DESK NOTES

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Equity Research

Americas | U.S. Investment Strategy | April 5, 2000

Fill and Kill

Succeeding with Survivors is Nothing New

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- **Cycles of increasing diversity and extinction are common in the fossil record. Over time the earth has experienced a steady increase in biodiversity, punctuated by large-scale extinction events.**
- **This pattern of diversity and extinction has been seen over and over in the corporate record as well. The history of the automobile and television, as well as the more recent history of the computer and disk drive industry, all offer evidence of dramatic drops in the number of active competitors over very short periods of time. The pattern of dot-com deaths has substantial precedent.**
- **History shows that companies surviving major industry shakeouts often post good returns for investors— even in industries with enormous ongoing competitive pressures.**

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Executive Summary

The rise and fall of Internet stocks has created enormous fervor. But the fundamental question at hand is a simple one: what should investors do today?

We should note at the outset that the Internet is a general-purpose, or enabling, technology. The Internet is not a substitute for a business model, and does not constitute a strategy in and of itself.[1] By the same token, the boom/bust of the Internet is by no means a unique phenomenon—we can document the same pattern in the biological record as well as the annals of American business.

This report contains three main points:

1. The biological record shows that when conditions are suitable, there is a sharp increase in speciation—that is, the number of species—generally followed by significant extinction. As ecological opportunities arise, species rush to fill them. Only after the space is filled does the methodical force of evolution winnow the population. One of the best-documented examples is the Cambrian Explosion, which took place roughly 550 million years ago. Business, like biology, is a messy affair: In the absence of the "great capital allocator in the sky", the path to long-term efficient capital allocation is littered with excesses and inefficiencies.
2. The boom/bust cycle has played out many times in American business. The automobile, television, disk drive and personal computer industries are but a few examples. Here again, a new industry spawned substantial variation and innovation, but only the "fit", or lucky, companies survived. The Internet has followed this pattern almost perfectly.
3. Investors that purchased baskets of "survivors" have fared reasonably well. The essential point for investors is that buying companies that have survived a major extinction event increases the odds of investment success even in industries with enormous ongoing competitive pressures.

From Biology to Business to Shareholder Benefit

"The Cambrian Era — 550 million years ago. It's the time when single-celled life first transitioned into multi-celled life, and every experiment of life — in every form and shape — was tried. What you had was the greatest rate of speciation ever seen, but it was also the greatest rate of extinction the planet has ever seen. I think that's exactly what you see going on here. Every experiment [on the Internet] is getting tried. Many of them are going to succeed, and many of them are going to fail."

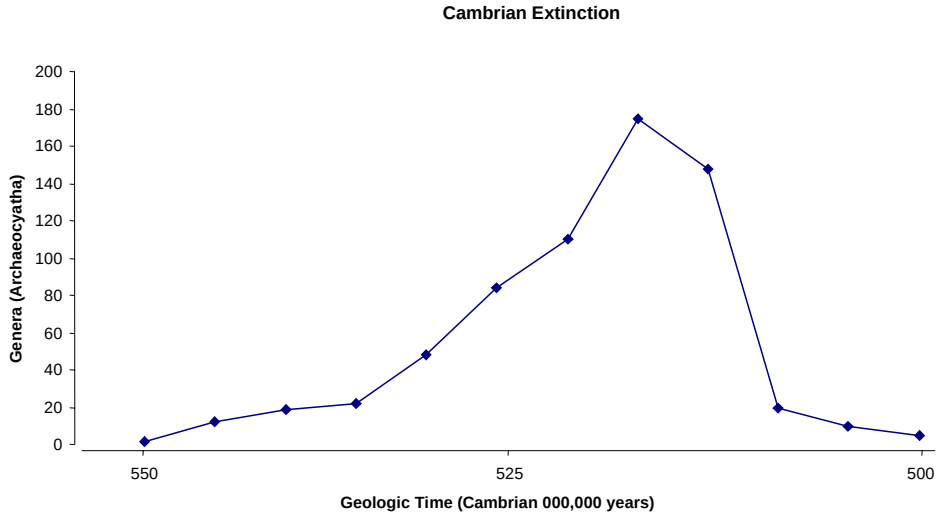
-Jeff Bezos[2]

