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FIN11 Termpaper



Robinhood: Helping out the little guy or in cahoots with the sheriff?

A closer look at millennial favourite Robinhood's impact on the financial market

Abstract

Robinhood (RH) is a new electronic trading platform operating in the U.S. The company has established itself as a popular trading application by offering users commission-free investment in publicly-traded companies, options, and other exchange-traded funds. In this paper, we have examined RH's impact on the financial market. We analyzed the extent to which their commission-free model makes the financial market more accessible and attractive to the millennial age group, and how this potentially brings liquidity and new money to the market. Further, we discussed the selling of order flow to High-Frequency Trading firms (HFTs). The controversy surrounding this practice has been the subject of significant media attention, and it begs the question of whether RH lives up to the reputation of its altruistic namesake. This can affect RH users directly by having their orders front run, and by making them pay price premiums for the securities of interest. Moreover, it also impacts the financial market in general by making the HFTs able to single out retail flow from the market and giving them a better understanding of market developments. The value of information and how it is used is a very important debate in modern business and equity trading follows suit. In our opinion, the story of RH offers crucial insight into how information used for trading can be acquired and used in years to come. In conclusion, it is hard to determine whether the impact of RH is net positive or negative, because it depends heavily on one's perspective.

Table of Contents

ABSTRACT **2**

1. INTRODUCTION **4**

2. PRESENTATION OF ROBINHOOD **4**

3. IMPACT ON TRANSACTION COSTS, TRADING ACTIVITY AND MARKET LIQUIDITY **5**

4. ROBINHOOD AND HIGH-FREQUENCY TRADING **8**

4.1 THE HFT-CONTROVERSY 8

4.2 EXPLAINING HFT 9

4.3 THE VALUE OF INFORMATION 11

4.4 FRONT RUNNING 13

4.5 FURTHER DISCUSSION ON MARKET IMPLICATION OF INFORMATION 15

5. CONCLUSION **17**

6. SOURCES **19**

1. Introduction

This paper aims to give the reader an understanding of the trading platform Robinhood's (RH) impact on the financial market. This will be accomplished by presenting an analysis of the observable effects we have been able to watch over the company's first years in business, and the potential long-term effects of this type of trading platforms. First, we will introduce RH's business model and the nature of online trading platforms in general. We will then engage in a detailed discussion of various aspects of finance and market microstructure, and how RH interacts with these factors.

A necessary clarification to make when discussing impact on the market is the difference between issues regarding ethics and strictly the functionality of the market as an economic tool. Both aspects will be touched on here, however, our main focus considering the scope of the FIN11-course will be on the latter.

2. Presentation of Robinhood

In 2013 Vlad Tenev and Baiju Bhatt, two Stanford University students, launched a new solution within trading. The two had experience building high-frequency trading platforms for financial institutions in New York. After realizing that traditional prosecutors within the HFT-market pay next to nothing for executing trades, they decided to challenge their way of doing business. Their concept was based on a simple idea: a commission-free stock trading application. RH enables customers to invest in publicly-traded companies and exchange-traded funds listed on U.S. stock exchanges without charging their customers any commission fees. Their motivation in doing so was to offer more people the opportunity to access the financial markets; their vision states, "We're on a mission to democratize America's financial system" (Robinhood, 2018). Officially, RH reports that they earn revenue is from collecting interest on customers' cash balances, and from margin lending (Carey, 2018). This simple but exciting idea drew attention from the very beginning, allowing them to earn 3 million dollars in investment before the product even launched. By March 2018, CNBC reported that the company had been valued at 5.6 billion dollars as a result of their innovative business model. Although the company has marketed themselves as 'lending hand to the man on the street,' it has been accused by several sources of being a 'wall-street puppet', in other words selling out their client's information to bigger firms. These conflicting claims raise several interesting questions, most importantly: is Robinhood helping out the little guy, or in cahoots with the sheriff?

