

# How Does Payment for Order Flow Influence Markets? Evidence from Robinhood Crypto Token Introductions

Tom Boulton (Miami University)

Tom Shohfi

Michael Walz (U.S. Securities and Exchange Commission)

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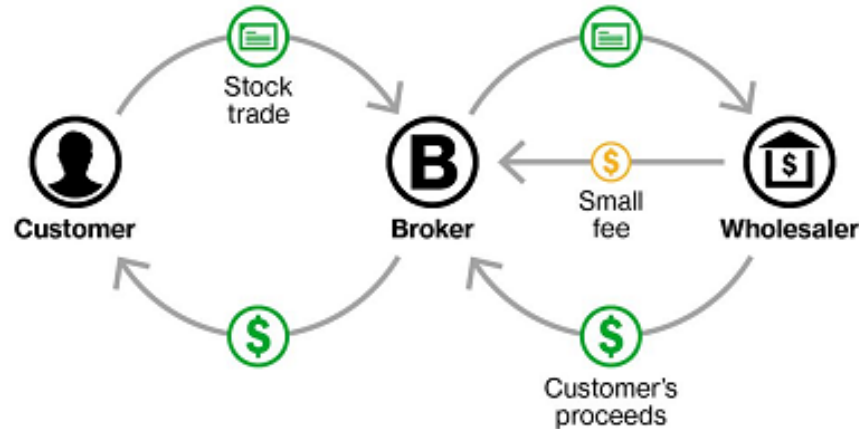
# Payment for Order Flow (PFOF)

## How Payment for Order Flow Works

Retail brokers typically don't execute their customers' orders. Instead they pass the trades to wholesalers like Citadel Securities or KCG that pay them a fee.

1 A **customer** instructs a **broker** to execute a stock trade.

2 The **broker** sends the trade to a **wholesaler**, and collects a fee.



3 The **wholesaler** is required to find the “best execution,” which could mean the lowest price, the speediest trade or the one most likely to be completed. The wholesaler returns the proceeds to the **broker**, who credits it to the **customer**.

Source: Medium.com



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# PFOF: Is it Good or Bad for Markets?

- Australia, Canada, Singapore, and the United Kingdom Have Banned PFOF
- EU Set to Ban PFOF by 2026
- SEC's Gensler: PFOF is a Conflict of Interest
  
- Equities Trading Costs are Lower than Ever!
- Trading Commissions Might Return if Brokers are not able to Monetize Customer Order Flow
- Broker-Dealers have Efficiently Outsourced Order Execution Functions

