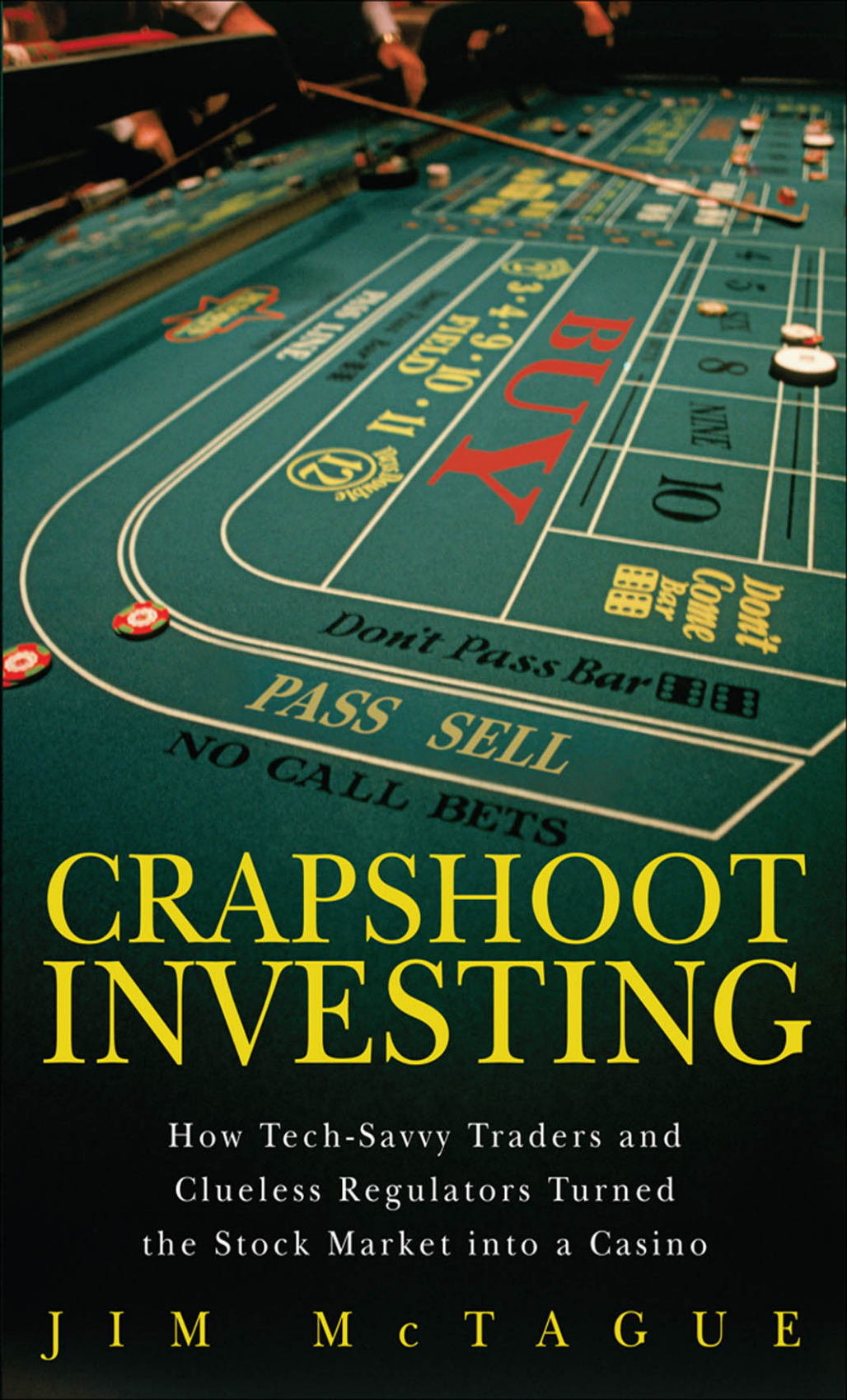

CRAPSHOOT INVESTING

How Tech-Savvy Traders and Clueless Regulators Turned the Stock Market into a Casino

JIM McTAGUE

Crapshoot Investing:

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Publishing as FT Press

Upper Saddle River, New Jersey 07458

Printed in the United States of America

First Printing March 2011 with modifications May 2011

Pearson Education LTD.
Pearson Education Australia PTY, Limited.
Pearson Education Singapore, Pte. Ltd.
Pearson Education Asia, Ltd.
Pearson Education Canada, Ltd.
Pearson Educatión de Mexico, S.A. de C.V.
Pearson Education—Japan
Pearson Education Malaysia, Pte. Ltd.

Library of Congress Cataloging-in-Publication Data:

McTague, Jim, 1949-
Crapshoot investing : how tech-savvy traders and clueless regulators turned the stock market into a casino / Jim McTague.
p. cm.
ISBN 978-0-13-259968-9 (hardback : alk. paper)
1. Investment analysis—United States. 2. Stock exchanges—Law and legislation—United States. 3. Electronic trading of securities. 4. Stocks—Law and legislation—United States. 5. Capital market—United States. I. Title.
HG4529.M397 2011
332.64'273—dc22

2010051301

ISBN-10: 0-13-259968-6

ISBN-13: 978-0-13-259968-9

To my wife, Rachel, for her understanding, help,
and encouragement.

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Acknowledgments

I want to thank my most memorable college professor and lifelong friend, Francis Burch, S.J., a brilliant scholar and author who encouraged me to become a columnist and an author.

This book was produced under a tight deadline to bring very important information to the attention of the investing public. I would not have been able to tackle the project without the encouragement of my colleagues at Barron's: Editor and President Edwin Finn; Managing Editor Richard Rescigno; and Assistant Managing Editor Phil Roosevelt. I also owe thanks to my officemate Tom Donlan, our editorialist and the author of several books, for his suggestions, especially those regarding Harvey Houtkin.

