

Spring 5-2016

High Frequency Trading: Perceptions Regarding Volatility and Regulation

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The University of Southern Mississippi

HIGH FREQUENCY TRADING: PERCEPTIONS REGARDING VOLATILITY AND
REGULATION

by

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A Thesis
Submitted to the Honors College of
The University of Southern Mississippi
in Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science in Business Administration
in the Department of Finance

May 2016

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Abstract

Although high frequency trading (HFT) makes up a large portion of day to day trading activity in US and global markets, Khashanah and colleagues (2014) found that nearly half of academic and business industry professionals feel that HFT provides an unfair advantage relative to other market participants, and that a majority of industry professionals share concerns that HFT increases volatility in markets. This creates an environment wherein there are increasing calls by various groups for increased regulation of HFT, and the same study by Khashanah et al (2014) finds that 59% of academics and 46% of industry professionals are of this opinion. The current study was designed to further examine perceptions of HFT, particularly with regards to its effects on volatility and further regulation, among a younger generation of respondents. By replicating the survey distributed by Khashanah and colleagues, this study aims to shed light on the opinions business students hold regarding HFT and draw comparisons between the industry professionals and academics and the results garnered here. Participants were asked to respond to a twelve question survey that asked for opinions about liquidity, price discovery, market crashes, and then respond to what they think an appropriate level of regulation for HFT should be. A Poisson regression analysis model was utilized in order to ascertain certain underlying trends in the data, and found correlations between major, age, and financial experience with negative perceptions of HFT.

Keywords: high frequency trading, volatility, liquidity, regulation, price discovery

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Introduction: High Frequency Trading as a Practice

As a practice that accounts for “73% of all U.S. equity trading volume” (McGowan, 2010), High Frequency Trading (HFT) is a large chunk of the country’s market activity, and as such, is a very hotly debated and researched topic. As with all technological advancements that lead to significant market advantages for certain companies, there have been a large number of criticisms and calls for regulation with regards to HFT for a variety of reasons. HFT has been accused of leading to higher levels of market volatility (Martinez and Rosu, 2011) and (Chapman, 2013), along with giving an unfair advantage to companies that implement it after identifying faster and faster algorithms. On the other hand, there has been great support for HFT from other members of the financial world for a multitude of reasons.

“High frequency (HF), or algorithmic trading, is computer determined trading; the algorithm makes important decisions such as timing, price, or in many cases, executing the entire order without human interaction,” (McGowan, 2010, p. 2). Another definition of HFT is “what many characterize as a subset of algorithmic trading that involves very rapid placement of orders, in the realm of tiny fractions of a second,” (Shorter & Miller, 2014). HFT is computer trading that uses high speed techniques and predictions to make a large volume of trades in a short amount of time to lead to large revenues over time. The history of HFT is one driven by technological improvements. Naturally, as technology increased, the scope and effectiveness of computerized trading was able to become more pronounced. Formerly, “buyers and sellers stood literally next to one another,” completing trades to make markets, but “once exchanges started implementing computerized communication, buy and sell orders could be executed much faster” (McGowan, 2010, pg. 5). After the 1980’s, computerized trading extended beyond

simply trading on the NASDAQ and the NYSE, and emerged into a new venue called electronic communications networks (ECNs). These ECNs allowed for the further development of algorithmic trading and the “rise of independent high frequency trading firms” (McGowan, 2010, p. 6) in the 1990s. The last two big developments that led to the boom in HFT that is present in markets today were 1) “decimalization” of the exchanges that changed the minimum stock tick size from 1/16th of a dollar to one cent and 2) the Regulation National Market System in 2005, which was designed to “modernize and strengthen the national equity markets” (McGowan, 2010, p. 7).

As far as the typical characteristics of a HFT firm go, the SEC is the go-to source, defining the common traits of HFT as “(1) utilization of high speed, complex computer programs and equipment to effect trades; (2) utilization of co-location services to reduce latencies; (3) extremely small time-frames for opening and closing positions; (4) placing numerous orders and quickly canceling them; and (5) ending the trading day in as close to a flat position as possible,” (Serritella, 2010, pg. 437). Jacob Loveless, author of “Barbarians at the Gateway”, discusses, in depth, the second characteristic of HFT that the SEC addresses: the co-location services. Collocation is simply moving the firm’s headquarters or systems where the exchanges of money occur. Because HFT operates at such fast speeds, every second counts, and so firms move into buildings as close as possible near the exchanges to shave microseconds off of the time it takes them to trade by shortening the length of the cables that transfer data. Obviously, the closer to the exchange that a firm can place itself, the more natural advantage it will have over its competitors. “In many markets, the length of the cable *within the same building* is a competitive advantage,” (Loveless, 2013, pg. 3).

HFT's goal, as is the goal with any and all traders in markets worldwide, is to make a profit, and if at all possible, a huge profit. Although it seems relatively simple to determine how HFT operates, there are a couple strategies that are typically employed to pull the maximum profit. According to Tim Parker of Investopedia, "One strategy is to serve as a market maker where the HFT firm provides products on both the buy and sell sides. By purchasing at the bid price and selling at the ask price, high-frequency traders can make profits of a penny or less per share. This translates to big profits when multiplied over millions of shares." As a market maker, HFT firms allow various buyers and sellers to enter into markets, while also creating a nice profit for themselves at the same time. This point is reiterated by McGowan as well: "Some HF traders are known as market makers and trade on signals to make markets by providing securities on each side of a buy and sell order." The other primary strategy employed by HFT is to "utilize algorithms to try to speculate where the markets are going to move in the short-term" (McGowan, 2010, pg. 3).

