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***Technology, Information Production,
and Market Efficiency***

by

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September 2001

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Cambridge, Massachusetts

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Technology, Information Production, and Market Efficiency

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Abstract

A well functioning securities market relies on the availability of accurate information, a broad base of investors who can process this information, legal protection of these investors' rights, and a liquid secondary market unencumbered by excessive transaction costs or constraints. When these conditions are satisfied, securities markets are likely to be broader and more efficient, with felicitous consequences for investment and resource allocation. This paper explores the effect of technological advances on these features of the market, emphasizing the incentives facing the producers of financial information.

¹ The authors are from Harvard University, Gildor Trading Company, and Harvard University respectively. They are grateful to their discussants for excellent comments and to the Federal Reserve Bank of Kansas City for its hospitality.

1. Introduction

In this paper, we discuss the effect of recent technological advances on the performance and efficiency of securities markets in the United States. We do not discuss the complementary question of the effect of financial development on the technological advance itself. In many respects, the technological advance has made it easier for new firms to go public and raise capital. The ease of going public also encourages other financial intermediaries crucial to the creation of new firms, such as the venture capitalists. There is, therefore, a kind of a virtuous circle. Here, however, we only look at the effect of technology on markets, and do not consider the other direction of causality.

There are four key requirements for a well functioning securities market: the availability of accurate information, the existence of a broad base of investors with access to this information, legal protection of these investors' rights, and a liquid secondary market unencumbered by excessive transaction costs or constraints.

All four of these requirements are important. Without the availability of accurate information, investors are unable to price securities, and might avoid securities markets altogether and simply invest in cash. Indeed, the available empirical evidence indicates that the quality of financial information, as measured by accounting standards, is an important determinant of stock market development. Absent a broad base of investors with access to information, markets also stagnate, as only a few specialists with superior knowledge would be willing to hold securities. Moreover, even in the presence of good and widely available information, financial markets are likely to stagnate when investor protection is weak. When the laws and regulations fail to protect investors, corporate insiders – whether managers or owners – tend to expropriate them in both emerging and developed economies (La Porta et al. 1997, 1998). Finally, it is becoming increasingly clear that investors value cheap trading and liquidity, and that their willingness to hold securities greatly expands as secondary trading opportunities improve.

Recent advances in information and communications technology have improved the state of securities markets in two, and possibly three, out of these four dimensions. First, technology allows information to be disseminated to a broad base of investors in real time and at low cost, thus expanding the universe of investors with access to information. Second, technology is also reducing the barriers to entry for providing financial services (e.g. market making and brokerage) and the resulting competition is driving down transaction costs. In addition to facing lower commissions, institutional and retail investors – aggressively pursued by competing intermediaries - now enjoy unprecedented ease of trade execution (via such innovations as online accounts). These changes are expanding market participation and facilitating dramatic increases in trading volume.

Third, one could argue – with less certainty -- that technology is indirectly improving the quality of investors’ legal rights. In some areas, technology in conjunction with new regulations is leveling the playing field for individual investors. A recent example is the SEC’s Regulation FD, which stems selective information disclosure by senior management. Management conference calls, previously limited to favored investment bank analysts and large fund managers, are now open to the general public via live Internet telecasts. On the other hand, improvements in technology have made it easier for corporate insiders and financial intermediaries to quickly trade on private information about customer order flow or company valuation. Moreover, many such trades often go unreported, especially when they take place in over the counter derivative markets. The overall effect of technological advance on investor rights remains unclear.

We are far more skeptical that the quality of information is keeping pace with the advances in other dimensions. The same rapid technological advances that are driving the marginal cost of information dissemination and trade execution to zero may also have implications for the incentives faced by information producers. As trading costs fall, the marginal investor may be becoming less experienced, less sophisticated, and less able to derive fundamental security values from raw

information. At the same time, the characteristics and business models of publicly traded companies are changing as the economy itself changes. Newly listed firms are far less likely to generate sufficient cash flows in the near term to internally finance the costs of expansion and compensation. A high current stock price becomes a vital cash substitute for these firms. These trends combine to create strong incentives for firms to distort the information they produce to the investor community.

We show that, indeed, there is evidence of deterioration in the quality of information that firms supply to investors. This deterioration may slow down the improvements in security markets that technological progress brings about. Moreover, private mechanisms such as litigation and information packaging by financial intermediaries are unlikely to solve the problem of information quality. Investor education and the regulation of information disclosure in particular may therefore play an important role in the development of securities markets in the foreseeable future.

2. Some Benefits of Technology of Securities Markets

In the introduction, we have outlined four dimensions of a well-functioning securities market. Along a number of these dimensions, markets benefit from advancing technology.

One obvious contribution of technology to the financial markets is cheap, real-time delivery of vast amounts of data. Any investor – institutional or retail – with an Internet connection now has 24-hour a day access to news, current and historical security prices, economic data, SEC filings (EDGAR), financial reporting data, analyst forecasts, investment advice, and the opinions of other investors (message boards, chat rooms). Further, web technology provides investors with continuous updates on the performance of their investment portfolios. The quantity of information at our fingertips is staggering when compared to just a decade ago.

	1989	1992	1995	1998
Direct Stock Holding	27	29.2	27.4	33.8
Direct or Mutual Fund Holding	31.5	35.3	38.6	48.5
Direct, Mutual, or Self-Directed Retirement Account	42.1	51.5	59.6	75.8
Direct, Mutual, Self-Directed, and Defined Contribution Retirement Account	52.3	61.4	69.3	84

Source: Shareownership 2000, NYSE

Paralleling the improvements in the dissemination of information, the number of participants in the U.S. securities markets has risen tremendously. Table 1, reproduced from NYSE's Shareownership 2000, reports a total of 84 million Americans participating in the equity market as of 1998, an increase of over 30 million since 1989. These are several drivers of this growth. The Baby Boomer cohort is preparing for retirement. In response to their demand, the styles and vehicles of investment, such as mutual, hedge, and exchange-traded funds, have proliferated. There are now more mutual funds in existence than traded securities. Employers are helping be expanding use of 401k plans and use of stock and option compensation.

Perhaps the clearest contribution of technology to market development is the reduction in trading costs, and the corresponding improvement in the liquidity of secondary markets. Advancing information and telecommunications technology lowers the barriers to entry for investors and the providers of financial services. Technology has catalyzed competition in the brokerage industry and the investor is capturing much of the benefit. Online accounts allow convenient and inexpensive access to the markets. Table 2 is also taken from Shareownership 2000.

