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Payment for Order Flow.
Implications for retail-investors and the role of the policies and of the decentralized exchanges

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Topic 3: Payment for Order Flow
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Abstract

The recent years have transformed financial exchanges into automated processes ruled by algorithms and online brokerage firms. Payment for Order Flow (PFOF) has been approved by the New York Stock Exchange (NYSE) in 2009. Although this practice made markets more efficient, there are questionable aspects of PFOF.

This paper highlights the problems associated with the PFOF analyzing the case of the online brokerage firm Robinhood Financial, LLC (Robinhood). In this paper are discussed the implications of the Securities and Exchanges Commission (SEC) policies, the use of data by market makers, the lack of transparency and the conflicts of interest that brokers face.

The alternative recommended policy and the technological proposal of decentralized exchanges presented in this paper aim to ensure transparency of individual transactions. The proposed policy will enable PFOF to continue to exist, while making retail investors aware of this practice. In addition, it is highlighted that from a transactional perspective, blockchain-based platforms are preferable over centralized platforms when reductions in the transaction costs are higher than increases in coordination and complexity costs. Moreover, once the blockchain scalability issue will be finally solved, Decentralized Exchanges might be the next logical step, allowing as high number of transactions as the ones on Traditional Exchanges.

Keywords: payment-for-order-flow, payment for order flow, securities and exchanges commission, sec, commission free, online brokers, nbbo, citadel, virtu, robinhood markets inc., robinhood, retail investor, blockchain, distributed ledger technology, dlt, smart contracts, decentralized exchange.

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Table of Abbreviations

CCP	Central Clearing Counterparty
CFMM	Constant Function Market Makers
ETF	Exchange-traded fund
FAQ	Frequently Asked Question
FINRA	Financial Industry Regulatory Authority
NBBO	National Best Bid and Offer
OTC	Over the counter
P2P	Peer-to-peer
PFOF	Payment for Order Flow
Robinhood	Robinhood Financial, LLC
SEC	Security and Exchanges Commission
UK	United Kingdom
US	United States of America

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1. SEC, FINRA and the Robinhood case

Robinhood Financial, LLC (Robinhood) is a US company that acts in the brokerage universe with an online presence. The company was launched in 2013 and made its services available to all investors in 2015.[1] Robinhood has become a well-known broker thanks to the availability of commission-free investing in stocks, options, ETFs, and cryptocurrencies.[2] The firm must adhere to the Security and Exchange Commission (SEC) and Financial Industry Regulatory Authority (FINRA) regulations policies. Despite monitoring by these agencies, there are concerns about Robinhood's use of payment-for-order-flow (PFOF) to generate revenue. PFOF is the compensation and benefit a brokerage firm receives for selling orders to different market makers for trade execution.[3]

Robinhood must adhere to FINRA Rule 5310 known as the Best Execution Rule, meaning that when Robinhood deliver a user's order to a market maker, they must "use reasonable diligence" to ensure that the "resultant price to the customer is as favorable as possible under prevailing market condition." (FINRA, 2014a). Robinhood has been fined different times for not routing customer orders to a market maker that would provide the best execution and then has always submitted a Letter of Acceptance.

On December 17, 2020 the SEC[4] fined Robinhood with $65 million dollars due to inferior trade prices that, in aggregate, deprived customers of $34.1 million even after taking into account the savings from not paying a commission.[5] Between 2015 and late 2018, Robinhood made misleading statements and omissions in customer communications, including those in FAQ pages, about its largest revenue drivers when describing how Robinhood generated income. As the SEC's order finds, one of Robinhood's selling points to customers was that trading was commission-free, but due in large part to its unusually high payment for order flow rates, Robinhood customers' orders were executed at prices that were worse than other brokers' prices. Robinhood provided misleading information to customers about the true costs of choosing to trade on their platform. Indeed, the SEC has accused the online broker app of predatory marketing on inexperienced and uniformed retail investors.

