



**U. S. Securities and Exchange Commission**  
Washington, D. C. 20549 (202) 272-2650

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**REGULATION AND THE TECHNOLOGY OF FINANCE**

**Inaugural Lecture**

**Center for the Study of  
Financial Markets and Institutions  
Brown University**

**February 10, 1989**

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Commissioner**

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# REGULATION AND THE TECHNOLOGY OF FINANCE

## Inaugural Lecture

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It is an honor and privilege to be here tonight before such a distinguished and unindicted group to present the inaugural lecture at the dedication of Brown University's Center for the Study of Financial Markets and Institutions. Needless to say, this Center is ideally situated to take advantage of a growing market: While no one in Washington can agree on what, if anything, to do about financial markets and institutions, it appears that everyone is enthusiastic about studying them.

Thus, in the wake of the October 1987 market unpleasantness we had studies by the Brady Commission, the SEC, the CFTC, the NYSE, the CME, the CBOT, and the GAO. In the aggregate, these studies ran many thousands of pages and weighed close to 20 pounds in their original form. Studies are sure to proliferate in the wake of recent revelations about fraud in Chicago's futures trading pits, and several members of Congress are enthusiastic about the idea of a blue ribbon multi-million dollar special study to examine the operation of the nation's securities markets. It therefore seems certain that there will be a demand for many more pounds of study of financial markets.

Therefore, while the efficient market hypothesis suggests that we cannot systematically make money by predicting whether today's prices are too high or too low, it seems perfectly clear that we can make a lot of money studying whether and why today's prices are too high or too low. This observation is known in Washington as Grundfest's first variation of the Heisenberg financial uncertainty principle: No one within one hundred miles of the Potomac is at all certain about what's going on in financial markets, but everyone is certainly willing to study the situation.

Unfortunately, the larger the group of people that learns of this uncertainty principle the greater the competition in the market for financial studies and the lower the rents that can be earned by academics who study traders and investment bankers. In the extreme, if this trend continues, and if the demand for study of financial markets and institutions becomes too broadly known, the earnings of professors and researchers who specialize in market studies will decline to the point where they earn only as much as the traders and investment bankers they study.

No one wants such a terrible fate to befall our academic brethren. So, out of deference to the continued economic well-being of our academics at Brown and elsewhere, I urge that we keep secret the pent-up demand for market studies and do what we can to preserve an infinite supply of grist for this new-born academic mill.

The theme of my talk tonight is innovation, regulation and the technology of finance. To understand the future of financial regulation in the United States it is necessary first to understand the future of financial markets, and to do that one must first appreciate the extent to which finance is a form of technology and not merely a manifestation of commerce. However, to describe finance as a form of technology is much easier said than done.

"Technology" conjures the image of white-smocked scientists scurrying about laboratories. "Technology" conjures the image of semiconductor circuits far smaller than a grain of sand. "Technology" conjures the image of recombinant gene techniques creating life forms that do not exist in nature.

"Technology" conjures many images, but it does not generally conjure the image of investment bankers wearing bright and sometimes garish suspenders; or of junk bonds trading among large institutional portfolios; or of mortgage backed securities sprouting where once there were no markets at all. And that's too bad because finance is a form of technology as real and palpable as engineering, biology, or chemistry. Indeed, it is, in part, because the vast majority of Americans, including policymakers, fail to appreciate the technological dimensions of finance that our financial markets are so widely misunderstood and so vulnerable to misregulation.

When I speak of finance as a form of technology I am not referring to the obvious but superficial fact that finance, as practiced today, requires the large scale use of computers and telecommunications facilities. Finance is hardly alone in this regard. Airline reservation systems, credit card companies, and home shopping networks also rely on the massive use of computers and telecommunications facilities. But they are heavy users of technology, and are not, in and of themselves, forms of technology.

My point about the technological dimension of finance is deeper. Like other forms of technology, finance has a distinct theoretical foundation. Advances in the theory of finance now lead to the creation of new marketplaces, to the introduction of new investment instruments, and to the evolution of new forms of productive activity, just as surely as progress in understanding the human immune system leads to new pharmaceutical products. Moreover, just as traditional forms of technology pass through phases of revolution, during which old paradigms are toppled by new and often radical theoretical perspectives, it is easy to find periods of revolution in the technology of finance.