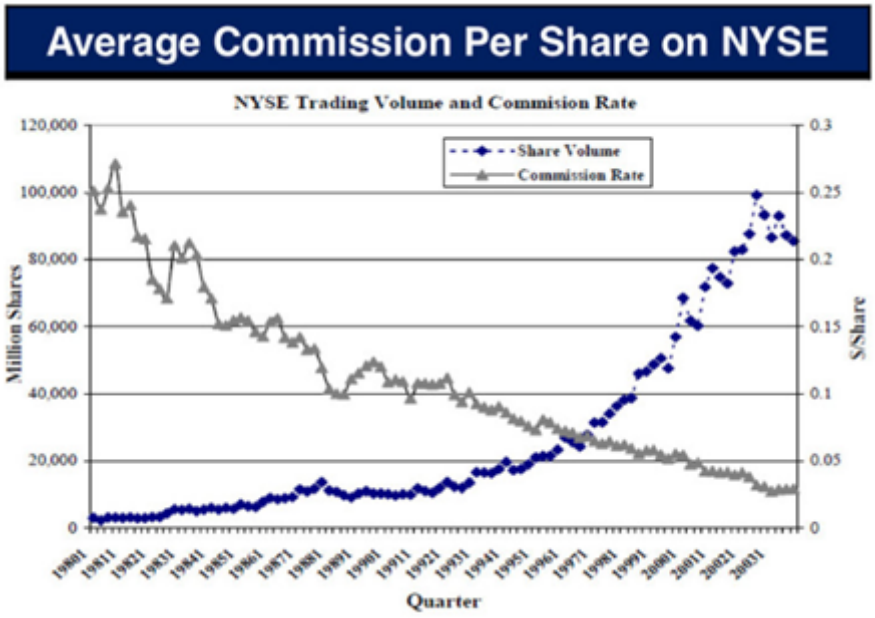
3. Impact on transaction costs, trading activity and market liquidity

As a commission-free brokerage, RH has created a unique role for itself as a brokerage platform. Companies offering electronic trading platforms have traditionally generated substantial revenue from initial sign-up fees and transaction costs from executed trades. By eliminating these costs traditionally borne by consumers, RH aims to facilitate easier access to the stock market for retail clients. The firm's quick rise to prominence speaks to the success of its business model, and further serves as evidence of a change in the traditional functioning of the stock market. This section of the paper analyze the impact RH has on the field of online investing and assess which aspects of the stock market that have been most affected by its rise.

With RH reaching the milestone of a million registered accounts in the last half of 2016, the success of the commission-free approach has become clear to other online brokerage firms (Kokalitcheva, 2016). In February 2017, two of the largest operators in electronic investing, Fidelity Investments and Charles Schwab Corp., reduced their trade commissions on U.S. stocks and exchange-traded funds by 38% and 23%, respectively (Krouse, 2017). Amid intense competition for clients, other online brokerages have since followed, making commission reductions a clear trend among firms offering electronic trading platforms. TD Ameritrade and E-Trade, both direct competitors of RH, reduced commissions within the last fiscal year (Shell, 2017) (Kim, 2017). Interestingly, the commission-reduction trend transcends these archetypical internet-based firms. JP Morgan Chase, for example, has launched a digital investment platform called "You Invest" which allows customers to execute up to 100 commission-free online stock and ETF trades each year (JP Morgan, 2018). The Vanguard Group has since followed by eliminating commission fees on all Vanguard ETFs and 1800 external ETFs (Vanguard, 2018).

A direct link between RH's emergence and the industry's commission reductions cannot yet be confirmed. At this point, one can only speculate as to how much impact the firm has had on the fee levels in electronic trading. However, there has been a clear trend, and such warrants a discussion of how fee reductions affect the market. Empirical studies have found that lower commission rates incite more active and frequent trading by all agents (Jones and Seguin, 1997). This has to do with the belief that, as Columbia professor Charles Jones claims, transaction costs should be of first-order importance in many trading decisions (Jones, 2002). In his paper on stock market liquidity and trading costs, Jones studied the New York Stock Exchange (NYSE) over a 74-year period starting in 1926. Jones observed a clear negative

correlation between annual NYSE turnover and one-way transaction costs. The author defines one-way transaction costs as half the quoted spread on stocks plus average one-way commissions on NYSE stocks, with commission usually composing a considerable part of the total cost. The found correlation is -0.8, meaning that a 1% increase in transaction costs will yield a 0.8% decrease in turnover (Jones, 2002). David Bianco, a well-known Wall Street strategist working for Deutsche Bank, studied the development of average commissions on stocks traded on the NYSE from 1980 to 2003 (Wile, 2014). Bianco's findings are illustrated in Figure 1, which shows trading volume on NYSE, counted as number of shares traded, and the average commission rates charged on NYSE shares traded. Share volume is read on the left vertical axis as million shares, while average commission is read on the right vertical axis as percentage of share price.



