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## What is Wealth?

Financial future shock is a term we have used this year to describe the disorientation many investors feel about the ever-accelerating pace of change in the investment environment. One symptom of confusion is the major bursts of volatility we have seen in recent years,

most recently in the March-April period this year. Another symptom is the frequent declarations from famous investors or academics that “the market is irrational” — which is often an excuse for poor performance or bad forecasts.

One of the most painful symptoms for many investors is that formerly reliable rules of thumb, such as buying and holding low P/E stocks, no longer seem to work. The frustration has been acute for many smart, quantitatively oriented investors who have relied on extensive statistical research that has shown how well certain accounting-based stock selection strategies have worked in the past.

This reminds us a bit of the disappointment felt by some of the early pioneers of economic forecasting based on large-scale computerized models of the economy. The models were great at tracking the past twists and turns of the economy — it was the future that was difficult. After a string of poor forecasts, one company started tweaking its models so often that industry wags gave it a well-deserved motto: “Predicting the Past with Ever Greater Precision.”

It's obvious to us why many investment strategies based on traditional accounting ratios or “reversion-to-the-mean” financial theories are not likely to work well in coming years. The reasons are that traditional accounting measures are increasingly out of touch with the basic economics of many modern industries, and that the world we live in

is getting farther and farther away from the cozy assumptions about “equilibrium” and “reversion to the mean” that continue to dance in the heads of many esteemed finance professors.

### Beyond Bricks and Mortar

To illustrate our views, let's consider a simple-sounding question: What is wealth? For most people, it's a fairly simple exercise. You tote up the market value of your real estate holdings and financial assets, subtract the debt you owe, and that gives you your net worth.

So when most people think about their wealth, or their net worth, they are thinking about *financial* wealth. And that turns out to be pretty abstract. In fact, financial wealth is basically nothing but digits on pieces of paper, which in turn are stored as a series of zeroes and ones somewhere in cyberspace. In that sense, the entire financial services business should really be classified as software, because digits come in from customers, are processed, and then sent back out again (hopefully in larger sizes).

The zeros and ones are important for a simple reason: they represent your claim on society's *real* wealth, which includes real estate, bricks and mortar, factories and the machines they contain, and all kinds of valuable intellectual property owned by companies or individuals. What's intellectual property? We will get into that, but just ask yourself a few questions and you will get the basic



# What is Wealth? (cont'd)

STERLING'S WORLD REPORT

idea. Would you feel wealthier if you owned the source code for the Windows 2000 operating system? Or the patent for Viagra? Or the copyright for *Harry Potter and the Goblet of Fire*?

When modern accounting systems began to evolve around 500 years ago, concepts of wealth reflected the agrarian society. You were wealthy if you owned land or cattle, and you were very wealthy if you had improved the land by building a home or, better yet, a castle.

The great cathedrals of Europe are a fitting metaphor for wealth 500 years ago. The cathedrals were truly the Great Work of the time, and were built by the finest architects, engineers, artisans and craftsmen Europe had to offer. They often took as long as 50 years to build and embodied thousands of man-years of labour. Since the rate of technological progress was very slow, the process of wealth accumulation was very slow as well. If you wanted another cathedral, you had to wait for another 50 years and invest thousands of additional man-years of effort.

With the advent of the Industrial Revolution some 200 years ago, the definition of wealth suddenly expanded to include things that had never

been seen before, like factories and steam engines. A Rip Van Winkle who woke up once every 20 years during medieval times would have often seen very little tangible evidence of wealth accumulation, since villages in the Middle Ages changed very little from century to century. But after the Industrial Revolution, Rip would have seen the relatively rapid appearance of large urban areas, with new buildings, railways and roads. A very astute Rip also would have noticed the growing importance of *intangible* forms of wealth, like patents that encouraged the commercialization of new medicines that made life incomparably more pleasant than before.

According to University of California economist Brad DeLong, "The 20th century is unique in its pace of economic growth. Such rapid growth in standards of living has never been seen before, anywhere — save possibly in the generation that saw the discovery of fire."