Chris Anderson, one of the smartest men on Wall Street, provided me with insights about the changing nature of the equities market. Ken Safian, another Wall Street legend, offered invaluable insights about high-frequency trading. Jamie Selway of Investment Technology Group LLC shared insights on market structure.

Will Ackworth of the Futures Industry Association was exceedingly generous in sharing his knowledge about the history of the commodities markets. Wayne Lee of NASDAQ, Ray Pellecchia of the NYSE Euronext, John Heine of the Securities and Exchange Commission, and Dan Chicoine of TD Ameritrade were especially helpful in connecting with market experts.

I also want to thank the many lawyers, regulators, and traders who spoke to me about market structure and high-frequency trading on deep background.

Finally, I offer special thanks to my daughter Alex, a patent litigator, and Bob Schewd of WilmerHale, a brilliant literary contract attorney, for assisting me in my negotiations with the publisher.

About the Author

Jim McTague has been Washington Editor of *Barron's Magazine* since 1994—a post that gives him privileged access to key players in Washington and on Wall Street. A credentialed White House and Capitol Hill correspondent, he's covered every administration since the first President Bush. McTague has appeared on NBC, CNN, CNBC, MSNBC, FOX, and is a frequent guest on FOX Business News. His extensive analysis of the underground economy in 2005 exploded the myth that illegal aliens were a small percentage of the U.S. population, triggering today's border security debate. McTague holds an MA in English from Pennsylvania State University and a BS in English from St. Joseph's University in Philadelphia.

Introduction

The stock market has changed radically since 2005, yet few persons realized the greatness of the seismic shift until May 6, 2010, when the major averages collapsed over the course of 10 minutes. The public suddenly realized that a venue designed to efficiently move capital from investors to the most promising enterprises had become as risky as a Las Vegas casino. This book is the story of well-intentioned but disastrously wrong-headed decisions by Congress and securities regulators that resulted in the destruction of a great American institution and possible long-lasting damage to the entire U.S. economy. Fixing this mess is without a doubt the most important challenge for U.S. policy makers in the years ahead, yet few of them understand this. They are still looking backward at the credit crisis of 2007 to 2008 and fail to see the bigger threat that is right before their eyes.

Just prior to May 6 during the first quarter of 2010, the all-clear siren sounded for shell-shocked Wall Street investors. All seemed well with the stock market. The major stock indexes, which had hit 12-year lows in March 2009 in the midst of the turbulent Great Recession, miraculously recovered by 74% the same month a year later. Investors once again were able to look at the returns in their retirement accounts without becoming physically ill. Confidence in the stock market, which had been badly shaken during the market meltdown of the previous two years, began to strengthen. In April 2010, retail investors began shifting money from safe havens like gold, commodities, and treasury bonds into equities and equity mutual funds, which was good news for cash-starved American enterprises.

Investors were understandably cautious—nervous as cats, actually—owing to what they had been through. And the stock market, despite its remarkable rebound, remained a frightening place. It was prone to jolting aftershocks in the form of wild, inexplicable, intraday price swings that saw the Dow Jones Industrial Average (DJIA) rising and falling by 100 or more points in a matter of hours. Prior to 2008, this sort of dramatic, volatile, intra-day shifting was rare. Often it took months for the DJIA to move 100 points, not half a day. Investors had grown accustomed over the years to parking their savings in the stock market for the long haul in the expectation of fairly predictable returns, not wild, hourly reversals of fortune. Since 2008, however, the market had become radically unstable, with 15 of the 20 largest intraday price swings in the history of the DJIA having occurred in 2008.[1] Heightened volatility seemed to be a new normal. Volatility as measured by the Chicago Board of Options Exchange SPX Volatility Index or the VIX had been highly elevated in both 2008 and 2009.[2]

An intraday move of 3% in the Standard & Poor's (S&P) 500 is considered unusually large. According to Birinyi Associates, a stock market research group, there were 42 days with 3% moves in 2008 compared to 1 day in 2007 and 0 days from 2004 through 2006 (see Figure I.1). Moves of 2% are significant. There were 149 2% days during the 1990s and nearly as many—131 from 2000 through 2006—explained in part by the devastating 9-11 attacks. The Great Recession beginning in 2007 eclipsed that trying period, with 156 days of 2% moves (see Figure I.2).

The market's intraday swings were particularly unnerving during the 146 trading days between October 1, 2008 and March 31, 2009.[3] Retail investors typically invest first thing in the morning, at the market opening. On these wild days, their newly purchased shares often dropped significantly in value by the time the market closed at 4 p.m. EST. Consequently, equity investors began to lose that old-time, buy-and-hold religion and became risk adverse to the extreme. No item of bad news was ignored; no piece of good news was accepted uncritically. No new money was flowing into the stock market, either.

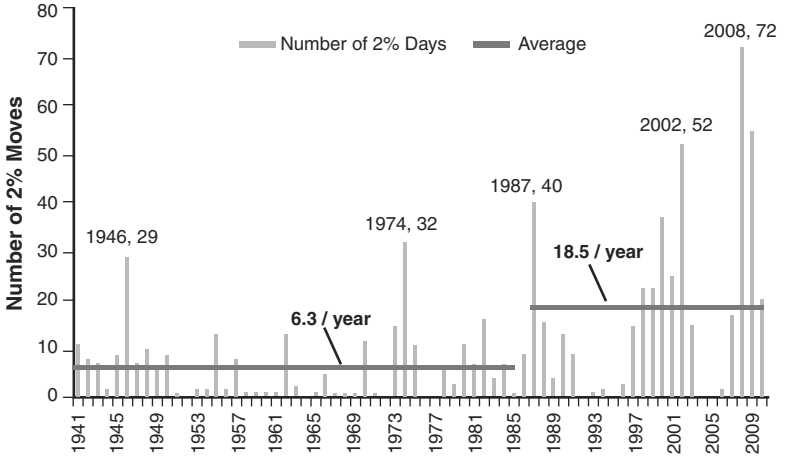

Figure I.1 Number of 2% +– Market Moves per Year.