Biology

Want to get a good sense of the boom/bust cycle in business? Gain some insight into the recent Internet bubble? Our prescription is simple: set up an appointment with your favorite paleontologist. As it turns out, there is a lot we can learn by studying the fossil record, where increases in the number of species and subsequent extinction are commonplace. In fact, this pattern provides an important lesson: Business, like biology, is a messy process. In the absence of the "great capital allocator in the sky", the path to long-term efficient capital allocation is littered with excesses and inefficiencies.[3]

One of the most vivid and well-documented examples of boom/bust in the evolutionary record is the Cambrian Era. What we know is that an enormous increase in the biodiversity of life occurred roughly 550 million years ago (scientists still debate the exact enabling factor) followed by a large-scale extinction event. And this cycle of increasing diversity and extinction has persisted over the last half a billion years, resulting in dramatic evolutionary swings.[4] Figure 1 shows the pattern of boom and bust during the Cambrian, illustrating an enormous increase in genera followed by high extinction.

Figure 1
Speciation & Extinction



Source: A. Hallam & P.B. Wignall, "Mass Extinctions And Their Aftermath"

The pattern plays out time and time again. Either an external force (e.g., change in the environment) or an autocatalytic process prompt an explosion in the number of biological forms.[5] These new species fill a previously empty space—they are biological innovations. But then the forces of evolution the take over, and

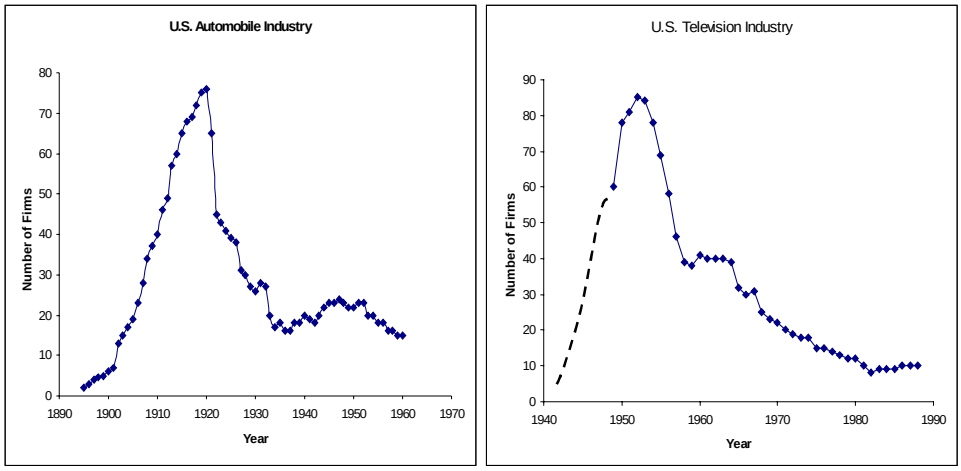
winnow down the successful species based on a combination of fitness and happenstance.[6] Is it bad genes or bad luck? It is undoubtedly a bit of both.[7]

Business

As it turns out, the business record smacks of the paleontological record. An enabling, or general-purpose technology, comes along and spawns a period of substantial innovation. In turn, the different "body types" compete and the less effective ones go out of business. The resulting pattern is a sharp upswing in the number of companies in the industry, following by a sharp downswing.