There are two primary factors that have led to the explosion and the resulting debate about HFT: pursuit of profit and concern about market stability. When discussing financial markets and players within those markets, the number one driving force is profitability and what those players can do to increase their own. HFT is a result of this motivation. As a tool that can be used to increase profits in a primarily safe and almost foolproof way, HFT has been adopted by firms to get that extra edge over their competition. However, change brings about more discussion, and the saying "with great power comes great responsibility" comes to mind when discussing HFT. Because it composes such a large portion of market activity, and it reacts so quickly to change,

detractors have made the claims that it can lead to “flash crashes”, a very rapid and explosive drop in market value caused by HFT firms backing away from securities that were, predictably, about to drop. In 2010 there was a large flash crash, and HFT activity was slammed as one of the primary contributors. Additionally, according to Holly Bell (2013) in her article “Government Should Not Overregulate the HFT Market”, there is fear that HFT will lead to a two-tiered market system throughout the world that could end up causing future market imbalances, with HFT firms on top and the rest of the traders on the bottom. The final point that makes HFT such a hot issue is that it isn’t just central to the United States, it’s a worldwide issue that is being addressed the same way in other countries, with lots of differing results. For example, Holly Bell’s article mentions that both France and Germany have taken steps to limit and even ban HFT activities (Bell, 2013), which in turn could lead to other countries taking similar routes regarding regulation.

The resulting national conversation is a tense one. The most notable and obvious look at this tension was created when Michael Lewis, a financial journalist, published his book “Flash Boys: A Wall Street Revolt”. In the book, which is primarily focused on the rise of HFT in US equity markets, Lewis claimed that the “stock market at the bottom was rigged” and that the “icon of global capitalism was a fraud” (Lewis, 2014, pg. 232). The book remained atop the New York Times Best Seller list for four weeks, indicating high levels of interest and concern about the issues that HFT has been linked to. Lewis’s claims have been highly disputed and debated since. Mazzola (2014) wrote an article titled “Michael Lewis’s Disservice to Wary Stock Market Investors”, entirely focused on the negative perception of the stock market that Lewis’s statements in “Flash Boys”

created, and how it would produce a domino effect and result in the average investor refusing to participate in the stock market, which leads to lower liquidity and a hoard of other issues that result from lack of participation in markets. This all points to the high level of unrest with regards to the stock market that has correlated in the rise with HFT.

The fact that HFT is a worldwide issue, along with the fact that it can potentially influence so many people, makes it a very significant issue. As referenced earlier, it has the potential to result in flash crashes and also cause severe market unpredictability because it's entirely electronic with little human interaction for large periods of time, so it has the power to cause a lot of damage if not monitored carefully. Because HFT is still a very controversial issue, there's a great deal of literature that is continually being produced on a daily basis that can provide greater insight into the thoughts of CEO's, firms, and the public. Adding more literature and research to the subject field will no doubt be helpful in providing more data for regulators to use in their efforts to regulate in the best interest of the people they serve. This study will attempt to create more data that can be evaluated when discussing HFT and its future in American markets.

The purpose of the study is to determine the perceptions of High Frequency Trading (HFT), with regards to volatility and regulation, among business students at the University of Southern Mississippi. As a result, the research question this study aims to answer will be: What are the perceived relationships between volatility, regulation, and High Frequency Trading among business students at the University of Southern Mississippi?

Factors Contributing to the Controversy Surrounding HFT

There are several intertwined factors that contributed to the controversy that surrounds HFT. It has been linked to increased market volatility, dramatic drops in market value (Flash Crashes), and has led to frequent discussions regarding the fairness of speed-based trading. Additionally, the security of computer trading systems has been called into question after the attempted theft of Goldman Sach's algorithmic trading code in 2009 (McGowan, 2010). Not only would the theft and manipulation of this system be a severe problem for obvious reasons, but the time at which it happened that "coincided with the current US recession" (McGowan, 2010) led to rampant speculation about the expansive and potential collapses that HFT issues could cause.

Volatility

Theft is simply one potential problem that HFT has been linked to. One of the most consistently made arguments pertaining to HFT is that it causes increases in market volatility. In his article "Robo-traders' risky business", Simon Chapman (2013) states that "even in normal market conditions, the algorithms used by HFT can increase the volatility of stock prices." In Martinez and Rosu (2011), the authors make the claim that price volatility increases with fast trading competition. Essentially, that the more aggressively HFT firms trade, they release a great deal of their information and then price volatility will equal fundamental volatility. Boehmer, Fong, and Wu (2012) found that, on average, greater HFT intensity improves liquidity and efficiency, but also increases volatility. The volatility that increases is also not limited to "good" volatility that usually arises from quicker price discovery, but incorporates a number of different volatility

measures. “The presence of HF traders generates periods of high market volatility and sharp price drops.” (Leal, Napoletano, Roventini, Fagiolo, 2014, pg. 20).

On the other hand, there are a variety of sources that make the claim that HFT has no effect on volatility in any measurable or significant way. Foremost among them is the study completed by Nicolas Bollen and Robert Whaley (2013) from Vanderbilt University. Their study, titled “Futures Market Volatility: What Has Changed?” provides an analysis of whether volatility of futures return has changed over time. The study found that “there is no evidence to suggest that realized return volatility in electronically-traded futures markets has changed through time,” (Bollen, 2013, pg. 2). Also, Jonathan Brogaard of the Northwestern University Kellogg School of Management published a study that constructed a hypothetical price path that removed HFTs from the market and showed that “the volatility of stocks is roughly unchanged when HFT initiated trades are eliminated and significantly higher when all types of HFT trades are removed,” (Brogaard, 2011, pg. 2).

The body of work by both parties, those who claim that HFT increases volatility and those who don't, is clearly very conflicted. The debate regarding volatility and HFT will likely not be settled any time soon, or without much more research.

The next big problem generally associated with HFT is the occurrence of flash crashes. Flash crashes are very quick, and extreme, drops in security prices. HFT has been linked towards increasing the effects of flash crashes. The biggest and most relevant example of a flash crash is the infamous Flash Crash of 2010 (Golumbia, 2013). On May 6th, the Dow Jones industrial average dropped roughly 1,000 points, and then recovered in minutes. According to Anne Kates Smith, the crisis began when (allegedly)

Waddell & Reed, a firm based in Kansas, initiated a computer program to sell \$4.1 billion worth of E-Mini futures contracts (Smith, 2010). This input caused other HFT firms to make their own set of movements and inputs to respond to the huge movement of futures contracts. In the end, “absurd prices—from as low as a penny to as high as \$100,000 for more than 300 stocks and exchange-traded funds” resulted, and more than 20,000 trades were cancelled (Smith, 2010).