Source: Birinyi Associates

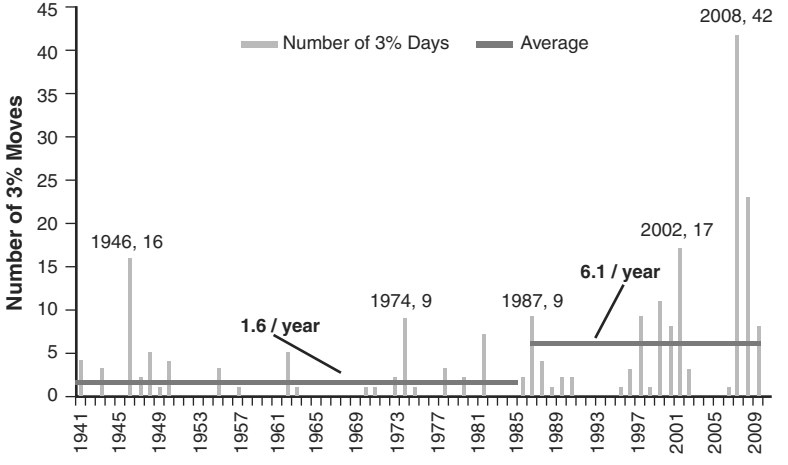

Figure I.2 Number of 3% +– Market Moves per Year.

Source: Birinyi Associates

"It's a *show me* market," said Robert Doll, the chief equity strategist at BlackRock Inc. "Fresh in everybody's mind is the carnage of late 2008 and 2009. Therefore, their mentality is to sell first and ask questions later."[4]

By early 2010, investors were not only exhausted, they were depleted. Most had seen their nest eggs reduced from 30% to 50% in

2007 and 2008. None but those who had lived through the Great Depression had ever experienced anything quite so frightening. Certainly, there had been tough times in the past, with recessions of 16-months duration in both the 1970s and 1980s. But equities since 1983 generally had been appreciating. Year after year, they were among the best-performing investments. Stocks had become so predictable that people forgot the risks. They forgot that stock market returns were not guaranteed and that the market was not a place to sink money that they could ill afford to lose.

Few people had foreseen the catastrophic collapse of the mortgage markets that would bring down well-known investment banks such as Bear Stearns and Lehman Brothers and that would trigger a credit draught and, consequently, the loss of more than 8 million jobs, which raised the total number of unemployed to 15 million persons. Just before the downturn, the public mood was optimistic. The economy appeared to be booming. The unemployment rate was at 4.7%, and the rate had been below 5% for 23 consecutive months. Housing prices were rising along with stock prices. With the rate of home ownership greater than 65%, the appreciation made people feel rich. They took out home equity loans to buy cars and vacation villas. The future looked golden.

On October 9, 2007, the DJIA hit a high of 14,164.53. That same day, the S&P 500 had made an all-time high of 1565.15. Popular MSN MoneyCentral blogger Jon Markman captured the narcoleptic euphoria of the pre-recession era in May 2007 when he guaranteed his readers that the DJIA would climb significantly higher. He wrote, "Unless the world economic system completely runs off the rails, Dow 21,000 by 2012 is a lock. And anyone who says that ain't so lives in a Neverland, where kids never grow up, companies never innovate, consumers stop buying stuff, and home sweet home is a bomb shelter." That bit of juvenile sarcasm turned out to be closer to the truth than Markman or anyone else ever could have imagined. The market did run off its rails. In 2008, the DJIA fell 37.8%, its worst swoon since the

1930s. The S&P 500 tumbled 36.6%, which was its third worst year on record. The NASDAQ plunged by 40.5%. And this was only the first act of the investment horror show. A year after the market peak, on October 9, 2008, the DJIA closed at 8579.19. The DJIA kept falling in 2009, finally hitting a bottom on March 6, 2009 when it closed at 6547.05, a level it had last seen on April 15, 1997. Billions in savings had been wiped out. The unemployment rate was at 8.6%—the highest level in 26 years—and would reach 10% before the year was out.[5]

So it was with a vengeance that the investing public relearned that the market can be an unforgiving place. During the Great Recession, not even highly diversified mutual funds provided shelter from the economic storm. Diversification didn't work when stocks and bonds and real estate were dropping in tandem.

The downturn had been especially brutal for the large contingent of baby boomers who had been planning for a comfortable retirement funded by their pension and 401(K) accounts. The oft-repeated, grim humor of the day was that their 401(K) plans had become 201(K) plans.

Boomers frantically liquidated what was left of their stock holdings and shifted the proceeds into the safest, most predictable investments available, including Treasury securities with negative yields when adjusted for inflation. In the words of mordant pundits, these investors were looking for the return of their capital as opposed to a return on their capital.

The March 2009 market recovery came as a surprise. There was no fundamental reason for the bulls to be running. In fact, their buying portended the end of the recession three months later.

The actual nature of a recovery was a matter of intense debate among bulls, bears, and super bears even before many recognized that the recession had ended. The most optimistic economists, and there were not many of them, predicted a V-shaped economic rebound, meaning that economic activity would pick up as quickly as it had come down in 2007 and 2008 during the credit and housing

crisis. In their view, the market rally reflected this outcome and thus was behaving rationally by bouncing back up like a super ball.

The conventional view was a pessimistic one. This broad camp argued that the recovery would be U-shaped, with slow gross domestic product (GDP) growth and high unemployment into the early years of the next decade. In their view, the stock markets were prematurely optimistic, the result of wishful thinking as opposed to solid earnings. There were some suspicions among this gloomy tribe that banks and Wall Street firms had been bidding up the price of stocks by trading them back and forth among themselves.[6] Such activity would generate higher returns for their substantial reserves of cash, which they were reluctant to lend, owing to economic conditions. It also would have boosted their capital positions.

A third, super-bearish contingent of economists predicted that the economy would sputter and then conk out sometime in 2010 as federal stimulus dollars diminished, a phenomenon they described as a double-dip recession. Some of them said the second leg of the slowdown might drag the country into a depression.