Table 2	
Online Commissions	
Mar-96 \$	52.89
Jun-96 \$	50.20
Sep-96 \$	46.69
Dec-96 \$	34.65
Mar-97 \$	32.19
Jun-97 \$	31.66
Sep-97 \$	21.10
Dec-97 \$	15.95
Mar-98 \$	15.53
Jun-98 \$	15.75
Sep-98 \$	15.75
Dec-98 \$	15.75
Mar-99 \$	15.75

Source: Shareownership 2000, NYSE

As of July 2001, Ameritrade charges commissions of \$8 for online trades and Brokerage America charges nothing. The online brokers, like the discount brokers before them, are not only competing amongst themselves, they are placing increased pressure on full-service brokerage houses. There were 18 million on-line accounts in 2000 according to Shareownership 2000 (compared to 4, 6, and 10 million in 1997, 1998, and 1999). Barber and Odean (2001) cite a Forrester Research projection that by 2003, 9.7 million U.S. households will manage more than \$3 trillion online – nearly 19 percent of total retail investment assets – in 20.4 million on-line accounts. In 1998, online trading accounted for 37% of all retail trading volume in equities and options (US GAO, 2000). While still dominant in assets under control, the full service brokerages are being forced to innovate and market their services more aggressively. One consequence of this competition may be increased investor participation. Increased participation benefits the financial system by increasing the capital available for investment.

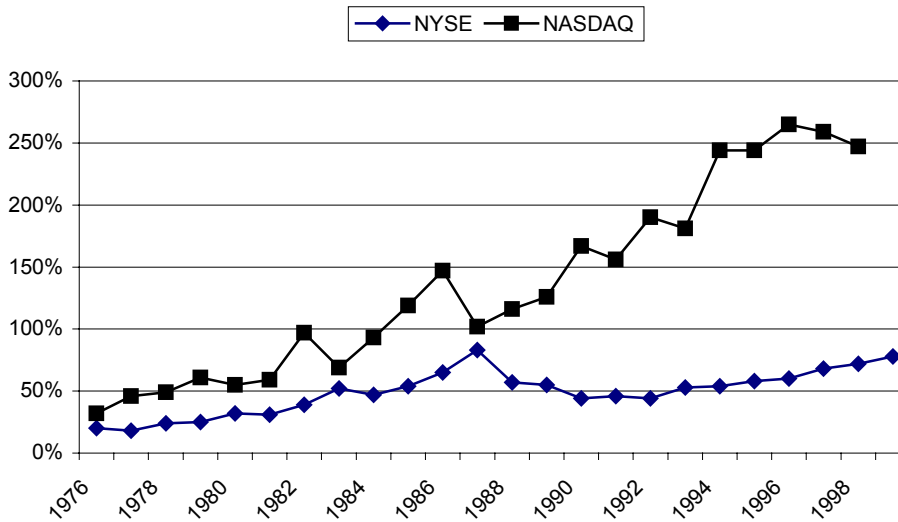
At the same time, technology driven competition among exchanges and market makers has driven down total trading costs. Jones (2001) reports that average one-way transactions costs (half-spread + NYSE commission) fell from 1.00% to 0.20% over the last 20 years. Decimalization

reduced effective spreads on the NYSE to roughly \$0.06 for high volume stocks according to Bacidore, et al. (2001).

There is some evidence that Internet accounts are driving increased retail trading. There were an average of 1,371,000 online trades a day by the first quarter of 2000, compared with 516,000 a day in March 1999 and 190,500 in March 1998, 48% of retail trades were executed online in the second half of 1999 (Stockownership 2000). Choi, Laibson, and Metrick (2000) study the trading behavior of 100,000 participants in two large 401k plans. They find that introduction of a Web channel doubled the frequency of trading and increased turnover by 50%. Barber and Odean (2001) find that: "... after going online, investors trade more actively, more speculatively, and less profitably than before." Chase, Hambrecht, and Quist (2000) estimate that online trading accounted for 17.6% of all equity trades in Q4, 1999 and 20.6% of all trades in Q1, 2000.

Lower costs and convenience of execution may provide a partial explanation to the enormous increase in trading and turnover seen in our secondary markets, as documented in Figure 1. The chart illustrates monthly trading volumes (scaled by shares outstanding) as provided by the Center for Research in Securities Pricing (CRSP). A decade ago some authors have argued that heavy trading is no indication of financial market health, and even recommended securities transactions taxes (Summers and Summers 1989). Indeed, there is evidence that heavier trading is detrimental to performance. Nonetheless, the liquidity made possible by technology obviously makes investors happier, if for no other reason than making them able to speculate, and in this way may contribute to the breadth of securities markets.

Figure 1. Dollar-Weighted Annual Turnover Rate



Source: Center for Research in Securities Pricing (CRSP)

Finally, technology and regulation are jointly leveling the playing field among investors. Technology provides regulators like the SEC with more powerful instrument for monitoring transactions for suspicious patterns and manipulative activity. Technology also reduces the informational disadvantage of outside investors relative to the insiders, thereby improving the effective rights of the former. Barber and Odean (2001) suggest that Internet technology might facilitate broadened participation in shareholder votes. Some regulations, such as the restrictions on private communications between corporate insiders and analysts, might also have beneficial effects on corporate governance. The Internet simplifies the logistics of simultaneously sharing this information with a dispersed audience.

3. Technology and the Incentives of Information Production

This section begins with a set of propositions for understanding the interaction between technology and the incentives of information production, which we use below to organize the data.

Proposition 1. The effect of technological advancement is to make information available faster, in greater quantity, and to more people, but it does not necessarily improve the quality of information.

Proposition 2. As technology progresses, the marginal recipient of information might be less able to process it correctly.

Proposition 3. The growing number of listed technology companies has flooded the market with profitless firms, which rely on selling equity to pay for their expenses.

Proposition 4. As a consequence of Proposition 2 and 3, firms face growing incentives to distort information they provide to investors in order to increase their stock prices. Because firms face virtual monopoly in the production of information about themselves, the quality of such information available to market participants deteriorates.

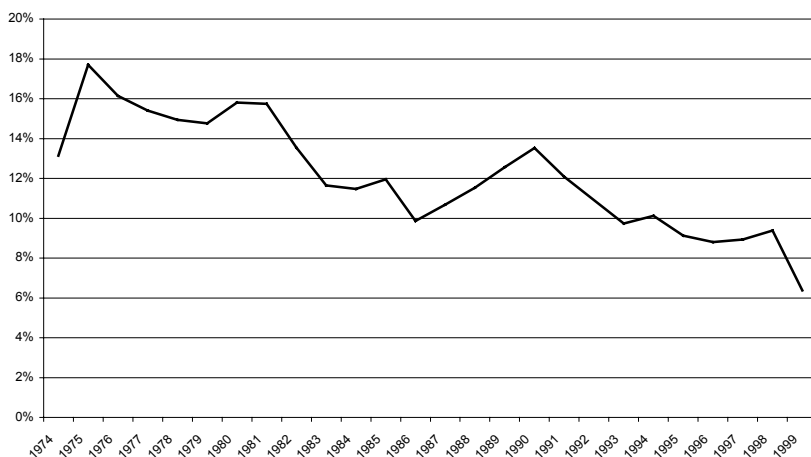
Proposition 5. Improvements to information technology would have greater benefits for markets if accompanied by regulations that ensure the accuracy and quality of the information transmitted to investors.

