

# Banking on the Information Age

SHANE GREENSTEIN  
s-greenstein@nwu.edu



..... Alan Greenspan, chair of the United States' Federal Reserve Board, has commented on the pervasiveness of information technology and the country entering a new era. This theme first appeared in a few of his dinner speeches around 1995. It found its way into policy speeches a few years later. Nowadays, you can even find it in Greenspan's congressional testimony.

Your first reaction to this might be, "Hey, welcome to the information age." The IT revolution is not, after all, recent news. It doesn't become news just because Greenspan came late to the party.

Actually, Greenspan's opinion indicates that something fundamental is happening here. A bit of background might help. Greenspan is a savvy, cautious thinker imbued with instincts for circumspection. He tends to deliver deliberately elliptical speeches suspicious of untested theories and respectful of hard facts. Common wisdom says financial markets might misconstrue any rash remark or off-handed humor as a signal of a major or even a minor shift in Federal Reserve policy, so he plays it straight. All the time. Thus, it comes as something of a shock when Greenspan publicly changes his mind about something. To wit, the country's central banker has decided that IT really does matter for economic growth and for fighting inflation. Why?

Let me put Greenspan's view in some perspective. It is not just that IT has made

financial markets more efficient. More precisely, he is focusing on three distinct long-term trends:

1. IT has become critical infrastructure for many facets of the modern economy.
2. Just as many great things today resulted from IT inventions that are two decades old, many great inventions today hold seeds for the future.
3. Changes to IT bring about largely unmeasured benefits to society in the form of new goods and services, and many of these benefits keep prices down.

## IT as critical infrastructure

A PC is necessary, though not sufficient, for conducting high-technology activity. That said, in the US as with most of the developing world, PCs have become so abundant as to make the issues concerning critical infrastructure rather subtle.

First, let's get one thing straight. The popular discussion about critical infrastructure arose from a marketing ploy. The simplest version shows up in brazen commercials from several computer companies. You see, poor Johnny has parents who don't own a PC. Johnny doesn't learn to search the Internet, doesn't learn to think properly, and gets failing grades. Now crank up the music. Here comes Cindy, whose parents invested heavily in online educational programs. Cindy's school report is a full-blown multimedia event. It includes a video stream, Web pages with

professional layouts, and grammatically correct poetic prose laced with quotes from Percy Bysshe Shelley. This child is obviously headed for great things. Not so poor Johnny, the PC deprived.

The point, of course, is that sellers want consumers to think of the PC as a critical component of their children's future success. Well, maybe. Then again, maybe not. Certainly, Greenspan doesn't care about your child specifically—he worries about whole neighborhoods of children. The concern is that neighborhoods of households lacking PCs will produce workers lacking the abilities to step into high-paying jobs later in life. These neighborhoods tend to occur in inner cities and in rural areas. So the argument goes: the US will hamper its future if children in these areas lack access to basic training in using IT. These policy advocates must then put PCs in schools and Internet connections in libraries to give Johnny a chance, even if his parents can't.

The validity of this argument is certainly debatable, but undoubtedly many policy-makers believe it. The present federal program to subsidize Internet access in disadvantaged areas' schools and libraries spends two billion dollars a year based partly on this premise.

Greenspan evidently has another version of this concern at the top of his agenda. He can see the pervasiveness of PCs. They have changed almost every occupation from architecture to zoology. PCs have become critical infrastructure for

many activities in most regions of the country.

Greenspan doesn't worry about abundant things such as hardware. He worries about scarce things such as adequate software, trained personnel, and so on. With good reason: In some regions it's difficult to find programmers in frontier languages. In some remote cities it's difficult to find engineers trained to service an unusual computing program. In some industries it's difficult to find consultants who understand how to translate the latest computing technology into useful applications for that industry. Where labor is difficult to find, costs go up. Too much of that is bad for economic growth.

### Technical change feeds on itself

Greenspan, for good or ill, is old enough to remember how the wave of invention associated with mainframes changed many essential features of financial markets—the markets he knows best. He must also have observed the patterns of the past two decades, when PCs transformed financial markets yet again. Watching E-trade and E-Schwab today, he might well feel a sense of *déjà vu*.

That long-term perspective informs some of the comments Greenspan makes today. Changes evolve slowly, especially in service industries. Only after the passage of time, and the gradual accumulation of many incremental improvements in processes and outputs, does dramatic change result. For a variety of reasons, experimentation and learning often can occur only within a market setting. It takes time to translate an invention into a viable commercial product—time to develop business models, create new distribution channels, let one set of users learn from another, and so on.

No one adoption pattern characterizes all IT, nor are these patterns necessarily similar to important historical episodes of diffusion such as for radio, television, or the automobile. Actually, new waves of IT invention set off new waves of IT invention by users, and each wave has its own diffusion curve of adaptation and adoption. For example, the invention of inexpensive

fiber optic cable did not immediately change the capability of phone service nationwide. Performance and features changed in fits and starts as digital switching technologies, repeaters, and software that increased fiber's capabilities were developed and adopted. Thus, new services showed up at different companies and in different regions at different times.

Similarly, such important contemporary technologies as the World Wide Web and enterprise resource planning have set off entirely new waves of invention. The Web (or at least technologies arising from it) prompts a great deal of new application development. Along with TCP/IP-based technologies, whole new business models are emerging for delivering and using data-related services. Similarly, the unification of distinct systems associated with enterprise resource planning permits a new wave of control of IT and businesses. These changes are not merely the tail ends of a diffusion curve that began long ago; they represent a renewed process. Such processes differ across regions of the country and across industries within specific regions.

Even a central banker can get excited about the cost conditions and economic opportunities that future users will face after the deployment of extremely inexpensive computing capabilities and low-cost, high-bandwidth fiber and wireless communications technologies. These deployments will induce (and already have induced, to some extent) the entry into this market of thousands of firms trying to solve technical and commercial problems that never previously existed.

### How IT benefits society

Ultimately, Greenspan cares most about changes to the price level from one year to the next. Will the IT revolution reduce inflation or not? This is the trillion-dollar question.

How could anyone answer this precisely? It's extremely difficult to find a direct relationship between investment activity yesterday and economic benefits from new technology today. Adding another computer in an office is not like

adding another truck to a construction firm, nor is developing a better wide-area network like adding robotic machinery to an assembly line. Real value comes from more than just a few new dollars earned by an enterprise that adopted a WAN; it also comes from the value created by the new services consumers use relative to what they would have used had the IT investment not occurred. This value is a hard thing to measure. Rarely does the standard productivity model provide an informative answer.

Moreover, investment and use differ over time and are associated with different economic goals. In other words, hardware-based measures of IT, such as the number of computers, data communication lines, or Internet servers, presume that different types of IT capital are not strongly heterogeneous in their capabilities. This simply isn't so.

The final output from organizations that use IT may also change over time. Some of these changes may generate new revenue; some may induce the entry into the market of new firms with business models using the new IT in a radical way; and some may induce exit. Thus, the key features of the new IT's final output may change radically over time.

It's easiest to assess the value of these changes if the new technology simply changes the prices of existing goods. Yet, because it's pervasive, fundamental changes in IT lead to widespread and complex change throughout the economy. Further, IT can change the economy in qualitative ways not easily converted into quantitative measures like price changes. Many of these benefits keep prices down—something that really matters to the main inflation fighter in the country. These benefits show up slowly and only through indirect means.

Greenspan appears to have bought into the perspective—an opinion that he only expresses cautiously, elliptically, and with many qualifiers—that the past investment in IT gave us lower prices today and may again tomorrow. That's quite an observation from the Federal Reserve chair—one that we can take all the way to the bank.