

## Commentary: Technology, Information Production, and Market Efficiency

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I am pleased to participate in this symposium on the information economy. My colleagues in Kansas City deserve thanks for again having arranged a stimulating program. I will begin by discussing some issues that relate directly to the paper by D'Avolio, Gildor, and Shleifer. I will then offer some broader comments on the actual or potential effects of information technology in markets for financial services.

This paper fits into the large literature on the economics of imperfect information. This line of research has generated important insights concerning economic behavior and the functioning of markets, showing, in particular, that imperfect information can lead to outcomes that are distinctly less favorable than those under complete information. Andrei Shleifer (with many co-authors) has been a leading contributor to this field.

The current paper argues that advances in information and communication technology have improved the functioning of financial markets in many ways, but this technology also has a dark side that may harm market efficiency. This concern centers on the stock market and reflects the following argument. Improvements in information technology—most notably, the rapid growth of the Internet—have made participating in the market much easier and cheaper and, as a result,

the market has drawn in many new and unsophisticated investors. These “noise traders” cannot differentiate between accurate and distorted information about a given company. Thus, company managers see greater opportunity to boost their firm’s stock price by fooling investors through the release of distorted information—and have a strong incentive to do so because of the shift toward stock-based compensation and the widespread use of equity financing in the “new economy.” In the end, according to the paper, more information is available, but its quality has deteriorated, which reduces the benefit from information technology for market efficiency.

Because the incentive to produce distorted information is so strong, the authors doubt that market mechanisms alone can correct the problem. They advocate a two-pronged strategy of enhanced disclosure requirements and investor education to improve market efficiency. These recommendations are very sensible. The emphasis on disclosure has long been a cornerstone of the regulatory framework in the United States, and it lies behind recent initiatives at the SEC to combat what the commission views as a variety of conflicts of interest that threaten the integrity of our financial markets. The authors’ other recommendation—greater education of investors—is also important, especially given the broadening participation in financial markets. The Federal Reserve, along with other government agencies, is working to promote financial literacy in several ways—by issuing regulations that make comparing financial products easier, by producing educational materials for the public, and by supporting private-sector initiatives, such as programs that design and disseminate course materials for use in schools.

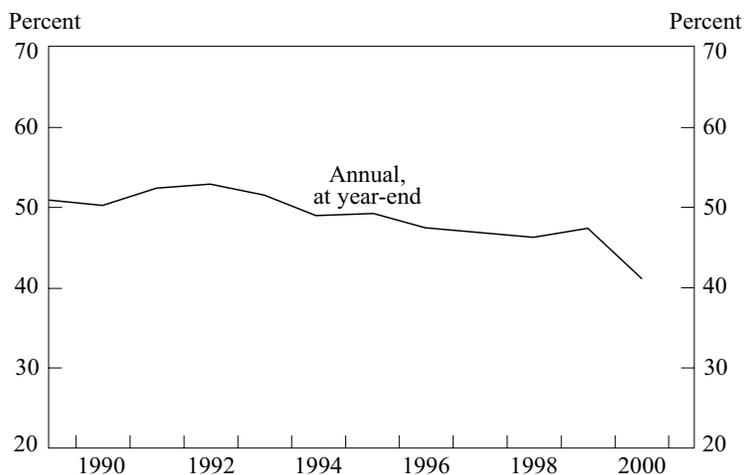
Although I certainly concur with the policy recommendations in the paper, I have some suggestions for tightening the analysis that lies behind those recommendations. For example, the paper implies that financial disclosure is generally weaker than in the past, and uses the media focus on pro forma accounting as one proof of the increasing weakness of financial disclosure. Increases in pro forma disclosures do not necessarily imply that misleading information is always being disclosed. While the authors demonstrate that, in a small number of firms, earnings from pro forma numbers are high relative to GAAP

earnings, it is not clear from the paper how severe a problem exists with regard to these disclosures. Similarly, while the paper attempts to show that earnings management can fool the market, virtually all the evidence is based on data from the 1970s, 1980s, and early 1990s, and, thus, it may not be relevant for the later years. Moreover, the analysis of more recent effects of earnings distortions tends to be loose. For example, the paper argues that the high turnover of shares in option-intensive companies may indicate that their shareholders are relatively unsophisticated—on the thought that the omission of option-related costs from GAAP earnings overstates the firm's true income and that uninformed investors trade heavily on this noise-ridden news. Perhaps. But the paper ignores other plausible explanations for the high turnover that may be unrelated to the sophistication of shareholders. One such explanation is that option-intensive firms are concentrated in the high-tech sector, where the flow of news and, hence, trading opportunities are greater than elsewhere in the economy.

