By Nicholas Economides

Professor of Economics, Stern School of Business, New York University, and Visiting Professor, Stanford University

The impact of the Internet on financial markets

The editor asked to me write a short paper for the inaugural issue of the journal. I thought that it would be most fitting to write on the truly fundamental transformation of financial markets brought by the most important network of the last fifty years, the Internet.

Technology always had an impact on financial markets. Often, as in the case of the telegraph, it was the use of new technology in the financial realm that necessitated the installation of the new network. Moreover, frequently, the introduction of new technology had tremendous and sometimes unexpected effects on the structure of financial markets. For example, many historians explain the eventual primacy of the New York Stock Exchange over the Philadelphia Stock Exchange on the liquidity New York attracted from orders collected over the telegraph. In the absence of the telegraph, both exchanges could survive as equals. But once the telegraph was installed, it led to the supremacy of one of the two. In another example, in recent years, another technological change, the availability of mathematical formulas for the pricing of options, spurred the mushrooming of the derivatives markets. Thus, a new global network is expected to have an impact on financial markets. In fact, the Internet, now in its eighth year as a commercial network, already has had an impact, and is expected to have a truly transforming influence on financial markets as it matures.

Definitions

The Internet is a multi-purpose, multi-point digital interactive worldwide telecommunications network. By its nature, the Internet facilitates multi-point information flows and all the processes that are based on information flows. Financial intermediation and financial exchanges are based on the exchange of information. In fact, at present, a transaction of exchange of any financial instruments, including cash, equities, bonds, and their derivatives, is just a recording of altered digital information.

Direct impact Of The Internet

The impact of the Internet on financial markets is multifaceted and profound. One sees immediately that, first, the Internet facilitates information flows. This includes (i) information used to evaluate actions, such as analyst's reports; and (ii) software and interfaces that facilitate information exchange, dissemination, and evaluation. Second, the Internet facilitates interaction among economic agents. This includes (i) the exchange of financial instruments and physical commodities, as well as of contingent claims on these; (ii) the creation and enhancement of markets; and (iii) multi-party live discussion of financial markets. Third, the Internet facilitates more direct access of economic agents to markets. And, since the Internet is truly a global network, all of the above can be done across national borders, as well as state and local jurisdictions.

The Impact of the Internet on financial markets

The Internet's impact as an enhancement of existing processes

Many, if not most, of the effects of the Internet are enhancements of existing processes and markets. However, even for those, often the extent of improvement can be so significant as to have profound consequences for market structure. A typical example of an improvement of an existing process is the elimination of the middleman (broker) in sending orders to financial markets. Before the Internet, this was possible by using the telephone. But the Internet allows it to be done much more efficiently through a direct connection to an electronic system. And, the Internet brings a wide availability of information both about current prices and past performance as well as various tools to analyze it.

This has been called the "democratization of trading process." Tools that were available only in trading rooms now are very widely available. To the shrewd and wise trader, these are very valuable and level the playing field. For the foolish or the informed- but not-knowledgeable trader, the Internet makes it easier to lose money. Overall, it is worth noting that the wide availability of rapid action trading technology has increased market volatility.

In another interesting example of a drastic enhancement of an existing process, the Internet has created tremendous pressure on eliminating price discrimination based on geography or national borders, as well as in increasing price competition among providers of standardized goods. Toll-free calling and mail order had already created such pressures. But the Internet's ability to allow for the collection of pricing information from dozens of sellers reduces search costs immensely, intensifies price competition among different providers, and all but eliminates geographically-based price discrimination by the same provider.

The Internet's impact as a creator of new processes and interactions

The Internet also creates processes, goods, and interaction that were not possible before. For example, digital goods can be delivered over the Internet. Digital goods encompass a large variety of items ranging from printed information to general software goods to music, pictures, video, and movies in digitized form.

Such delivery can be faster, more efficient, and cheaper than traditional distribution. Moreover, content in digitized form is searchable for words and patterns, so it is arguably of enhanced value. An interesting example of distribution of digital goods on the Internet is Napster. By leveraging the dual nature of computers as clients and servers, as well as the geometric expansion of network effects, Napster has been extremely successful in facilitating peer-to-peer transfers of music among computer users. Irrespective of the legality of the transfers, it is evident that distribution of music over the Internet can be very efficient and may, over time, replace traditional distribution methods.

Another example of an interaction that is made possible by the Internet is multi-party, text-based chat functionality with the possible combination of interactive drawing and speaking. The creation of communities based on common interests and the possibility of rapid interaction among members of the community worldwide is a profound social and political change brought on by the Internet, although at this point its effect on financial markets is uncertain.

The Internet as a facilitator of a "winner-takes-most" world

The Internet, like most networks, tends to create a "winner-takes-most" world, where one firm has a lion's share of the activity in a market. A market structure of small, but equal, firms or small, but equal, market exchanges is less likely to survive in a post-Internet world. Small advantages tend to be magnified and to become more prominent as the Internet smoothes out flows and removes frictions that used to support early egalitarian market structures.

