

## Chapter 8.2

# Financial Markets in the Internet Age

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### ABSTRACT

The chapter reviews how the financial markets historically have been affected by new technologies and shows that, time and again, technological advances have impacted the very workflow of the financial market processes including the available financial instruments. Present technologies are discussed leading to a framework for how they form the basis for building intelligent agent systems. An overview of multi-agent systems is provided followed by several examples of multi-agent systems supporting investors in financial markets.

### INTRODUCTION

The age of networked intelligence along with the Internet has played a major role in formulating the financial markets of today. Dramatically increased distribution of all forms of information and near instantaneous transactions across the globe have created the opportunity for radically

greater access to financial markets for all interested participants. This has led to new types of markets with greater global access to financial markets, and has allowed entirely new financial products to be offered.

Throughout history, technology has driven advances in the efficiency and liquidity of financial markets. This has led to wave after wave of innovation in the types of securities traded, the “reach” of the market participants, the distribution of news and information, and the type of market exchange auction. This chapter will show that the financial markets have been heavily influenced by Internet technology.

The chapter provides a background of how financial markets have functioned throughout history. Also, it shows that, time and again, technological advances have impacted the very workflow of the financial market processes including the availability of information, the potential for ever increasing participation, the timeliness of executing transactions and the overall increase in the efficiency and liquidity of the financial markets. As the main topic, the chapter shows

the important results of Internet technologies on the financial markets in just seven years since the Internet became a commercial resource and a rapid trend toward more intelligent systems for automated transaction processing, order execution, and information filtering.

Financial markets exist to facilitate the buying and selling of financial instruments. These have traditionally consisted of stocks (equity ownership stake), options (a contract to buy or sell a financial instrument by a set date at a set price), bonds (debt obligations) and futures contracts for commodities and financial instruments. Financial markets are made up of many players, both active and passive. These include issuers of financial instruments (initial sellers), secondary buyers and sellers of financial instruments, the providers of the marketplace (exchanges and auctions), the regulators and information providers. Each of these groups can be further subdivided. For example, buyers and sellers may consist of large institutions, smaller financial organizations, professional traders and individual investors.

Technology-driven changes to the infrastructure of the financial markets have resulted in a complex, fast changing environment for the investor whether professional or amateur. Examples of such changes include instant availability of wide-ranging information, standards for financial transaction formats, online financial transaction servers ready to receive transactions over the Internet, and ever more complex hybrid financial instruments with numerous trading and investment strategies. To manage one's investments, there is a trend toward the use of a new form of expert system known as intelligent agents. By building a collection of the software intelligent agents with varying roles and specialties, it is possible to develop a coordinated team of these software experts to respond to the dynamics of the financial markets and provide the investor with balanced guidance in the management of portfolios.

This chapter focuses on the common stock

of corporations as the financial instrument for examining the impact of technology on the financial markets. For clarity regarding the availability of information we will focus on two categories — information about the companies whose stock is being bought and sold and the information about the current price of a stock that is referred to as price discovery. This distinction will help to pinpoint which type of information availability various technologies have impacted.

## **HISTORY OF FINANCIAL MARKETS AND TECHNOLOGY**

This section considers the history of financial markets from the early origins. Focus is on the more recent history of the U.S. markets including the NYSE, AMEX and NASDAQ.

### **Early Financial Markets**

Buelens and Cuyvers (2000) chronicle the history of financial markets in Europe. They note many European “financial capitals” throughout time, most of which were located in Italy until the 15<sup>th</sup> century. These include Rome (100 AD), Genoa and Venice (11<sup>th</sup> and 12<sup>th</sup> centuries), Siena (12<sup>th</sup> and 13<sup>th</sup> centuries), and Florence (14<sup>th</sup> century). As the markets of Italy went into decline in the 15<sup>th</sup> century, the financial centers moved to Antwerp, Belgium (1531) and Amsterdam (1611). For the most part, these early “financial capitals” did not incorporate formal exchanges. Antwerp is noted as the place where the stock market was born. Many foreign merchants moved to Antwerp as other financial centers were in decline. The driving technology of the time tended to be access points to trade routes which were typically port cities. The key port cities with strategic access to trade routes and financial capital were essentially the “networks” of their day. In 1531, the city of Antwerp built a meeting place for merchants, which became the first building in the world designed as

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