The endless debate among economists and market gurus, carried almost daily on the business pages, heightened the skittishness of investors. Yet many of them crept back into the market in April because of a greater fear they might miss a ride on a profitable post-recession bull market that would enable them to put their 2007 to 2008 losses behind them. They were desperate to recoup their savings. And they remembered tales by their great grandfathers about the Great Depression and the fortunes that were made by investors who had jumped into the market after it had crashed. Given their nervous condition, however, it would not take much of a fright to send them scrambling back to the sidelines.

Fast-forward to May 6, 2010, a day with nerve-jangling headlines. The citizens of nearly bankrupt Greece were rioting, casting doubts on the future of the Euro. There was an election in Great Britain that would have a material effect on its economic prospects. Millions of

gallons of crude oil were spewing from a broken BP wellhead nearly a mile under the waters of the Gulf of Mexico, threatening unspeakable damage to one of the world's most magnificent marine habitats and disaster for the tourist and fishing industries of at least four states. The DJIA, which had been at 11,151.83 just three days earlier, had closed on April 5 at 10,868.12. Investors who had been creeping back into the market were worried and began to take some profits, which seemed the wise thing to do. Some commentators were predicting that events in Europe might tip the world's economy back into a deep recession.

Then at 2:30 p.m. EDT occurred one of the most bizarre and mysterious meltdowns in stock market history, an event destined to become known as the Flash Crash.[7] The DJIA plunged more than 700 points in ten minutes, its largest one-day fall ever. Then in the next ten minutes, it began to recover. The speed at which the event transpired was both stunning and alarming. There had been other one-day market plunges, most notably Black Monday in October 1987. But the regulators supposedly had fixed the markets after that staggering event so that nothing like it could ever happen again. This infamous day on May 6 showed investors that the equities market had become explosively volatile and that they could be wiped out in a matter of seconds. And it raised suspicions that the event had been deliberate, engineered by a new breed of market player, the so-called high-frequency traders. These tech-savvy traders pitted a new generation of computing machines against human investors, and the machines always seemed to win.

Some of the same physicists and mathematicians who had designed the exotic, synthetic mortgage securities that had wrecked havoc on the world's credit markets in 2007 and 2008 were now day-trading millions of shares of stocks, holding on to them for 2 minutes or less to make a fraction of a penny here and a fraction there, which at the end of the day added up to real money. Data showed that an estimated 73% of all U.S. equity trades involved high-frequency traders, who could execute an order in milliseconds.[8]

They thrived on volatility, which is anathema to long-term investors; and the suspicion was that the high-frequency traders were somehow at the bottom of the increasingly extreme, intraday market moves, using their superior technology and algorithms to manipulate stock prices. Even more disconcerting, the exchanges were selling these traders unfair advantages. In a real-life version of *The Sting*, these high-frequency traders knew of the prices of stocks and the direction of the market before the data was posted on the *ticker*—the consolidated tape that supplies the data to the public. It's small wonder then that retail investors took their money and ran for the doors immediately following the Flash Crash. Some headed back to bonds. Retail day traders, who bought and sold shares dozens of times each session, shifted their focus to the commodities markets, reasoning that if the stock market had become as risky as a pork bellies pit, they might as well go over to the CME, formerly known as the Commodities Mercantile Exchange (CME), where margins and taxes were more attractive, and play with its stock index futures. So many retail day traders made the switch that Ameritrade began introducing new commodities services aimed specifically at them. It was the firm's most robust area of growth.

"We see things commonly now that we didn't see 6 months ago," said Chris Nagy, managing director of routing order strategy for Ameritrade during a September 2010 interview. He went on, "Retail traders who sometimes acted as equity market specialists were saying, 'This market isn't fair.'"

And most retail investors stayed on the sidelines through the fall because the volatility seemed more pronounced in the aftermath of the Flash Crash. Economist Ed Yardeni perfectly captured retail investors' mood when he wrote in his August 5, 2010 newsletter, "The stock market has been exhibiting bipolar symptoms in recent months with intense mood swings from mania to depression and back. ...Since the S&P 500 peaked on April 23 through yesterday, it has been down 38 days and up 33 days. During the down days it lost a whopping 527 points. During the up days it gained 437 points. Over the same period,

the DJIA lost 4,231 points during the 37 down days and gained a total of 3,708 points during the 34 up days. All that commotion, with so little motion one way or the other, has generated lots of swings between bearish and bullish emotion, leaving most investors exhausted."

In fact, the markets would never be the same. Well-intentioned regulators and lawmakers had meddled with market structure over the years and inadvertently changed what had been considered a national treasure into a casino dominated by unpredictable, high-speed computers. The Flash Crash was a symptom of the mess they had made.

This book tells the real story of the Flash Crash and its causes—one that you will not find in the official government accounts. It describes how Congress and the Securities and Exchange Commission, or SEC, beginning in the early 1970s played God with the market, setting out to create a paradise for long-term investors and inadvertently changed it into a financial purgatory. Blind in their belief that automation would make the markets fairer and more efficient, they inadvertently wrecked one of the world's great capital-allocation and job-creation engines and turned it into a wild playground for algorithmic traders. Initial public offerings of new, dynamic companies have all but disappeared. Capital, the lifeblood of the economy, is flowing into less productive assets, such as government bonds, precious metals, and third-world countries. And investors remain sidelined because the market is now the equivalent of a crapshoot.

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1

Strange Encounters

Beginning in 2007, two long-time equities traders named Sal Arnuk and Joseph Saluzzi noticed some weirdly disturbing price movements in the stock markets as they observed client trades on their multiple screens in a small trading room in quiet Chatham, New Jersey. When they went to hit a bid on certain exchanges, the price suddenly disappeared and either a lower or higher bid instantly appeared in its place. It was as though some invisible, malign force was attempting to trick the traders into chasing the stock up or down the price ladder. Never before had they seen anything like it. The ghostly presence was so incredibly fast that there was absolutely no chance of the traders ever winning the game. The deck was stacked against them. If they took the bait, they would always end up paying more or getting less than the market's consolidated tape of prices had initially advertized.

