

### Mr. Greenspan considers some of the effects of technological change

Remarks by the Chairman of the Board of Governors of the US Federal Reserve System, Mr. Alan Greenspan, at the Annual Convention of the American Bankers Association in Boston, on 5/10/97.

It is always with mixed feelings of pleasure and trepidation that I accept an invitation to speak at the American Bankers Association annual convention. I still have a disconcerted remembrance of my acceptance of your first invitation, which had been scheduled for October 20, 1987. That speech had to be scratched at the last minute as the result of a certain adversity in stock price adjustments the day before. Experience suggests, however, that history does not repeat with a fixed periodicity and, besides, I have crossed my fingers.

The theme of your convention this year is timely. It is exactly when rapid innovation and institutional and technological change are taking place that market participants should take time to contemplate the opportunities and the risks, what to retain and what to change. Only then can the banking industry create the most value-added for customers, employees, and society, and as a consequence, for shareholders.

As in recent years, the future role of banks and other providers of financial services will surely be significantly affected by the same basic forces that have shaped the real and financial economy world-wide: relentless technological change. This morning, I would like to describe some of the effects of technological change in both the financial and nonfinancial sectors and discuss a few of their more important implications. I will begin with the real economy.

#### Technological Change and the Real Economy

The most important single characteristic of the changes in U.S. technology in recent years is the ever expanding conceptualization of our Gross Domestic Product. We are witnessing the substitution of ideas for physical matter in the creation of economic value -- a shift from hardware to software, as it were. The roots of increasing conceptualization of output lie deep in human history, but the pace of such substitution probably picked up in the early stages of the industrial revolution, when science and machines created new leverage for human energy and ideas. Nonetheless, even as recently as the middle of this century, the symbols of American economic strength were our outputs of such physical products as steel, motor vehicles, and heavy machinery -- items for which sizable proportions of production costs reflected the exploitation of raw materials and the sheer manual labor required to manipulate them. However, today's views of economic leadership focus increasingly on downsized, smaller, less palpable evidence of weight and bulk, requiring more technologically sophisticated labor input.

Examples of this trend permeate our daily lives. Radios used to be activated by large vacuum tubes; today we have elegantly designed pocked-sized transistors to perform the same function -- but with the higher quality of sound and greater reliability that consumers now expect. Thin fiber optic cable has replaced huge tonnages of copper wire. Owing to advances in metallurgy, engineering, and architectural design, we now can construct buildings that enclose as much or more space with fewer materials.

A number of commentators, particularly Professor Paul David of Stanford University, have suggested that, despite the benefits we have seen this decade, it may be that the truly significant increases in living standards resulting from the introduction of computers and

communications equipment still lie ahead. If true, this would not be unusual. Past innovations, such as the introduction of the dynamo or the invention of the gasoline-powered motor, required considerable infrastructure investment before their full potential could be realized.

Electricity, when it substituted for steam power late last century, was initially applied to production processes suited to steam. Gravity was used to move goods vertically in the steam environment, and that could not immediately change with the advent of electric power. It was only when horizontal factories, newly designed for optimal use of electric power, began to dominate our industrial system many years after electricity's initial introduction, that national productivity clearly accelerated.

Similarly, it was only when modern highways and gasoline service stations became extensive that the lower cost of motor vehicle transportation became evident.

### Technological Change and the Financial Economy

It is surely not news to a group of bankers that the same forces that have been reshaping the real economy have also been transforming the financial services industry. Once again, perhaps the most profound development has been the rapid growth of computer and telecommunications technology. The advent of such technology has lowered the costs, reduced the risks, and broadened the scope of financial services, making it increasingly possible for borrowers and lenders to transact directly, and for a wide variety of financial products to be tailored for very specific purposes. As a result, competitive pressures in the financial services industry are probably greater than ever before.

As is true in the real economy, it is difficult to overestimate the importance of education and ongoing training to the advancement of technology and product innovation in the financial sector. I doubt that I need to tell any of you about the importance of education and training for employees. But the same is almost surely true for your customers. Surveys repeatedly indicate that users of electronic banking products are typically very well educated. For example, data from the Federal Reserve Board's Survey of Consumer Finances suggest that a higher level of education significantly increases the chances that a household consumer will use an electronic banking product. Indeed, this survey indicates that, in late 1995, the median user of an electronic source of information for savings or borrowing decisions had a college degree -- a level of education currently achieved by less than one-third of American households.