The PFOF increases the adverse selection that occurs when there is asymmetric information between buyers and sellers. This unequal information distorts the market at the expense of the retail investors and to the advantage of market makers, leading to market failure.

[1] Robinhood Markets. "Start Investing. Stop Paying." Accessed May 3, 2021.
[2] Robinhood Markets. "Robinhood Financial Fee Schedule." Page 1. Accessed May 3, 2021.
[3] Investopedia. "Payment for Order Flow (PFOF)". Accessed May 10, 2021.
[4] Securities and Exchange Commission (SEC) and Robinhood. Accessed May 10, 2021.
[5] SEC. "SEC Charges Robinhood Financial With Misleading Customers About Revenue Sources and Failing to Satisfy Duty of Best Execution". Accessed May 11, 2021.

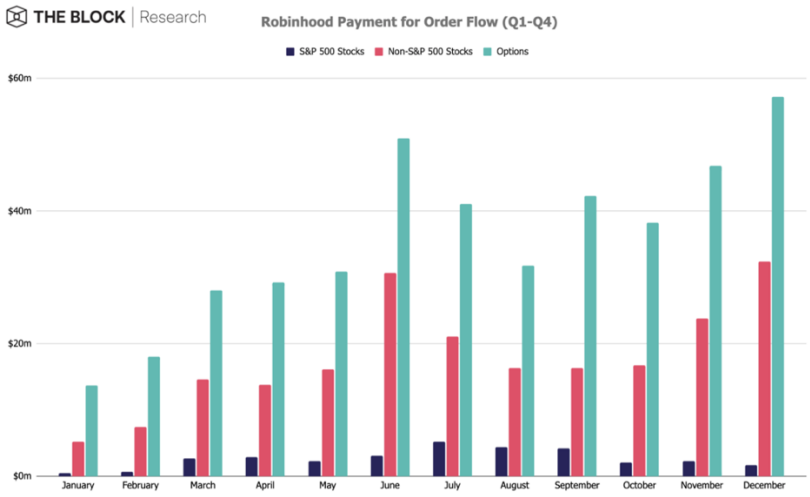
2. Robinhood: the business model

Robinhood has become famous because of commission-free investing in stocks, ETFs, options and cryptocurrencies.[6] While that was a huge advantage in the company's early years, there are many commission-free brokers to choose from now. The company's revenue comes from three main sources: (1) interest earned on customers' cash balances, (2) selling order information to high-frequency traders and (3) margin lending.

Robinhood reports that it executes 95.12% of orders for S&P500 stocks at National Best Bid and Offer (NBBO) or better.[7] However, Robinhood doesn't disclose its price improvement statistics, which could lead one to make negative assumptions about its order routing practices.

2.1. Key Statistics

- Robinhood generated $682 million in payment-for-order-flow revenue in 2020, a 514% increase year-on-year.[8]
- Robinhood added $3.4 billion to its balance sheet during the GameStop stock squeeze, after suspending trades for a week.[9]
- In May 2020, Robinhood revealed it had 13 million active user whose average age is 31[10] while it was 26 when the app was launched in 2015[11].
- Robinhood was valued at $11.7 billion in its private fundraising round in September 2020, although the bids in the secondary market equate to a valuation of $40 billion.[12]



Source: www.theblockcrypto.com

[6] Robinhood Markets. "Robinhood Financial Fee Schedule." Page 1. Accessed May 3, 2021.
[7] Robinhood Markets. "Stocks Order Routing and Execution Quality." Accessed May 9, 2020.
[8] Robinhood Revenues. "Robinhood's revenue in 2020". Accessed May 5, 2021.
[9] Robinhood balance during GameStop stock squeeze. techcrunch.com. Accessed May 5, 2021.
[10] Robinhood active users. nytimes.com. Accessed May 5, 2021.
[11] Robinhood users' age. "Young, Poor and Looking to Invest? Robinhood Is the App for That". Accessed May 5, 2021.
[12] Robinhood Valuation. "Robinhood shares are soaring just like the stocks that trade on Robinhood". Accessed May 5, 2021.