Obviously, changes this drastic in the DOW and other metrics is concerning to markets worldwide, and so research into the causes and potential relationship between HFT and flash crashes became a regular occurrence. “The presence of high-frequency trading increases market volatility and plays a fundamental role in the generation of flash crashes,” (Leal, Napoletano, Roventini, Fagiolo, 2014, pg. 1). Additionally the “events surrounding the May 6 flash crash suggest that HFT firms, whilst not triggering the crash, rapidly withdrew from the markets as they began to move, thereby intensifying the liquidity crisis,” (Regulatory Issues Raised, 2011, pg. 27). In essence, this study doesn’t claim that HFT firms necessarily *caused* the crash, but did have some measurable and significant impact on its severity.

One more example of a flash crash was in 2013, when a Twitter hoax led to a 150 point drop in the Dow Jones Industrial Average in just a couple minutes. A fake tweet sent out from the Associated Press Twitter account that asserted that there had been an explosion in the White House triggered a number of technological actions performed by pre-programmed trading systems. The pre-programmed ‘stops’ triggered a large number of sell orders as a result of declines in prices of stock indexes and futures contracts that arose because of panic from the “news” broken by the tweet. The markets did recover,

but it was another signal of very fragile markets in the event of a catastrophic event (Strauss, Shell, Yu, Acohido, 2013). Flash crashes are worrisome not only to financial analysts and those who make a living off of trading, but to the general public. The DOW is an indicator of overall economic health, and anything that has a lasting and negative impact on economic health can be perceived as having a detrimental effect on the public.

Regulation

There are two primary opinions regarding the handling of HFT: 1) let the government step in and regulate to whatever extent they wish to 'level the playing field' or 2) let the market regulate itself and allow HFT to develop on its own.

Khashanah, Florescu, and Yang (2014) polled 40 academics and financial industry professionals with regards to their assessment of characteristic behavior of HFTs, assessment of impact of HFT on markets, and assessment of need for regulating HFT in the future. They found that both academics and industry professionals viewed HFT as providing liquidity, but that less than half of each group said that it obscured price discovery (the process of figuring out the price of an asset by analyzing the actions of buyers and sellers). Additionally, they found that a majority of industry responses (54%) while only 41% of academic responses claimed that HFT increased market volatility (one of the primary concerns regarding HFT). This same poll by Khashanah, Florescu, and Yang found that 46% and 48% of industry and academic responses respectively "believed HFT had an unfair advantage over other market participants." Finally, in what is probably the most valuable insight into the research conducted by Khashanah, Florescu, and Yang was that 59% of academics and 46% of industry professionals called for more regulation of HFT.

Holly Bell (2013), associate professor of business at the University of Alaska, wrote an article titled “Government Should Not Overregulate the HFT Market”. “Attempts by regulators to slow the market down by forcing intermediaries to hold a security for a specific period of time, charge a transaction fee, or lower cancellation ratios would create market distortions that ultimately would harm all investors and raise the costs of trading. An investor providing liquidity simply would widen his or her spreads to compensate for the greater risk and pass this cost along to customers in the form of higher fees. In both case she argued that as liquidity decreased and costs to investors increased, resulting in an overall decrease in market efficiency,” (Bell, 2013, pg. 17). Bell highlighted an important point, in that investors can always compensate for risks created by regulation by passing those associated risk expenses down to customers through fees.

In a survey conducted by Convergenx Group (2014), a group of 357 respondents answered questions related to fairness, regulation, and confidence in the markets of the respondents. 51% of the respondents replied by saying HFT was either ‘Harmful’ or ‘Very Harmful’, indicative of a desire for further regulation, while the other 49% replied by saying HFT was ‘Neutral’ (30%), ‘Helpful’ (15%), or ‘Very Helpful’ (4%), indicative of a neutral or positive paradigm. With regards to regulation, 43% called for either ‘Much More Regulation’ (4%) or ‘More Regulation’ (39%), while 57% called for either ‘Same Amount of Regulation’ (38%), ‘Less Regulation’ (14%), or ‘Much Less Regulation’ (5%). Only 19% of respondents had a favorable view of HFT as helpful, but 57% either thought less regulation was needed or the current amount of regulation was sufficient (Noll, 2014). This would make it seem that most respondents were adopting a

wait and see strategy, or don't want to be the first one to step up and call for more regulation.

Method

Students in the College of Business were invited by email to participate in this survey. The final sample contains 79 responses. The sample consisted of four Freshmen, four Sophomores, 20 Juniors, 43 Seniors, and eight Graduate students. The sample was made up of 42 Males, 35 Females, and 2 who did not wish to disclose their gender. First, students were presented with a primer on high frequency trading (Appendix A). After reading this primer, the respondents then completed the survey (Appendix B). The majority of the survey questions were taken from Khashanah et al (2014), excluding the demographic questions. This allowed for a direct comparison with previous data. In addition, we created a variable that served as a proxy for the overall level of negativity about HFT. We used this variable in a regression analysis to determine which respondents had the most unfavorable views on HFT.

Results

Survey Responses

Because the survey so effectively separates results on a question by question basis, the crux of the analysis will come down to simply analyzing the answers for each question in the survey and comparing those results with the results of the original survey. It should be noted that in the original study, the answers for the following questions were broken down into answers by Industry and Government Professionals, and answers by Academia Professionals, whereas in our study it is simply one collective group of respondents represented here as students in the USM College of Business.

The overwhelming majority of respondents agreed that HFT does increase liquidity in markets on average (Graph 1). This response is not surprising, considering the vast majority of students, regardless of their degree plan, are aware of the general consensus that a higher volume of trades leads to greater ease of transferring funds to cash due to the ease of movement with which money is transferred. The positive responses correspond nearly identically with the original survey by Khashanah et al, who found that 68% of respondents agreed that HFT increases liquidity in markets.

In the original study by Khashanah and colleagues, most of the respondents agreed that HFT obscures price discovery. The respondents of this survey agreed at a much higher rate, but were directly in the middle of the two original responding bodies with a 25% rate of neither agreeing nor disagreeing. It is worth noting that the same proportion of respondents chose to neither agree nor disagree as they did to disagree, as seen in Graph 2.

