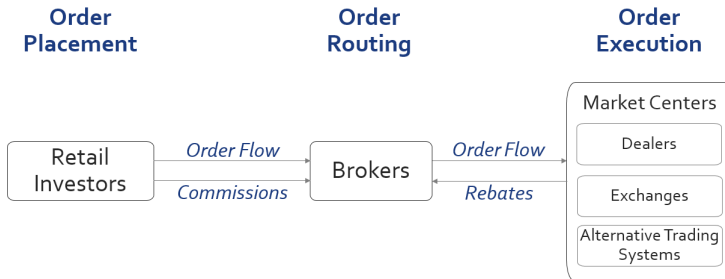
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April 11, 2018

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 \implies brokers cannot simultaneously consider rebates as an objective while maximizing execution quality ¹
 - ▶ Empirics \implies broker order routing for *limit* orders was negatively impacted by payment for order flow ²

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

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

Data

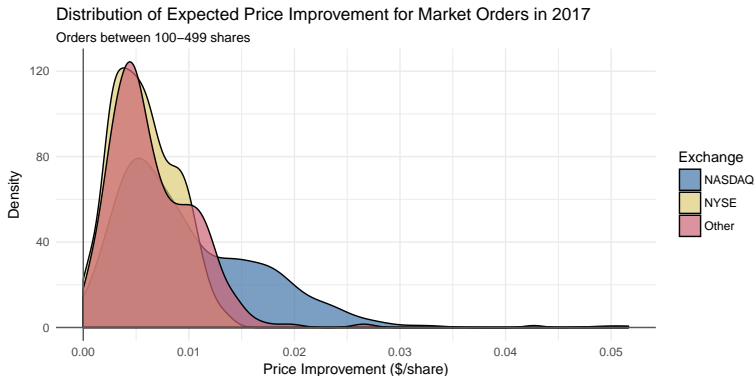
606 Disclosures

- ▶ 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

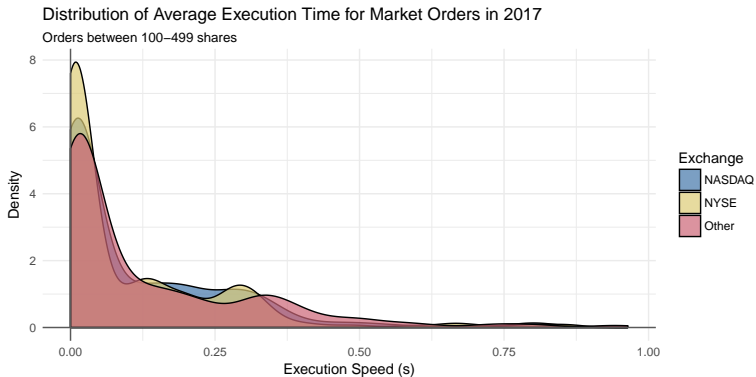
605 Disclosures

- ▶ 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

	<i>Dependent variable: Market Share</i>			
	(1)	(2)	(3)	(4)
Percent of Shares Price Improved	-0.0536 (0.129)		-0.0461 (0.131)	
Percent of Shares Price Improved $\times D_i$	-0.497** (0.191)		-0.503** (0.192)	
Avg Price Improvement	14.25*** (2.895)		14.18*** (2.875)	
Avg Price Improvement $\times D_i$	-6.677 (4.279)		-7.200 (4.256)	
Expected Price Improvement		14.75*** (3.206)		14.62*** (3.190)
Expected Price Improvement $\times D_i$		-13.55** (4.600)		-13.98** (4.578)
Avg Execution Time for Price-Improved	-0.117** (0.0400)	-0.116** (0.0402)		
Avg Execution Time for Price-Improved $\times D_i$	0.0982* (0.0411)	0.102* (0.0413)		
Avg Execution Time for All Shares			-0.0586** (0.0195)	-0.0581** (0.0198)
Avg Execution Time for All Shares $\times D_i$			0.0514* (0.0202)	0.0531** (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 $Prlmp_ExpAmt$ 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 $Prlmp_Pct$ finds a loss in \$1.3 million per year

Table: SLS Regression Results (POF Brokers)

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

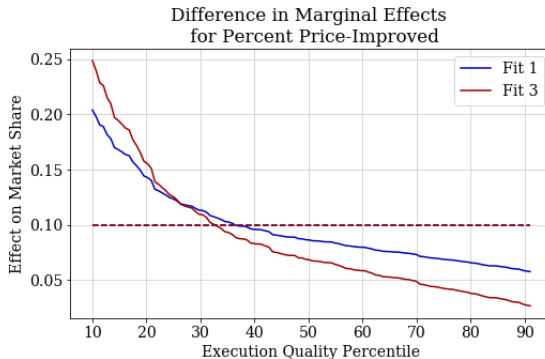
Table: SLS Regression Results (Non-POF Brokers)

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

Semiparametric Results

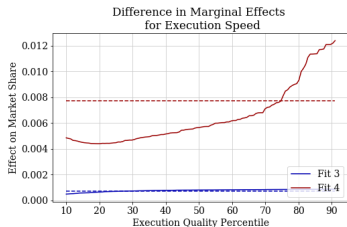
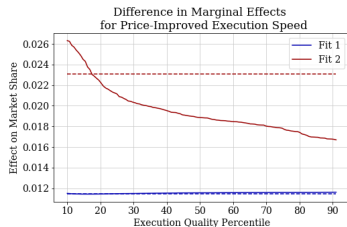
- ▶ Significance of coefficients
 - ▶ Average Price Improvement was significant for POF brokers but not Non-POF
 - ▶ Execution Speed was always significant for Non-POF brokers but only significant in half the regressions for POF brokers
 - ▶ Logical signs for significant coefficients

Marginal Effects



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

Marginal Effects



- ▶ Difference in marginal effects for execution speed were unexpectedly positive \Rightarrow 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 Prlmp_ExpAmt by \$0.01 \implies 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 Prlmp_Pct \implies POF broker would miss out on \$0.26 million per year in price improvement

Conclusion

Regressions

- ▶ Parametric approach \implies significant welfare impacts
- ▶ Semiparametric approach \implies 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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