The graph shows that average commission rates, illustrated by the grey line, have fallen steadily over the period from levels around 20-25% of share prices in the 1980s to levels below 5% since the start of the new millennium. The number of shares traded has been rising steadily in the same period, making the figure conform with Jones' proven correlation.

These studies indicate that transaction fee levels are highly relevant for trading activity in financial markets, meaning that commission cuts can bring increased turnover and liquidity to the market. Trading volume will naturally vary as a result of the impact of many variables

beyond commission rates, but the clear link between the two serves as an indication of the importance of commission rate variations. Although Bianco proves that fee levels have been falling consistently for a long time, RH's decision to cut commissions completely was nevertheless unexpected. With other brokerages reacting by cutting or eliminating own commissions, retail investors now have wide possibilities to trade more cheaply than ever before. If, as Jones and Bianco emphasizes, traded volume increases when transaction costs decrease, reductions of traditional levels in online investing can contribute to increased trading activity, making RH's rise an impactful emergence.

RH's users are attracted and retained by more than the firm's commission-free offering. The simplistic app, created to make trading as easy as possible, has won several design awards, including the Apple Design Award in 2015. With elegant design (figure 1) and easy maneuvering, the app attracts more young investors than the traditional brokerages have historically been able to. According to RH, the average age of their account owners is 31 years old (Low, 2018). With such a low average age, there is reason to believe that a significant portion of users are investing for the first time. Indeed, this has been a main objective for the firm; "Learn by Doing" is one of their slogans. By successfully engaging a segment of the population not previously involved in investing, RH has brought new additions to the stock market, thus proving itself as an influential agent among online brokerage firms.

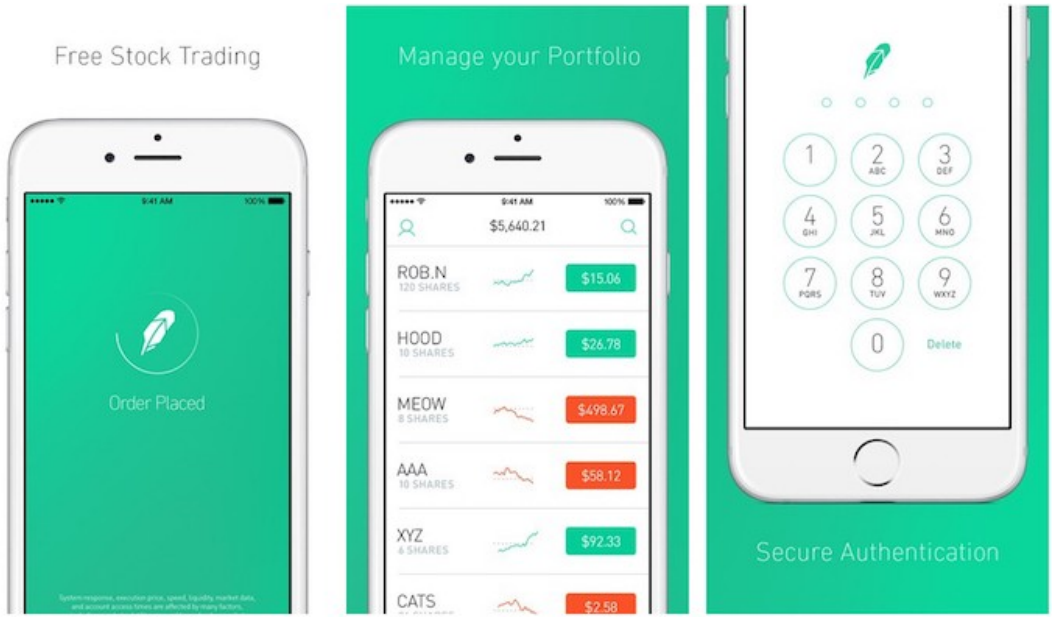


Figure 1: Screenshot from the application.