Perhaps the most controversial question with regards to implication is the question related to the extent to which the respondents agree that HFT increases the frequency of market crashes (Graph 3). The respondents of our survey fall roughly in the middle of the Industry and Academic answers (Industry: 30.77% agree, Academia: 51.85% agree, USM Students: 39% agree). However, the most notable aspect of this question is the high rate of neither agreeing nor disagreeing, as more than 30% of respondents in each group did not agree nor disagree with the statement, effectively confirming the idea that most business-minded respondents are cautious about assigning all blame of market crashes on a single entity.

When asked if high frequency traders have an unfair advantage over other market participants, the Industry and Academic answers were essentially identical: 46 and 48% agreed, 38 and 37% disagreed, and 15 and 14% did not know. Despite this consistent belief in the original study, the respondents of our survey did not hold the same inclination (Graph 4). Only 37% agreed that HFT gave an unfair advantage, while 28% disagreed, and a significant 35% did not answer one way or another. The original study noted that it is clear that more studies are needed to give a definite answer to this question, and we agree. A bit of difference should be expected considering how ambiguous the word ‘unfair’ can be; however, this question contains a valuable insight into the thoughts of future business workers. Based solely on opinion, the results of this question in our survey could very well lead one to think that the younger generation holds technological innovation in high regard, and looks at that as a competitive advantage, rather than an unfair advantage. To quote the authors of the original study, this question “contains the most interesting results in this part”.

The next series of questions were related to the future of HFT, specifically with regards to regulation. As a portion of the future business world, the opinions reflected in this section are of particular significance because they could represent future actions taken in a regulatory manner concerning the most prolific trading system in the history of the world. When asked if markets need more regulation restricting the amount of quotes or trades per unit of time, the answers in the original study varied significantly. Over 50% of academics agreed, while 25% did not know, and only 18% disagreed; on the other hand, 54% of industry/government professionals disagreed, while 38% agreed.

Again, our results lay somewhere in the middle, with 44% agreeing, and 32% disagreeing (Graph 5).

The next question addressed the extent to which HFT should be regulated in the future. In this instance, the answers in our survey lined up almost exactly with the academia responses from the original study: 59% academia and 55% business students agree with increased regulation, 0% academia and 1% business students think HFT should be banned, 11% and 22% think HFT should be self-regulated, and 29% and 22% think HFT should be unchanged with regards to regulation (Graph 6). The industry responses were approximately similar (49% agree with more regulation, 15% think it should be unchanged, 23% think it should self-regulate) except for the number who think HFT should be banned (15%) which is significantly higher than either of the other parties.

In a slight deviation from the original study, the final question regarding HFT regulation allowed for a different response. The original survey asked the respondents to choose only one method of regulation, whereas our survey allowed the respondent to choose multiple methods of regulation. Obviously, either method of surveying is valid; the difference in methodology is simply an attempt on our part to not shoehorn the respondent into one singular answer when multiple regulations may be acceptable. With these changes in mind, comparison between the original study and our study regarding this question would be pointless. The main point to be drawn from Graph 7 is that each regulatory method drew at least a 36% support rate, which implies that although a number of respondents (44%) indicated earlier that they think HFT should either be unchanged regarding regulation or self-regulated, that the proponents of further

regulation in fact support several means of regulation, often times all offered suggested regulation methods. This indicates an existing dichotomy that is fairly present in most business and political landscapes: those in favor of regulation are staunch advocates and heavily in favor of several methods, while those who oppose regulation are incredibly in favor of deregulation and self-regulation. It is worth noting, however, that the majority of respondents in the original survey chose to “Limit order cancellation ratios” as their preferred method of regulation, which is generally regarded as the least invasive, or most gentle of the forms of regulation. Likewise, that was the most selected method of regulation in our survey as well.

Regression Model

Finally, we get to the regression model and its results as seen in Graph 8. We created a variable that counted the number of responses with negative perceptions towards HFT. Each time they answered one of these questions in a negative way, it added to the count. So, more negative responses equals a higher value on that variable. The following responses to each survey question were considered negative and added to the overall negative perception ranking count variable:

1. Disagree
2. Agree
3. Agree
4. Agree
5. Agree
6. Where they chose option 2 for more regulated

7. Added all the choices to the total

Since this variable for negative perceptions is a count variable, I used a Poisson regression analysis model. The independent variables were:

- Educational level (higher number equals higher education)
- Finance major (a dummy variable equal to 1 if the respondent is a finance major and 0 otherwise)
- Male (a dummy variable equal to 1 if the respondent is a male and 0 otherwise)
- Under21 (a dummy variable equal to 1 if the respondent is under 21 and 0 otherwise)
- Financial experience (a count variable assessing how much practical finance experience the respondent has)

While the explanatory power of the model (R^2) is quite low at 3.34%, there are still some interesting results.

1. The coefficient for finance majors is positive and significant. This implies that finance majors have more negative perceptions of HFT.
2. The coefficient for under21 is positive and significant. Younger respondents had more negative perceptions of HFT.
3. Financial experience is also positive and significant. Having more practical financial experience is associated with more negative perceptions of HFT.

These results are interesting and somewhat unexpected. While we had expected younger respondents to be more literate with and accepting of technological innovations such as HFT, the younger respondents were actually more negative about the impact of HFT on financial markets. Respondents with more knowledge about finance (through practical

experience or finance coursework) were also more negative about the impact HFT has on financial markets. Rather than being more open to potential benefits, these respondents were more concerned about the unregulated activity and volatility.

Conclusions

Previous research has suggested that there is a difference in opinion spanning across the breadth of issues surrounding HFT between industry/government and academic respondents. In our survey, we had respondents who could fall into any of those categories in the near future, and in what could have been expected, on average, their answers fell somewhere in the middle of the two groups. Additionally, other extensive research has been done that exemplifies some harshly negative attitudes towards HFT among highly educated business minds, and our survey regression results do indeed point toward a negative perception among finance majors and those with more financial experience. Our survey results fall generally in line with the original study's results, however, that does not mean that there is no need for further research concerning HFT, its effect on markets, or its possible regulation.

If anything, the results we have found here lend themselves to increased need for further research into the opinions of other groups specifically regarding thoughts on regulation. The growing body of literature in that area should extend to those in the profession of politics, being as they are the primary driving forces behind regulatory doctrine, and data describing their thoughts on HFT will shed a great deal of light onto the future of HFT in its entirety.