Table 1 Robinhood data summary

Year	Revenue	Total transactions	Valuation	Users
2015	$2.9 million	-	-	0.5 million
2016	$9.3 million	$0.5 billion	-	1 million
2017	$21 million	$50 billion	$1.3 billion	2 million
2018	$69 million	$100 billion	$5.6 billion	6 million
2019	$111 million	$150 billion	$7 billion	10 million
2020	$673 million	$350 billion	$11.7 billion	13 million

Sources: Alphacaution, CNBC, TechCrunch, Robinhood.

2.2. Robinhood competitors and Alternatives

- *E*trade:* only stocks, options and ETFs are commission free. The company receives revenue from (1) interest on margin balances, (2) commissions for order execution, (3) payment for order flow and (4) management services.[13]
- *Charles Schwab:* most commission are 0. The company receives revenue from (1) interest on margin balances, (2) commission for order execution, (3) payment for order flow and (4) management services.[14]
- *Freetrade:* based in the UK. Zero-fee on trades executed at the end of the day. The company receives revenue from (1) instant trades, (2) ISAs and (3) premium management services.[15]
- *eToro:* few instruments and operations are commission-free. The company receives revenue from (1) trading operations, (2) interests fees and (3) currency conversion.[16]

Table 2 Robinhood and peers

Company	Users	AuM	Average account size
Robinhood	13 million	$20 billion	$3,500
*E*trade*	3.7 million	$600 billion	$100,000
Charles Schwab	31.9 million	$3.8 trillion	$240,000
Freetrade	0.34 million	-	£2,000
eToro	20 million	-	-

[13] E*Trade. "Pricing and Rates". Accessed May 5, 2021.
[14] Charles Schwab. "$0 commissions on online trades". Accessed May 5, 2021.
[15] Freetrade. "Pricing". Accessed May 5, 2021.
[16] eToro. "eToro fees". Accessed May 5, 2021.

2.3. Before Robinhood, back to 2018

In 2018, plenty of brokerages offered reasonable fees and commissions. Consider stock and ETF commissions: Firstrade leaded the way among firms that charge a fixed rate, at $2.95 per trade, followed by Fidelity and Schwab ($4.95) and TD Ameritrade ($6.95). The rest of the firms employed variable pricing that depended on how often user traded or on the size of your average monthly balance. E*Trade's standard $6.95 commission dropped to $4.95 for clients who make 30 or more trades per quarter. Ally Invest shaved a dollar off its fee, to $3.95, for investors with a daily balance of $100,000 or more or who traded at least 30 times per quarter.[17]

3. The role of Market Makers

Market makers like Citadel Securities and Virtu Financial consider the data from order flows valuable. The market makers are not allowed to use order flows data to front-run their own orders before the execution of customer orders to generate an additional profit. Although, market makers can use the order flows data to forecast the market activity and then engage in arbitrage pricing at the same time as when orders are being executed.

Market makers want order flows from Brokers because they want to use the data to trade against brokers' users[18]. Retail investors and uninformed traders or noise traders tends to "exhibit contrarian trading strategies"[19] thus the "the more noise traders lose money, the greater benefit to informed traders, and so more information production takes place". From this point-of-view the PFOF is resulting in the exploitation of retail investors.

On the flips side, market makers provide large amounts of liquidity to the market and, as outlined by the SEC in 2000, PFOF contributes to narrowing quoted spreads on the market.[20] It is in the exchange's best interest to have narrow spreads because it gives the market greater credibility and safer ratings.

Market efficiency is important because it manifests itself in transparent and unbiased prices. It is debatable whether policies that impact trade frequency to hinder PFOF are worth the cost of decreased market efficiency. From a utilitarian perspective, PFOF results in a greater amount of good for all stakeholders.