RH's business model is, in the words of its founders, meant to offer "more people the opportunity to access the financial markets." By cutting commissions, the firm has attracted young investors and further increased the accessibility of the financial markets for a wide range of investors. As cutting commissions has been proven to increase trading activity, one can argue that the firm has developed a business model capable of substantial market impact. This is especially true considering how other brokerages seem to have been influenced by RH's rise, leading to cuts in transaction costs throughout the field of online investing. Although it is uncertain whether RH's emergence will bring considerable changes to the level of online transactions costs on a long-term basis, the firm certainly has developed a platform capable of increasing market participation and activity.

4. RobinHood and High-Frequency Trading

4.1 The HFT-Controversy

A stir was caused in the financial news cycle when Seeking Alpha writer Logan Kane announced that "Robinhood Is Making Millions Selling Out Their Millennial Customers To High-Frequency Traders" (Kane, 2018). In the article, Kane goes details allegations that the online broker's SEC filings show that the firm not only accept payment for order flow, they also appear to be selling their customers' orders for over ten times more than other brokers who engage in the practice. RH reported receiving an average of $0.00026 per dollar traded (Robinhood SEC3Q, 2018). E-Trade, a competitor in online investing, sells their order flow at a rate of $0.0010 per share (E-Trade SEC3Q, 2018). The difference obviously being RH reporting payment per dollar whereas E-Trade reports payment per share. As of November 30th, 2018, the average price of a single stock on NASDAQ100 was $171.70. This means that reporting payment on a per-dollar basis will show an approximately 171 times lower rate than reporting per share if you have an order flow evenly distributed on this index. The article does not explain why this difference in payment for order flow between the platforms occurs but claims that the information sold from RH is used for front-running, a concept we will explain in detail later. Furthermore, the author alleges that the main customers of this information are "certainly not saints" and goes on to list controversies the different firms have been involved in. This includes insider trading and violations of securities laws. These companies operate as market makers for RH customers, but they also have HFT-wings in the company.

The article does not state that any charges have been pressed but ends with the very charged statement that "there is a material difference in the disclosures between what Robinhood and other discount brokers are showing that suggests that something is going on behind the scenes that we don't understand at Robinhood."

RH's founder, Vlad Tenev, responded to the allegations on the firm's blog by claiming the market makers used by RH do not front run orders and that getting rebates from market makers is common among similar firms (Tenev 2018). The blog post does not, however, explain the large sums received from the market makers or how RH ensures how these are being used.

In the following section, we will look at HFT-firms: how they function, how they make money, and their place in the market. With this basic understanding in place, we will go on to examine how information from RH potentially can be used by these firms. We will not speculate in the legality of the operations, as information about how the sold order flows actually are being used is not available to us.

4.2 Explaining HFT

High frequency trading uses algorithms to analyze markets and make decisions based on information gained about market conditions. Powerful computers make it possible to transact orders in milliseconds, making money on arbitrage and trading on news that impacts the fundamental value. Some high frequency traders also front-run buy-side traders. Front-running is trading based on knowledge about upcoming transactions that will influence the price of the stock, which earns a profit for the front-runner. This is legal if the high-frequency trader does not obtain the information improperly. For instance, it is illegal for a broker to front-run their costumers' order flow.

In his article "What to Do about High-Frequency Trading," Harris shares his views about the HFT-firms impact on the financial markets (Harris, 2013). According to Harris, there is value for the market in the practice because firms using arbitrage strategies "make markets liquid by providing investors with opportunities to trade." Further, he references "numerous reliable studies" showing that "transaction costs for both retail and institutional traders have decreased substantially with the growth of HFT." According to Harris, this can be explained by the powerful computers needed for HFT being much more cost-effective than human traders. He

makes the case that "regulators must be very careful that they do not inadvertently harm the high-frequency traders who make markets liquid."

The article also discusses the potential damaging effects of HFT. Firstly, in the section "Harmful HFT," Harris makes the claim that, while uninformed traders always have lost to informed traders, HFT has made reaction time to information another arena in which some traders have an unfair advantage. Harris offers a solution to this problem by suggesting that companies be required to "notify exchanges when they expect information will be revealed during trading hours so that the exchanges can halt trading before the news arrives." He also points to government practices of releasing important information only when the market is closed, and liquidity providers have closed their orders.