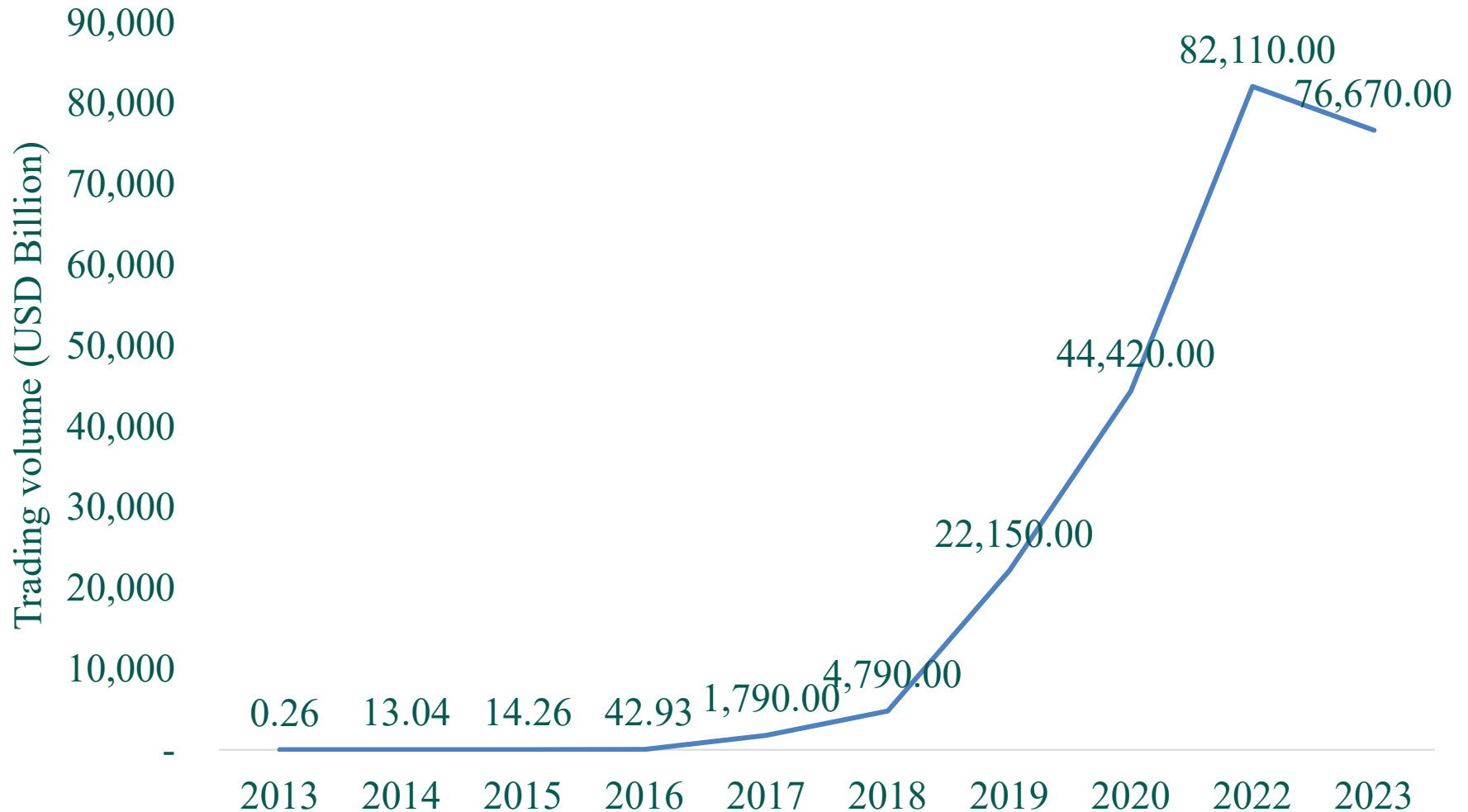


# PFOF in the Literature

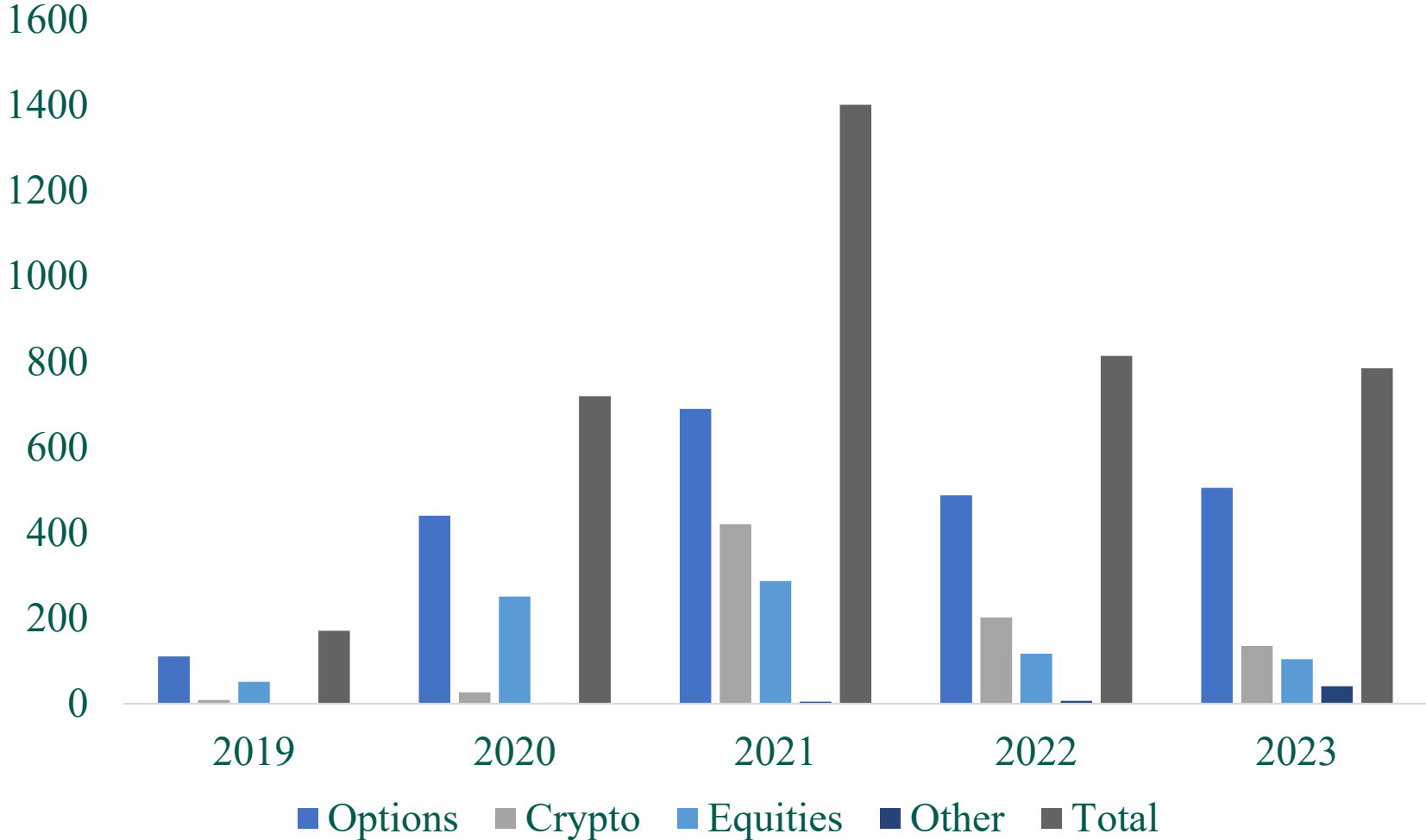
- Hu and Murphy (2024): More Internalization by Broker-Dealers is Associated with Higher Spreads and Worse Price Improvement in Equities Markets
- Ernst and Spatt (2022): Broker-Dealers have Incentives to Push Customers into Asset Classes with Higher PFOF, Particularly Options over Equities
- Levy (2022): PFOF is Generally Associated with Price Improvement, but Varies by Broker-Dealer



# Figure 1 – Crypto Asset Trading Volume



# Figure 2 – Robinhood PFOF Revenue



# PFOF Rates / Non-Compliance

- Robinhood's PFOF Revenue as % of Order Value
- Equity: 0.8 bps
- Options: 8 bps
- Crypto: 35 bps (From Robinhood Earnings Call)

(in millions)	Three Months Ended September 30,		Nine Months Ended September 30,	
	2021	2022	2021	2022
Transaction-based revenues:				
Options	\$ 164	\$ 124	\$ 527	\$ 364
Cryptocurrencies	51	51	372	163
Equities	50	31	235	96
Other	2	2	4	5
Total transaction-based revenues	267	208	1,138	628

Source: Robinhood 10-Q

- No 606 Reports for Non-Compliant Crypto Space
- Wholesaler Trades are Not Made Public