The cornerstone of our argument is the growing incentive of corporate managers to distort corporate information provided to investors. Most managers prefer a high current stock price. A high current stock price makes it cheaper to pay employees with equity, to raise funds through share issues, and to make acquisitions. It also makes managers stock options more valuable. For a number of reasons, the need to maintain a high equity price has been growing with technology-induced changes in financial markets.

Changes in characteristics and compensation structure of listed firms are increasing the degree to which management is focused on current stock price. Newly listed firms are far less likely to generate positive current cash flows. Fama and French (2001) explore the decline in the number of dividend payers, which they show is the result of a sharp increase in the (mostly NASDAQ) listed

companies that never pay dividends. Indeed, the fraction of companies that are profitable at the time of their listing has fallen from 80% down to 50% of the last twenty years. Nor do these firms quickly attain profitability or positive cash flow. Figure 2 plots the equal weighted mean annual cash flow (scaled by assets) for U.S. (non-financial) companies contained in the COMPUSTAT database. This measure, as well as a similar ratio for earnings, has declined to nearly one half their levels twenty-five years ago. These trends are driven mainly by NASDAQ listed stocks, which begin to outnumber NYSE listings in the early part of the 1990s.

Figure 2. Mean Annual Cash Flow (% of Assets)

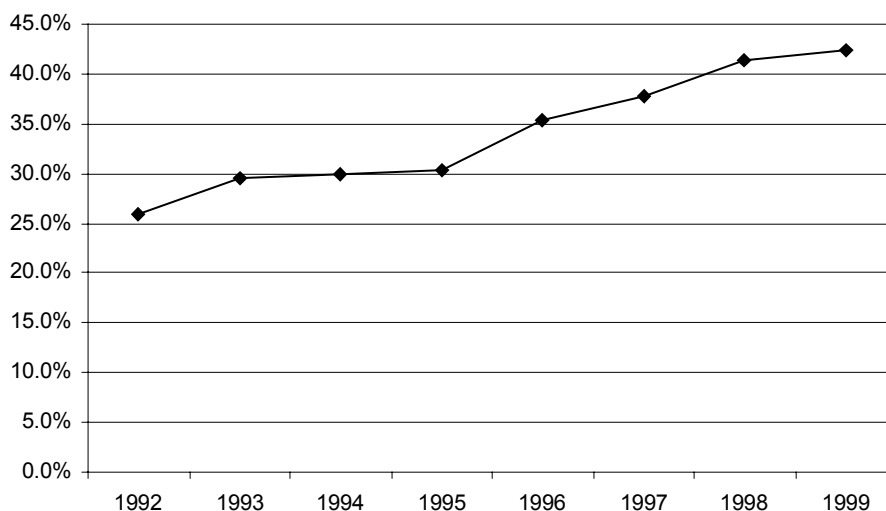


Source: COMPUSTAT

These changes in the characteristics of publicly traded firms stem partly from technological advances. Many of these companies come from Internet, software, biotechnology, and telecommunication industries whose operating life cycle is marked by an initial period of research and development that often consumes more cash than it generates. Further, computer technology facilitated the success of the NASDAQ market, which provided a listing venue for thousands of firms incapable of meeting NYSE listing standards. Indeed, equity financing of such firms is the sign of an enormously successful financial system – the envy of the rest of the world.

As we document in Section 5, for firms that do not generate sufficient cash internally, marketable stock is a vital currency for financing investments in real capital as well as acquisitions. Stock has also increasingly become a leading method of acquiring and retaining human capital. Figure 3 plots the growth of stock and options as a percentage of total CEO compensation as measured by COMPUSTAT. The proportion of equity-linked compensation increased from 25% in 1992 to 45% in 1999.

Figure 3. Stock and Options as % of Total CEO Compensation



Source: COMPUSTAT

In sum, technological advances have brought to the securities market a large number of firms with attractive growth opportunities but no current profits. For these firms, their own equity becomes the crucial means of payment for both labor and capital. To survive and realize their growth opportunities, these firms rely on high equity prices. As a consequence, these firms face extremely strong incentives to provide investors with information that would help keep stock prices high. The argument that “honesty is the best policy” does not work in such markets, since firms

would not be around in the future to reap the benefits of their honesty if they cannot raise current finance. The question becomes: can the strategies of nurturing investor optimism work?

Who is the marginal investor?

Modern financial theory holds that two forces determine security prices in liquid financial markets. The first is investor sentiment – the average demand of large numbers of relatively unsophisticated investors trading in a security. The second is arbitrage – the trading of relatively few sophisticated investors aiming to bring prices to efficiency and earn profits by doing so. Financial theory holds that equilibrium security prices are determined by trading among these various investors, but that the forces of arbitrage are limited and insufficient to bring prices in line with fundamental values of particular securities (e.g., De Long et al. 1990, Shleifer 2000). While attenuated by arbitrage, investor sentiment still has an influence on security prices. As a consequence, strategies to improve this sentiment, and in particular to increase the optimism of the relatively less sophisticated investors about a security pays off even in a liquid financial market. This theory, then, explains why managers might want to mislead investors: it can pay off in terms of higher stock prices.

In this section, we present some evidence indicating that many participants in financial markets are becoming less sophisticated. Our paper's argument does not depend on this evidence: even if the sophistication of investors is staying constant, the growing incentives to manipulate the information provided to the investors would lead to the deterioration in the quality of this information. Nonetheless, at least some evidence suggests that this second factor contributing to the problem of information quality is operative as well.

In the period of rapid technological advance, the growing need for a higher stock price has combined with the improvement in the ability of managers to successfully manipulate investor

perceptions. This is so for several reasons. First, the growing number of individual investors, itself resulting in part from changes in technology, has probably resulted in the decline in the sophistication – or at least experience – of the marginal investor. Table 3 presents information from the Spectrum/Thomson database of institutional stock ownership for 2000.