The following section Harris titled "very harmful HFT" and here the subject is front-running. The practice is difficult to regulate as most regulation will impact not only the damaging sides of HFT, but also the liquidity providing benefit it gives the market. There are two different ways to front-run. One can try to predict orders that are yet to be submitted, which is known as trading on "order anticipation." Or, one can "quote match" or trade in advance of orders that have already been submitted.

Order anticipation uses pattern-recognizing algorithms to predict upcoming price changes. Quote matching is also dependent on powerful computers, but here the speed is way more important than having the best algorithm. Trading ahead of slower traders submitting limit orders gives the HFTs the benefit of buying the equity at a lower price than the market level after the other order executes. When the price then moves in their favor, they can pocket the difference. If, unexpectedly, the price moves against them, they can immediately exit their position trading with the existing limit order and break-even.

This kind of trading demands that a given trader is faster than their competition. This need for speed has led to what Harris calls a "technological arms race." Harris warns that such an arms race would create a climate where only the wealthiest could compete as their slower opposition, unable to acquire the expensive technology needed, would be wiped out. In a scenario where only a small group of HFT firms offer liquidity, the market will suffer higher transaction costs, which in turn hurts the economy by making investing less attractive. But, it is not only technological factors that determine the speed at which traders can operate. Maximizing speed is important, but so is minimizing distances. In "Trading and Electronic Markets: What Investments Professionals Need to Know," Harris explains that this has led to a practice known

as "collocation" where exchanges allow traders to locate their servers in the rooms where exchange servers operate.

The final concern regarding HFT is a general fear relating to electronic trading systems. The systemic risk of having the market depend on potentially poorly constructed systems has shown itself in the 2010 May flash crash (Treanor, 2015) and "the fall of knight capital" (Phillips, 2012).

Financial markets stand to reap both benefits and potential negative implications of this type of trading. Regulators will have to deal with the issue of creating legislation that address the problems without removing the positive effects. We will now look at the cooperation between RH and the HFT-firms. The HFTs are necessary means of providing liquidity and the brokerage-free model, but is it really a free lunch for RH's users, or does it come with a hidden cost?

4.3 The Value of Information

As RH has only retail clients, the order flow they sell to HFTs is uninformed. Uninformed traders differ from informed traders in that well-informed traders are "[…]traders who can predict future price changes better than others can" (Harris, 2015, p. 22). For RH's retail clients, this is not the case. HFTs, such as Wolverine and Citadel, will see profitable opportunities in trading with uninformed order flow. Harris points out that "…well-informed traders will win on average regardless of whether the uninformed traders are buyers or sellers because they can predict with some accuracy in which direction prices will move" (Harris, 2015, p.23). When HFTs buy order flow, they will receive valuable information about other traders' intentions. This will give the HFTs a "great advantage" over uninformed traders and make the informed traders able to "…profit at the expense of less-informed traders" (Harris, 2003, p.7).

Data from a financial trading system simulation performed at NHH on August 29th, 2018 offers a view on how informed traders tend to profit from trading with uninformed traders. As traders operated with different tasks, making their P&Ls incomparable, the most functional data to analyze was the traders' volume weighted average price (VWAP), a ratio of value traded to total volume traded over time. Figure 2 shows the finishing VWAPs of all traders in the simulation. Each informed trader is represented by an orange marker, and each uninformed trader by a blue marker. The market VWAP, which at the end of the simulation was 71.4, is shown in the figure as a horizontal line at this value. The figure is split in two panels, with Panel A illustrating a recommendation to buy VWAPs and Panel B illustrating a recommendation to

sell VWAPs. The market simulation included 24 traders, with one half being informed and the other being uninformed. Panel A does not include all uninformed traders, because not all uninformed traders executed buy orders. Informed traders received noisy information about the traded stock's fundamental value, which made them able to predict price movements. The figure proves that most informed traders were able to keep their buy VWAPs lower than the uninformed buyers, while also maintaining higher sell VWAPs. As informed traders predicted price movements more accurately, they were able to buy in undervalued markets and sell in overvalued markets, thus finishing with lower buy VWAPs and higher sell VWAPs than the uninformed traders.

The data from the simulation underscores Harris' assertion that informed traders will outperform uninformed traders. When HFT's receive uninformed order flow from RH, their information level increases as they obtain insight on other traders' intentions and become able to predict price movements more accurately.