Markets with network effects lead to a "winner-takes-most" world

A market exhibits network effects (or network externalities) when the value to a buyer of an extra unit is higher when more

units are sold, everything else being equal. In a traditional network such as the Internet, network externalities arise because a typical subscriber can reach more subscribers in a larger network.

In a virtual network, network externalities arise because larger sales of component A induce larger availability of complementary components B1, ..., Bn, thereby increasing the value of component A.[1] The increased value of component A results in further positive feedback.

For example, the existence of an abundance of Windows-compatible applications increases the value of Windows. In a financial exchange market, the abundance of orders on both sides of the market, that is, the "thickness" or high liquidity of the market, decreases the variance of expected price and increases the payoff of traders. In turn, this brings extra liquidity to the market resulting in increasing volume inequality among financial exchanges.[2]

Economic theory and empirical observation have shown that markets with strong network effects, such as financial exchange markets and many others facilitated by the Internet, are "winner-take-most" markets when the product offerings of firms are differentiated.[3] That is, in these markets, there is extreme market share and profits inequality. The market share of the largest firm can easily be a multiple of the market share of the second largest. The second largest firm's market share can be a multiple of the market share of the third, and so on. This geometric sequence of market shares implies that, even for a small number n, the nth firm's market share is tiny.[4]

The Internet's impact on the liquidity of financial, business-to-business, and business-to-consumer exchanges

As a direct consequence of network externalities, high liquidity of a financial or other exchange increases the value of transactions in that exchange, brings in more orders, and further increases liquidity. This leads to the extreme inequality of size and profitability of exchanges and firms affected by market liquidity considerations as discussed above. Moreover, consumers are willing to pay more for the high liquidity exchange. Therefore, its profits can be a large multiple of profits of other exchanges. Similar inequality arising out of network externalities occurs in many other products and services.

Intensification of competition

In network markets, the addition of new competitors, say under conditions of free entry, does not change the market structure in any significant way once few firms are in operation. The addition of a fourth competitor to a triopoly hardly changes the market shares, prices, and profits of the three top competitors.[5] This is true even under conditions of free entry.

However, the fact that the natural equilibrium in network industries is winner-take-most with very significant market inequality does not imply that competition is weak. To the contrary, the competition race on which firm will create the top platform or be the top exchange, and reap most of the benefits is, in fact, very intense. Moreover, the network also has an expansionary effect as it typically makes it easier and cheaper to buy the good or service. Thus, the size of the market also expands.

In a way, it may seem paradoxical that there is intensification of competition combined with increasing market concentration, since that is not possible in non-network markets. But in network markets, and markets facilitated by the Internet, intensification of competition goes hand-in-hand with increasing market concentration.

Under intense competition, small competitors are forced to innovate to avoid being completely squeezed out of the market. In a very interesting example, radically breaking with tradition, the Island ECN decided to open its limit order book to the public so that it can attract more liquidity. Traditionally the limit order book was held close to the vest of the specialist or the exchange. So far, opening the limit order book to the public has been successful for Island, but it has not prompted the same action by larger competitors.

1 For a detailed discussion of these issues see Economides (1996).
2 See Economides (1993), (1994), Economides and Schwartz (1995).
3 See Economides and Flyer (1998).
4 Due to the natural extreme inequality in market shares and profits in such markets at any point in time, there should be no presumption that there were anti-competitive actions that were responsible for the creation of the market share inequality or the very high profitability of a top firm. Great inequality in sales and profits is the natural equilibrium in markets with network externalities and incompatible technical standards. No anti-competitive acts are necessary to create this inequality.
5 See Economides and Flyer (1998). Table 1, taken from this paper, shows market coverage and prices as the number of firms with incompatible platforms increases. Maximum potential sales was normalized to 1.

Table 1: Quantities, Market Coverage, And Prices Among Incompatible Platforms

Number of firms l	Sales of largest firm q1	Sales of second firm q2	Sales of third firm q3	Market coverage $\Sigma_{j=i}^{l} q_j$	Price of largest firm p1	Price of second firm p2	Price of third firm p3	Price of smallest firm pl
1	0.6666			0.6666	0.222222			2.222e-1
2	0.6357	0.2428		0.8785	0.172604	0.0294		2.948e-2
3	0.6340	0.2326	0.0888	0.9555	0.170007	0.0231	0.0035	3.508e-3
4	0.6339	0.2320	0.0851	0.9837	0.169881	0.0227	0.0030	4.533e-4
5	0.6339	0.2320	0.0849	0.9940	0.169873	0.0227	0.0030	7.086e-5
6	0.6339	0.2320	0.0849	0.9999	0.169873	0.0227	0.0030	9.88e-11
7	0.6339	0.2320	0.0849	0.9999	0.169873	0.0227	0.0030	0

Note that the addition of the fourth firm onward makes practically no difference in the sales and prices of the top three firms. Inequality of profits is even more pronounced.

Disintermediation and standardization

As mentioned earlier, one of the direct effects of the Internet is the elimination of the middleman. When brokers that used to intermediate between customers and markets are eliminated and orders go directly to market, there are two important consequences. First, the specialized information that was available from brokers exclusively to their large clients is no longer available just to large clients. Large clients typically lose an advantage. Second, the products offered in markets tend to be standardized, and this increases liquidity further. Moreover, often the existence of the network brings together two markets of similar products that used to be traded under different specifications, which now become a single market of higher liquidity and increased standardization.