The price jumps were aggravating. Arnuk's and Saluzzi's job was to obtain the best execution price on large orders of shares for their institutional clients, which included large mutual fund managers such as INVESCO. Somebody was threatening their livelihood. Their firm, Themis Trading LLC, was named for a Greek goddess who personified fairness and trust.[1] Someone subtly was trying to subtract these two attributes from the market, and this got their blood boiling. It also got them wondering how the bastard was doing it.

The blocks of stock handled by Arnuk and Saluzzi were not small potatoes. They frequently ranged in size from 300,000 shares to 2 million shares. The transactions had to be conducted gingerly to avoid

"information leakage" that could cause imbalances in the market, raising the cost of transacting the business. The stock market always had provided a habitat for predators who exploited weaknesses and inefficiencies in its structure, and if you did not avoid these cold-hearted traders, you had about as much chance as an anchovy in a shark tank. The game of hide and seek was relentless. The predators always were probing for new weaknesses. If, for instance, the predators discovered through the grapevine that a seller had a huge inventory of stock to unload, they would short the stock, sending its price lower and costing the institution precious nickels, dimes, and pennies. If they discovered that a mutual fund or a pension fund was attempting to accumulate a large position in a stock, they would front-run the order, buying up the shares ahead of the bigger buyer and then selling the shares to him for a cent or two more than he would have paid if his intentions had remained secret.

To avoid predation, mutual funds employed numerous strategies to camouflage both their identities and their order size. If a big mutual fund wanted to sell several hundred thousand shares of a stock to rebalance its portfolio, they might use a trusted broker as an intermediary to locate another, equally large institution to buy the position at a negotiated price. It was hush-hush. Blabbermouths were excluded from such arrangements.

If a large counterparty could not be found, they might take a portion of the order to a so-called *dark pool*, an off-exchange venue where block traders anonymously submit buy and sell orders, hoping to get at least a portion of the order executed. Some dark pools were exclusive. Participants were expected to be fair and honest, and any violation of the rules could result in immediate suspension or even permanent expulsion. Because the bid and offers in a dark pool were not posted in the public or "lit" markets, they did not affect the prices on the consolidated quote. The public or lit market had no idea that a seller was looking for buyers and vice versa until stock was actually sold. Then the execution price was listed on the *consolidated tape*—the data feed one sees crawling across the bottom of CNBC.

To sell the remaining shares, the fund often resorted to automated trading software to break up the block into smaller orders, which then were sent to the various lit exchanges. The size and frequency of the orders was determined by algorithms looking at price and volume and the time parameters of the transaction. Finally, the funds and institutions enlisted the aid of human traders such as Arnuk and Saluzzi to use their wiles to avoid the predators.

Each of the methods had an Achilles' heel. For instance, there were limits on order sizes at the dark pools. And the algorithms that were employed to slice and dice big orders could be reverse-engineered in a matter of milliseconds by a predator's faster, more sophisticated algorithm, allowing it to automatically front-run the order. In the course of a year, a millisecond advantage for a high-frequency trader over the institutional traders can be worth $100 million.[2]

The funny business detected by Arnuk and Saluzzi was on a much higher level than the usual pitfalls that traders faced. The flickering prices were so radical that it was like a squadron of F-16 fighter jets suddenly appearing among the Sopwith Camels of World War I. Ironically, the phenomenon had appeared just about the time the U.S. Securities and Exchange Commission (SEC) had implemented its Regulation NMS (National Market System)—a sweeping reform aimed at increasing competition among the exchanges to both decrease customer costs and make the stock market friendlier to long-term investors. The rule, demanded by Congress in 1975, finally had been produced by the SEC 30 years later in 2005 and activated 2 years after that. Clearly, there was a link. Intrigued, the two traders decided to dig into the matter.

Arnuk and Saluzzi had not been spoiling for a fight or longing for the limelight. They had no idea what they were getting into and no premonition that their discovery would rattle the investment world. Since 2002, both had been living the good life in the upscale suburban community of Chatham, a rustic borough tucked off a highway near the uber-chic Short Hills Mall. Take the exit off of Route 24 by

Neiman Marcus and, behold, you were on Main Street in *Leave It to Beaver* land, with handsome, 1940s-era wood houses, tree-lined streets, and neatly trimmed lawns. Chatham was just 25 miles from Wall Street, but it might as well have been 10,000 miles away. None of Lower Manhattan's furious rush was evidenced here. There were no throngs of sharp-elbowed, driven people barreling down sidewalks, no blaring taxis clogging the streets. During the week, it seemed as quiet as Sunday.

Both men were veterans of Wall Street. After a decade working for big firms, they had traded a 2-hour round-trip commute between Manhattan and Brooklyn for a 10-minute, round-trip commute that saved them enough time to coach their kids' Little League games.[3] This was a utopia. They could balance their priorities of breadwinning and parenting with no maddening traffic jams and crowded subways in between.

They leased an office in a quaint, wooden retail village in the heart of town, opposite a dance studio, a tea restaurant, a tennis shop, and a beauty salon. It was not the locale usually associated with a trading floor. Their space was open and airy and had big windows on three walls to let the sun shine in. If they hadn't taken the space, it probably would have been occupied by a real estate office or a small accounting firm.

Inside, it had the air of a man cave, with golf clubs leaning against the wall. Arnuk and Saluzzi and three other traders dressed their Saturday's best: dungarees or shorts, and tee shirts. And there were lots of computers. Their "trading floor" was a long desk topped with four or five multiscreened computer screens where they watched the world, the markets, and their clients buy and sell orders and talked about the frustrating New York Mets between trades.