Technological innovation and more sophisticated users have accelerated the second major trend -- financial globalization -- which has been reshaping our financial system, not to mention the real economy, for at least three decades. Both developments have expanded cross-border asset holding, trading, and credit flows and, in response, both securities firms and U.S. and foreign banks have increased their cross-border operations. Once again, a critical result has been greatly increased competition both at home and abroad.

A third development reshaping financial markets -- deregulation -- has been as much a reaction to technological change and globalization as an independent factor. Moreover, the continuing evolution of markets suggests that it will be literally impossible to maintain some of the remaining rules and regulations established for previous economic environments. While the ultimate public policy goals of economic growth and stability will remain unchanged, market forces will continue to make it impossible to sustain outdated restrictions, as we have recently seen with respect to interstate banking and branching.

In such an environment, I share your frustration with the pace of legislative reform and revision to statutorily mandated regulations. Nonetheless, we should not lose sight of the remarkable degree of re-codification of law and regulation to make banking rules more consistent with market realities that has occurred in recent years. Deposit and other interest rate ceilings have been eliminated, geographical restrictions have been virtually removed, many banking organizations can do a fairly broadly based securities underwriting and dealing business, many can do insurance sales, and those with the resources and skill are authorized to virtually match foreign bank competition abroad. Moreover, it seems clear that there is recognition by the Congress that the basic financial framework has to be adjusted further. The process, as you know, is not easy when the results of regulatory relief create both a new competitive landscape and new supervisory and stability challenges.

Change will, I believe, ultimately occur because the pressures unleashed by technology, globalization, and deregulation have inexorably eroded the traditional institutional differences among financial firms. Examples abound. Securities firms have for some time offered checking-like accounts linked to mutual funds, and their affiliates routinely extend significant credit directly to business. On the bank side, the economics of a typical bank loan syndication do not differ essentially from the economics of a best-efforts securities underwriting. Indeed, investment banks are themselves becoming increasingly important in the syndicated loan market. With regard to derivatives instruments, the expertise required to manage prudently the writing of over-the-counter derivatives, a business dominated by banks, is similar to that required for using exchange-traded futures and options, instruments used extensively by both commercial and investment banks. The writing of a put option by a bank is economically indistinguishable from the issuance of an insurance policy. The list could go on. It is sufficient to say that a strong case can be made that the evolution of financial technology alone has changed forever our ability to place commercial banking, investment banking, insurance underwriting, and insurance sales into neat separate boxes.

Nonetheless, not all financial institutions would prosper as, nor desire to be, financial supermarkets. Many specialized providers of financial services are successful today and will be so in the future because of their advantages in specific areas. Moreover, especially at commercial banks, the demand for traditional services by smaller businesses and by households is likely to continue for some time. And the information revolution, while it has deprived banks of some of the traditional lending business with their best customers, has also benefitted banks by making it less costly for them to assess the credit and other risks of customers they previously would have shunned. Thus, it seems most likely that banks of all types will continue to engage in a substantial amount of traditional banking, delivered, of course, by ever improving technology.

Community banks, in particular, are likely to provide loans and payments services via traditional on-balance sheet banking. Indeed, smaller banks have repeatedly demonstrated their ability to survive and prosper in the face of major technological and structural change by providing traditional banking services to their customers. The evidence is clear that well-managed smaller banks can and will exist side by side with larger banks, often maintaining or increasing local market share. Technological change has facilitated this process by providing smaller banks with low-cost access to new products and services. In short, the record shows that well-managed smaller banks have nothing to fear from technology, globalization, or deregulation.

For all size entities, however, technological change is blurring not only traditional distinctions between the banking, securities, and insurance business, but is also having a

profound effect on historical separations between financial and nonfinancial businesses. Most of us are aware of software companies interested in the financial services business, but some financial firms, leveraging off their own internal skills, are also seeking to produce software for third parties. Shipping companies' tracking software lends itself to payment services. Manufacturers have financed their customers' purchases for a long time, but now increasingly are using the resultant financial skills to finance noncustomers. Moreover, many nonbank financial institutions are now profitably engaged in nonfinancial activities.

Current facts and expected future trends, in short, are creating market pressures to permit the common ownership of financial and nonfinancial firms. In my judgement, it is quite likely that in future years it will be close to impossible to distinguish where one type of activity ends and another begins. Nonetheless, it seems wise to move with caution in addressing the removal of the current legal barriers between commerce and banking, since the unrestricted association of banking and commerce would be a profound and surely irreversible structural change in the American economy.