My second suggestion is that the authors be more careful about asserting that information technology has greatly expanded the presence of uninformed investors in the equity market. Based on my reading of the available data, this occurrence seems far from clear, and I would like to spend a couple minutes indicating why.

Let's begin by looking at the aggregate data on household equity holdings from the Federal Reserve's flow of funds accounts.<sup>1</sup> These data include direct holdings by households, along with the various forms of indirect equity holding that involve professional management (such as investing through mutual funds). If uninformed individuals have played a growing and direct role in the equity market, as the paper argues, we might expect to see that direct holdings by households have become a larger share of the total equities outstanding. However, as Chart 1 shows, we see just the opposite. This result may reflect the fact, as indicated in Chart 2, that during the past decade, households have been reducing the portion of their equities that they hold directly and have increasingly invested through mutual funds and variable annuities (which are essentially mutual funds combined with life insurance). That is, households have been handing over more and

**Chart 1**  
**Direct Equity Holdings of Households and Nonprofit Organizations as a Share of Total Equity Outstanding**

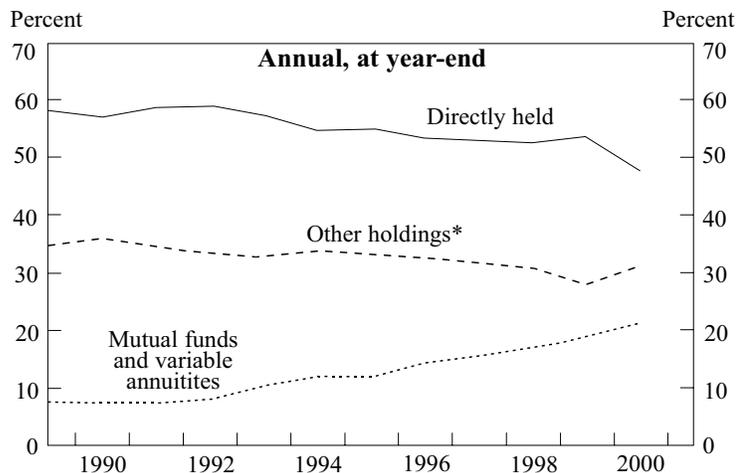


Source: Flow of Funds Accounts, Federal Reserve Board. Underlying data are from Table L.213 (Corporate Equities).

more of their equity portfolio to professional managers, who tend to be relatively well informed investors.

Household-level data on equity ownership paint a similar picture. It is true, as shown by Table 1 in the paper, that the number of U.S. households owning equity in some form has increased substantially. However, this table also shows that relatively little of this increase reflects broader direct ownership of equity. According to the Federal Reserve's Survey of Consumer Finances—which is the original data source for this table—only 19 percent of U.S. households owned individual stocks outside retirement accounts in 1998, barely above the 17 percent share in 1989. Like the aggregate data, these figures suggest that new investors have largely been putting their money in managed accounts.

**Chart 2**  
**Composition of Equity Holdings of Households**  
**and Nonprofit Organizations**



\*Includes bank personal trust and estates, private pension funds, and state and local government retirement funds.

Source: Flow of Funds Accounts, Federal Reserve Board. Underlying data are from Table B.100.e (Balance Sheet of Households and Nonprofit Organizations with Equity Detail).

What do we actually know about the new investors who have chosen to buy individual stocks in recent years? To my knowledge, the best source of such information is the “Equity Ownership in America” survey conducted in 1999 by the Investment Company Institute and the Securities Industry Association. The following table uses these data to compare the households that first purchased individual stocks after 1995 with the households whose first purchase was between 1990 and 1995.<sup>2</sup> I’ve split the sample at 1995 to assess whether the increased access to information and sharply lower trading costs since then have lured a cohort of clearly uninformed investors to the market.