Both men love baseball, although neither played beyond the youth-league level. As adults, they both coached their sons' teams with passion. Arnuk, who had attended the prestigious Poly Prep high school in Brooklyn, a private high school whose alumni include former SEC Chairman Arthur Levitt, had bonded with his father and siblings as he grew up watching baseball on a black-and-white television. He

also bonded with his own kids through baseball. Arnuk was a sturdy, soft-spoken man who wore black-rimmed glasses and looked like a professor. His calm exterior belied his highly competitive side. Saluzzi, who had attended Bishop Ford High School in Brooklyn, carried himself like a ball player. He was trim and walked with a relaxed, surefooted gait.

The Brooklyn natives went a long way back and appeared to be as close as brothers. They had met in the late 1980s at Morgan Stanley, their first employer after college. Arnuk, who grew up in Brooklyn's Bay Ridge section, had a BA in finance from SUNY Binghamton University; and Saluzzi, who hailed from the Sheepshead Bay neighborhood, had a BA in finance from NYU. After a few years at the prestigious firm, they both concluded independently that to advance in the world of finance, they'd have to obtain graduate degrees. So they both left Morgan Stanley to enroll in MBA programs. Arnuk started attending the Stern School of Business at NYU part time; and Saluzzi resigned a few months later to attend the Kenan-Flagler Business School of the University of North Carolina.

Arnuk graduated in 1991, and Saluzzi in 1993. Arnuk began working for Instinet, a global brokerage firm that specialized in computerized trading. He recruited Saluzzi for a job there. They were neighbors at this point. Both men had married and secured homes in Bay Ridge.

In 2002, Saluzzi and Arnuk got tired of the rat race and decided to move to New Jersey and start their own company. Arnuk was the first to go, and he convinced Saluzzi to join him in a trading venture.

They were not making the kind of big money that drives a congressman to denounce Wall Street from the floor of the House or the Senate, but they were not doing badly either. The business wasn't exclusively about money anyway. They were self-sufficient. They were their own bosses. But in 2007, someone was threatening their business by playing unfairly. It was like a ball player shooting up on steroids so he could muscle the ball farther than anyone else.

Someone in the market was using the equivalent of steroids to trade in and out of the market faster than everybody else.

As the men began to track down the hombre, they learned just how radically Regulation NMS had changed the market, and it surprised them. The change had engendered an explosion in the number of high-frequency traders plying the markets with super-charged computers and advanced pattern-recognition and statistical software designed to beat the market. These guys always had been around, but now there seemed to be a lot more of them, and their robotic trading machines were much faster than anything ever deployed in the markets. They programmed these overclocked computers to make money buying and selling stocks without direct human oversight. For every dozen firms, there were hundreds of these robotic trading wunderkinds, and their numbers were growing every day because venture capitalists and hedge funds were bankrolling start-ups left and right. Clearly, a lot of people thought high-frequency trading (HFT) was a path to quick and easy profits.

The general investment public had no idea that this market version of the *Invasion of the Body Snatchers* was under way. Some of the biggest players in the high-frequency trading sector were not household names: They were proprietary trading firms such as Getco and Tradebot and hedge funds such as Millennium, DE Shaw, WorldQuant, and Renaissance Technologies. Others were household names, but investors hadn't paid much attention to their forays into mechanized trading because it was a relatively small portion of their earnings and they did not break out the numbers in their annual reports. Goldman Sachs, which had become notorious in the public's eyes, owing to its role in the collapse of the mortgage market, had a sizable high-frequency trading desk. Registered brokers like Bank of America and Lime Brokerage and Credit Suisse offered suites of exotic trading algorithms and other services to customers who wanted to engage in the practice. But they all were secretive about the success of these operations. Why tempt copycats?

Joining the gold rush were commodities traders and teams of computer scientists and mathematicians with formulas designed to outsmart any human trader. The human brain was not smart enough or quick enough to compete with the over-clocked, nitrogen-cooled computing engines designed by whiz kids and trading hundreds of millions of stock shares every day. The trader-scientists began writing algorithms so that their computers could outsmart competing trading computers, triggering the equivalent of an arms race. Teams of mathematicians and computer scientists worked round-the-clock to improve their machines.

Arnuk and Saluzzi discovered that these new competitors had another significant technological advantage: Most of them possessed servers that were "collocated" at or near the exchanges. This meant that for a steep, monthly rental, a high-frequency trading firm was allowed to link its servers directly to the servers of the stock exchanges and get price and trading data milliseconds faster than anyone who could not or would not spring for such a hookup, like retail investors. In the view of the HFT crowd, this "low-latency" networking was completely within the bounds of acceptable behavior. Alistair Brown, founder of Lime Brokerage, which caters to high-frequency traders, said in a magazine interview in 2007, "Any *fair* market is going to select the best price from the buyer or seller who gets their order in their first. Speed definitely becomes an issue. If everyone has access to the same information, when the market moves, you want to be the first. The people who are too slow are going to be left behind."[4]

Depending on which strategies they employed, the HFT firms programmed their computers to hold the stocks anywhere from 2 minutes to 2 days. Their object was to make a little money on each trade, not swing for the fence. It was a fairly predictable business because the shorter the period of time under study, the easier it is to forecast the future based on historic pricing, volume, and other data. Systems become increasingly unstable over time, which is why long-range weather forecasts are unreliable and which is why hedge funds

making multiyear credit bets lost their shirts in 2007. The lesson of 2007 had made a deep impression on so-called quants, which was short for "quantitative investors." They embraced HFT with religious fervor. Less risk equaled more money. The founder of Tradebot, an HFT located in Kansas City, Missouri, told students in 2008 that his firm typically held stocks for 11 seconds and had not suffered a losing day in four years.[5]

There was no public source of information of HFT industry profits, just anecdotes and rumors, so no one knew for certain how much money they were pulling down in a given year. The best conservative estimate was $20 billion just for firms that tried to earn small spreads and fees from the exchanges by playing the role of market maker. They represented less than 10% of the HFT universe.

A market maker takes the opposite side of an incoming order to earn a small profit on the spread on fees. Often this is less than 2 cents per share. But if the HFT firm trades millions of shares each day, it can rack up a handsome annual return. Some earn returns of close to 300%.