Percentile	NYSE	NASDAQ
99.0%	90.5%	78.2%
95.0%	75.9%	63.6%
90.0%	69.3%	54.9%
75.0%	57.5%	34.3%
Median	38.0%	15.8%
25.0%	15.2%	5.0%
10.0%	2.0%	0.9%
5.0%	0.8%	0.2%
1.0%	0.2%	0.0%
Mean	37.5%	22.1%

Source: Spectrum /Thomson Financial

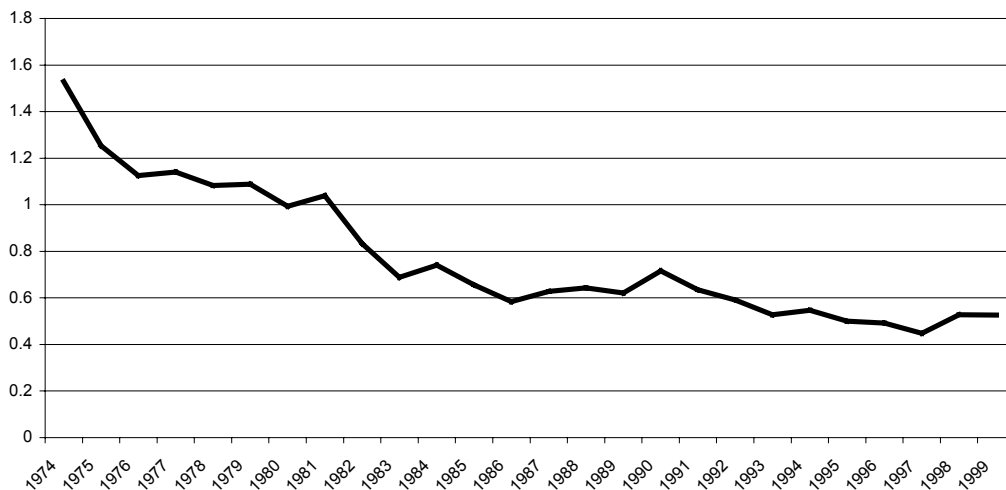
It shows that large (13F) institutions hold 38% of the shares of the median NYSE stock compared to only 16% for median NASDAQ stock – i.e., NASDAQ stocks are more likely to be held by individual, retail investors. Blume (2000) reports that institutional trading accounted for more than 90% of the consolidated share volume of NYSE stocks, whereas more than 50% of NASDAQ trading is retail. Indeed it appears to be predominantly individuals, as well as the mutual funds that cater to their preferences and acquire stocks individual investors like, who are determining prices in the technology heavy NASDAQ market, which has benefited most from unrealistic stock valuations.

Second, not only has technology brought less experienced investors in droves to the stock market, but also many of the people who serve their needs are not much more experienced. Barber and Odean (2001) cite that half of the nation’s brokers, financial planners, and advisors began their careers in the 1990s. Shareownership 2000 reports that the fraction of shareholders under the age of 35 who traded 6 or more times per year increased from 1.1% in 1995 to 13.2% in 1998. A May 17,

2001 Financial Times article reports on the growing influence of television’s “money-honeys” on investors, citing the academic work of Busse and Green (2001): “When [CNBC reporter] Ms. Bartiromo makes a favourable comment about a company during her regular "Midday Call" spot, its share price jumps an average of 60 points within a minute - 11 points in the first 15 seconds, 20 in the next 15 seconds, and 12 points in the remaining 30 seconds.”

For the growing number of no-earnings, no cash-flow companies, conventional stock valuation models are of little use. Those eager to apply multiples have turned to revenues for lack of a positive denominator. Figure 4 plots the steady decline of average Book to Market ratios over the last 25 years using COMPUSTAT and CRSP data. More companies are valued for their far off growth opportunities. When fundamentals are so far out, intangible, and difficult to value, the odds of convincing investors of spectacular earnings in a distant future improve.

Figure 4. Mean Book to Market



Source: COMPUSTAT and CRSP

There is another important way in which technology might have made this problem worse. The growing abundance of information available to unsophisticated investors is likely to have created, in their minds, an illusion of knowledge. Barber and Odean (2001), citing experimental evidence from the psychology literature (e.g. Oskamp (1965)), write: “When people are given more

information on which to base a forecast or assessment, the accuracy of their forecasts tends to improve much more slowly than their confidence in the forecast.” Unlike in times past, when investors obtained delayed or second-hand information about companies, they now have access to news at almost the same time as the experts. But they are unlikely to be able to process this information correctly, especially when it is presented in a way specifically designed to mislead them.

Finally, as we argue in Section 6, market mechanisms are likely to exacerbate rather than improve the situation. Financial intermediaries have been knowing and eager participants in the process of confusing investors, for clear incentive reasons. Arbitrage is also least effective precisely in the securities with few substitutes and with enormous price volatility. For all these reasons, the advances in technology have created a market with ripe opportunities for misleading investors.

4. The Evidence on Information Quality

The centrality of accounting information

Many players in the financial system produce the information that has an impact on market valuations. Each has his own particular incentives to bias or distort. This summer, professional stock analysts were summoned down to Washington to testify to Congress on the quality of their recommendations (only 0.8% were “sell” and “strong sell” in advance of a 60% drop in the NASDAQ). The incentive to promote enthusiasm for stocks may be related to the lucrative business of underwriting IPOs conducted by the employers of these analysts, and perhaps the analysts, and their employer’s, own stockholdings in the companies they promote.

The Internet is another source of potentially compromised information. Here the producers of information on stocks may act strategically to effect short-term trading strategies. Anecdotal evidence is abundant. The SEC filed 180 Internet fraud cases as of September 2000, including two false press releases, which moved the prices of Emulex and Pair Gain by –62% and 30%

respectively. Included also were cases against a 15 year old in New Jersey for stock manipulation via chat room and message boards, and the infamous Tokyo Joe for manipulation via information on his web pages and email alerts. The latter emphasizes the challenges the Internet poses to the regulation of investment advisors.

But these examples are, in our opinion, minor relative to the deterioration in the quality of the accounting data, the information produced by companies themselves. One reason is that many investors naively consume company-produced information. In the most recent National Credibility Index compiled by the Public Relations Society of America Foundation in conjunction with Columbia University, the annual report was ranked first by investors as a source for reliable investment information. In contrast, online sources of information fell to the bottom one-third of the rankings. The annual report earned a Credibility Rating of 83.76 (#1), financial web sites a 56.2 (#26), and Internet chat rooms a 28.45 (#38). In light of these data, it is crucial to focus on company-produced information, an area where the company in fact has monopoly over supply.

Company produced, independently audited, accounting data appears to be taken at face value by many investors. Accounting information may be inherently opaque to many readers. In the preface of the SEC Release, *A Plain English Handbook*, Warren Buffett writes: “For more than forty years, I've studied the documents that public companies file. Too often, I've been unable to decipher just what is being said or, worse yet, had to conclude that nothing was being said.” While partly facetious, this statement is indicative of the difficulty with which a lesser sage will be able unravel distorted or managed accounting reports.

The quality of accounting information is perceived as a growing problem. There are many aspects of this problem. Such issues as accounting for options compensation, merger accounting, and patterns of disclosure of corporate information have received considerable attention (e.g., Samuelson and Varian 2001). Here we only deal with a selection of the issues.

The media has focused on the rapid increase in the use of “pro-forma” accounting, which provides companies with tremendous liberty from the conformities of GAAP. In May of this year, the New York Times described how Computer Associates reported pro-forma annual earnings of \$931 million, in contrast to \$95 million calculated under GAAP principles. Table 4, reproduced from the May 14, 2001 Business Week article, “The Numbers Game,” provides examples of firms that produce two sets of earnings reports for investor consumption. The optional Pro forma results typically dominate the required GAAP calculations.