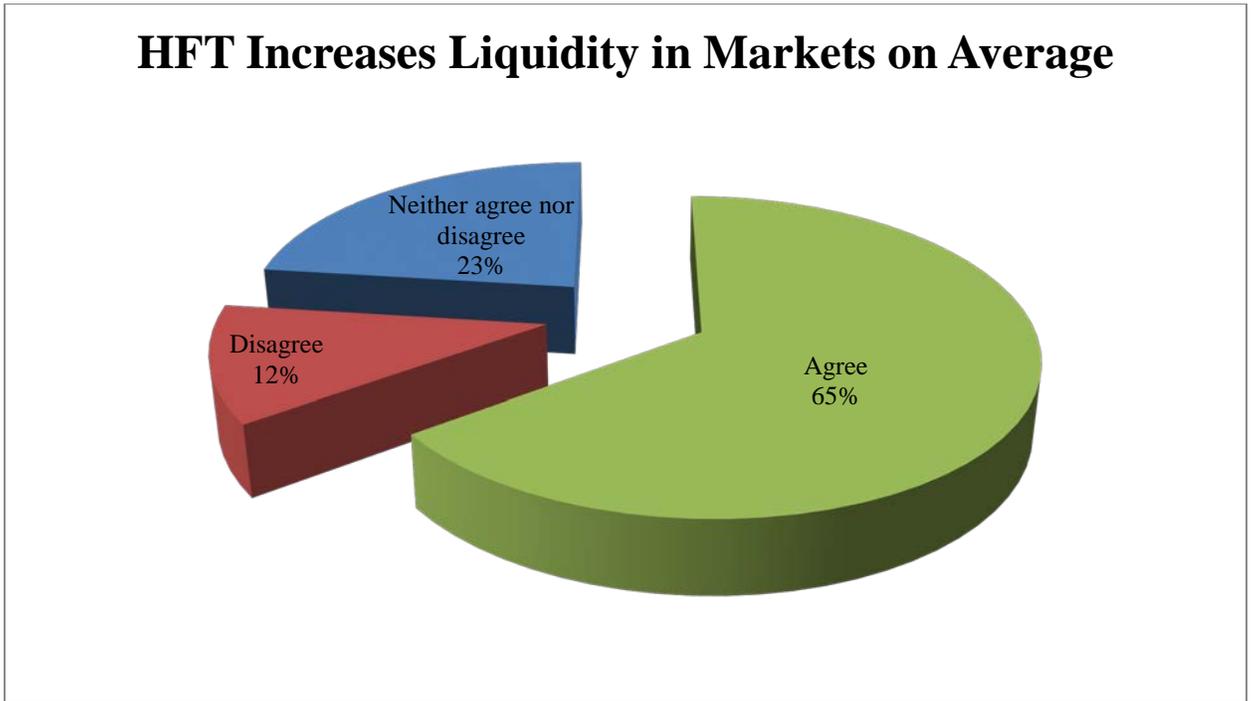
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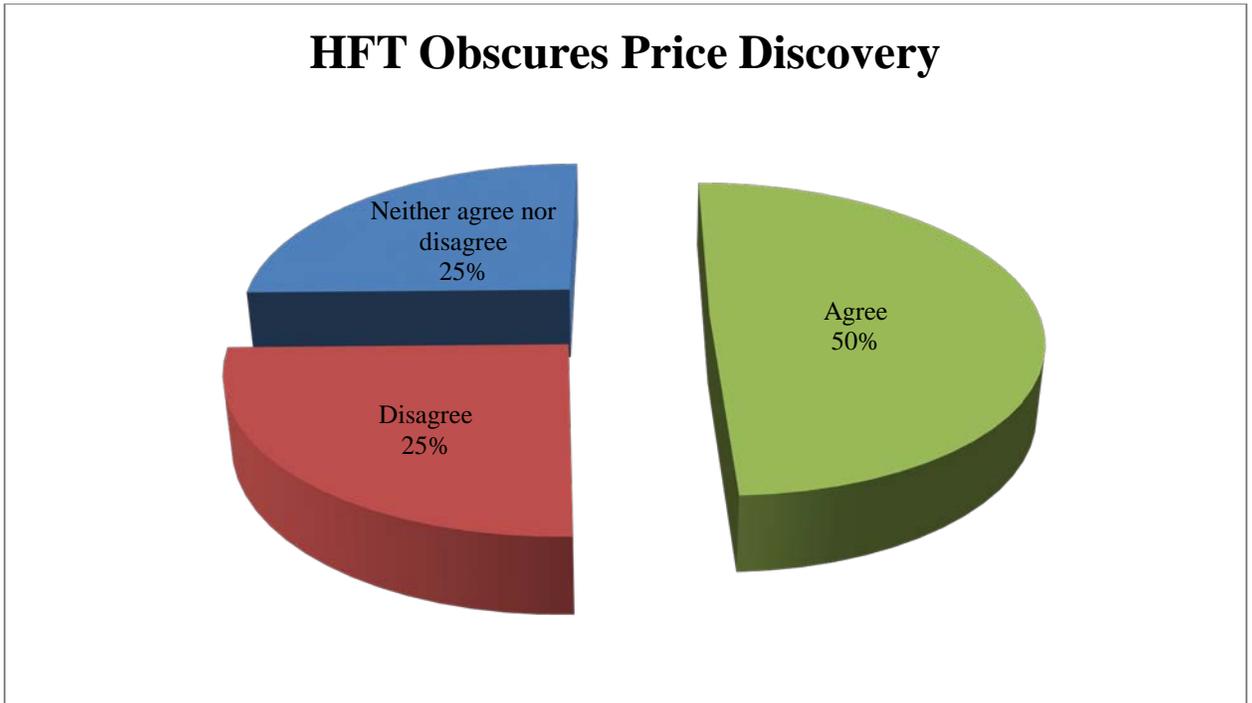
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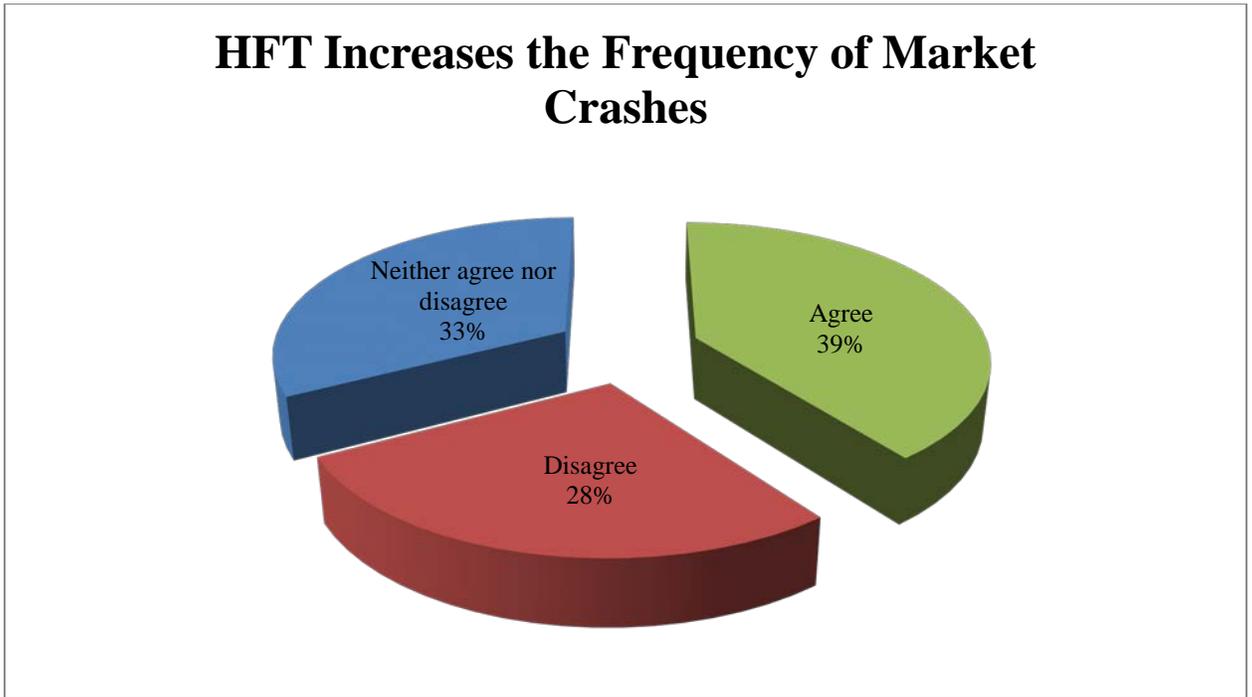
Graph 1: HFT Increases Liquidity in Markets on Average