By December 2008, Saluzzi and Arnuk had a strong suspicion as to what was going on in the markets. Like all good investigators, they had cultivated inside sources from a number of HFT firms. What they found was disturbing: Based on their reading of the facts, high-frequency shops were using their superior computing power in new, devious, and possibly unethical ways to covertly attack institutional customers and consequently raise their trading costs. Some of the strategies looked like bare-faced attempts to manipulate the market. Arnuk and Saluzzi detected signs of *momentum ignition*, in which an algorithm initiates a series of trades in an attempt to trick other machines into believing that a particular stock is headed higher or lower; and *spoofing*, a practice in which the machines feign interest in buying or selling a stock to manipulate its price. The victims of these questionable techniques included mutual funds and pensions, so in the final analysis, it was the small investor who was getting nicked by

this new iteration of Wall Street avarice. No one had noticed—least of all the SEC and examiners at the Financial Industry Regulatory Authority (FINRA), an industry-financed outfit charged with policing brokers and the stock exchanges. The SEC staff members had so little day-to-day personal contact with Wall Street professionals that they knew almost nothing about what was really happening there beyond the direction of the stock averages. They relied on FINRA, which had a reputation of being less than diligent.

Arnuk and Saluzzi were not politically connected. Theirs was a small-fry firm. But they felt compelled to sound an alarm and bring their suspicions to the attention of the broader investing public. Something was askew in the marketplace. So the men elected to disseminate their findings in a white paper to their 30 institutional clients and then post the paper on their blog. Those clients typically ran just 2% to 5% of their order flow through Themis Trading. Arnuk and Saluzzi figured the clients were losing lots of money to high-frequency traders on the remainder of the order flow transacted elsewhere because they were unaware of what was going on.

They titled their paper "Toxic Equity Trading Order Flow on Wall Street: The Real Force Behind the Explosion in Volume and Volatility." The white paper read more like an op-ed piece than the academic treatise suggested by its title. Arnuk and Saluzzi offered no empirical evidence, just their hunches. Hard evidence was tough to come by; no one, not even HFT consultant Tabb Group, could say with absolute certainty how many HFT firms existed. The HFT corner of the market was unregulated. It was also guarded. Traders worked behind closed doors with upmost secrecy to protect their "secret sauces," the algorithms that they used to outsmart other traders. The duo did have 40 years of combined trading experience, however. They understood the mechanics of the market, and they had seen hundreds of schemes designed to take advantage of unwary investors. And they had their snitches. They were convinced that such scheming was occurring now on a grand scale.

The white paper asserted that the explosion in market volatility that most people ascribed to the global financial crisis that had begun in August 2007 was largely the product of high-frequency traders who had invaded the market *en masse* to exploit changes wrought by SEC's new rules.

"The number of quote changes has exploded," they wrote. "The reason is high-frequency traders searching for hidden liquidity. Some estimates are that these traders enter anywhere from several hundred to one million orders for every 100 trades they actually execute." HFT machines would enter an order and cancel it almost immediately, just to see if there was buying interest at a particular price level. Arnuk and Saluzzi referred to this practice as *pinging*, conjuring the image of a destroyer conducting a sonar sweep for a hidden submarine. High-frequency trading computers would issue an order ultrafast away from the listed price of a stock, and if nothing happened, they would cancel it immediately and send out another. The machines were looking for hidden information to use to their advantage, such as whether there were big institutional customers afoot trying to fill large orders.

The strategy was cunning. Say there was an institutional trader who had instructed a computer to purchase shares of a stock for between $20.00 and $20.03, but no higher. Theoretically, no one else in the marketplace would know this. The high-frequency trader's algorithm, however, might recognize that a pattern of purchases for the particular stock's shares at $20 was typical of algorithms employed by institutions accumulating a large position. So the HFT algorithm would ping the institution's algorithm, offering perhaps to sell 100 shares of the stock to the institution at $20.05. If nothing were to happen, the HFT algorithm immediately would cancel the trade and offer 100 shares at $20.04. If nothing again happened, it would cancel and offer $20.03. If the institution's algorithm were to buy the stock, the HFT algorithm would know that it had found a buyer willing to pay up to $20.03 for a stock listed at $20. The HFT algorithm then

would quickly plunge back into the market, offering to buy the same stock at a penny above the institution's original $20.00 bid. Then it would turn around and continuously sell those shares to the institution's algorithm at $20.03. That extra penny, Arnuk and Saluzzi asserted, amounted to a "stealth tax" on retail and institutional investors.

Most investors—retail lambs and the large, bovine institutional traders—didn't realize that they were being bled because it was a death by a thousand cuts as opposed to a pneumatically propelled bolt to the forehead. They had no way of knowing that an uninvited middleman had come between them and the stock market.

This sort of shenanigan had begun in 2007 because Regulation NMS took away the duopoly status of NASDAQ and the New York Stock Exchange (NYSE) by allowing any exchange to trade listed securities. Previously, the majority of trades on NYSE-listed stocks were done on the NYSE and NASDAQ-listed stocks in the NASDAQ market. New computerized exchanges proliferated, anxious to get a slice of NASDAQ's and the NYSE's lucrative business. To survive in the face of the new competition, NASDAQ and the NYSE were compelled to go public. Suddenly, they were accountable to stockholders who vocally demanded a decent return on their investment; so the once-dominant exchanges had to fight tooth and claw against the new competitors for the trade volume they had lost. They soon discovered deep-pocketed customers in the form of the high-frequency traders, who were arbitraging price inefficiencies among the dozen or so equity exchanges and between the equities markets and the commodities markets. The NYSE and the NASDAQ solicited the HFT business, as did all the other exchanges. They offered these prime customers special trading advantages as an inducement.