Table 4. Company	Pro Forma	GAAP	Increase in Earnings/Share
JDS UNIPHASE	\$0.14	(\$1.13)	\$1.27
CHECKFREE	-0.04	-1.17	1.13
TERAYON	-0.43	-1.01	0.58
AMAZON.COM	-0.22	-0.66	0.44
PMC-SIERRA	0.02	-0.38	0.4
CORNING	0.29	0.14	0.15
QUALCOMM	0.29	0.18	0.11
CISCO SYSTEMS	0.18	0.12	0.06
EBAY	0.11	0.08	0.03
YAHOO!	0.01	-0.02	0.03

Source: “The Numbers Game”, Business Week, May 14, 2001

In an effort to obtain a crude measure the proliferation of pro-forma accounting, we searched LEXIS/NEXIS for company press releases that contained pro-forma financial results. Table 5 contains the number of hits over the last twenty years on the PR Newswire (similar results were seen obtained looking at the Business Wire).

Year	Table 5. Reports of Pro Forma Earnings
2001	1468*
2000	1066
1999	625
1998	693
1997	657
1996	504
1995	381
1990	64
1985	43
1980	9

*Annualized estimate of 734 thru 7/1/ 2001

Source: Authors' tabulations using a LEXIS/NEXIS search of PR Newswire

This is not to say that GAAP always provides economically more meaningful information about the firm's profitability than do the pro-forma numbers. Indeed, as we show below, even within GAAP there are tremendous opportunities for misleading investors. But that is not the point. Efficient regulation often calls for the creation of bright line standards which, while not guaranteeing the best outcomes in all cases, can be enforced by the regulators (Glaeser et al., 2001), and therefore lead to superior outcomes on average. Failure to respect these standards, even if justified on the grounds of superiority in a particular case, is likely to lead to inefficient overall outcomes, as the ability of regulators to enforce accurate disclosure of information to investors deteriorates.

The SEC is clearly concerned with the quality of accounting data. This is evident in the tone of several speeches by former Chairman Levitt including "The Numbers Game" in 1998 and "Quality Information: The Lifeblood of Our Markets" in 1999. The SEC special task force on financial fraud brought 79 financial statement and reporting actions in 1998, 90 in 1999, and 100 in 2000. A September 2000 article in CFO.com enumerated 22 CFO who were sentenced or awaiting sentencing for jail terms for accounting fraud since 1993 (10 of which occurred in 2000).

Increased SEC scrutiny, or perhaps increased aggressiveness by CFOs, may be behind the recent rise in earnings restatements. A recent study by Financial Executives International (FEI) and

NYU graduate student Min Wu quantifies the trend (see Table 6). They associate these restatements with losses of market value of \$31.2 billion in 2000, \$24.2 billion in 1999, and \$17.7 billion in 1998. The largest event involved Microstrategy (MSTR) whose stock fell by \$11.9 billion over three days surrounding a revenue recognition based restatement of earnings.

2000	156
1999	150
1998	91
1997	59
1996	58
1995	50
1994	61
1993	32
1992	51
1991	48
1990	33

Source: Financial Executives International (FEI), 2001

	Freq.	Pct
NYSE	228	21.1%
AMEX	84	7.8%
NASDAQ	715	66.2%
OTC	48	4.4%
Bulletin	5	0.5%

Source: Financial Executives International (FEI), 2001

Table 7 reports the distribution of restatements across exchanges as reported in the FEI study. Two-thirds of all restatements are by NASDAQ firms. This is partly driven by the disproportionate number of restatements in the computer manufacturing and software industries. Arthur Andersen finds that these two segments accounted for 27% of all restatements from 1997 to 2000.

So far our discussion has been limited to illegality and to deviations from GAAP accounting. While important, such occurrences remain infrequent among over 10,000 publicly traded companies.

The remainder of this section focuses on activity consistent with current GAAP standards, but which nonetheless reduces the overall quality of information available to investors.

Accounting Treatment of Stock Options

We have drawn attention to the growing importance of stocks and stock options in the compensation of corporate employees. Yet accounting for these options remains problematic. In his Chairman's letter of the 1998 Berkshire Hathaway Annual Report, Warren Buffett asks: "If options aren't a form of compensation, what are they? If compensation is not an expense, what is it? And if expenses shouldn't go into the calculation of earnings, where in the world should they go?"

GAAP does not require that stock option grants be expensed in the calculations of corporate income reported in the financial statements. The only requirement is that the companies provide footnotes with estimates of how much it would cost if option grants were expensed. Even such limited disclosure is resented by many corporations, which lobby against it (Samuelson and Varian 2001). A 1999 Fed Study by Liang and Sharpe estimate that the omission of option expenses inflates reported earnings by slightly more than 10% per year. The consultant firm Smithers and Co., LTD. estimates this effect to be around 12% on average. Yet behind these averages exists large variation across industries and firms. According to the Smithers report, the impact is greatest within the information technology sector, where the average annual cost of option grants was 31% of reported profits in 1999 (compared to 16% for telecommunications). Individual examples from the Smithers report illustrate the economic magnitude of the omission: accounting fully for option expenses, AOL would need to restate its \$92 million gain in 1998 to a \$4.3 billion loss. Similarly, CISCO would need to restate its 1998 \$1.35 billion gain to a \$4.9 billion loss.

Why is this important? While options do not need to be recognized in financial statements, SFAS 123 does require that certain information sufficient to value these options be disclosed.

Typically this information appears in the notes to the statements. This might make valuation difficult for some investors, as it requires them to sift through footnotes and understand option valuation. If shareholders cannot unravel the true cost of option grants, the incentive to compensate using such grants, and to lower the cost of such compensation through information distortion, are all the greater. Moreover, if investor sentiment can be inflated by the failure to include option costs in the calculation of earnings, stock prices will be higher, which gives firms a better currency to use.