Figure 2: Data from NHH August 29. 2018. Left: Panel A. Right: Panel B.

It might seem that retail investors using the RH app do not value their information as highly as the former HFT platform developers who founded the company. Taking advantage of the difference between how millennials and technology companies value private information may be the key to RH's $5.6 billion valuation. A study by USC's Annenberg Center for the Digital Future shows that Millennials (ages 18-34) are willing to give up private information as long as they are rewarded for it (USC Annenberg, 2015). 56% will share their location for coupons or deals, and 51% say they will share information with companies if they get something in return. Information has always been highly valued in the stock market because, as mentioned,

it can be used to gain the only truly valuable insight; the probable movement of prices. The RH platform is just a new way of extracting it.

4.4 Front Running

One of the ways the use of order flow information could directly hurt RH customers is by having their orders front run. This is just one of the many ways to utilize order flow information. In order to demonstrate how information from RH clients' order-flow gives the HFT companies an opportunity for risk-free profit, we have created a simplistic model, which illustrates this in different stages (see Figure 3). We chose to show how a bid market order for 4 stocks of HP Inc. from a RH customer could be exploited by Wolverine, a company RH sells order-flow to.

The order is placed in the program by the user and sent to the RH server. Then, the order is transferred to the market maker that pays RH for order flow: in our scenario, Wolverine LLT. The firms paying for the RH order flow operate as both market makers and HFTs. It is natural to assume the whole company has access to the same information. Naturally, the market makers need the information for making the trade.

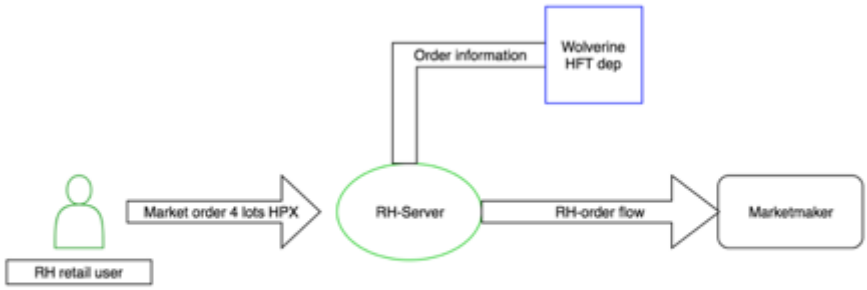


Figure 3: Model of RH's Order Flow Information Use.

The market maker part of the company executes the order at the market price. If the HFT wing also gets the information, they can use it to front-run the order by buying enough shares to clear the lowest price-level in the order book and then selling the shares back to the retail buyer at a slightly higher level. If we imagine this order book for HP Inc. at the time the market order is placed by the RH-user, as shown in Figure 4.

	ORDERBOOK		
Volume	Bid	Ask	Volume
5	22.55	22.60	4
2	22.54	22.62	2
5	22.52	22.63	7
8	22.51	22.64	4

Figure 4: The order book without influence from HFTs.

The HFT-system knows the market order with a bid for 4 shares is incoming. The system therefore clears the lowest ask-level in the order book by buying at 22.60 with a market order of its own, shown below (Figure 5).

	ORDERBOOK		
Volume	Bid	Ask	Volume
5	22.55	~~22.60~~	~~4~~
2	22.54	22.62	2
5	22.52	22.63	7
8	22.51	22.64	4

Figure 5: The market price bought by the HFTs.

Then, it immediately offers the shares as a limit order between the lowest and next-to lowest ask-level, making the order book when the order from the RH retail client arrive looks as shown in Figure 7.

	ORDERBOOK		
Volume	Bid	Ask	Volume
5	22.55	22.61	4
2	22.54	22.62	2
5	22.52	22.63	7
8	22.51	22.64	4

Figure 7: The market price available for RH clients.

The order executes at 22.61 and the HFT firm pockets the difference of 4 cents, while the RH client pays 4 cents more than what he or she would have if the front running did not happen. Of course, this would not be possible for every trade because it requires the trade to be large enough to move the market price, but it demonstrates how information on order-flow potentially can be used to the benefit of HFT firms and damaging to retail clients directly. At the same time, RH's customer base is largely comprised of small investors and retail clients, a segment of traders who rarely moves big enough blocks of capital to attract material interest from HFTs.