His own estimate of the growth in material wealth across centuries, illustrated graphically in Chart 1, shows the dramatic acceleration in wealth creation seen since the Industrial Revolution. Prof. DeLong takes great care to emphasize how imprecise such estimates are. For example, he notes that few of us would be willing to trade our current lifestyles with those of 100 years earlier when many of the things we take for granted today were unavailable at any price to even the wealthiest robber barons of the past (think penicillin).

## The Explosive Growth of Invisible Wealth

Is the pace of material wealth creation likely to slow down anytime soon? Not likely. Consider the dynamics of the Information Age, which arguably started during the Second World War when large-scale electronic computing was developed. When Rip Van Winkle wakes up during the Information Age, he still sees an impressive accumulation of things — homes, factories, gadgets and gizmos.

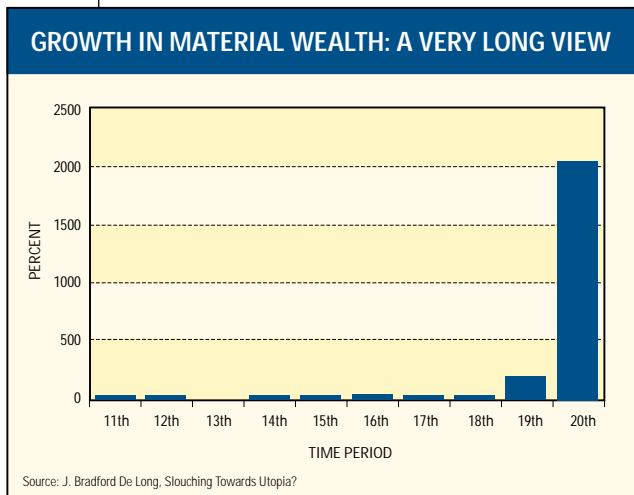


Chart 1. Wealth grew at an unprecedented rate in the 20th century — and the pace is likely to quicken in the Information Age. So much for “reversion to the mean.”



# What is Wealth? (cont'd)

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But there is more to wealth in the Information Age than ever before — far more than meets the eye. If building cathedrals was the Great Work of the medieval period, building the Global Computer — the sophisticated hardware, software and telecommunications systems that are developing into a global network — has become the Great Work of the Information Age.

Building the Global Computer is attracting tens of thousands of the brightest minds from around the world, and resulting in creations of stunning ingenuity and complexity. But pity poor Rip Van Winkle, because many of these creations are virtually invisible. Consider the microchip, which is roughly the size of your fingernail. The real wealth embedded in the microchip is in the intricate circuitry etched onto the chip, circuitry which is best seen using powerful microscopes. As we noted in our book *Boomernomics*, the level of complexity embodied on advanced microchips is the equivalent of putting a street-by-street map of the entire North American continent on a tiny wafer. In other words, the complexity and ingenuity — and probably the embedded man-years of effort — dwarf the achievements of the builders of the great cathedrals (see Chart 2).

Unlike Europe's cathedrals, the real wealth embedded in microchips can be replicated very

quickly and very cheaply. The first chip may cost billions to produce, but additional chips are then replicated in the world's fabricating plants at a rate of more than one billion chips per week. Software is a similar story, with huge development costs and trivial replication costs.

Consider the world's rapidly expanding telecommunications networks, which are increasingly moving toward fibre-optic systems that promise nearly unlimited carrying capacity or "bandwidth." These systems are becoming increasingly dependent on signal-switching technologies involving millions of gadgets like "micro-electro-mechanical mirrors" which are invisible to the human eye.

Consider also the biotech industry, which appears to be on the cusp of producing a torrent of new breakthrough of genomics-based medicines and therapies. At a cutting-edge biotech facility, Rip might currently see only modest facilities, some scientists and technicians in lab coats, and a lot of mice in cages. But the mice may be so-called "xeno-mice," which have been bio-engineered to produce antibodies that can be used safely by humans. These mice represent real wealth in the form of tens of millions of dollars' worth of research that may be able to produce hundreds of millions of dollars of profits. Just as Rip had to get used to identifying new forms of wealth with the advent of the Industrial Revolution, he has to adjust his concepts again for the Information Age.

## Accounting for the Quantum Age

After his travels through time, an astute Rip Van Winkle is likely to draw two major conclusions. First, he is likely to conclude that real wealth, including much that is intangible or invisible, is now growing at an explosive and unprecedented pace.