Discretionary Accruals

Even more difficult than extracting information on option grants from financial statement footnotes is the task of unraveling the management of discretionary accruals. Accruals are simply those non-cash items that determine standard accounting income:

$$\text{Net Income} = \text{Cash Flows} + \text{Accruals}, \quad (1)$$

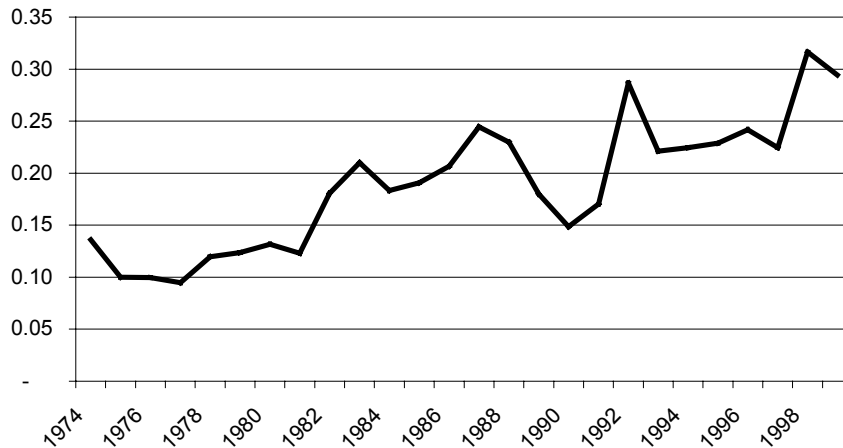
$$\text{Accruals} = \Delta \text{ Current Assets (excluding cash)} - \Delta \text{ Current Liabilities} - \text{Depreciation}. \quad (2)$$

Determining what component of accruals is discretionary is a challenge for the econometrician. Dechow, Sloan, and Sweeney (1995) evaluate the power of several methods used in the accounting literature. They find that the most effective model defines discretionary accruals as the residual to an OLS estimated model of total accruals as a function of assets, sales, and property plant and equipment.

To illustrate the way in which discretionary accruals reflect earnings management, consider the case of Sunbeam, Inc. The SEC found evidence that the firm had engaged in “channel stuffing” which involves “borrowing” sales from future quarters by getting customers to agree to purchase large amounts of inventory before needed. Payment was not expected for several months, the retailers had the right to a full refund for any unsold items, and Sunbeam itself paid for the storage of the inventory until it was sold. This sudden surge in accounts receivable might be classified as

discretionary or abnormal accruals under a properly specified econometric model. Even the simple model used in our analysis ranked Sunbeam in the ninth highest decile of discretionary accruals in fiscal year 1996 when they allegedly began this strategy. (Sunbeam subsequently was forced to restate earnings, fired its colorful CEO “Chainsaw” Al Dunlop, and filed for bankruptcy.)

Figure 5. Mean Discretionary Accruals (Top Decile)



Source: Authors' calculations based on COMPUSTAT data

Based on a large sample study of firms in the COMPUSTAT database from 1974-1999 we find evidence that firms are becoming more aggressive in taking positive accruals. Figure 5 charts the mean discretionary annual accruals (as a percentage of average firm assets) among firms in the top decile of this category. The top decile is most relevant given that Houge and Loughran (2000) find that investors seem capable of unraveling earnings management in the lower deciles. This measure has more than doubled since 1974 to nearly 30% in 1999.

Degeorge, Patel, Zeckhauser (1999) investigate the frequency of earnings management in a sample of 100,000 quarterly earnings reports from 1974-1996. They show that firms make great efforts to exactly match analyst forecasts or just beat them by a penny. Heroic in this category is CISCO, which until the end of 2000 had strung together 14 consecutive quarters of beating analyst

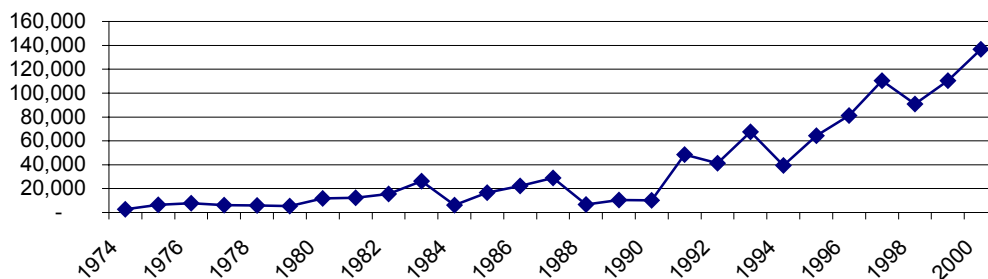
expectations by exactly one penny. Such results are less likely to be a coincidence than an outcome of deliberate earnings management.

In summary, this section has presented evidence indicating that firms manage their earnings, and that the quality of information available to outside investors has deteriorated over time. We have not addressed all aspects of such deterioration. For example, we have not dealt with an important issue of merger accounting. In addition, we have not dealt with other important types of information that firms provide to investors, which are increasingly being compromised. Many investors, for example, rely on information about insider trading activity in forming their judgment of security markets. The growth of technology has made it possible for insiders to enter derivative transactions with investment banks rather than trade in their shares directly. Since such transactions go unreported, outside investors have lost another important source of company information. Overall, the data point to some significant problems in the quality of information available to investors.

5. Company Benefits of Successful Earnings Management

SEOs and IPOs

Figure 6. Seasoned Equity (\$MM)



Source: Securities Data Company (SDC)

Figure 6 presents the historical information on the growth of secondary equity offerings in the United States. It points to the tremendous explosion of this market, particularly in recent years, paralleling the advances in technology that we have discussed.

Managing earnings increases the stock price and reduces the cost of capital. Two-thirds of the 392 CFOs surveyed in a study by Graham and Harvey (2001) indicated that their decision to make a seasoned issue of equity was tempered by “the amount by which our stock is undervalued or overvalued by the market.” Almost 63% cited as a determining factor, “If our stock price has recently risen, the price at which we can sell is ‘High’.” This appears to be more than talk: Baker and Wurgler (2002) provide evidence that amount of equity in a firm’s capital structure is dependent on the path taken by its book to market ratio. Some firms actively seize opportunities to issue stock when it appears “high” relative to book values.

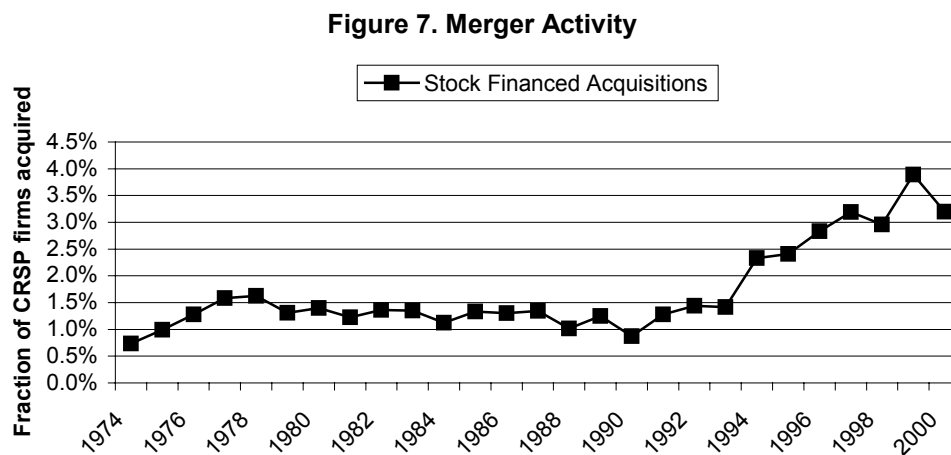
Teoh, Welch and Wong (TWW 1998) show that these CFOs may occasionally have a hand in generating the overvaluation of their stock. They write, “In the offering year, the asset-scaled discretionary current accruals of issuers exceed their pre-issue performance-matched industry peers by 2.9%.” In addition to documenting that some firms may attempt to distort information, the study provides striking evidence that these firms may be quite successful at confusing investors. TWW sort a sample of 1265 issuers from 1976-1989 into quartiles based on discretionary accruals taken in pre-issue financial reports. For the 48 months after the offering, issuers in the aggressive (top) quartile underperform the conservative (bottom) quartile by a return of 40% (25% market-adjusted).