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[17] "The best online brokers, 2018". Accessed May 6, 2021.
[18] Egan M. "Robinhood trading app fined for 'failures'". Accessed May 11, 2021.
[19] Bloomfield, Robert J., and O'Hara, Maureen and Saar, Gideon. "How Noise Trading Affects Markets: An Experimental Analysis (May 2007)".
[20] SEC. "Special Study: Payment for Order Flow and Internalization in the Options Markets". Accessed May 11, 2021.

4. The role of Blockchain

The problems discussed above can be avoided thanks to distributed ledger technologies (DLT) and specifically with its most prominent form: the blockchain. It fulfills the need to preserve competition among market makers and liquidity providers, as well as to lower transaction fees.

In the case of centralized platforms, a single entity sponsors and owns the core infrastructure. In the case of blockchain-based platforms, the records of all transactions are stored on all the nodes of the network, so that the core of the platform is shared and distributed across the users.

Blockchain-based platforms have the main features in decentralized governance and a distributed data infrastructure. This structure (1) is able to disintermediate transactions and reduce their linked costs (Halaburda, 2018)[21], (2) brings cost savings by replacing the central servers with a peer-to-peer network and (3) guarantees more transparency (Atzori, 2015; Catalini and Gans, 2017)[22]. Although, duplicating all records and updates of the data can make the reconciliation and integrity of the ledgers slower and more costly, putting additional restrictions to the scalability of blockchain-based platforms.

4.1. Decentralized finance

In a decentralized finance ecosystem, new financial technologies can become the building blocks for future innovations, promoting new combinations and new products. However, one of the main requirements here is interoperability.[23]

With high interoperability, financial capital and value can flow seamlessly across different services and borders, potentially creating an internet of value. To reach this goal a first solution is the emergence of one dominant platform (e.g. Ethereum), while a second solution might be to increase interoperability across blockchains.

In case of centralized finance, moving capital and value across borders often entails friction and delay due to different geographic locations and their related fiat currencies. Decentralized finance generates distributed trust thanks to radical transparency and distributed consensus among users. There is no more the need of a trusted intermediary, thus expanding the scale and scope of potential transactions (Seidel, 2018)[24]. On the flip side, achieving distributed trust can dramatically increase the

[21] Pereira, J., Tavalaei, M. M., & Ozalp, H. (2019). Blockchain-based platforms: Decentralized infrastructures and its boundary conditions. *Technological Forecasting and Social Change*, *146*, 94-102.
[22] Schär, F. (2020). Decentralized finance: On blockchain-and smart contract-based financial markets. Available at SSRN 3571335.
[23] Interoperability. "Blockchain Interoperability: Towards a Connected Future". Accessed May 11, 2021.
[24] Chen, Y., & Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of decentralized business models. *Journal of Business Venturing Insights*, *13*, e00151.

costs of preparing, processing, and storing information (Kumar et al., 2019).[25] Another problem is the lack of accountability: when something goes wrong, no central party can take actions to freeze transactions, fix problems, and restore normal operations (Palatnick et al., 2019).[26]

4.2. Decentralized Exchanges

Decentralized Finance is based on the use of a smart contract on a public blockchain. Among its various implementations, one of the most relevant for the future of market makers, regards decentralized exchanges.

Decentralized exchanges allow users to remain in exclusive control of their assets until the trade is executed thanks to the smart contract's architecture, mitigating the counterparty credit risk. Depending on the exact implementation, the smart contract may assume additional roles, effectively making many intermediaries such as escrow services and central clearing counterparties (CCPs) obsolete.

