Book Review

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Following the collapse of the financial markets, word spread among traders that firms with high-frequency trading (HFT) systems had earned an estimated $20 billion during the market correction (Salmon 2009). This shocking revelation left many to question whether these largely unregulated computer traders contributed to the massive stock market decline. As Michael Durbin points out in the preface to All About High-Frequency Trading, there was powerful circumstantial evidence that HFT systems had become very influential players in the financial markets. For example, from 2005 to 2009, average daily trading volumes of NYSE-listed stocks tripled, the average number of daily trades increased eightfold, and the average trade execution dropped from more than ten seconds to less than one second. Humans were not capable of executing trades that fast.

All About High-Frequency Trading offers insights into this world of computer-executed electronic trades which take place at increasingly faster speeds, and provides the reader with a discussion of how to develop an HFT system. A typical HFT system is comprised of numerous computer servers running incredibly efficient software and listening to market data in search of profitable trading opportunities. The book’s heavy emphasis on fast computing and networking capabilities provides a natural teaching supplement to an accounting information systems (AIS) course. Additionally, Durbin’s discussion of basic trading terminology, the procedures of financial exchanges, and specific trading strategies gives his book a broader appeal to other business disciplines (e.g., finance). One criticism of the book is that it is rather technical in the introductory chapters (particularly Chapter 3), and much of the terminology used in these chapters is not put in the HFT context until later in the text. Consequently, I suggest that AIS instructors have the students proceed to Chapters 4 and 5, and then go back to Chapters 2 and 3.

SUMMARY OF THE BOOK

Durbin begins his book by describing how he first entered the world of HFT. He went to work for the Citadel Investment group in 2003 to help them develop an automated trading system for the U.S. Equity Markets. In addition to submitting millions of quotes daily through its “market making” component, this system would also use its “electronic eye” component to scan all market quotations and orders for inefficiencies that it could arbitrage away. According to Durbin, in 2005, the Citadel’s HFT system was responsible for more than 10 percent of all options trading in the United States. By 2008, their market shares had grown to a staggering 30 percent.

Before diving into the details of HFT systems, Durbin provides a comprehensive overview of trading in U.S. Equity markets in Chapters 2 and 3. He starts by defining stocks, options, and futures, as well as related securities (i.e., exchange traded funds). He then describes how various exchanges facilitate the purchase and sale of these securities, including the physical locations of the
exchanges, as well as the order book. He discusses numerous trading strategies that HFT system architects should be aware of before they develop their own system. For example, he explains basic investor trading strategies (market orders and limit orders on the bid/ask spread [i.e., “joining the market”]), as well as more advanced investor strategies (reserve orders, iceberg orders, and time slicing).

In Chapter 4, Durbin explains a few of the critical issues that HFT systems developers must consider when creating a successful system. Due to the paramount importance of speed in an HFT system, Durbin attributes a considerable amount of space discussing various techniques for maximizing speed. Although his focus is on the technical hardware and software necessary to construct a high-speed HFT system, Durbin is careful to stress that the most important factor in the construction and implementation of a successful HFT system is the team of people assembled to run it. Once a team is formed, Durbin recommends that the architect build, rather than buy, many of the components of the HFT system. This part of the book provides instructors with a practical application of systems analysis and design that could be useful for AIS students. Durbin’s programming advice for maximizing speed by designing a system that allows the user to change one component, or repair a component, or add an entirely new component without compromising the entire HFT system, provides a wonderful example of system planning and feasibility analysis. His book details how this can be achieved through a delicate balance of modularity and coupling, where there are enough modules so that no one particular module is overloaded, but not so many modules that the messaging system between modules gets bogged down.