Changing legal norms

The law that governs the Internet is, to say the least, uncertain. There are crucial unanswered questions on intellectual property law and contract law, as well as many issues of transnational application of laws. The global nature of the Internet brings to the fore a number of conflicts in business law, as well as of intellectual property and privacy laws of various countries. Moreover, by its nature, the Internet has created new products that span borders. How national and international laws will deal with them is uncertain.

Security And Privacy

The Internet was created as a basic network of low security on top of which more sophisticated secure communication can be established. The Internet was intentionally originally created to effect only loose integration among the computers it interconnected, which were running various operating systems. In its present form, the Internet allows easy unauthorized access to proprietary user data even for sophisticated users who take precautions.

Moreover, the vast majority of Internet users are totally unaware of the security threat that the Internet poses on their private information. By its nature, communication is two-way; in the absence of sophisticated protocols to block access to private data and to encrypt transmitted data, Internet communication remains very insecure.

Many firms collect elaborate information about activities of individuals on the Internet, expecting to use it to target adver-

tisements and prices to these individuals. In principle, individualized prices can be used to extract more surplus as the particular individual reveals through past behavior his/her willingness to pay for a good. In this way, individualized prices can eliminate the benefits of mass markets to consumers. Similarly, individualized advertisements (or individualized sequences of ads on the web) can, in principle, be targeted to have the biggest impact based on past behavior. There is not enough evidence yet to show that either individualized pricing or individualized ads have been successful on the Internet, but they may become successful in the future.

Even if the business case for collecting vast amounts of information on behavior on the Internet is not yet proven, it has raised significant privacy concerns. Information on activities that most individuals consider private (such as reading a particular page of a newspaper on the Internet or monitoring trading activity of a particular stock) may also be the property of various vendors (for example owners of web servers) that facilitate this activity. In the United States, people are used to the high legal protection of privacy of telephone conversations. Such a high standard of privacy has not been established for electronic mail and other activities on the Internet. The conflict over privacy is looming large in cyberspace law.

Overflow of information

The Internet has been extremely successful in facilitating information flows. Both consumers and managers are overwhelmed by the abundance of information. Both groups are unable to take full advantage of the information that flows to them every minute.

The need for information filtering is critical. The most needed tools in the upcoming puberty of the Internet will be information filtering tools and interfaces, such as search engines and hierarchical classification systems. In the absence of such efficient tools, both consumers and managers will fall back to brand names and rules of thumb to select useful information. If in the present Internet expansion phase content is king, its next phase will likely be ruled by information filtering and interfaces.

Conclusion: expect the unexpected

This short article discusses some important consequences of the emergence of the Internet as a global communications network. The Internet facilitation of information flows smoothes competitive frictions, intensifies competition, and promotes a winner-takes-most world.

The Internet threatens firms, markets, processes, systems, exchanges, and supply and distribution mechanisms that have this far been protected from global and intense competition behind national borders, regulatory rules, or geographic location. The Internet brings financial markets even more forcefully into a regime of intense competition and very significant inequality: a winner-takes-most world with a very intense race for the winner and with significant benefits for market participants.

The Internet has been full of surprises. These include

- its very rapid commercialization and expansion,
- the emergence of the Internet browser as a must-have "killer" application in 1994-5,
- the world-wide fast expansion in the use of electronic mail,
- the huge success of live text-based multi-party chat, and
- the emergence of Napster as 6% of all Internet traffic in the fourth quarter of 2000, among others.

The nature of the Internet is such that it holds a tremendous promise of new processes, goods, and services. Thus, despite the careful analysis above, I would venture to say that the Internet application and use that would become the most prominent in the next ten years is likely not yet conceived and its impact is unanticipated. On the Internet, expect the unexpected, and you will likely be pleasantly surprised!

References

- Economides, Nicholas (1993), "Network Economics with Application to Finance," Financial Markets, Institutions & Instruments , vol. 2, no. 5, pp. 89-97, http://www.stern.nyu.edu/fmii93.pdf .
- Economides, Nicholas, (1994), "How to Enhance Market Liquidity," in Robert A. Schwartz (ed.) Global Equity Markets, Irwin Professional. New York: 1994, http://www.stern.nyu.edu/how.pdf .
- Economides, Nicholas (1996), "The Economics of Networks," International Journal of Industrial Organization, vol. 14, no. 2, pp. 675-699, http://www.stern.nyu.edu/networks/top.html .
- Economides, Nicholas, and Fredrick Flyer (1998), "Compatibility and Market Structure for Network Goods," Discussion Paper EC-98-02, Stern School of Business, N.Y.U., http://www.stern.nyu.edu/98-02.pdf .
- Economides, Nicholas and Robert A. Schwartz, (1995), "Electronic Call Market Trading," Journal of Portfolio Management , vol. 21, no. 3 (Spring 1995), pp. 10-18, http://www.stern.nyu.edu/93-19.pdf .