**Table 1**  
**Selected Characteristics of Households that**  
**First Purchased Individual Stocks in the 1990s**  
**(Median 1998 values, except for variables calculated as percentages)**

Household Characteristics	First Purchase of Individual Stocks Outside Retirement Plans	
	1990-1995	After 1995
Age as of survey	42	41
College or postgraduate degree (percent)	63	52
Income	\$62,500	\$62,100
Financial assets as of survey	\$120,000	\$70,600
Number of individual stocks owned as of survey	3	2
Number of individual stock transactions in 1998	0	2
Willing to take more than average risk (percent)	44	55
Already had owned a stock mutual fund (percent)	33	41

Source: Unpublished tabulations provided by the Investment Company Institute, based on data from the "Equity Ownership in America" survey, jointly sponsored by the Investment Company Institute and the Securities Industry Association in 1999.

As the table shows, the two groups of investors appear to be similar in important respects. There is almost no difference in median age (early 40s) or income (about \$62,000) between the two groups, and investors in both groups tend to be well-educated, although the proportion with a college or postgraduate degree is a little lower for the new-investor group. With regard to their portfolios, the median investor in each group held only a few stocks and did little or no trading in 1998.<sup>3</sup> The new-investor group tended to have a higher self-assessed tolerance for risk, which might suggest that these investors gravitated more to technology stocks, which have had such a wild ride in recent years. However, it's also noteworthy that this group had more

exposure to the equity market through prior ownership of stock mutual funds than did investors who first purchased individual equities between 1990 and 1995.

These observable characteristics are, of course, only crude proxies for what we really want to measure—the degree of market knowledge and sophistication. Still, this survey provides little reason to believe that the new purchasers of individual stocks are especially likely to be duped by misleading information. The survey results, combined with the data indicating a shift toward institutional holdings of equity, cast doubt on the authors' assertion that information technology has "brought unsophisticated investors in droves to the stock market."

I would feel more comfortable with an alternative story, which goes as follows. The late 1990s were a period of optimism about the prospects for the U.S. economy, reflecting the pickup in productivity growth that was generated, in large part, by information technology. The resultant optimism about the economy's growth prospects was accompanied by a complacent attitude toward risk, fed by the long bull market dating back to the early 1980s. In this environment, many investors—not merely newcomers—purchased stock on the belief that business plans would become reality. The problem was not, for the most part, that new investors came to dominate the market but that many investors' attitude toward and perception of risk changed markedly. This explanation of recent events, which avoids the less-compelling aspects of the paper, appears to provide a stronger foundation for the authors' observations.

Given the panel topic of finance in the information age, I would now like to broaden the discussion by considering the actual or likely effects of technology on product attributes, pricing, and welfare in markets for other financial products. Since I read the paper to be focused mainly on the retail market, I shall continue in that vein.

For a number of retail financial products, new technologies have surely led to a general increase in welfare. New delivery technologies, such as the Internet, when combined with automated underwriting and

credit scoring, have given borrowers the opportunity to select from a broader set of providers of credit cards, mortgages, and even some types of small business loans—one of the most informationally opaque financial products. Competition has been enhanced as new technology makes it easier for non-banking institutions to offer these products and for out-of-market financial firms to compete with local financial institutions. In addition, securitization—which is also dependent on advances in information technology—has broadened the pool of lenders by allowing loan originators to package risk and then shift the risk to the parties best able to bear it.

At the same time, automated underwriting and credit scoring are improving the ability of lenders to evaluate and price credit risk, which has allowed credit to be extended to a wider range of borrowers. The rapid growth in the market for subprime mortgages is but one example of the broader access to credit. In effect, advances in information technology are helping to ameliorate a key imperfection in loan markets—namely, the outright denial of credit to relatively risky borrowers in the face of limited information. Recent events indicate that this product market is still evolving.