There are four main categories of decentralized exchanges, consisting in open exchange protocols following the latest infrastructure standards and improvements.[27]

1) *Decentralized order book exchanges:* use smart contracts for transaction settlement with two different options to manage order books; on-chain which require more blockchain transactions and consequently more network fees, or off-chain which need the involvement of a third-party that provides, charging a fee, ordered lists with quotes.
2) *Constant function market makers (CFMM):* are smart contract-liquidity pools that use a constant product model (`xy=k`) to determine every exchange rate and its variations; it cannot be depleted because this model rearrange prices according to the reserve ratio. The implicit bid/ask spread of the constant product model (plus a small trading fee) is a clear incentive to the accumulation of additional funds from liquidity providers.
3) *Smart contract-based reserve aggregation:* is a mechanism to consolidate liquidity reserves via smart contracts linking all large liquidity providers; they set prices, but the smart contract enables automatically the best execution on behalf of the user.
4) *P2P/OTC protocols*: follow a two-step approach similar to traditional OTC markets where, after finding the right counterparty, comes the bilateral negotiation; this means that any third party is unable to front-run someone accepting an offer by observing the pool of unconfirmed transactions.

[25] Chen, Y., & Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of decentralized business models. *Journal of Business Venturing Insights*, *13*, e00151.
[26] Chen, Y., & Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of decentralized business models. *Journal of Business Venturing Insights*, *13*, e00151.
[27] Schär, F. (2020). Decentralized finance: On blockchain-and smart contract-based financial markets. Available at SSRN 3571335.

5. Conclusion

PFOF impacts over the retail investors also key stakeholders such as the exchanges, the market makers, and other investor groups.

Commission-free trade give the chance to retail investors to trade financial instruments. The financial venues benefit from PFOF because market makers provide large amounts of liquidity to the market. On the other side, the online broker should stop cheating retail investor showing just the nice cheek of their offer, hiding the black side of the PFOF.

To reach a good balance between the gain of the big players and the improvement of the financial stability, there should be an effective market policy that includes clarifying the Best Execution Rule and increasing transparency through public disclosure of execution quality. In particular, whenever an order is executed, it should be immediately disclosed to the general public. Additionally, this policy would ensure that users can freely choose to opt-out of PFOF mechanism.

SEC's decision gave the chance to exchanges to progressively gain monopoly power. On the flip side, the SEC has permitted PFOF to continue to enhance competition. However, brokerage firms cannot mislead customers about order execution quality.

With an effective regulation, online brokerage firms can continue to increase accessibility to markets while respecting the data rights of users.

Decentralized finance may increase the efficiency, transparency, and accessibility of the financial infrastructure thanks to the multiple roles of smart contracts as custodians, escrow agents, and CCPs, as well as lowering the counterparty credit risk. However, it has also some risks such as smart contract execution, regulatory concerns, operational security, and dependencies on other protocols and external data. Moreover, from a transactional perspective, blockchain-based platforms are preferable over centralized platforms when reductions in the transaction costs are higher than increases in coordination and complexity costs. Hence, entrepreneurs and innovators have recognized the possibilities of creating an open financial system that has limited or no involvement from financial institution. Whether it will be successful or not depends on if the next developments to solve the remaining problems, like the most important one regarding the scalability of the blockchain technology, and as much as the future trade-offs will be managed optimally.

References

Bloomfield, R., O'hara, M., & Saar, G. (2009). *How noise trading affects markets: An experimental analysis.* The Review of Financial Studies, 22(6), 2275-2302.

Carey, T.W. (2021). *Payment for Oder Flow (PFOF).* Retrieved 05 03, 2021, from https://www.investopedia.com/terms/p/paymentoforderflow.asp

Chaparro, F. (2021). *Robinhood payment for order flow (Q1-Q4).* Retrieved 05 03, 2021, from https://www.theblockcrypto.com/post/93321/robinhood-payment-for-order-flow-2020

Chen, Y., & Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of decentralized business models. *Journal of Business Venturing Insights*, *13*, e00151.