Were we fully confident of how emerging technologies would affect the evolution of our economic and financial structure, we could presumably develop today the regulations which would foster that evolution. But we are not, and history suggests we cannot, be confident of how our real and financial economies will evolve. If we act too quickly, we run the risk of locking in a set of inappropriate rules that could adversely alter the development of market structures. Our ability to foresee accurately the future implications of technologies and market developments in banking, as in other industries, has not been particularly impressive. As Professor Nathan Rosenberg of Stanford University has pointed out, ". . . mistaken forecasts of future structure litter our financial landscape."

Indeed, Professor Rosenberg suggests that even after an innovation's technical feasibility has been clearly established, its ultimate effect on society is often highly unpredictable. He notes at least two sources of this uncertainty. First, the range of applications for a new technology may not be immediately apparent. For instance, Alexander Graham Bell initially viewed the telephone as solely a business instrument -- merely an enhancement of the telegraph -- for use in transmitting very specific messages, such as the terms of a contract. Indeed, he offered to sell his telephone patent to Western Union for only \$100,000, but was turned down. Similarly, Marconi initially overlooked the radio's value as a public broadcast medium, instead believing its principal application would be in the transmission of point-to-point messages, such as ship-to-ship, where communication by wire was infeasible.

A second source of technological uncertainty reflects the possibility that an innovation's full potential may be realized only after extensive improvements, or after complementary innovations in other fields of science. According to Charles Townes, a Nobel Prize winner for his work on the laser, the attorneys for Bell Labs initially refused, in the late 1960s, to patent the laser because they believed it had no applications in the field of telecommunications. Only in the 1980s, after extensive improvements in fiber optics technology, did the laser's importance for telecommunications become apparent.

It's not hard to find examples of such uncertainties within the financial services industry. The evolution of the over-the-counter derivatives market over the past decade has been nothing less than spectacular. But as the theoretical underpinnings of financial arbitrage were being published in the academic journals in the late 1950s, few observers could have predicted how the scholars' insights would eventually revolutionize global financial markets. Not only were additional theoretical and empirical research necessary, but, in addition, several generations

of advances in computer and communications technologies were necessary to make these concepts computationally practicable.

All these examples, and more, suggest, that if we dramatically change the rules now about banking and commerce, with what is great uncertainty about future synergies between finance and nonfinance, we may well end up doing more harm than good. And, as with all rule changes by government, we are likely to find it impossible to correct our errors promptly, if at all. Modifications of such a fundamental structural rule as the separation of banking and commerce accordingly should proceed at a deliberate pace in order to test the response of markets and technological innovations to the altered rules in the years ahead.

The need for caution and humility with respect to our ability to predict the future is highly relevant for how banking supervision should evolve. As I proposed to this audience last year, regulators are beginning to understand that the supervision of a financial institution is, of necessity, a continually evolving process reflecting the continually changing financial landscape. Increasingly, supervisory techniques and requirements try to harness both the new technologies and market incentives to improve oversight while reducing regulatory burden, burdens that are becoming progressively obsolescent and counterproductive.

Concerns about setting a potentially inappropriate regulatory standard were an important factor in the decision by the banking agencies several years ago not to incorporate interest rate risk and asset concentration risk into the formal risk-based capital standards. In the end, we became convinced that the technologies for measuring and managing interest rate risk and concentration risk were evolving so rapidly that any regulatory standard would quickly become outmoded or, worse, inhibit private market innovations. Largely for these reasons, ultimately we chose to address the relationship between these risks and capital adequacy through the supervisory process rather than through the writing of regulations.

### Conclusion

In conclusion, it is clear that both the real and the financial economies have been, and will continue to be, changed dramatically by the forces of technological progress. Banks will be under constant challenge to harness these forces to meet the ever-shifting competition. In such an environment, many existing rules and regulations will, if not modified, increasingly bind those banks seeking to respond, let alone innovate. Thus, there is a profound need for legislators and banking supervisors also to adapt to the changing realities. But do keep in mind that the government has an obligation to limit systemic risk exposure, and centuries of experience teach us the critical role that financial stability plays in the stability of the real economy. Bankers also have an obligation to their shareholders and creditors to measure and manage risk appropriately. In short, the regulators and the industry both want the same things -- financial innovation, creative change, responsible risk-taking, and growth. The market forces at work will get us there, perhaps not as rapidly as some banks may desire, but get there we will.