The potential risk of having some of your profits reduced by your orders being front run is something every user of online trading platform would be well-advised to take into consideration. As the typical RH trader uses smaller trades, the benefit of the commission-free platform might largely outweigh the slippage. However, as they build their portfolio and start making larger investments, this situation might change. If we imagine a typical commission of $7 per trade, we can calculate that the volume in the trade above would have to be quite a bit larger before this would happen. No single RH trader will lose large amounts of money on this basis and that might be the brilliance of the model, because it does not incentivize anyone enough to complain. Another solution to this specific problem for the trader is to use limit orders, as this scenario would not be possible with a limit order bid. However, for many, this will be a larger issue of privacy.

4.5 Further Discussion on Market Implication of Information

Order flow information like that from RH can be used as a tool to foresee emerging trends and make it possible for large investors to predict with an increased degree of certainty which way any market will move. If they receive a large enough bulk of order flow information, they will be able to make market-reflective models and graphs showing future movement before it has happened. Given the already enormous source of computer power they have available, it is plausible to assume they will be able to process the information quickly enough for this to be possible.

Computers used in HFT trading already monitor many different markets, stocks, and other instruments at a rapid pace. They can execute huge order volumes in fractions of a second and process all information a lot more quickly than “regular” traders (Bacha, 2017). Having the order flows of actual investors available could feed these computers with sufficient information to actually know what the market will do next. This assumes there is enough order flow; predictably, they would need order flows from millions of investors in big markets. With a little imagination, these computers could be presented as a 21st century time machine. After processing all the aforementioned information in matter of seconds, these machines will have an advantage of knowing what the market is going to do in the next second or two (Massa & Mamudi, 2017). With the ability to execute a large amount of orders in milliseconds, they would in theory have the ability to accurately act on and benefit from market movements and trends even before they have happened.

Retail investors are synonymous with “individual” investors. These investors typically trade in small lots of shares at a time, with no sizeable market share or impact. Their counterpart is

institutional investors, representing the big players; banks, insurance companies, pension funds et cetera. Institutional investors often take sizeable market positions (usually exceeding 10,000 shares per trade), and thus choose all of their investment projects based on thorough analysis (InvestorGuide, 2018). With their financial and informational strength and weight in the markets, they tend to act on information other, smaller, investors do not possess. As a result, information on how the big institutions trade is very valuable for both long-term and short-term investors.

RH is a trading platform made exclusively for attracting young retail investors. By selling their order flow information to HFT companies, these companies have the ability to separate the retail investors from the institutional in a market, thus observing clearly where the institutional investors put their money, and act accordingly to earn as much as possible on positive trends and lose as little as possible on negative ones. In other words, HFTs gain a significant advantage by paying for these order flows, and even though they pay RH ten times as much in fees for them, they will potentially make a lot more by implementing the information in their algorithms (Kane, 2018).

The power HFTs are granted when they buy the information making it possible to see how the market moves tenths of a second before anyone else, makes it possible for "the lucky initiated" to make billions of dollars every year. However, it also damages the market beyond simply making the playing fields more uneven. When using order flow information from RH, amongst others, to "track" institutional flow, they try to put in orders and absorb liquidity before the big investors put in their orders (Fedorov, 2017). Additionally, they close their orders counter to these big investors, and the result of these actions is institutional investors end up paying much higher prices than they would normally in a market without this involvement. For long-term investors, this does not necessarily have a huge impact on results. For professional traders and short-term investors who go in and out of positions at a frequent rate however, it can rob away important earnings (Marcial, 2018).

The presence of HFTs in the markets also poses a macroeconomic risk by putting a mist around the actual volume of "real" equity traded each day, week, month and/or year (German, 2014). The term "real equity" is related to invested equity in order to create more value, not simply owning some shares for a split second to turn a profit of a tenth of cent per trade. By moving in and out of hundreds of thousands of trades each day they inflate the market volume which in turn creates a misrepresentation of genuine demand in the markets. In reality, the effect has been hiding the fact that exchange volumes have gone down. This has a powerful impact on the

general economy. When exchange volumes decline, it means investors are more hesitant about putting their money in the stock market. Thus, the lower demand drives up the cost of capital and slows down the overall investment activity. However, because volume appears to be a lot higher due to high-speed trading, it makes it more difficult for economists to actually discover these genuine underlying macroeconomic trends (German, 2014).