"Before 2007 and Regulation NMS, you really didn't have this high-frequency stuff," said Saluzzi. "The NYSE was still a slow market, and 80% of the trades were on the floor of the exchange. But once those trades migrated to newer, electronic exchanges, trading became fast. Overall market volume went from 3 billion shares to

10 billion shares because regulation NMS opened a whole new playground for high-frequency traders, and they went crazy."

Some of the exchanges offered the HFT firms rebates of subpennies-per-share for serving as market makers and buying stocks from other customers. Buy and sell tens of millions of shares a day, and that fraction of a cent adds up to substantial profit. Arnuk and Saluzzi said in their white paper that the rebate scheme inadvertently led to what they termed *hot-potato trading* that inflated market volume statistics and made the market seem much more liquid than it was.

"If two guys trade 1,000 shares back and forth a million times, that's a billion shares. Did a billion shares actually trade, or did the thousand shares change hands a million times between two guys playing hot potato? We argue that the real volume is 1,000 shares."

The volume, real or not, generated data for the consolidated tape, which in turn was a marketable product. The more data that an exchange generated for the tape at year end, the bigger its share of the revenues from sales of that data to information vendors and brokerages. So they were not about to crack down on this practice.

Saluzzi and Arnuk charged that the high-frequency traders were playing other games as well, all because they were able to move faster than everyone else. In part, it was because the NYSE and the NASDAQ had invited them to collocate their servers close to the exchange's servers. This arrangement reduced the time required to get an order executed. The cost ranged from $1,500 to $50,000 per month for each server cabinet. There also was an installation charge that ran anywhere from $5,000 to $50,000. The NYSE was so grateful for the new business that it took steps in October 2007 to make it easier for program traders to move the markets higher and lower. The NYSE publicly removed curbs that shut down the program trading if the market moved more than two percent in any direction, the white paper stated. NYSE asserted that the approach to limiting market volatility envisioned by the use

of the "trading collars" was not as meaningful today as it had been in the late 1980s when the rules were adopted. The rules had been put in place in 1987 following Black Monday, the largest one-day crash since the Great Depression. The white paper said, "On a more commercial level, the NYSE had been at a competitive disadvantage because other market centers that didn't have curbs were getting the program trading business."

One nefarious-sounding strategy, cited by the white paper, was designed to quickly move the price of a share higher by 10 to 15 cents by employing a handful of 100- to- 500- share trades executed in rapid succession. Then the high-frequency trader would suddenly short the stock, knowing full well he had artificially pumped up the price and that it shortly would begin to fall.

In a fictional example by the authors, an institutional buyer is trying to accumulate stock between $20 and $20.10 per share. Using the same techniques as the rebate trader, a high-frequency trader spots the $20 bid as an institutional order. When the institution next bids $20.01, the high-frequency trader buys stock at $20.02, driving up the price. The institution follows and buys more shares at $20.02. The high-frequency trader in this matter runs the stock up to $20.10 per share, with the institution chasing the stock. At this point, the high-frequency traders also stock short at $20.10 knowing it is highly likely that the price of the stock will fall back to the low $20 range.

Finally, the two traders accused their high-frequency competition of a sin known in the parlance of the industry as *momentum ignition*. The high-frequency traders engage this strategy to juice a market already moving up or down, creating either a major decline or a big upward spike in prices. A trader could rapidly submit and cancel many orders, and execute some actual trades to "spoof" the algorithms of other traders into action and cause them to buy or sell more aggressively. Or the trader might try to trigger some standing stop loss orders that would cause a price decline. By establishing a position early on, the trader could profit by liquidating the position if he is

successful in igniting a price movement. This strategy might be most effective in less actively traded stocks, which receive little help and public attention and are vulnerable to price movements sparked by a relatively small amount of volume.[6]

After sending the paper to clients, Arnuk and Saluzzi posted a copy of the white paper on their blog site, where they expected its contents to be discovered by the larger investing world and then widely disseminated and discussed. That, after all, was the way things regularly happened on the World Wide Web, wasn't it?

"We were not trying to make a name for ourselves," Arnuk said later. "All that we wanted to do was fix what was wrong. We were sharing it with our customers so they could improve what they were doing when they traded away from us."

The charges by Arnuk and Saluzzi were sensational and potentially explosive. The markets were being manipulated. No one else had noticed what they had noticed. Regulators had been asleep. They hadn't blown any time-out whistles or thrown any penalty flags for spoofing or momentum ignition or pinging. This was outrageous, because the SEC and FINRA were supposed to be cleaning up their act after missing abuses like Bernie Madoff's outrageous Ponzi scheme.

But after the two traders disseminated the white paper, nothing happened—nothing at all. Investors in December 2008 had other things on their minds. They were consumed by bailouts, failures, bankruptcies, and the incoming Democratic administration of Barack Obama. The white paper was little more than background noise.

"Outside of our clients, no one made a stink or even mentioned our findings," recalled Arnuk.[7]

The two men may have been disappointed, but they were not quitters. For them, this was personal. The HFT firms were a threat to their way of life. They continued to plug away, albeit in relative obscurity. In a prescient, follow-up white paper published in early July, Arnuk and Saluzzi warned of the possibility of a lightning-fast

market collapse induced by high-frequency traders with unfiltered connections to the stock exchanges through so-called "sponsored access agreements" with a registered broker. The brokers essentially vouched for the integrity of their customers without doing real due diligence. The firms might be thinly capitalized or controlled by criminals, for all the regulators knew.

"Many of these arrangements do not have any pre-trade risk controls since these clients demand the fastest speed. Due to the fully electronic nature of the equity markets today, one keypunch error could wreak havoc. Nothing would be able to stop a market destroying order once the button was pressed," they wrote.

Once again, few people paid attention. It sounded shrill and farfetched, like the Y2K scare that had predicted a meltdown of computers worldwide on January 1, 2000 because twentieth-century computer programs would not recognize dates after 1999. This apathy about their white paper would begin to evaporate days later as a result of a quasi-comic confluence of events involving the FBI, short-tempered Wall Street bankers, a Bulgarian-born blogger, and a preening U.S. senator.

Endnotes

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