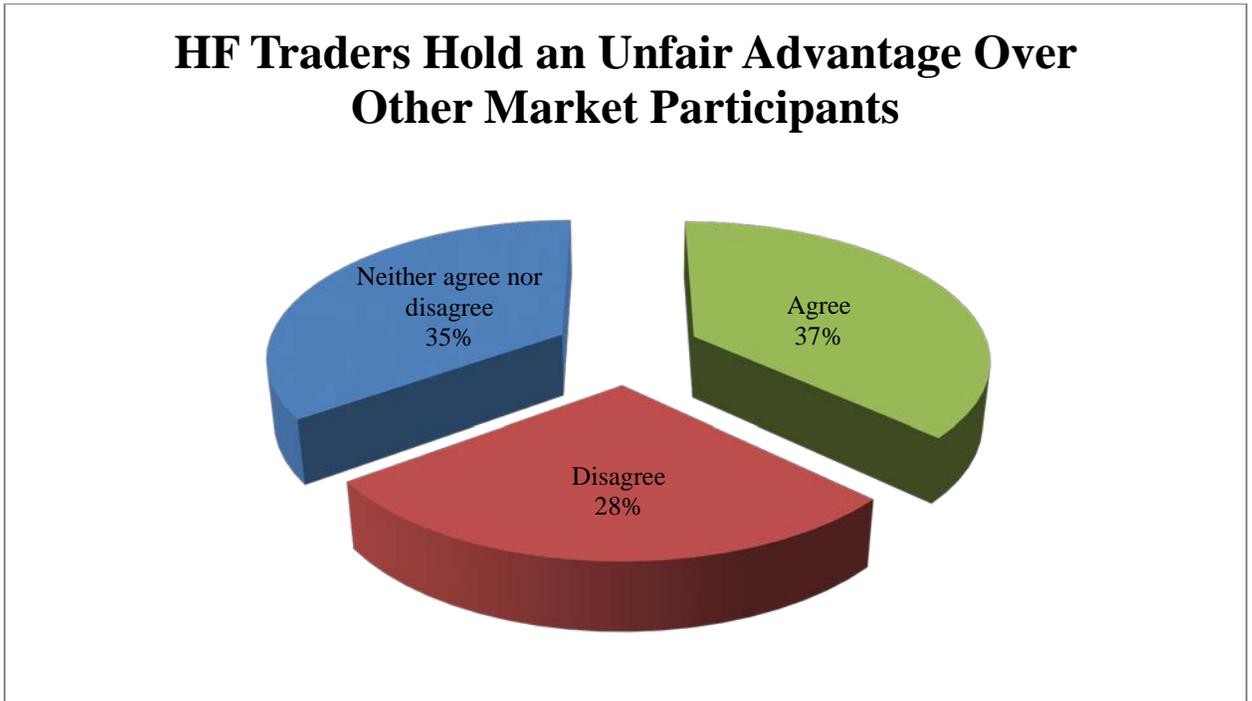
Graph 2: HFT Obscures Price Discovery



Graph 3: HFT Increases the Frequency of Market Crashes

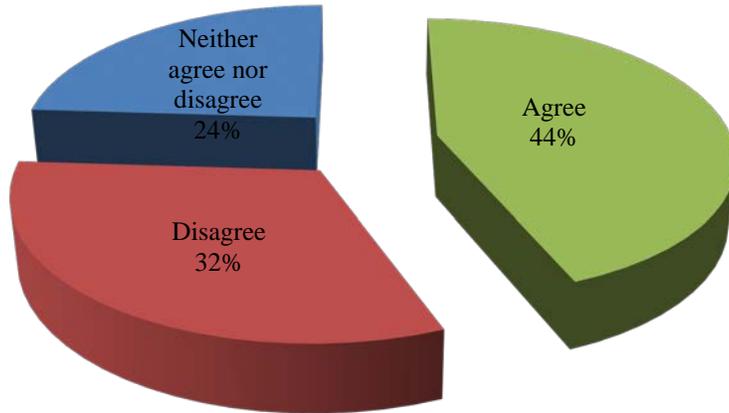


Graph 4: HF Traders Hold an Unfair Advantage