# Table 1 – Robinhood Crypto Introductions

Name	Kaiko Symbol	Listing Date	Information URL
Aave	aave	10/24/2022	<a href="https://twitter.com/robinhoodapp/status/1584532320551174145">https://twitter.com/robinhoodapp/status/1584532320551174145</a>
Avalanche	avax	8/8/2022	<a href="https://twitter.com/robinhoodapp/status/1556624446093373440">https://twitter.com/robinhoodapp/status/1556624446093373440</a>
Bitcoin	btc	1/25/2018	<a href="https://twitter.com/RobinhoodApp/status/956557558017179648">https://twitter.com/RobinhoodApp/status/956557558017179648</a>
Bitcoin Cash	bch	7/12/2018	<a href="https://blog.robinhood.com/news/2018/7/12/litecoin-and-bitcoin-cash-now-on-robinhood-crypto">https://blog.robinhood.com/news/2018/7/12/litecoin-and-bitcoin-cash-now-on-robinhood-crypto</a>
Bitcoin SV	bsv	11/29/2018	<a href="https://twitter.com/askrobinhood/status/1068346552341561344?lang=en">https://twitter.com/askrobinhood/status/1068346552341561344?lang=en</a>
Cardano	ada	9/1/2022	<a href="https://twitter.com/RobinhoodApp/status/1565323169409351681">https://twitter.com/RobinhoodApp/status/1565323169409351681</a>
Chainlink	link	6/28/2022	<a href="https://twitter.com/RobinhoodApp/status/1541765004885577730">https://twitter.com/RobinhoodApp/status/1541765004885577730</a>
Compound	comp	4/12/2022	<a href="https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets">https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets</a>
Dogecoin	doge	7/16/2018	<a href="https://blog.robinhood.com/news/2018/7/15/dogecoin-is-now-on-robinhood-crypto">https://blog.robinhood.com/news/2018/7/15/dogecoin-is-now-on-robinhood-crypto</a>
Ethereum	eth	1/25/2018	<a href="https://twitter.com/RobinhoodApp/status/956557558017179648">https://twitter.com/RobinhoodApp/status/956557558017179648</a>
Ethereum Classic	etc	8/6/2018	<a href="https://blog.robinhood.com/news/2018/8/5/ethereum-classic-is-now-on-robinhood-crypto">https://blog.robinhood.com/news/2018/8/5/ethereum-classic-is-now-on-robinhood-crypto</a>
Litecoin	ltc	7/12/2018	<a href="https://blog.robinhood.com/news/2018/7/12/litecoin-and-bitcoin-cash-now-on-robinhood-crypto">https://blog.robinhood.com/news/2018/7/12/litecoin-and-bitcoin-cash-now-on-robinhood-crypto</a>
Polygon	matic	4/12/2022	<a href="https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets">https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets</a>
Shiba Inu	shib	4/12/2022	<a href="https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets">https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets</a>
Solana	sol	4/12/2022	<a href="https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets">https://blog.robinhood.com/news/2022/4/12/robinhood-lists-four-new-crypto-assets</a>
Stellar Lumens	xlm	8/8/2022	<a href="https://twitter.com/robinhoodapp/status/1556624446093373440">https://twitter.com/robinhoodapp/status/1556624446093373440</a>
Tezos	xtz	10/24/2022	<a href="https://twitter.com/robinhoodapp/status/1584532320551174145">https://twitter.com/robinhoodapp/status/1584532320551174145</a>
Uniswap	uni	7/14/2022	<a href="https://twitter.com/RobinhoodApp/status/1547608038860697606">https://twitter.com/RobinhoodApp/status/1547608038860697606</a>
USD Coin	usdc	9/20/2022	<a href="https://twitter.com/RobinhoodApp/status/1572215405791580164">https://twitter.com/RobinhoodApp/status/1572215405791580164</a>



