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THE NEW TECHNOLOGY OF FINANCE

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THE NEW TECHNOLOGY OF FINANCE

It's a pleasure to be invited to address this Fifth Annual Current Financial Issues Conference of the Financial Executives Institute. As many of you are aware, the Commission takes a strong interest in the work of the FEI, and we share many mutual areas of concern. To me, one of the more pleasant aspects of dealing with the FEI is that it is a forward looking organization. The FEI is more interested in what is likely to happen tomorrow than what happened yesterday. That, I believe, is a critical perspective in today's financial marketplace. And that brings me to the topic of my address--the future, and the technology of finance.

It probably comes as no surprise to hear that we are in the midst of a technological revolution that is unequalled in the history of mankind. In the past decade alone, breakthroughs in biotechnology have allowed us to create life-forms that are unknown in nature. We now have the tools to produce by the gallon substances that could before be collected only by the microgram. Breakthroughs in semiconductor and computer technology have led to processing speeds and memory capacities that not long ago were unthinkable. The recent dramatic decline in the costs of computation has brought us to a point where computers are often treated like commodity items--items that are as simple to manufacture, market, and operate as television sets, stereos, and other run-of-the-mill consumer goods. The progress in telecommunications is equally striking. Satellites and fibre optics now allow computers to link around the world in large, high speed digital networks that provide low cost and virtually instantaneous data links and voice channels. Similarly, progress in software technology promises easier to use applications systems, along with artificial intelligence and expert systems that could dramatically change the way we work in a wide variety of situations.

But, as one runs down a list of current technological breakthroughs, there is an area of remarkable progress that is typically overlooked. It is overlooked even though it directly or indirectly touches hundreds of millions of people a day, in countries around the world, and influences where they work, what they buy, how they produce, and even how they govern themselves. In a sense, this area is the Rodney Dangerfield of technological progress because, as a technology, "it don't get no respect"--at least nowhere near as much as it deserves.

I am talking about the revolution in the technology of finance. The technology of finance has, I believe, undergone a revolution that is as profound and far-reaching as anything that has happened in biotechnology, computation, or telecommunications. The content and implications of this revolution are often overlooked because few people think of finance as a technology. It follows, unfortunately and incorrectly, that if finance is not a technology, it cannot be part of a technological revolution.

But, finance is a technology. Sure, finance relies on and benefits from technological progress in other areas--particularly in computers and telecommunications. Sure, without advances in computers and telecommunications the modern practice of finance would be impossible. But the important point to recognize is that, even if we get rid of all the computers and telephones on Wall Street, there would remain underlying techniques for raising money and investing capital.

Progress in the techniques whereby an economy raises and invests its funds constitutes progress in the technology of finance. It is here--in the techniques by which funds are collected and reallocated--that progress in the past decade has been tremendous.

In my address today I will touch on four aspects of the revolution in the technology of finance.

One of the major advances in the technology of finance has been remarkable progress in the ability to define and reallocate risk--the ability to take streams of future earnings and obligations and match them more accurately so that borrowers and lenders can tailor their obligations and revenue streams to suit their needs.

A second major advance is the evolution of "portfolio thinking"--an awareness that it is not enough to pick investments in isolation. Instead, investments must be coordinated so that portfolios as a whole have a desired set of risk and return characteristics.

A third major breakthrough is the emergence of the efficient market hypothesis as a paradigm for understanding how capital markets work. In this area, although much has already been accomplished, much more work remains to be done. This is particularly true with regard to our current understanding of how and why markets attain and maintain particular degrees of efficiency.

Finally, a consequence of this revolution in the technology of finance is that the market now places a greater premium on sophistication and specialization in understanding how the new marketplace works. As I will explain, this may be a major contributing factor to the dramatic growth in the investment banking sector because investment bankers have become the sophisticated specialists who have mastered the operation of the new technology of finance.

Redefining and Reallocating Risk

Perhaps one of the more obvious forms of progress in the technology of finance is the market's new-found ability to redefine and reallocate risk. Progress in this area has recently been apparent in the evolution of new securitized instruments that take pools of home mortgages, car loans, or other receivables, and then aggregate and subdivide them so that investors can buy just the risks they want, and borrowers can get access to a larger pool of capital at lower cost.

As a specific example, let's take the case of the good old 30-year fixed rate home mortgage. Back in the dark ages, about 1980 or so, a bank would lend the funds and would carry the loan in a portfolio that would be relatively small compared with the total size of the home mortgage market. The bank's portfolio was relatively undiversified in terms of geographic location and the socio-economic characteristics of the borrowers.