Once the programming structure is in place, the next step is to use the most efficient software possible. Durbin’s insight into how to achieve greater efficiency could be used by instructors to better explain electronic data processing systems in the classroom. To improve efficiency, firms must not only devote a significant amount of time to continuously improving the efficiency of trading algorithms, but also carefully choose which programming language to use. Other concepts that the architect should consider in maximizing HFT system speed involve choosing an optimal sub-pub messaging system between components, processing off the core through TCP/IP offload engines, and parallel processing through the use of multi-core processors to simultaneous tasks (this tip can be very effective for quickly calculating option prices for multiple securities). Durbin also suggests that most aggressive HFT firms arrange for direct market data feeds from every exchange on which they trade, and collocate their server in the same physical location as the exchange server to shave milliseconds off trade executions.

Finally, in Chapter 4, Durbin notes that successful HFT systems will have carefully constructed wide-area networks (WAN) so that the collocation sites can share data fast, as well as real-time monitoring so that problems can be uncovered in a timely fashion. From a research perspective, Durbin suggests that many developers resort to a trial and error approach when attempting to increase speed on the margin. This discussion blends well with those interested in computer-mediated communication research.

Durbin explains how a typical HFT system could be constructed in Chapter 5. This chapter represents a nice supplement when explaining systems planning in the classroom. Durbin’s hypothetical HFT is written in C++, runs on a custom distribution of Linux, installed on servers with multi-core processors, and broken up into the following five components: thinkers, listeners, pricers, traders, and managers. The goal is for these components to work together to achieve a low-latency loop. The thinkers take direction from humans and convert it into instructions for other components. The listeners take in market data (stock, option, and futures quotes, as well as news feeds) and publish it for the other components. The pricers take the information from the listeners and calculate new equity security prices in real time. The traders interact directly with the exchange for purposes of submitting orders and quotes, and are often custom written for each exchange. Finally, the managers control the work of the other components and maintain position data for each

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security. Typical manager components include: a fuse box to shut down the system in the event of a glitch, a trade log to keep track of every trade, a position manager to keep a running total of all positions in the HFT system, a risk manager to help limit losses, and a Profit and Loss calculator. The risk management aspects of the manager function discussed by Durbin could be used by instructors to help explain the importance of enterprise risk management or, more broadly, corporate governance. After providing the reader with a detailed description of the HFT, Durbin describes how all of the components would interact in a typical trading strategy. This example allows the reader to see the HFT in action.

Durbin concludes his book by summarizing the current HFT debate. Critics of HFT systems often cite unethical price manipulation, over-trading to earn rebates, rogue trading caused by coding errors (potentially behind the May 6, 2010, flash crash), the practice of placing fake customer orders, and the controversial flash orders (i.e., when exchanges publish buy/sell orders that are not within the bid/ask spread to give market makers a sneak peak at what people are willing to pay) to voice their opposition. The defenders of HFT argue that their practices foster tighter, deeper markets, which facilitates liquidity and benefits investors by allowing them to, presumably, sell at higher prices and buy at lower prices. Further, the arbitrage trading function of HFTs helps ensure price consistency among multiple exchanges.

**IMPLICATIONS AND CONCLUSIONS**

*All About High-Frequency Trading* offers insights into the techniques used by HFT system architects to develop viable electronic trading systems. In addition, it offers a comprehensive overview of the structure of the U.S. Equity Securities markets to provide the reader with the requisite background information to understand the strategies explored throughout the remainder of the book.

From a teaching perspective, the systems-related information presented in Chapters 4 and 5 could be used as a supplement in an undergraduate AIS course. Specifically, Durbin’s insights on how to improve communication speed between HFT components can be used to help students see how system planning and feasibility analysis is relevant. In addition, Durbin’s detailed discussion about how to build an HFT system provides students with a comprehensive example of systems analysis and design, and how effective enterprise risk management can help ensure that the system runs as intended. Finally, the level of trading information presented in Chapters 2 and 3 would provide a supplement to a graduate-level finance (investments) course.

From a research perspective, Durbin’s discussion of how information flows through an HFT system would appeal to AIS research in the area of knowledge sharing in a computer-mediated environment, while the construction of HFT systems would appeal to the literature on systems analysis and design. The trading strategies used by HFT systems may also appeal to areas of economics-based research. For example, “over-traded” securities may provide new insights into the information conveyed by increased trading volumes.

**REFERENCES**


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