Indeed, we are today experiencing a revolution in the technology of finance that is unparalleled in human history. The seeds of this revolution were sown in the 1950's with the advent of portfolio theory and the subsequent evolution of the efficient market hypothesis, the capital assets pricing model,

the Black-Scholes formula for option valuation, contingent claims analysis, arbitrage pricing theory, and literally hundreds of other variations on these and other basic theoretical themes.

These breakthroughs in the theory of finance have forever changed the way we think about markets. They have also caused tremendous changes in the mechanisms for raising capital and allocating risk in the economy. These breakthroughs have established the foundation for huge new markets in currencies, swaps, options, futures, hybrid instruments, indexed products, mortgage backed securities, securitized obligations, and hundreds of other practical applications that we simply cannot foresee today.

More important, however, is the fact that changes in the technology of finance can have profound implications for the entire structure of a society. Changes in the technology of finance can create tremendous new economic opportunities while rendering obsolete traditional modes of production and forms of organization. Changes in the technology of finance thus have implications that spread far beyond the trading pits and exchange floors, and reach into every nook and cranny of our economic system and its social order.

Thus, unless we come to appreciate the extent to which finance is a form of technology, the depth of the ongoing revolution in financial technology, and the linkages connecting that revolution with the rest of the economy, we

will fail to understand some of the most powerful forces driving change in our modern and highly internationalized economic system.

The implications of such a failure would be profound. A government that fails to understand its own financial markets is unlikely to regulate those markets wisely. A government that fails fully to appreciate the forces leading to change is unlikely to embrace change. Indeed, if we are to succeed in properly regulating our new financial markets we may well need a revolution in the art of regulation that is at least as fundamental as the revolution in the technology of finance.

These are abstract observations, but they have clear and concrete implications that span a wide range of markets and regulatory structures. To demonstrate the pervasive nature of the revolution in the technology of finance, and its implications for regulatory thinking, I would like to focus on three short case studies, each of which can be introduced by a question.

The first question is: What is money? The technology of finance is gradually but firmly changing the nature and definition of money. Money is less and less a government monopoly and more and more a byproduct of innovation in private markets. This evolution has profound potential consequences for policymakers who--whether they recognize it or not--rely on an implicit government monopoly over money in order to make their policies work.

The second question is: Why are there takeovers? Part of the answer to this question can be found in the revolution in the technology of finance, which today allows substantial accumulations of capital through managerial structures that avoid the need to separate ownership from control. Simply put, organizational structures that may once have made sense when large scale enterprises required separate classes of owners and professional managers are no longer efficient now that the technology of finance has evolved to a point that allows integration of management with control. The vast restructuring of American industry that we are experiencing today may thus be, at least in part, a consequence of a seemingly unrelated and abstract change in the financial marketplace.

The third question is: Who needs S&Ls? Despite the tens of billions of dollars of losses generated by this industry, I mean this question as a question, not as a statement. The technology of finance has clearly progressed to a point where the market is able to provide mortgage financing more efficiently and at lower cost than can S&Ls that attempt to hold mortgages in their own portfolios. But, if the purpose of S&Ls is to provide financing for home ownership, and if that financing can be provided more cheaply through other means, then why continue to support a separate S&L sector? Here again, the failure of policymakers to appreciate dramatic changes in the technology of finance, and in the structure of



capital markets, has substantial and expensive implications for the economy.

### What is Money?

The first question I would like to pose is deceptively easy, and may seem to border on the trivial, but don't let its simplicity fool you. What is money? Each of us can start exploring this question by looking in our wallets and comparing our credit cards with the folding green stuff that says "In God We Trust."

For a large number of transactions in our modern economy it's at least as easy to use a credit card as it is to pay with the Divine Trust document. If that's so, then what is money? And, if money can come from some place other than the government's central bank, what then does it mean to have a monetary policy? Moreover, how "tight" can a central bank's grip on the money supply be if money doesn't necessarily come from the central bank and if the central bank's money must compete with other private sources of credit and mechanisms of exchange?

