

The Impact of E-Business: A Historical Perspective

J. Bradford DeLong

delong@econ.berkeley.edu <http://www.j-bradford-delong.net/>

At the end of the 1950s—when electronic computers had largely replaced electromechanical calculators—there were roughly 2000 installed computers in the world. These were machines like Remington Rand UNIVACs, IBM 650s or 702s, or DEC PDP-1s. Their processing power averaged perhaps 10,000 instructions per second. Today—forty years later—we are talking orders of magnitude only here—there are approximately 200 million active computers in the world with processing power that averages approximately 100,000,000 instructions per second. This is a million-fold increase in forty years. And it leaves to one side the accompanying improvements in data storage and data communications technologies that are of equal magnitude.

How does this compare to past economic transformations? The fifty years after the invention of electricity saw an increase in mechanical horsepower that was perhaps a hundredfold. And the coming of electricity revolutionized American industry, as Paul David has pointed out many times in the past decade.

Now some believe that the information technology revolution is not very important. They think that improvements in data processing and data communications technology soon run into diminishing returns. This is not totally implausible: of the four microprocessors currently dedicated to my personal use, two are off right. The other two? Each is running, but each is running at about 5% of its possible load. We have built a computer system that vastly outstrips the imagination of science fiction writers of previous generations, and we use it to play games of solitaire by the billions. We have worldwide communications bandwidth unimaginable even a generation ago, but as Henry David Thoreau asked of the telegraph, how much do we really have to say? Investments in information processing and communications technology may be subject to diminishing returns that set in rapidly, which would mean that 10,000 computers are only a little better than one.

A decade ago such skepticism about the long-run economic implications of our data processing and data communications technologies was the conventional wisdom. But the past five years have converted many skeptics. Perhaps diminishing returns to investments in information and communications technology will not set in rapidly. In the past, each upward leap in computer processing power has brought with it a new dimension of capabilities and uses: the first computers produced tables useful for calculating artillery trajectories. The next generation were used not to make sophisticated calculations, but to make the extremely simple calculations needed by the Census, and by the human resource departments of large corporations. The next generation of computers were used to stuff data into and pull data out of databases in real time—airline reservations processing systems, insurance systems, inventory control.

Computers came to the American office as wordprocessors and what-if machines, devices to answer questions like “what if this paragraph looked like that?” or “what if this cash flow growth rate were only half as fast?” More recently computers have become embedded into objects as sensors and controllers, and have reached outward to become windows to access the worldwide library that we are now building. For paralleling the revolution in data processing capacity has been a similar revolution in data communications capacity.

I won't say whether this particular leap forward in technology is larger than in the past—bigger than the steam engine or the automobile. How could I? What metric would we use? In their day television, or the internal combustion engine, or the railroad, or the steam engine were technological leaps that transformed the economy and society as well. You only have to begin thinking about the problems of measuring changes in economic structure and changes in rates of economic growth across structural transformations

before you conclude that the problems of measurement are unsolvable—leaving aside the fact that the Bureau of Economic Analysis’s NIPA do not “see” network television at all.

I also can’t say whether the pessimistic conventional wisdom of a decade ago or the more optimistic recent point of view is more correct. In the macroeconomic universe where I usually dwell, the answer to this question depends on the shape of the aggregate production function. But in reality there is no such thing as an aggregate production function, and no such thing as the diminishing-returns-to-scale parameter that determines how much extra production is generated by larger investments in communications and computer capital. There are only industries and sectors—and whether the computer revolution will unleash a new economic golden age depends on what happens industry-by-industry, sector-by-sector. Whether the pessimistic or the optimistic view is correct depends on the details—on whether these technologies do amplify productivity industry by industry.

But let me ask two big questions before we break up into our industry-by-industry group:

First, we don’t know yet how to make the intellectual property system work for the coming e-economy. Back in the Gilded Age, intellectual property was not such a big deal. Industrial success was based on knowledge, yes. But industrial success was based on knowledge crystalized in dedicated capital. Lots of people knew organic chemistry. Few companies—those that had made massive investments—could make organic chemicals.

Now intellectual property is rapidly becoming a much more important source of value. And the political system’s response seems to be to tighten up on intellectual property rights. To reinforce the rights of “owners” at the expense of the freedom of “users.” The underlying idea is that markets work because everything is someone’s property. Property rights give producers the right incentives to make, and users the right incentives to calculate the social cost of what they use. But with information goods the social cost of distributing information is close to zero. What will be the right intellectual property system for tomorrow?

Second, the governmental foundations underpinning the market system necessary to make it function well are not fixed in stone. As technology and society change, what the government needs to do in order to make the market function changes as well.

Consider again the Gilded Age: the coming of the large corporation to late-nineteenth century America. You needed more than the improvements in production technology that made possible the large-scale factory in order to arrive at the large industrial organization. From today’s standpoint we can look back and say that the coming of the large corporation required four things:--Limited liability and the stock market.

- Investment banking.
- The federalization of regulation in the interest of free interstate commerce.
- An antitrust policy

You needed legal and institutional changes-limited liability and investment banking-to assemble the capital to build factories on the scale needed to serve a continental market. You needed political changes—antitrust policies—to try to make sure that the enormous economies of scale within the grasp of the large corporation were not achieved at the price of replacing competition by monopoly You needed institutional changes to make sure that the new corporations could serve a continental market.

For example, think of Swift Meatpacking, subject of an ongoing dissertation at Berkeley by Gary Fields. His business was based on a very good idea: mass-slaughter the beef in Chicago, ship it dressed to Boston, and undercut local small-scale Boston-area slaughterhouses by a third at the butchershop. This was a very good business plan. It promised to produce large profits for entrepreneurs and investors and a much better diet at lower cost for consumers. But what if the Massachusetts legislature were to require for

reasons of health and safety that all meat sold in Massachusetts be inspected live and on the hoof by a Massachusetts meat inspector in Massachusetts immediately before slaughter?

Without the right system of governance—in this case federal preemption of state health and safety regulation affecting interstate commerce—you wouldn't have had America's Chicago meatpacking industry (or Upton Sinclair's *The Jungle*). That piece of late-nineteenth century industrialization wouldn't have fallen into place.

The Gilded Age industrialization of America gave us some malefactors of great wealth. It gave us the core endowment of at least one major west coast university (as ex-governor of California Leland Stanford used a sweetheart deal between the Central Pacific Railroad he promoted and the construction company he and his three partners owned to divert a lot of British investors' money into his own pockets—crony capitalism at its finest). It also gave the average American the highest standard of living and the most productive industry in the world in the first half of the twentieth century.

By contrast, in Europe there was no continental market because of national tariffs. Without the continent-spanning market, fewer of the possible economies of scale could be attained. In Britain, with next to no pre-World War I development of investment banking, you didn't get assembly of the pools of capital to build the large factories in the first place. British businesses stayed smaller-and much less efficient-than their American counterparts.

In Germany, with no antitrust policy worthy of the name, there was no brake on the cartelization of modern industry. Political theories that German industrial cartels poisoned Germany's politics in the first half of the twentieth century are now out of favor. But surely cartel-driven output restriction made the average German household a poorer place.

Because American institutions changed to support, nurture, and manage the coming of mass production and the large-scale business enterprise chronicled by Alfred Chandler—and because European institutions did not—it was America that was on the cutting edge of the future at the start of the twentieth century. It was America that was “the furnace where the future was being forged,” as Leon Trotsky said.

So what changes in the government-constructed underpinnings of the market are needed for e-business to flourish? And what failures to change—or what changes made in support of vested interests—would hobble it?