
Trading and Electronic Markets: What Investment Professionals Need to Know (a summary)

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Many financial problems involve trading in organized markets. Solving these problems successfully requires that traders effectively execute orders while appropriately controlling their transaction costs. This book provides buy-side financial analysts, investment managers, and investment sponsors with the tools to understand and manage recent innovations in trading that involve the automation of both trading systems and trading strategies.

The Implications of the Zero-Sum Game

Investing is a zero-sum game when performance is measured relative to the value-weighted market index. If some investors beat the market, others must underperform. Because investors incur transaction costs when they trade, investing—especially active investing—is a negative-sum game. Controlling transaction costs thus is essential for investors who seek to beat the market or their peers.

The observation that trading is a zero-sum game (or a negative-sum game when transaction costs are included) has an extremely important implication for active investment managers who base their trading decisions on financial analyses. Those managers who regularly underperform the market do not do so because they systematically choose the wrong securities to hold in their portfolios. Being systematically wrong requires as much skill as being systematically right. Rather, managers who regularly underperform lose simply because they trade.

In a zero-sum game, well-informed traders cannot profit from trading with one another. Active investment managers can profit only if other traders are willing to trade with them.

Understanding the reasons why people trade thus can help investment managers and risk managers improve their investment discipline. The most successful managers trade only when they expect that trading will advance their mission, which requires that they understand both why they are trading and why others may lose to them.

The text identifies various reasons for trading. Many people trade because they obtain some benefit besides profits when trading. Investors and borrowers move money forward or backward in time, risk managers transfer risk to others, and gamblers obtain excitement and stories to tell from their trading activities. In contrast, profit-motivated traders trade only because they expect to profit. They profit from analyzing fundamental information better than others do, from obtaining new information before others do, from dealing with other traders, or from anticipating the orders that other traders have submitted or will submit.

Investment managers who trade on information need to know when they can expect to profit. Well-informed traders can profit only when price is different from fundamental value. Since prices generally are close to fundamental values, informed traders can profit only when (1) prices change and fundamental values do not or (2) fundamental values change and prices do not. The first case occurs when uninformed traders cause prices to change. The traders most likely to recognize these opportunities are analysts who estimate fundamental values. The second case occurs when events cause fundamental values to change. Traders who collect news are the first to learn about such events.

The competition among informed traders seeking trading profits causes prices to be informative. As prices become more informative, the opportunities for further speculative trading profits decrease. The number of informed traders and their profits thus depend on the costs of acquiring and processing information and on the total liquidity available to informed traders.

Prices can never fully incorporate all available information. If they did, informed traders would not invest in information that is costly to acquire; if informed traders did not collect that information and trade on it, prices would not be informative. Active investment management thus must be profitable—but only for those traders who can most efficiently collect and process information and only in markets where other traders are willing to trade with them.

Uninformed traders lose on average to well-informed traders simply because they trade. If they trade directly with informed traders, they are on the wrong side of the market. If they trade on the same side, their orders tend not to execute (and they wish that they did) or their trades are very expensive. And if they trade through dealers, they lose because dealers widen their bid and ask prices to recover from all traders what they lose to informed traders.

For uninformed traders, the single most important determinant of their overall transaction costs is the decision to trade. Uninformed traders who do not trade do not lose to informed traders. This observation explains why passive buy-and-hold investment strategies, such as indexing, have grown so popular in recent years.

Transaction Cost Measurement and Management

Effective control of transaction costs requires that they be measured. Buy-side traders and the developers of algorithms measure transaction costs to

1. determine whether their brokers are working effectively on their behalf and to confirm that they are getting value for their brokerage commissions,
2. determine whether they should be trading more or less aggressively,
3. better understand whether they are competing with other traders who are trading on the same information,
4. inform their portfolio managers about liquidity conditions in various securities, and
5. design and fine-tune trading algorithms.

The text explains how analysts measure transaction costs and use them to improve their trading processes.