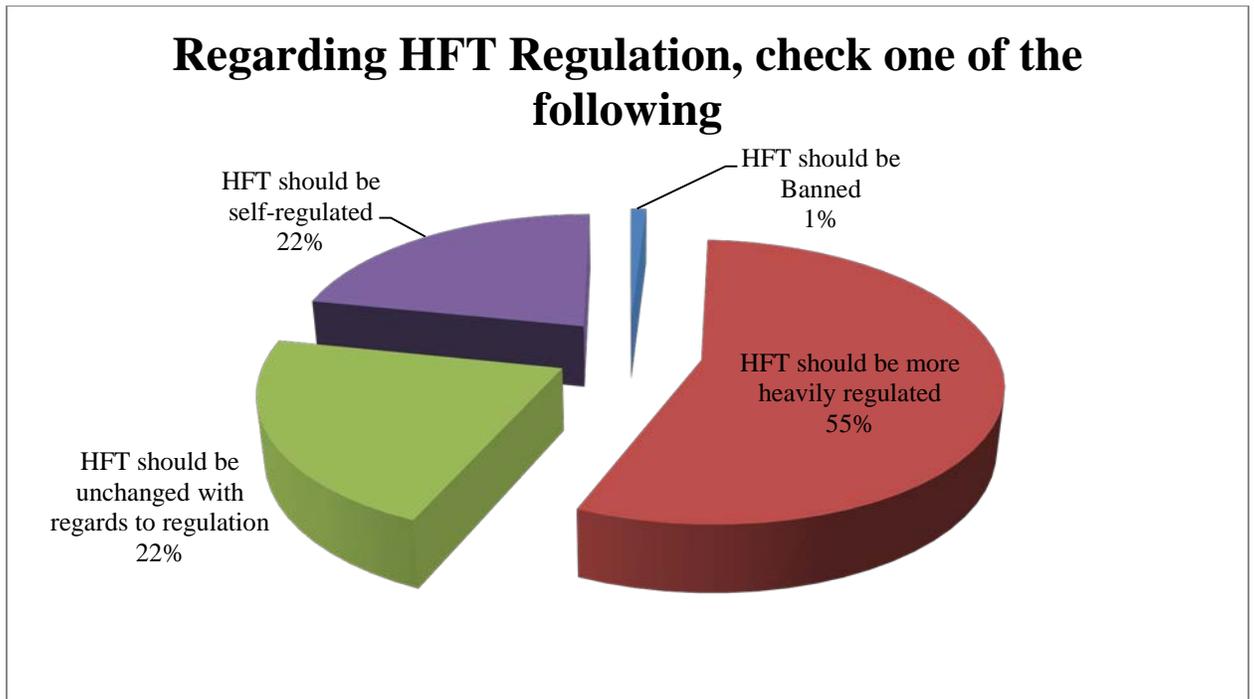


Graph 5: Markets Need More Quote Regulation

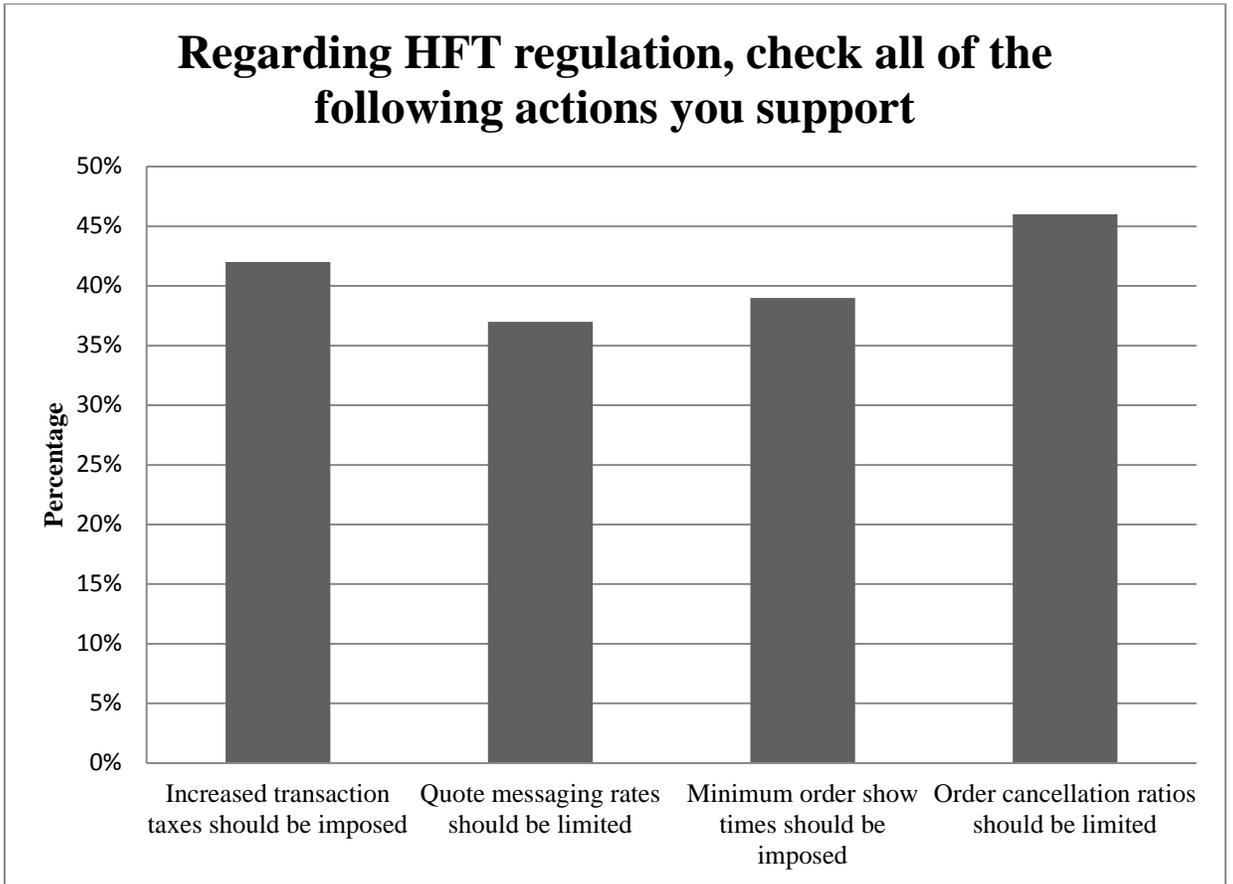
Markets Need More Regulation Restricting the Amount of Quotes/Trades per Unit of Time