5. Conclusion

The commission-free trading idea implemented in RH's business model has made it easier for conventional retail investors to enter the financial market. A free and user-friendly electronic trading application seems to be appealing for the intended customer base, namely millennials, who have embraced the concept by signing up in millions. Their successful appearance on the U.S. financial scene has created a trend amongst trading platforms, forcing others to follow the same reduced-cost structure.

RH's public intention is to democratize the financial markets and reduce the market share currently retained by the big Wall Street banks; to act like the character of Robin Hood, who steals from the rich and gives to the poor. In RH's opinion, brokerage commissions are ripping off retail investors. Ever since their founding, they have built a reputation promoting financial counterculture, and an "anti-Wall Street" perception, making it easier and cheaper for "the little guy" to enter the stock market. In light of this, it is somewhat legitimate to say Tenev and Bhatt's vision of democratizing America's financial system is underway. The remaining doubts concern the sacrifices necessary to achieve the commission-free model.

The Seeking Alpha article by Logan Kane revealed some alarming facts regarding RH's customer data, and how the data is used by RH as a primary source of income, though officially the company rejects said allegations. The concept of payment for order flow is not a new one, but through deeper research into RHs' business model, Kane revealed how they are able to charge ten times more for their information than peer trading platforms. Selling their customer data to high-frequency trading companies at top dollar spurred further controversy concerning RH's credibility. As a company focused on espousing "anti-Wall Street" values, this is somewhat hypocritical approach. With information on the direction in which prices will move, traders will profit when trading with traders without this information. By using data from a NHH trading simulation, we have presented a figure able to demonstrate the competitive advantages of informed traders, showing their ability to outperform the uninformed traders.

When RH sells order flow to HFTs, they improve the HFTs' level of information, making their advantage over uninformed traders increase.

The information flow HFTs receive from RH and other no-commission trading platforms are strictly from retail investors. HFTs take a particular interest in institutional information flow for their investing algorithms. The good information flow makes it possible to separate retail from institutional investors to gain a clearer view of how the big players will invest. In short, this method enables them to "track" what the greatest influencers in the markets aim to do next, and thus enabling them to implement their strategies accordingly.

Payment for order flow to market makers and HFTs is not a particularly new concept. However, RH's business model, successful as such, attracts a vast number of customers that previously have kept out of financial instrument markets; millennials. By reducing the transactional costs of trading to zero, RH attracts a group of customers that previously may have kept away due to an aversion or inability to pay high commissions. In the U.S., millennials represent a larger part of the population than Baby Boomers (born between 1946 and 1964) and attracting this group of tens of millions of people to the financial markets makes them as a whole a significant market player. Knowing which trades they make gives a critical advantage over other big market players. The possibility of buying that information arguably creates a more uneven playing field. Payment for order flows is already a controversial subject in financial markets, due to the fact that it gives some market players an informational advantage, which in essence reduces the idea that everyone has equal opportunities and information to perform trades. RH makes it possible to further increase the gap between those who can afford to pay for this information, and those who can't: retail investors. Ironically, RH makes money on an act of 'de-democratizing' the financial markets, the opposite of their publicly-stated intentions.

Regarding the impact on RH clients, the conclusion is dependent on how they value access to free trading versus their privacy. This is an interesting phenomenon to observe as information becomes a more valuable resource and generational gaps develop in how we value our own privacy. It is only natural to assume that this will become an even larger part of the trading world as new methods of both acquiring and using information to analyze developments in the market are discovered. In light of this, we can look at RH as an interesting window into the future of trading. Predicting human behavior through algorithms seems to be critically important for competing in all aspects of the business world in the years to come, and trading does in no way look like an exception.

We have observed, discussed, and tried to explain different ways that RH has been able, and has the potential, to impact the financial market and its participants. To conclude on whether this impact is largely positive, negative or just a natural part of the way trading is developing, is difficult because it depends on several unknown factors and the subjective values of the individual observer. It is, however, clear that it is more difficult to separate the wicked sheriffs from the merry men in the dense woods of the 21st century's financial market than in the Sherwood forest of medieval Britain. A general rule, however, seems to be that everyone is primarily looking out for their own bottom line.

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