Indeed, we have reached a point in the technology of finance where the money you owe on your credit card can be securitized to create instruments that can be bought and sold in huge international markets, that can be denominated in yen, pounds, francs, or marks, and that can support securities that rank either with the safest gilt-edged instruments or with the riskiest of junk bonds. Moreover, all of this can be done

without having a single kopek or drachma pass through a bank where it might be tainted with deposit insurance or some other form of government subsidization. In other words, the whole credit and transaction process can be conducted entirely outside the government sector.

The more one thinks about the financial technology supporting this evolution the more remarkable these developments become. In effect, your credit card is a mini-license to issue a personal junk bond. After all, our individual debt obligations are not rated by Standard and Poor's or by Moody's, and many of these personal obligations charge interest far in excess of the prime rate. Thus, by every objective standard, every time we use a credit card we are issuing a short-term, small denomination junk bond.

Who would want this micro-denomination plastic junk, and what can the technology of finance do with these low grade personal IOUs? Much like semiconductor manufacturers can transmute common sand into megabit memories, the technology of finance allows highly speculative micro-denomination plastic personal IOUs to be transmuted into a wide range of products that bear no resemblance to their humble origins.

For example, by aggregating many of these IOUs, each with relatively random and low quality characteristics, it is possible to fashion pools of debt that have rather predictable payment patterns. Moreover, by subdividing and reallocating interests in these pools of personal junk bonds it is possible

to create investment vehicles that are either gold-plated or far riskier than any individual cardholder's IOU. Thus, a sufficiently overcollateralized pool of credit card debt can support the highest investment grade rating, even though it is composed of junk plastic debt. The pool can be further subdivided to increase or decrease prepayment risk; or it can be stripped to create different layers of sensitivity to changes in interest rates. The technology of finance can thus transform my low grade plastic personal credit card obligations into high quality financial paper that is readily accepted by financial institutions around the world.

As these developments take place behind the scenes, it is important to notice that governments need not be involved anywhere in the process. From beginning to end--from issuance of the card through marketing and payment of the vast pools of debt--the private sector is able to finance and organize the creation and maintenance of a medium of exchange, and a store of value that, to use Richard Darman's test, walks like money, smells like money, and quacks like money.

Indeed, to the extent that private forms of money are taking the place of the folding green stuff, the economic power of the manufacturers of the folding green stuff--i.e., the world's central banks--is being slowly eroded. In the extreme, one could imagine a situation in which central banks went out of the money supply business and one could readily construct scenarios describing how the technology of finance

could tool up to provide similar mediums of exchange and stores of value.

Put another way, we may be carrying in our wallets tiny agents of financial revolution that could one day force changes in the way governments attempt to control their own economies. Will the day come when we need a revolution in the techniques of central banking, monetary policy, and fiscal policy to match the revolution in the technology of finance? These are the sort of questions that tend to answer themselves.

#### Why Are There Takeovers?

The second question I want to explore is: Why are there takeovers? Takeovers have many causes and it is impossible to single out any one factor as the dominant force behind the current wave of corporate restructuring. Nonetheless, I think it clear that changes in the technology of finance have been a powerful force in the takeover market. New financing techniques have created an environment that allows us to eliminate certain inefficient organizational forms and substitute in their place new corporate structures that may well be more competitive than the traditional structures that they replace.

This story begins in the 1930s with the classic work of Berle and Means describing the separation of ownership and control in large corporate organizations. Berle and Means observed that the quantities of capital needed in order to

operate many firms at an efficient scale was so great that capital would, of necessity, have to be raised from large pools of investors. Individual investors would own a relatively small portion of the firm's equity. Because each owner's equity interest was so small, it would not make sense for the individual owners to become actively involved in the firm's operation. Management would, instead, have to be delegated to a group of professional managers who did not have significant ownership interests in the firm.

Unfortunately, the separation of ownership from control creates substantial agency problems that can adversely affect the efficiency and profitability of corporate operations. For example, the compensation of many corporate executives depends far more on the corporation's size than on its return to equity or on the performance of its stock price. A recent study by Michael Jensen at Harvard suggests that for every \$1,000 change in shareholder wealth, CEO compensation changes by less than \$2. Jensen also finds that the probability that a CEO will be dismissed because of poor performance is quite low, and that the economic penalty associated with dismissal may be quite small, particularly once one takes into account the handsome severance and consulting arrangements that are hardly rare in the executive suite.