Graph 6: HFT Regulation Methods



Graph 7: HFT Regulation Methods Part II



Graph 8: Regression Model

```

. poisson negperceptionrank educationlevel financemajor male under21 finexp, vce(robust)

Iteration 0:  log pseudolikelihood = -156.11175
Iteration 1:  log pseudolikelihood = -156.11175

Poisson regression                               Number of obs   =       78
                                                Wald chi2(5)    =       13.45
                                                Prob > chi2     =       0.0195
log pseudolikelihood = -156.11175              Pseudo R2      =       0.0334
    
```

negpercept~k	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
educationl~l	-.052774	.062795	-0.84	0.401	-.1758499	.0703019
financemajor	.2231092	.1081397	2.06	0.039	.0111592	.4350592
male	.0859029	.1110511	0.77	0.439	-.1317532	.303559
under21	.2422579	.1294756	1.87	0.061	-.0115097	.4960254
finexp	.041233	.0239237	1.72	0.085	-.0056566	.0881226
_cons	1.100465	.2564179	4.29	0.000	.5978957	1.603035

Appendices

Appendix A: Survey Primer



THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

This survey is designed to evaluate your knowledge of and feelings towards high frequency trading activity. The survey should take approximately 10-15 minutes to complete. You must be 18 years old to participate. This research project has been approved for distribution by the IRB at the University of Southern Mississippi and is being conducted under the supervision of Dr. Kimberly Goodwin. There are no risks associated with participation, and you are free to end your participation at any time. If you do complete the survey, you will have the opportunity to be entered into a drawing to receive a \$50 Amazon gift card. If you have any questions or comments, please contact the research supervisor at kimberly.goodwin@usm.edu.

>>

Survey Powered By [Qualtrics](#)



THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

This study will determine your perceptions of High Frequency Trading (HFT), with regards to volatility and regulation. "High frequency trading is an automated trading platform used by large investment banks, hedge funds and institutional investors which utilizes powerful computers to transact a large number of orders at extremely high speeds." (Definition courtesy of Investopedia). There are generally two distinct views of HFT in the financial world: that it is a positive force that creates market liquidity and eliminates gaps between buyers and sellers, or that it is a volatile instrument that leads to market crashes and inequality in trading markets.

>>

Survey Powered By [Qualtrics](#)

Appendix B: Survey

1. What is your level of education?
 - a) Freshman
 - b) Sophomore
 - c) Junior
 - d) Senior
 - e) Graduate Student
2. What is your major?
3. What is your gender?
 - a) Male
 - b) Female
 - c) Prefer not to disclose
4. How old are you?
 - a) 18-21
 - b) 21-25
 - c) 26-30
 - d) 31-35
 - e) 36-40
 - f) 41 or older
5. Select all that apply:
 - a) I use/have used a financial adviser
 - b) I have at least 1 bank account in my name
 - c) I regularly read the financial section of the newspaper
 - d) I regularly talk with friends and relatives about financial topics
 - e) I have taken a finance class
 - f) I own investment products such as bonds, stocks, and mutual funds
 - g) I have a mortgage
 - h) I took out a loan to pay for college
 - i) I have other debt/loans excluding college and mortgages
 - j) I have a debit card
 - k) I have a credit card

The next few questions will assess your views of HFT as it relates to volatility in markets.

6. HFT increases liquidity in markets on average.
 - a) Agree
 - b) Disagree
 - c) Neither Agree nor Disagree
7. HFT obscures price discovery.
 - a) Agree
 - b) Disagree
 - c) Neither Agree nor Disagree
8. HFT increases the frequency of market crashes.
 - a) Agree
 - b) Disagree
 - c) Neither Agree nor Disagree
9. High Frequency traders have an unfair advantage over other market participants who do not practice HFT.
 - a) Agree
 - b) Disagree
 - c) Neither Agree nor Disagree

The next few questions will assess your views regarding regulation of HFT.

10. Markets need more regulation restricting the amount of quotes/trading assets per unit of time.
 - a) Agree
 - b) Disagree
 - c) Neither Agree nor Disagree
11. Regarding HFT regulation, check one of the following:
 - a) HFT should be banned.
 - b) HFT should be more heavily regulated
 - c) HFT should be unchanged with regards to regulation
 - d) HFT should be self-regulated
12. Regarding HFT regulation, check all of the following actions you support/agree with:
 - a) Increased transaction taxes should be imposed.
 - b) Quote messaging rates should be limited.
 - c) Minimum order show times should be imposed.
 - d) Order cancelation ratios should be limited.

Appendix C: Institutional Review Board Approval



INSTITUTIONAL REVIEW BOARD

118 College Drive #5147 | Hattiesburg, MS 39406-0001

Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 16021202

PROJECT TITLE: Perceptions of High Frequency Trading

PROJECT TYPE: New Project

RESEARCHER(S): Daniel Beck

COLLEGE/DIVISION: College of Business

DEPARTMENT: Finance

FUNDING AGENCY/SPONSOR: N/A

IRB COMMITTEE ACTION: Expedited Review Approval

PERIOD OF APPROVAL: 02/12/2016 to 02/11/2017

Lawrence A. Hosman, Ph.D.

Institutional Review Board