Automated underwriting and credit scoring are also substantially reducing the time and cost involved in making credit decisions. These savings contribute to the overall welfare improvement brought about by information technology. In the area of mortgage lending, for example, credit decisions today are routinely made in minutes rather than days and at much lower cost than a decade ago. Freddie Mac reports that the cost of originating mortgage loans processed through their system has fallen hundreds of dollars, helping to overcome one of the main barriers to homeownership—a lack of available savings to meet closing costs and downpayment requirements. Another benefit of automated underwriting is that credit decisions have become more transparent to both lenders and potential borrowers. Individuals can easily obtain their credit report and credit score, check whether any information in the report is incorrect, and learn how they can improve their credit standing.

In short, while the paper raises important concerns about equity markets, other areas of finance provide evidence that the information age has brought significant benefits in the form of increased transparency and competition, lower costs, more appropriate pricing, and broader access to credit.

Technology has also expanded the ways in which customers can conduct business with financial institutions, which has the potential to increase welfare. For example, the need for “in-person visits” has diminished as financial service providers have established centralized call centers to facilitate telephone banking, developed Web sites to allow Internet banking and software to permit PC banking, and promoted the use of direct deposits and pre-authorized debits. According to recent statistics, nearly 40 percent of all U.S. banks now provide some form of Web site through which they can communicate with customers, and almost 15 percent provide Web sites that can be used to conduct banking transactions. These numbers are growing rapidly. Of the banks with more than \$500 million in assets, nearly 50 percent now provide Web sites that can be used to conduct transactions. As the need for in-person visits declines, we might expect customers to broaden the geographic area within which they search for providers of financial services, leading to increased competition. Clearly, mortgages and credit cards already fall into this category of financial product.

Nonetheless, the implications of these newer delivery channels for banking products other than mortgages and credit cards seem more potential than real for the vast majority of bank retail customers. For example, despite the expanded options made available to customers as a result of technological advances, data collected in the Federal Reserve’s 1998 Survey of Consumer Finances and 1998 Survey of Small Business Finances indicate that households and small businesses still rely very heavily on in-person visits to carry out their financial transactions. Eighty-one percent of households surveyed in 1998 indicated that they used in-person visits as a means for conducting business with a financial institution, and 86 percent of small businesses indicated that during 1998 they relied upon such visits as their most common method for dealing with their primary financial institution.

Only 6 percent of households reported having used a computer to conduct business with a financial institution in 1998. Electronic access to financial institutions, no doubt, will continue to grow, and the next Federal Reserve Survey of Consumer Finances will provide valuable data about the changes through 2001. In the meantime, the facts I have highlighted and other data already available demonstrate that the use of electronic technologies for dealing with a financial institution deserves monitoring and continuing analysis and evaluation.

It is also worth noting that some technology-driven financial services have been commercial failures. In the world of payments, stored value cards are clearly technically viable but have yet to be widely used. The “cashless society” appears little closer today than when that phrase began to be used forty years ago. One likely explanation is that network effects are important in determining which innovations succeed or fail. In many retail payment experiments, too few consumers or merchants use a payment network or a new instrument for these technology-driven services to become economically viable.

In concluding, the paper has added a note of caution to the discussions of the potential welfare-improving elements of finance in the information age. Though I have taken exception to some of the detailed analysis in the paper and noted that other financial products likely have been enhanced by the emergence of new technologies, it is clear that technology has not changed all elements of the delivery of financial services or cured all market imperfections. Likewise, not all technology-derived financial products have achieved commercial success. The authors are to be commended for reinforcing these common-sense lessons. By doing so they give further impetus to both financial literacy and regulations that foster market experimentation and development while appropriately protecting those that need to be protected and responding to market imperfections when they appear.

## **Endnotes**

<sup>1</sup> Technically, these data combine nonprofit organizations with the household sector; however, the nonprofits are a small part of this aggregate, so we can safely regard the data as pertaining to households.

<sup>2</sup> This comparison is based on unpublished tabulations of the survey data that were kindly provided by the Investment Company Institute.

<sup>3</sup> However, there are some very active traders in both groups. The average number of stock trades for each group in 1998 was seven, far above the median.