Thus, once a CEO makes it to the top, he appears, on average, not to have much direct financial incentive to cause an increase in the corporation's stock price. The CEO also

appears to be rather well insulated from adverse personal financial effects in the event the corporation does not perform well. If one wanted to view the situation cynically one could say that once CEO's get to the top they have all the benefits of academic tenure, other than the pay.

Given a compensation structure that values corporate size and stability, and provides only trivial financial incentives for improved corporate stock price performance, it should come as little surprise that, given a choice between an investment that increases the corporation's size and one that increases the corporation's profitability, an executive might--all other things equal--rationally decide to increase the company's size. The executive could reach this conclusion although the corporation's owners, the stockholders, would rather see a smaller more profitable enterprise.

The gap between ownership and control also generates tremendous opportunities for corporate waste. For example, press reports indicate that, following the Beatrice leveraged buyout, corporate overhead was reduced by about \$100 million per year. The LBO achieved these savings by, among other things, cutting back on image advertising that was unrelated to specific product sales, eliminating the sponsorship of automobile racing events, and reducing a bloated corporate staff that did not add to the profitability or productivity of the conglomerate's operating divisions. It is clear that these expenditures were made because they benefitted the

corporation's conglomerate managers, not the corporation's owners, and that if the owners were running the shop those expenditures would never have been approved.

It's valuable, by the way, to step back for just a moment and consider the economic value that is created when corporate overhead is reduced by \$100 million per year without any adverse effect on profitability. Capitalized at 10% per year in perpetuity, and net of tax effects, a savings of \$100 million per year has a present value of \$1 billion. Thus, if a new management team knows that it can shave \$100 million a year from a target's overhead then, putting aside tax considerations, it can afford to pay stockholders a premium of up to \$1 billion based on overhead savings alone. This is not chicken feed, and the opportunities for such savings can explain a meaningful percentage of the premiums paid in certain leveraged buyout transactions.

Fortunately, the revolution in the technology of finance has provided the market with new tools for avoiding the agency problems that arise when management is separated from control. In particular, the analytic tools of contingent claims analysis and options pricing, combined with the growth of large pools of capital that can quickly provide billions of dollars of financing from a relatively small set of sources, have created an environment in which management and control can be combined even though the enterprise requires vast pools of capital for its operations. Thus, the size of a

corporation is no longer an excuse for the existence of separate classes of owners and managers, or for the prevalence of agency problems.

At this point, it is impossible to avoid the dread words "junk bond." Junk bonds are, perhaps, one of the most important products to have emerged as a result of the revolution in the technology of finance. In many respects, however, junk bonds are not much of an innovation at all because they can easily be thought of as securitized and liquified commercial debt that is not much different from loans that have for decades been carried on bank books. Nonetheless, because junk bonds can be used to raise large sums of high risk capital to support substantial refinancings that are inconsistent with traditional corporate incentive structures, junk bonds have become valuable financial tools in the effort to eliminate the agency problems that abound when ownership is separated from control.

At this point, it is also impossible to avoid the words "management buyouts." Management buyouts effectively remove the gap between ownership and control and thereby eliminate a significant part of the potential for agency problems in large corporate structures. By integrating management and ownership, MBOs essentially solve the problem that so troubled Berle and Means more than a half century ago.

The ability to remove the gap between ownership and control in large corporate structures has many interesting



policy implications. Clearly, to the extent that such integration improves economic efficiency, MBOs are beneficial and should not be impeded by legislation or regulation. Just as clearly, however, the success of MBO transactions threatens the dominance of the large publicly held corporation, in which the providers of equity or debt capital are relatively powerless in comparison with the corporation's professional management. Many politicians and corporate managers have a vested interest in seeing the continued dominance of publicly traded corporate form of organization because it maximizes the power and influence of the nonowner class. A shift from the publicly traded form of organization, with all its agency costs, to the privately held form of organization, shifts power to the providers of corporate capital and thereby causes a dislocation of subtle political and social relationships that have built up over many decades.