Detrixhe, J. (2021). *Robinhood shares are soaring just like the stocks that trade on Robinhood.* Retrieved 05 05, 2021 from https://qz.com/1971633/robinhood-pre-ipo-secondary-shares-signal-40-billion-valuation/

Egan, M. (2019). *Robinhood trading app fined for 'failures'.* Retrieved 05 11, 2021 from https://edition.cnn.com/2019/12/19/investing/robinhood-trading-app-fine-finra/index.html

eToro. (2021). *eToro Fees.* Retrieved 05 05, 2021, from https://www.etoro.com/trading/fees/

E*Trade. (2021). *Pricing and Rates.* Retrieved 05 05, 2021, from https://us.etrade.com/what-we-offer/pricing-and-rates

Financial IT. *Robinhood's revenue.* Retrieved 05 05, 2021, from https://financialit.net/news/trading-systems/robinhoods-revenue-increased-514-yoy-682m-2020

Freetrade. (2021). *Pricing.* Retrieved 05 05, 2021, from https://freetrade.io/pricing

Huang, D. (2015). *Young, Poor and Looking to Invest? Robinhood Is the App for That.* Retrieved 05 05, 2021 from https://www.wsj.com/articles/BL-MBB-31486

Huang, N. S., & Ermey, R. (2018). *The best online brokers, 2018.* Retrieved 05 06, 2021 from https://www.kiplinger.com/article/investing/t023-c000-s002-the-best-online-brokers-2018.html

Mascarenhas, N., & Wilhelm, A. (2021). *Robinhood's long weekend brings a total of $3.4 billion to its balance sheet.* Retrieved 05 05, 2021 from https://techcrunch.com/2021/02/01/robinhoods-long-weekend-brings-a-total-of-3-4-billion-to-its-balance-sheet/?guccounter=1

Pereira, J., Tavalaei, M. M., & Ozalp, H. (2019). Blockchain-based platforms: Decentralized infrastructures and its boundary conditions. *Technological Forecasting and Social Change*, *146*, 94-102.

Popper, N. (2021). *Robinhood Has Lured Young Traders, Sometimes With Devastating Results.* Retrieved 05 05, 2021, from https://www.nytimes.com/2020/07/08/technology/robinhood-risky-trading.html

Robinhood. (2020). *Fee Schedule*. Retrieved 05 03, 2021, from https://cdn.robinhood.com/assets/robinhood/legal/RHF%20Fee%20Schedule.pdf

Robinhood. (2015). *Start Investing. Stop Playing*. Retrieved 05 03, 2021, from https://blog.robinhood.com/news/2015/3/11/start-investing-stop-paying

Robinhood. (2021). *Stock order routing*. Retrieved 05 09, 2021, from https://robinhood.com/us/en/support/articles/stocks-order-routing-and-execution-quality/

Schär, F. (2020). Decentralized finance: On blockchain-and smart contract-based financial markets. Available at SSRN 3571335.

Schawab. (2021). *$0 commissions on online trades.* Retrieved 05 05, 2021, from https://www.schwab.com/pricing

SEBA Bank. (2020). *Blockchain Interoperability: Towards a Connected Future.* Retrieved 05 11, 2021, from https://www.seba.swiss/research/blockchain-interoperability-towards-a-connected-future

SEC. (2020). *Order instituting administrative and cease-and- desist proceedings pursuant to section 8a of the securities act of 1933 and section 15(b) of the securities exchange act of 1934, making findings, and imposing remedial sanctions and a cease-and-desist order.* Washington D.C.: SEC Press.

SEC. (2020). SEC Charges Robinhood Financial With Misleading Customers About Revenue Sources and Failing to Satisfy Duty of Best Execution. *Press Release*. Washington D.C.: U.S. Security and Exchange Commission.

Securities, U. S., & Exchange Commission. (2000). Special Study: Payment for Order Flow and Internalization in the Options Markets. *Office of Compliance Inspections and Examinations/Office of Economic Analysis, 1.*

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		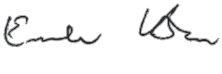

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