Now, however, those loans can be pooled and sold into the marketplace. That reduces the lenders' risks while increasing the diversification available to investors. Home buyers are better off because the pool of available capital has increased, and investors are better off because they have additional and attractive investment opportunities. Bankers, in the meantime, get otherwise illiquid and nondiversified assets off their books and out into a marketplace that is better able to evaluate and absorb the interest rate and other risks that come with holding 30-year home mortgage paper.

Although the first generation of these instruments was finely crafted, recent experience taught us that there was demand for additional subdivision of the risk inherent in holding a securitized mortgage instrument. The sharp decline in interest rates over the past year made it clear that home buyers would quickly pay off high interest rate mortgages wherever they could finance at lower rates. Thus, there was a "call" provision hidden in those mortgage-backed securities. That fact came as an unpleasant surprise to some investors who thought they had relatively high rates locked in.

The response to this perceived problem was a further advance in the technology of finance that allows investors to select a degree of repayment risk.¹ One solution was to subdivide a single pool into a sequence of three or four different securities in which one sub-pool is guaranteed against prepayment risk. This increases the repayment risk on remaining sub-pools but allows investors to pick and choose more precisely the type of risk they want to assume for their money.

Another approach works roughly like this: a mortgage pool is divided into two securities--one security gets half the principal payments and only a third of the interest payments while the other gets two-thirds the interest payments and the other half of the principal. This structure produces a low yield security selling at a discount that will have an unusually high prepayment rate in comparison with other discounted securities. It also produces a high yield security selling at a premium that will have a lower prepayment rate than other instruments with comparable yields. Again, investors are presented with choices they otherwise wouldn't have.

The technology of finance thereby creates securities with different degrees of repayment risk--some with lower prepayment risks and others with higher prepayment risks. Investors can take and pay for the type of risk they want, and all this exotic risk-return structure is created from a pool of plain vanilla 30-year fixed rate home mortgages.

When this type of progress is combined with the availability of interest rate swaps, currency risk-swaps, interest rate caps, and access to international pools of capital that are far larger than any local bank's lending base, it's easy to see how homeowners, and many others, stand to benefit from the revolution in the technology of finance.

Portfolio Thinking

Another major insight of the new technology of finance is the importance of "portfolio thinking," or the identification of a class of investments that work well together.² Before

¹See Monroe, Mortgage-Backed Bond Innovations Are Proliferating, Wall St. J., Oct. 29, 1986, at 6.

²The modern roots of "portfolio thinking" date back to Markowitz, Portfolio Selection, 7 J. Fin. 77 (1952). For an accessible explanation of the portfolio approach see, R. Brealey & S. Myers, Principles of Corporate Finance 117-163 (1984).

the advent of "portfolio thinking," many investors tried to identify the most promising individual stocks or bonds and then sought to buy them as a group--thinking that this was the smartest way to invest.

"Portfolio thinking" teaches us that such strategies are likely to be inferior because they ignore the interrelationships, or covariances, among investment vehicles. These instrument-specific strategies can thereby cause investors to assume a greater than necessary degree of risk in order to achieve a desired return.

If you want a rough analogy, we can compare "portfolio thinking" to the process involved in picking a baseball team. If you try to put together a team by selecting the nine top vote getters in MVP balloting, you may wind up with a team long on outfielders and pitchers, but woefully weak at shortstop, second base, or wherever. In other words, you might wind up with terrific players and a lousy team. Portfolio thinking, on the other hand, could persuade you to pick some players that don't even make it into the MVP balloting--because they could give you a balanced team that has a better chance of beating a smorgasbord of highly paid all-stars. If you don't believe me, ask George Steinbrenner.

The consequences of "portfolio thinking" have had significant implications for Wall Street. A large number of studies have concluded that, on average and over time, professional money managers do not outperform risk-adjusted market portfolios.³ Whether or not everyone in this room accepts that proposition is almost besides the point: the

³E.g., Sharpe, Mutual Fund Performance, 39 J. Bus. 119 (Jan. 1966); McDonald, Objectives and Performance of Mutual Funds, 1960-1969, J. Fin. & Quantitative Analysis 311 (June 1974); Modigliani and Pogue, An Introduction to Risk and Return, Fin. Analysts J. (March/April, May/June 1974); R. Brealey, An Introduction to Risk and Return from Common Stocks, Ch. 4 (1969). These findings have been reexamined recently using the methodology developed to evaluate a manager's ability to time the market and select individual securities. See Henriksson and Merton, On Market Timing and Investment Performance. II. Statistical Procedures for Evaluating Forecasting Skills, 54 J. Bus. 513 (Oct. 1981). The recent studies reach the same general conclusions as earlier work. See Chang and Lewellen, Market Timing and Mutual Fund Investment Performance, 57 J. Bus. 57 (Jan. 1984); Henriksson, Market Timing and Mutual Fund Performance: An Empirical Investigation, 57 J. Bus. 73 (Jan. 1984); Jagannathan and Korajczyk, Assessing the Market Timing of Managed Portfolios, 59 J. Bus. 217 (April 1986).