Politicians and managers are unlikely to welcome such changes with open arms. Accordingly, it should come as little surprise that, behind the scenes, there may be a somewhat different agenda at work in the campaign against corporate takeovers than is often publicly discussed. In that debate, little is said about corporate debt, job loss, long-term planning, research and development, productivity, or competitiveness. Instead, power is the implicit topic of discussion and the changes wrought by progress in the technology of finance may be opposed not because those changes

are harmful in any economically rational sense, but because of their collateral consequences for structure of the power relationships that exert control over the American economy.

### Who Needs S&Ls?

The third question, who needs S&Ls?, sounds more like a Congressman's wish than an inquiry into the technology of finance. There is, however, a strong connection.

Today's newspapers are replete with stories describing the S&L debacle. Substantial steps have been taken over the last week or so to resolve those problems. In particular, we are finally hearing numbers that are approaching realistic estimates of the magnitude of the loss in the S&L industry. Earlier estimates of \$40-\$50 billion in losses were, I think, wildly optimistic. More recent calculations suggesting losses in the vicinity of \$100 billion, on a present value basis, are far more credible.

How did we get into a \$100 billion S&L mess?

A small but interesting part of the answer is fraud. When a savings and loan association, like Vernon Savings & Loan, has a 97% nonpayment rate on its loan portfolio, that's more than bad luck. In fact, you could pick a random street corner within a mile of here and hand out \$100 bills to the first 100 passersby, ask them to sign notes promising repayment with interest in a year, and you would get back more than \$300 in principle. But, as I've already suggested, fraud can explain only a fraction of the aggregate loss, and the

legal process will be able to recover only a small fraction of that which was stolen.

We got ourselves into the \$100 billion S&L mess by forgetting basic free-market principles and running the S&L industry as though it was intended to be a subsidized and protected sector. Deposit insurance was wildly under-priced; there were no risk-sensitive capital requirements or insurance premiums; the industry was allowed to follow accounting conventions that made a mockery of reality; and, through it all, policymakers refused to face up to the problem until it got too big to ignore.

More fundamentally, however, policymakers did not stop to ask the most basic question of all: Why do we have a separate S&L industry and why are we trying so hard to protect it? When savings and loans were first formed, they were intended to provide a source of financing for local residential real estate. Typically, the S&L would service local loans and hold those loans in its portfolio. As long as S&Ls arguably had a comparative advantage in evaluating, carrying, or servicing local loans, they arguably had a niche in which they could perform a valuable service.

There is, however, little reason to believe that in today's marketplace, S&Ls, as a class, have any real comparative advantage in providing financing for local residential real estate. Indeed, the tremendous growth of the mortgage-backed securities market makes it clear that S&Ls are

not the most efficient holders of mortgage loans. Rather than hold those loans in S&L portfolios, it is far more sensible and profitable to pool and securitize those loans in the market where they can be bought by investors.

To a large extent, the growth of the mortgage-backed security market, which also stands as one of the more substantial accomplishments of the new technology of finance, effectively rings the death knell for savings and loans, insofar as their purpose is to hold portfolios of mortgage paper. Further, if we want to subsidize home ownership in the United States, we don't have to do that through a savings and loan industry. Subsidies intended to benefit homeowners by propping up S&Ls do far more to prop up S&Ls than they benefit homeowners.

Because of the new technology of finance, S&Ls will have to retool if they are to survive. Their old markets and their old *raison d'etre* are gone forever. They will have to start focusing on providing local service and on servicing loans as areas where they might still have a comparative advantage. It is, however, clear to many market participants that the changes induced by the revolution are not to their liking. So, if the question is "Who needs S&Ls?" the easy and polite answer is "not as many people as used to, or as you might think."

## Conclusion

In conclusion, the revolution in financial technology is not only here, it is gaining speed. The revolution and its implications are not well known, nor are they widely understood. Accordingly, we should not be surprised to find substantial opposition to many of the changes that are likely to occur in our financial markets. The regulatory challenge as we head into the twenty-first century will be to channel this technology revolution with understanding, and not to politicize or stifle it. A great deal hinges on whether we succeed or fail in this mission, and it is, to put it candidly, too early in the process to know whether we will ultimately succeed or fail.