Secondly, he may surmise that "modern" accounting is becoming increasingly disconnected with the economic realities of wealth creation in

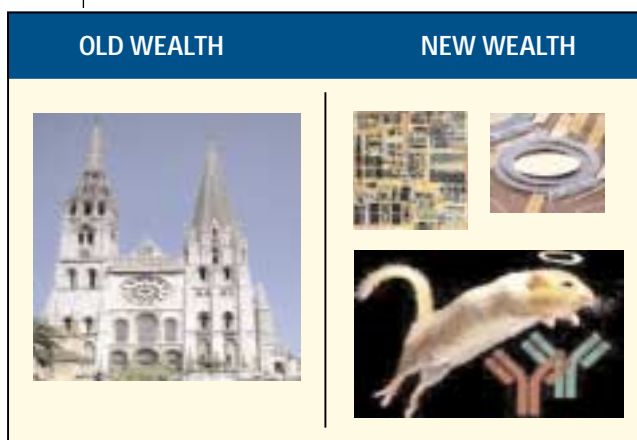


Chart 2. The great cathedrals represented wealth in the Middle Ages, and took decades to build. Today's wealth is often nearly invisible and cheap to replicate. Examples include microchips, micro-mechanical mirrors and bio-engineered mice.



## What is Wealth? (cont'd)

the Information Age. As we pointed out in “New Metrics for the New Millennium” in the November 1999 *Perspective*, research-intensive companies that immediately write off their research expenses or software development costs may be dramatically understating their earnings relative to capital-intensive businesses that write off factory and machinery costs over long time periods.

As Prof. Baruch Lev of New York University has noted, the book values of many technology companies do not include the value of “knowledge assets” that are difficult to measure. The problem is that traditional accounting methods, which were developed centuries ago, are often only capable of tracking only 10 to 15% of the true asset value of modern companies. As Lev notes, “We are using a 500-year-old system to make decisions in a complex business environment in which the essential assets that create value have fundamentally changed.”

We are initiating a consulting relationship with Prof. Lev to help us develop better measures of corporate earnings power and asset values in research-intensive industries and will report from time to time on the results of our joint research.

As shown on Chart 3, Lev is able to demonstrate with proprietary measures that the reported price-to-book value measures of many premier technology companies are vastly out of line with economic reality. The reason is that current financial reports fail to capture the value of patents, trademarks, customer acquisition costs and other intangible assets. When appropriate adjustments are made to these companies’ balance sheets, their valuations become quite comparable to many “Old Economy” companies that are typically less research-intensive.

We are inspired by the words of Luca Pacioli, the Italian mathematician who developed double-entry accounting in the 1400s: “If you cannot be a good accountant,” Pacioli wrote, “you will grope your way forward like a blind man and may meet great losses.”

In short, the question “What is wealth?” is not so simple after all. Those who are interested in preserving their wealth and in participating in the explosive growth of new types of wealth are in need of both new concepts, such as the concept of knowledge capital, and new measurements — like the measurements that Baruch Lev is pioneering.

Our objective is simple: to be ahead of the pack in understanding and exploiting these new concepts and new measurements. If we are successful, we hope our clients will be able to thrive in an era of “financial future shock” — and fully participate in what promises to be a period of impressive wealth creation ahead.

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THE SCOPE OF KNOWLEDGE			
Company	Knowledge Capital (\$ billion)	Market Value/Book Value	Market Value/Knowledge Capital
Microsoft	\$210.9	28.0	2.2
Cisco Systems	\$105.4	31.6	2.1
Intel	\$170.5	10.5	1.5
Dell Computer	\$86.6	45.8	1.2
Pfizer	\$63.4	15.8	2.2
General Motors	\$51.8	2.7	0.8
AT&T	\$89.3	7.6	2.2
Mobil Oil	\$20.6	4.3	3.9
Deere	\$4.7	2.2	2.0
Dow Chemical	\$15.9	3.3	1.6

Note: Knowledge capital is an estimate of value a company gets from its patents, brands, trademarks, capital expenditures and research and development, and business process.

Source: Baruch Lev, CFO Magazine Feb 2000

Chart 3. Measuring the value of “knowledge capital” is critical for assessing corporate valuations in research-intensive industries.