# Table 2 – Crypto Asset Summary Stats

Name	Unit Price	Market Capitalization	Daily Dollar Volume	Daily Trades	Active Trading Platforms
Aave	\$75.740	\$1,105,053,320	\$30,352,776	213,449	29
Avalanche	\$21.296	\$7,563,894,885	\$152,979,480	526,477	22
Bitcoin	\$10,252.060	\$200,174,661,561	\$974,400,000	1,001,481	25
Bitcoin Cash	\$828.961	\$16,198,567,369	\$70,454,280	126,008	14
Bitcoin SV	\$79.530	\$1,532,259,166	\$2,522,275	11,507	7
Cardano	\$0.450	\$15,856,258,810	\$199,666,920	670,354	22
Chainlink	\$8.685	\$4,835,374,220	\$113,497,728	435,061	35
Compound	\$103.262	\$816,884,230	\$23,386,457	150,343	29
Dogecoin	\$0.004	\$571,843,952	\$419,848	8,701	4
Ethereum	\$667.741	\$80,300,992,176	\$307,200,000	612,983	22
Ethereum Classic	\$13.929	\$2,001,573,042	\$49,179,888	117,786	12
Litecoin	\$92.817	\$6,849,506,322	\$58,716,768	165,426	18
Polygon	\$1.218	\$11,335,066,980	\$259,200,000	846,788	30
Shiba Inu	\$0.00002	\$11,740,334,448	\$1,123,200,000	1,110,413	25
Solana	\$81.064	\$33,869,298,882	\$640,800,000	1,651,827	18
Stellar Lumens	\$0.116	\$3,236,822,298	\$31,923,696	244,432	23
Tezos	\$1.288	\$1,233,238,799	\$8,163,278	84,563	20
Uniswap	\$6.499	\$3,825,061,652	\$48,716,184	327,057	35
USD Coin	\$1.000	\$43,537,884,267	\$379,200,000	250,093	28



# Table 3 – Crypto-Hour Summary Stats

<i>Variables</i>	(1) <i>Mean</i>	(2) <i>Std. Dev.</i>	(3) <i>Median</i>	(4) <i>Min</i>	(5) <i>Max</i>
<i>log(Dollar Volume)</i>	14.408	2.218	14.663	6.337	18.207
<i>Order Imbalance</i>	0.052	0.300	0.006	-0.650	1.000
<i>log(Trade Size)</i>	6.015	1.135	6.130	2.051	8.263
<i>C-S Spread</i>	0.020	0.048	0.006	0.000	0.314
<i>Volatility</i>	0.003	0.007	0.001	0.000	0.048

- **H1a: More Wholesaler Activity Off Trading Platforms**
  - Dark Uninformed Trading (or Trading On-Chain)
  - Lower Dollar Volume, Lower Order Imbalance, Higher Trade Size, Higher C-S Spread, Higher Volatility
- **H1b: More Wholesaler Activity On Trading Platforms**
  - Wholesalers Conduct Offsetting Trades on Trading Platforms
  - Higher Dollar Volume, Higher Order Imbalance, Smaller Trade Size, Lower C-S Spread, Lower Volatility
- **3 Specs: All, USD Countercurrency Only, BTC/ETH Only**



# Table 4 – Volume

<i>Variables</i>	(1) <i>log(Dollar Volume)</i>	(2) <i>log(Dollar Volume)</i>	(3) <i>log(Dollar Volume)</i>
<i>PFOF Introduction</i>	-0.057*** (-16.916)	-0.152*** (-34.229)	0.069*** (5.329)
<i>log(Dollar Volume)<sub>t-1</sub></i>	0.777*** (192.296)	0.682*** (117.279)	0.872*** (111.283)
<i>Subsample</i>	Full	USD Only	BTC/ETH Only
<i>Hour of Day FE</i>	Yes	Yes	Yes
<i>Token FE</i>	Yes	Yes	Yes
<i>Countercurrency FE</i>	Yes	No	Yes
<i>N</i>	240,532	80,262	25,920
<i>R<sup>2</sup></i>	0.933	0.939	0.861