Teoh, Welch and Wong (1998a) find a similar pattern of behavior in a sample of IPOs. While data on pre-IPO financial reporting are not available, the authors study their first public financial statement. The logic is that if they had engaged in aggressive earnings reporting prior to the IPO, they would not want to risk the fallout (potential lawsuits) of a sudden reversal. Further, many of the IPOs insiders are “locked” in to share positions for the first year and have a tremendous

incentive to maintain a high stock price until the lockup expires. As in their SEO study, the authors divide their sample of 1526 IPOs into quartiles based on discretionary current accruals. The most aggressive quartile of issuers underperforms the conservative issuers by 15% to 30% (depending on the risk adjustments) over the three years following the first financial report.

In sum, there appear to be large economic incentives for companies to distort the information they produce in advance of issuing initial and seasoned equity.

Mergers and Acquisitions



Source: CRSP Mergers Database

Figure 7 presents the data on the growth of acquisitions for equity by the listed companies in the United States. Like the data on SEOs, it shows tremendous growth in recent years.

Improving the terms in stock financed acquisitions presents companies with yet another incentive for biasing company information in favor of a higher near-term stock price. Shleifer and Vishny (2001) model managers as making acquisitions to rationally exploit relative mispricing of their stock in a sentiment driven market. While the authors treat relative exuberance for a stock as exogenous, it is realistic to assume managers themselves may take actions to inspire or sustain

pricing errors that benefit their stock price prior to an acquisition. Theoretically, the target also has incentives to manage earnings higher to improve the terms of trade in a stock for stock deal.

Erickson and Wang (1998) look for empirical evidence on whether such behavior exists. The authors study a sample of 55 stock for stock mergers completed between 1985 and 1990. They find that unexpected accruals as a percentage of assets steadily increase each quarter preceding a merger announcement, reaching a maximum in the quarter of the announcement. In contrast, they find no such pattern among firms that completed cash mergers. The authors believe this to be “consistent with income increasing accounting accrual manipulation by acquiring firms in the period prior to the announcement of the merger agreement.” The unexpected accruals is increasing in the size of the deal, which the authors feel may proxy for the marginal benefit or incentive for distorting earnings. Finally, they do not find evidence that targets in stock deals manage earnings. They attribute this to timing: as mergers are generally announced and agreed in less than one quarter, there is no time for the target to release distorted earnings.

6. Does the market solve the problem?

As always in finance, the central question is whether earnings manipulation is successful. Financial economists, over the years, have come up with many arguments indicating that market forces by themselves assure the failure of earnings manipulation. Investors can use litigation based on either common law or statutes to enforce honesty. Sophisticated financial intermediaries can process company reports, see through the distortions, and inform the possibly less sophisticated retail investors about the possible manipulation. Even if they do not, these intermediaries, as well as other arbitrageurs, would through their own trading activity bring security prices back to efficiency, undermining corporate attempts at manipulation. Competitive markets have many mechanisms that assure efficiency despite the best efforts of manipulators.

Nonetheless, both economic theory and evidence call for considerable skepticism about the effectiveness of such market mechanisms. Litigation has not been a huge deterrent to companies, especially after legislative changes in 1995. The incentives of financial intermediaries are closer to those of security issuers than the retail public. The forces of arbitrage are likely to be extremely weak, and possibly destabilizing, in these markets.

Begin with the question of litigation. In the 1980s and early 1990s, it was common for investors to sue corporations for delayed release of material information and other misrepresentations. In December of 1995, however, Congress enacted the Private Securities Litigation Reform Act of 1995, overriding President Clinton's veto. This act had a number of provisions, but overall it had a chilling effect on the ability of investors to sue firms for inaccurate reports. Litigation rates subsequently plummeted. Although some periodicals have reported increases in litigation in 2000 and 2001, most new cases deal not with the question of disclosure, but rather with manipulation of prices of the newly listed stocks by underwriters. It does not appear likely that litigation in the United States, with its class action suits, will serve the purpose of undoing information manipulation. And one can only speculate whether the trends in information manipulation we have reported would have been possible without the 1995 Act.

Consider next the financial intermediaries. Such intermediaries make money by underwriting initial and secondary public offerings, arranging mergers, and collecting brokerage commissions. All three of these activities benefit from high stock prices. IPOs, SEOs, and mergers are all extremely dependent on high prices, and security trading – especially by retail investors – is highly procyclical. Compared to the profits directly related to high stock prices, those from unwinding bubbles must be miniscule. Indeed, investment banks have been willing and happy corroborators in maintaining investor optimism about technology stocks, as evidenced for example by the preponderance of buy recommendations and optimistic growth forecasts. Even if investment

banks can sort through the distortions in earnings reports, they have very little incentive to share this knowledge with the investing public.

Nor are the sources of arbitrage likely to be effective in undoing share price bubbles resulting from distortions in the accounting information. As a significant body of research on behavioral finance has shown, arbitrage works when convergence of relative security prices is rapid and certain (see DeLong et al. 1990, Shleifer 2000). Arbitrage works effectively in making sure that derivative prices are close to their theoretical values, or that two bonds with nearly identical cash flows have nearly identical prices. There is no theoretical reason to think that arbitrage will work to bring prices of volatile individual securities with highly uncertain fundamental values close to fundamentals, especially if short selling is required to undertake an arbitrage transaction.

To illustrate this point, consider the task of an arbitrageur who is virtually certain that CISCO is highly overvalued. This arbitrageur must borrow CISCO and sell it short, and then hedge his position by buying a “substitute” portfolio of technology stocks. In addition to facing various borrowing costs related to putting on and maintaining a short position (D’Avolio 2001), this arbitrageur runs many risks. The substitute portfolio may be far from perfect, and if CISCO appreciates relative to that portfolio, this arbitrageur will lose. Moreover, CISCO can appreciate in value either because it does surprisingly well, or because the bubble becomes even greater. For all these reasons, arbitrage activity tends to be focused on markets where securities have close substitutes, and on anomalies where mispricing gets corrected quickly and without much uncertainty. Arbitrage deals with local rather than with global inefficiencies. Indeed, we do not see a great deal of arbitrage activity in individual stocks without close substitutes, and there is no theoretical reason to believe that earnings manipulation will be undone through arbitrage.