The best measure of implicit transaction costs (market impact) is the implementation shortfall method, which compares trade prices with prices that stood when the trades were first ordered. The VWAP (volume-weighted average price) method, which managers commonly use, has many problems.

Keeping track of the opportunity costs associated with trades ordered but not executed is very important because this information can help traders know when they should trade more aggressively. Effective two-way communication between portfolio managers and their buy-side traders is also very important to improving investment performance.

Electronic Trading

Trading at organized exchanges now depends critically on the automated electronic systems that exchanges and their trader clients use. Electronic trading systems arrange trades by matching orders submitted by buyers with those submitted by sellers. Many traders—especially dealers and arbitrageurs—use electronic systems to generate the orders that the exchanges process.

Innovative electronic trading systems—and the trading strategies that they facilitate—substantially decrease buy-side transaction costs. But some strategies that high-speed traders use to exploit other traders hurt large traders. Investors can protect themselves from losses to these parasitic traders through some simple trading strategies.

In comparison to floor-based trading systems, electronic order-matching systems enjoy many advantages. Most obviously, electronic systems are very

cheap to operate once built. They do exactly what they are programmed to do. They keep perfect audit trails. Electronic exchange systems that support hidden orders keep those orders perfectly hidden—unlike floor brokers, who may inadvertently or fraudulently reveal their clients' hidden orders to friends or confederates. Electronic order-matching systems do not get tired, call in sick, complain about their bonuses, or drop pizza crumbs into their keyboards. And they operate when bad weather or other events can prevent workers from convening on a floor. These efficiencies have allowed electronic trading systems to displace floor-based trading systems in almost all instruments for which order-driven markets are viable.

The proliferation of exchange electronic trading systems has led to the adoption of electronic trading strategies by proprietary traders, buy-side traders, and the electronic brokers that serve them. Proprietary traders include dealers, arbitrageurs, and various types of front runners—all of whom are profit-motivated traders. In contrast, buy-side traders trade to fill orders for investment and risk managers who use the markets to establish positions from which they derive various utilitarian and profit-motivated benefits. Electronic brokers serve both types of traders.

Electronic trading strategies are most profitable or effective when they act on new information quickly. Accordingly, proprietary traders and electronic brokers build automated trading systems that are extremely fast. These systems often can receive and process information and place a trading instruction at an exchange in less than a few milliseconds and sometimes much faster.

High-frequency traders (HFTs) generally complete round trips composed of a purchase followed by a sale (or vice versa) within a minute and often as quickly as a few milliseconds. During the course of a day, they may trade in and out of an actively traded security or contract more than a thousand times but usually only in small sizes. The most common high-frequency-trading strategies are dealing and arbitrage.

Low-latency traders include traders who trade on electronic news feeds and certain parasitic traders. When trying to open or close positions, they often need to send or cancel orders very quickly in response to new information, but they may hold their positions for as long as a day and sometimes longer.

Electronic news traders subscribe to high-speed electronic news feeds that report news releases from corporations, governments, and other aggregators of information. News traders profit when they can trade with stale orders that do not yet reflect the new information.

Most large buy-side traders use electronic order management systems (OMSs) to manage their trading. These systems keep track of the orders that

portfolio managers want filled, which orders have been sent out to be filled, and which fills have already been obtained.

Buy-side traders often employ electronic brokers to arrange their trades. In addition to supporting standard order instructions, such as limit or market orders, these brokers often provide a full suite of advanced orders, trading tactics, and algorithms. The brokers' electronic trading systems generally manage these advanced orders, tactics, and algorithms, but in some cases, exchanges may perform these functions.

A *trading tactic* is a plan for executing a simple function that generally involves the submission of multiple orders. A pegged hidden sell order set to always float one tick below the best offer is an example of a common trading tactic.

Algorithms are programmed strategies for filling orders. Algorithms may use combinations or sequences of simple orders, advanced orders, or trading tactics to achieve their objectives. Many algorithms break up large orders and submit the pieces to various markets over time to make it difficult for other traders to infer that a trader is trying to fill a large order. Good algorithms generally obtain low-cost executions by knowing when and where to offer liquidity via limit orders, when to use market orders, and how to most effectively keep the market from becoming aware of their efforts. They reduce the price impacts of large trades.