This pattern has played out over and over in the business world. Take two giants in the annals of American industry—the automobile and television (see Figure 2). In both cases investors allocated capital liberally in the early phases, as each industry's growth potential was positive but uncertain. But both saw steep declines in the number of competing firms over time, especially when the industry gravitated around major design innovations.[8]

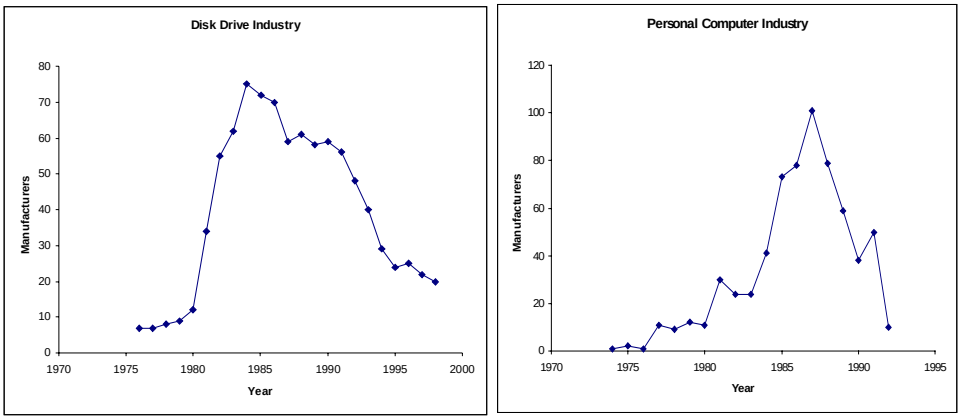
Figure 2
The Decline of Firms



Source: James M. Utterback, "Mastering the Dynamics of Innovation".

The more recent histories of the disk drive industry and the personal computer industry (Figure 3) show the same pattern, albeit over a much shorter time frame.[9]

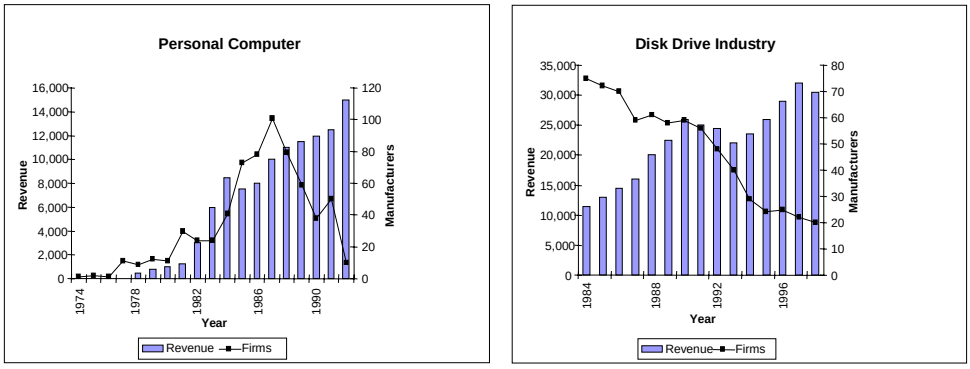
Figure 3
More Decline



Source: DISK/TREND reports, *Management Science*, and CSFB estimates.

Importantly, the extinction of many competitors often occurs while the industry's aggregate sales growth continues to rise. This provides some hint about the potential success of those companies that survive. Figure 4 shows the same extinction patterns in Figure 3, but superimposed on industry sales figures.