non-debatable fact is that more and more money is being invested according to a philosophy that recognizes that active management, also popularly known as "stock-picking," may not generate gains worth its costs. This world view has caused a sharp increase in the size of indexed portfolios that are designed simply to match the performance of a predetermined index--not to beat it, and certainly not to do worse than the index. Similarly, this world view has caused increased interest in performance fee arrangements. Under these arrangements, an adviser's compensation depends on the extent to which he can outperform a pre-defined index benchmark.

The growth of "portfolio thinking" has also had some interesting implications for the market's performance. The S&P-500 is probably the most widely used index benchmark for index funds or performance fees. A recent study suggests that stocks that are added to the S&P-500 experience a sharp increase in volume immediately subsequent to their addition to the index.⁴ Apparently, trading volume increases because portfolios that seek to track the S&P-500 have a sudden demand for a position in the newly-indexed company's shares. Along with this sharp jump in volume comes a sharp price increase of roughly 3 percent that is subsequently gradually reversed in the market. This type of sharp run-up and reversal appears to be consistent with a "price pressure" effect that is also observed in certain large block-trade scenarios. This finding is a quite remarkable testament to the spread of "portfolio thinking" in the economy because it demonstrates that a pure portfolio-price effect can be associated with stocks that have no new information about them coming to market, other than their inclusion in the most widely followed of all portfolio indexes.

The Mechanisms of Market Efficiency⁵

Behind much of this progress in the technology of finance lie the insights that emanate from the efficient market hypothesis. As one leading scholar has observed, "there is no

⁴Harris & Gurel, Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures, 41 J. Fin. 815 (1986).

⁵This title is taken from Gilson & Kraakman, The Mechanisms of Market Efficiency, 70 Va. L. Rev. 549 (1984). For a related analysis, see Gordon & Korhauser, Efficient Markets, Costly Information, and Securities Research, 60 N.Y.U.L. Rev. 761 (1986), and Easterbrook & Fischel, Mandatory Disclosure and the Protection of Investors, 70 Va. L. Rev. 669 (1984).

other proposition in economics [or finance] which has more empirical evidence supporting it than the efficient market hypothesis."⁶ Although I agree with that assessment, at the same time I recognize that there are intriguing and potentially important anomalies in the data supporting the efficient market hypothesis. To me, however, the most interesting observation is that we don't really understand how and why the market is as efficient as it is--and not more efficient or less efficient. We also don't fully understand how markets come to be efficient and sustain particular degrees of efficiency.

There is an apocryphal story that helps illustrate this point. A University of Chicago professor and a graduate student are walking down Wall Street. The student spots a \$100 bill lying on the ground right under the professor's foot. He points it out and suggests that the professor pick it up. The professor says, "No way. Wall Street is efficient. There couldn't possibly be \$100 lying in Wall Street because someone else would have picked it up by now or it would have been arbitrated away." So, the student picks up the \$100 and walks away whistling.

By the way, the student in this story never finishes his dissertation. Instead, he goes on to make a mint in investment banking. The professor is now trying to land a job consulting for that student, but seems to be having a tough time getting a commitment.

The point of the story is that markets are efficient because people do go through the effort to pick up those \$100 bills, and they go through the effort to ferret out where those \$100 bills might be found. It's precisely because of that effort that these \$100 bills are as rare as they are: they are there for the picking, but they are generally picked up only by those clever enough and quick enough to find them and pocket them.

Another way of thinking about this aspect of the stock market, and about the technology of finance in general, is to recognize that there are really two parallel markets at work. First, there is a market for information about securities. Second, there is a market for the securities themselves. Equilibrium in the information market determines pricing in

⁶Jensen, Some Anomalous Evidence Regarding Market Efficiency, 6 J. Fin. Econ. 95 (1978).

the securities market.⁷ As we all know, the market for information is not costless, nor is it perfect. Technological progress in the market for information provides significant advantages in the market for securities. So, it should come as no surprise that the people who make the most money on Wall Street are those who are most effective in the market for information--without, of course, violating our insider trading laws.

The Value of Sophistication and Specialization

This leads naturally to my final point. There has always been a premium on sophistication and specialization on Wall Street. But with the new developments that characterize the technological revolution in finance, the premium on sophistication and specialization is growing at a torrid pace. More and more, transactions will flow to those institutions and individuals who have mastered the new technology, and understand how to operate in the new marketplace.