# Table 5 – Order Imbalance

<i>Variables</i>	(1) <i>Order Imbalance</i>	(2) <i>Order Imbalance</i>	(3) <i>Order Imbalance</i>
<i>PFOF Introduction</i>	0.001 (0.942)	-0.008*** (-5.705)	-0.010*** (-3.695)
<i>Order Imbalance<sub>t-1</sub></i>	0.464*** (110.881)	0.112*** (18.312)	0.267*** (22.473)
<i>Subsample</i>	Full	USD Only	BTC/ETH Only
<i>Hour of Day FE</i>	Yes	Yes	Yes
<i>Token FE</i>	Yes	Yes	Yes
<i>Countercurrency FE</i>	Yes	No	Yes
<i>N</i>	240,478	80,244	25,914
<i>R<sup>2</sup></i>	0.452	0.473	0.077



# Table 6 – Trade Size

<i>Variables</i>	(1) <i>log(Trade Size)</i>	(2) <i>log(Trade Size)</i>	(3) <i>log(Trade Size)</i>
<i>PFOF Introduction</i>	0.006 (1.481)	0.032*** (7.009)	-0.005 (-0.400)
<i>log(Trade Size)<sub>t-1</sub></i>	1.031*** (293.583)	1.100*** (176.832)	1.024*** (184.703)
<i>Subsample</i>	Full	USD Only	BTC/ETH Only
<i>Hour of Day FE</i>	Yes	Yes	Yes
<i>Token FE</i>	Yes	Yes	Yes
<i>Counter crypto asset FE</i>	Yes	No	Yes
<i>N</i>	240,478	80,244	25,914
<i>R<sup>2</sup></i>	0.862	0.888	0.795



# Table 7 – Implied Spread (Corwin-Schultz)

<i>Variables</i>	(1) <i>C-S Spread</i>	(2) <i>C-S Spread</i>	(3) <i>C-S Spread</i>
<i>PFOF Introduction</i>	0.001*** (7.966)	0.002*** (12.024)	0.000 (0.176)
<i>C-S Spread<sub>t-1</sub></i>	0.899*** (190.057)	0.935*** (345.869)	0.780*** (90.186)
<i>Subsample</i>	Full	USD Only	BTC/ETH Only
<i>Hour of Day FE</i>	Yes	Yes	Yes
<i>Token FE</i>	Yes	Yes	Yes
<i>Countercurrency FE</i>	Yes	No	Yes
<i>N</i>	240,397	80,225	25,896
<i>R<sup>2</sup></i>	0.842	0.944	0.609



# Table 8 - Volatility

<i>Variables</i>	(1) <i>Volatility</i>	(2) <i>Volatility</i>	(3) <i>Volatility</i>
<i>PFOF Introduction</i>	0.012*** (6.620)	0.023*** (7.837)	-0.003 (-0.851)
<i>Volatility<sub>t-1</sub></i>	0.888*** (189.572)	0.886*** (155.673)	0.970*** (234.715)
<i>Subsample</i>	Full	USD Only	BTC/ETH Only
<i>Hour of Day FE</i>	Yes	Yes	Yes
<i>Token FE</i>	Yes	Yes	Yes
<i>Countercurrency FE</i>	Yes	No	Yes
<i>N</i>	240,452	80,234	25,914
<i>R<sup>2</sup></i>	0.836	0.903	0.942





# Conclusion

- First Paper to Examine PFOF in Crypto Markets
- PFOF Rates in Crypto Markets are Relatively Large, Reflect Highly Uninformed Trading
  - 35 bps Compared to 8 (0.8) bps for Options (Equities)
- Introduction of PFOF Crypto Markets Leads to:
  - Lower Volume on Trading Platforms
  - Net Sell Order Imbalances, Higher Average Trade Size
  - Higher Implied Spreads (Approx. \$4.8M in Daily Costs)
  - Greater Return Volatility
- BTC/ETH Largely Unaffected





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