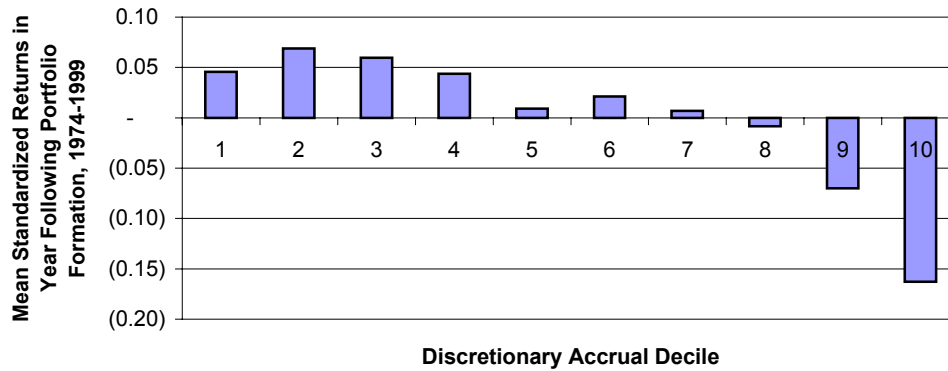
The available empirical evidence in fact suggests that it is not. Chan, Chan, Jegadeesh, and Lakonishok (CCJL 2001) describe a trading strategy that is long a portfolio of firms with high

quality earnings (low accruals, decile 1) and short a portfolio of those reporting low quality earnings (high accruals, decile 10). Testing this strategy on a broad sample of non-financial common stocks from 1971-1995, CCJL find that it on average earns 8.8% (7.4% risk adjusted) per year. Probing deeper, CCJL confirm that this is driven by the discretionary component of current accruals. Applying this long-short strategy based on non-discretionary accruals produced returns that were not significantly different than zero.

In another large sample (40,679 firm-years), Sloan (1996) also finds that investors systematically fail to unravel earnings management. He reports that a strategy of buying stocks in the bottom accruals decile and shorting those in the top decile earned a size-adjusted return of 10.4% over the period 1962-1991. Impressively, this strategy generated a positive return in 28 of the 30 years. Houge and Loughran (2000) replicate and then extend Sloan's work in two ways. They show most of the profits from accrual sort strategies are driven by being short the highest accrual firms. This indicates that investors are rather efficient in valuing accruals up until the highest realizations. In addition, they show that a strategy sorting companies by cash flows (buy high, sell low) also generates abnormal profits, indicating a broader failure by investors to understand the quality of earnings. They show that combining the strategies (e.g. short firms with lowest cash flows and highest accruals, buy highest cash flows lowest accruals) provides superior results.

Using our own calculations, we have updated these results. To this end, we sort each year into decile portfolios based on discretionary current accruals. In accordance with the studies of CCJL (2001), HL (2000), and Sloan (1996), we find that high discretionary accruals predict low future returns. Echoing HL (2000), we find that this effect is strongest in the 10th decile of accruals. Figure 8 illustrates our findings.

Figure 8. Next Year Return



Source: Authors' calculations based on COMPUSTAT and CRSP data

In summary, we do not believe that market forces can in themselves discipline firms to report accurate information. One can argue alternatively that perhaps the problems we discuss are temporary, and will go away as the Internet bubble itself unravels. We are not optimistic about these “time will cure all” arguments. In fact, the American market now has thousands of listed companies with no immediate earnings prospects, and with no access to external funds to pay expenses. Unless or until these firms go bankrupt, they have every incentive to continue providing optimistic information to investors. A bet that the problem will be taken care of by time alone is essentially a bet on massive bankruptcy or consolidation of technology companies.

7. Conclusion

New technology is rapidly democratizing securities markets. The costs of gathering information and executing trades are being driven down to negligible levels. These changes allow a rapidly growing base of investors to participate in the financial system. In fact, in the years to come, “transaction costs” and “the costs of providing information to investors” are likely to become unimportant in assessing the quality of securities markets in the United States.

In principle, these developments can facilitate an enormous expansion of financial markets, as more and more different kinds of cash flows become securitized. There will be possibilities of securitization of not just portfolios of car and home loans, but of new ideas, small partnerships and even some kinds of individual human capital. Transaction costs will not be the limiting factor of such expansion, but investor protection and information will be. All the available evidence indicates that, for financial markets to develop, investors need to gain accurate information about the cash flows, and to have their claims on these cash flows protected by the law against expropriation. The better the information these investors receive, and the more secure their rights, the greater will be the expansion of financial markets, with all the accompanying benefits for growth.

Yet the trends associated with the very technological progress that has democratized securities markets are also increasing the benefit of distorting information. These trends include the listing of companies at an early, cash constrained stage in the operating life cycle. For these companies, their stock is a currency they rationally seek to inflate. Even mature companies are increasingly granting stock options – a strategy that raises the benefits of a high current stock price. At the same time, information technology has rapidly widened market participation. The marginal investor may be becoming less sophisticated and experienced, and hence more likely to be taken by misleading information. In this setting, the benefits of distorting information are increasing.

We have argued that market mechanisms – such as security litigation by shareholders, intermediation of information delivery and arbitrage – are unlikely themselves to solve the problems raised by misleading information. There is much more money to be made from misleading investors than from getting prices to equilibrium values.

For this reason, regulation that protects investors is essential. Indeed, the (checkered) history of financial development in the 20th century is largely a history of growth of financial systems that have protected outside investors effectively, and of a failure of systems that have not. The two areas

where both law and regulation are particularly important are protection of investors from outright expropriation, and disclosure of accurate information. In the emerging markets, the regulation frontier is surely the protection of investors against expropriation. For the future of financial markets in the United States, disclosure is likely to be critical for continued progress.

The research we have summarized points to some specific areas where disclosure standards can be improved: discouraging pro forma earnings reports, accurate expensing of stock option grants, restrictions on accruals – but of course there are others. Indeed, markets are likely to be well ahead of regulators in this area, and the best that the regulators can hope to do is to keep up. Still, it appears to us that, given the developments in financial markets in the near future, the focus on mandatory disclosure may be more appropriate than on other dimensions of regulation.

Unfortunately, one cannot be entirely optimistic that such regulation is forthcoming. Traditionally in the U.S. economic history, an important impetus for regulation is expensive litigation, which brings the plaintiffs and the defendants together to seek relief (see e.g., Glaeser and Shleifer 2001 on the progressive era regulatory reform in the United States). After changes in securities litigation after 1995, however, litigation does not appear to be an important problem for companies manipulating information disclosure. There is of course always a possibility that legal innovation brings forward an avalanche of lawsuits, which are then followed by cost-reducing regulation, but at this point this remains only a possibility.

Another approach is to directly diminish the benefit of providing misleading information via investor education. New investors need the skills to interpret and process accounting and other economic data. Arming investors with a better understanding of financial statements, as well as of the biases those housed in their own psyches, provides the strongest incentive for the production of quality information.

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