Again, there should be nothing surprising in this trend. In medicine, practitioners who know only how to read X-rays find that much of their diagnostic business is lost to physicians familiar with CAT scans and NMR techniques. In computer technology we find the same trend: an 8-bit microprocessor may have produced a perfectly wonderful machine for a 1978 world, but puts a competitor at a serious disadvantage in 1986 when customers are looking forward to 32-bit architectures. Similarly, financial business will flow to those firms that understand the latest developments in the technology of finance and, just as importantly, have the ability to implement and execute new types of transactions. Being second best in the new technology simply may not be good enough.

This rather straightforward observation helps explain a lot about the changing landscape of the financial marketplace. One of the more interesting developments of the past decade has been the emergence of certain large investment banks as powerful forces. Although investment banks have been with us for many years, their capitalizations, profitability, and significance in the market have recently grown at an extraordinary pace. Part of the reason for this growth is

⁷For examples of formal models that develop parallel securities pricing and information market equilibria see Grossman & Stiglitz, On the Impossibility of Informationally Efficient Markets, 70 Am. Econ. Rev. 393 (1980), and Verrecchia, Information Acquisition in a Noisy Rational Expectations Economy, 50 Econometrica 1415 (1982).

that the new technology of finance places an increased premium on the specialization that is necessary in order to take advantage of new techniques. For example, although we may all know what "securitization" means, and we may all understand in a rather general way how home mortgages and automobile loans can be repackaged into publicly traded securities, there are literally hundreds of small steps in the process. Each step must be executed well for the process to work as a whole. Business will flow to those firms best able to perform these functions at lowest cost--and that requires specialization--a lot of it.

Before the recent evolution in the technology of finance there were also gains to specialization. Those gains were not, however, as great as they are now. With the old technology, many publicly traded and privately held companies could afford to keep a larger part of their finance function in-house because they could perform many jobs just about as well as the Wall Street professionals. Therefore, the incentive was not as strong to substitute Wall Street's market-oriented process for an internal capital allocation process that relied on management judgment more than real-time market prices.

No more--few companies are in the market so regularly that they can rationally afford the commitment necessary to develop and maintain, on an in-house basis, the capacity to allocate capital as well as it can be allocated by specialists who have regular access to the new technology. Few companies have incentives to reach for this degree of specialization, and few companies have the incentive to invest, on a continual basis, in developing the market intelligence necessary to determine precisely which financing structure in which market is likely to yield the lowest effective cost of capital.

That's why the demand for investment banking services has grown so dramatically. The investment bankers are the specialists who continually invest in the new technology of finance, and who have mastered its intricacies. Companies that need financing, as well as investors looking for profit opportunities, both have an incentive to allow the specialists to mediate the terms of the exchange because specialists can add value.

This development again has many parallels in the history of technology. Breakthroughs in technology often create fortunes for companies and individuals savvy enough to master the new realities of the marketplace. That's true whether one looks at fortunes made in the 19th century in dynamite and steel processing, or in the 20th century in computers and biotechnology. It's true also on Wall Street where the new

technology has and will continue to create substantial wealth for those who are able to dance safely and well at the cutting edge of the technology.

The New Technology of Finance and the Old Technology of Regulation

Although my assessment of the new technology of finance has, to this point, been upbeat, I am compelled to leave you with a somewhat sober message.

It's easy to be optimistic about the potential of the new technology of finance, but we should not forget the clear lessons of history. Technology has its benefits and it has its costs. Even if a technology is clearly beneficial in the aggregate, there is some circumstance under which it can backfire and have an unintended or unforeseen side-effect. Regulation also has its benefits and its costs. Even if a regulation is clearly beneficial in the aggregate, there can well be some circumstances under which regulations also can have unintended or unforeseen harmful effects. Just as the perfect technology has never been invented, the perfect regulation also has never been written.

The difficult situation confronting regulators today is that we are asked to regulate the market of the '80's but many of our regulatory tools were crafted in the '30's. A regulator's job would be tough enough under a regulatory structure that recognizes the implications of internationalization and the intricacies of the new technology of finance. But, with a regulatory system rooted in the 1930's, our regulatory tools are often revealed to be ill-suited to the task.

For better or worse, that's the state of affairs we have today. As regulators, we try to do the best we can to adapt our statutes and regulations to new market realities. But there are, unfortunately, serious limits on the Securities and Exchange Commission's ability to be responsive in the face of new developments. This simple fact may, one day, turn out to be at the core of a fundamental conflict between progress in the technology of finance and the reality of regulatory structures. Clearly, it would be better if the technology of regulation is updated to match the technology of finance--but that depends on the technology of politics, and about that I will make no predictions.