Electronic traders use many methods to improve their trading. They may hide their orders, use very small orders to discover hidden orders, and repeatedly cancel and resubmit their orders. They often train their systems using machine-learning methods.

Electronic traders must be fast to trade effectively, regardless of whether they are proprietary traders or buy-side traders. Electronic traders have three needs for speed: They must (1) take a trading opportunity before they lose it to others, (2) submit orders before others to be first in line, and (3) cancel orders they no longer want to fill before someone else fills them.

Electronic traders do not need to be fast to trade effectively—they just need to be *faster* than their competitors. The reason electronic trading systems are now so incredibly fast is that electronic traders have been trying for years to be faster than their competitors. To trade quickly, electronic traders buy high-speed data links, use very fast computers that they locate next to exchange servers, write highly efficient code, and often preplan their responses to new information.

Computers have come to dominate the implementation of many trading strategies because they are so efficient and so unlike human traders. They can continuously watch and respond to information from many instruments and

many markets simultaneously. Their responses to new information are extraordinarily fast. They do only what they are instructed to do, and they are not forgetful. The efficiency of electronic trading strategies has led to their widespread adoption by proprietary traders, buy-side traders, and brokers—and to substantial drops in transaction costs for both retail and institutional traders.

Practitioner and Regulatory Issues Associated with Fast Electronic Markets

The text concludes with extensive discussions about nine issues associated with fast electronic markets that concern practitioners and regulators.

1. Does speed help capital formation? No one makes capital allocation decisions in milliseconds, but the liquidity offered in fast secondary markets makes new issues more attractive.
2. The competition among HFTs has created an arms race in which each trader tries to be faster than the next. The high costs of HFT technologies make entry quite costly and suggest that successful incumbents may someday be protected from further competition.
3. Many traders believe that high-speed markets are unfair because electronic traders can see and react to more information—and sooner—than can manual traders. Whether this advantage is fair depends on the values of the observer. Some traders have always had better access to the markets than others.
4. Electronic trading has created systemic risks that concern regulators and practitioners. Developers must be extremely careful when instructing their machines to ensure that the machines do only what the developers want and not what they do not expect. Traders, brokers, and exchanges must all surveil order flows to ensure that they are appropriate.
5. Exchanges earn substantial profits from selling high-speed proprietary data feeds to HFTs, often to the disadvantage of traders with slower access. These sales allow exchanges to extract some of the profits that HFTs make from orders that other traders send to exchanges.
6. In many countries, people can trade stocks away from established exchanges in dark pools and through internalizing dealers. Off-exchange trading concerns many practitioners and regulators because it fragments trading, making it more difficult to find liquidity. If it grows too large, it could imperil price formation.

7. *Maker-taker pricing* is a pricing model that some electronic exchanges use to price their order-matching services. Takers of liquidity pay high exchange fees that subsidize rebates to liquidity makers. This model and its related converse, taker-maker pricing, have created substantial agency problems. Together, they have decreased the tick size to one-half cent for sophisticated traders in US equity markets.
8. Some parasitic electronic trading strategies allow clever traders to exploit public investors, especially those trading large orders. Several changes in market structure can protect these investors, who can also take actions to protect themselves.
9. Some exchanges have created special order types that appeal to HFTs and that sometimes disadvantage slower traders. Traders need to be aware of these orders when considering where to route their orders.

Conclusion and Appendix

The text concludes with some suggestions for simple changes in bond market structure that could substantially decrease transaction costs. Investors would be much better off if they could see a national best bid or offer consolidated from various electronic bond-trading systems, as they can for equities. They also would benefit if brokers allowed them to place limit orders on such systems.

The book concludes with an appendix that identifies the causes of the Flash Crash of 2010 and reports what regulators and traders have done to reduce the probability and magnitude of recurrences.

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The complete book can be found at
<http://www.cfapubs.org/toc/rf/2015/2015/4>.



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