Figure 4
The Personal Computer and Disk Drive Industry

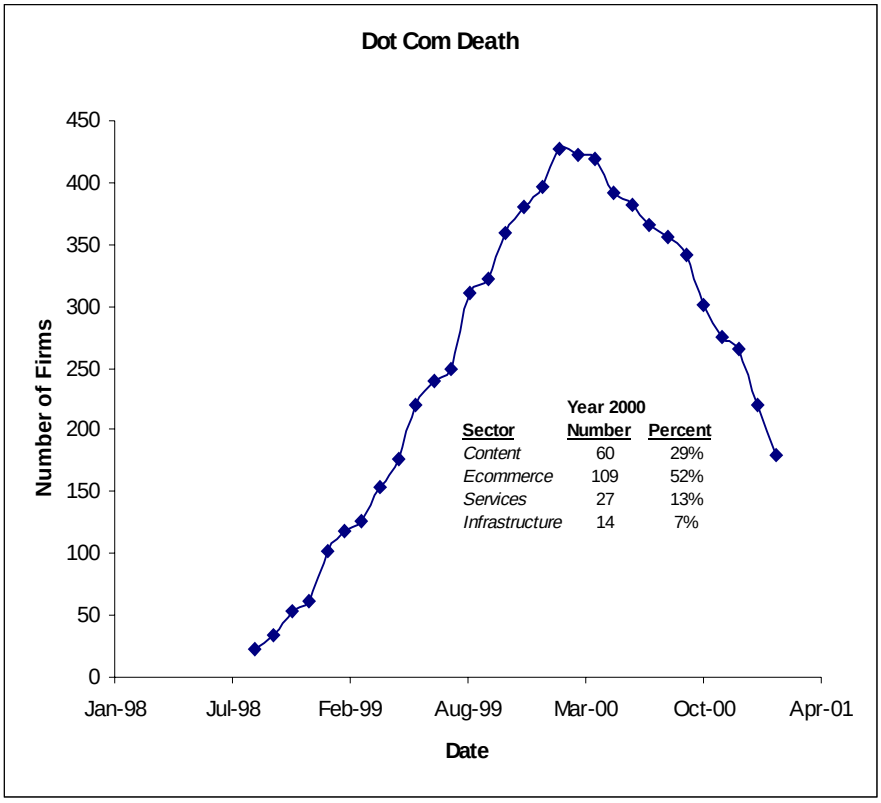


Source: DISK/TREND reports and *Management Science.*

With this pattern in mind, we turn to the Internet. The Internet, arguably the greatest enabling technology that has come along, spawned a huge number of "inventions"—most of them questionable. But in the business landscape just as the biological landscape, it is difficult to know, a priori, which companies (species) will succeed or fail. While "inefficient", the biological and business solution is to try out lots of alternatives and see which ones survive.

The population of Internet companies is following the same pattern that we've seen in industry time and time again. At the very least, 210 Internet companies failed last year, with an additional 49 failing in January of 2001 (see Figure 5).[10] If this latest capital allocation cycle was indeed a mania—as many observers contend—then it's a pattern that occurs consistently and often in American economic history.[11] Investor sentiment has mirrored this phenomenon: the initial euphoria that surrounded the industry has yielded to the prevailing pessimism.

Figure 5
Internet Failures



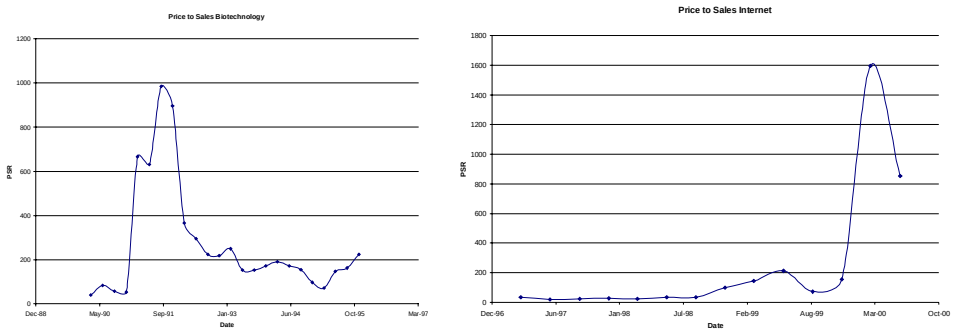
Source: WebMergers.com, CommScan and CSFB analysis.

In addition to an explosion in the number and variety of competitors, the early phases of an innovation launch often see detonation in the market value of public firms. To illustrate, Figure 6 shows the remarkable similarity in price to sales ratios for the illustrated biotechnology and Internet indexes.[12]

Both industries had uncertain adoption rates and impact on their end markets. In the early phases, every company seemed a potential winner, with large yet uncertain market growth. Only the time frame is different: it was 1990-1991 for the biotechnology companies, and August 1999 to the present for the Internet companies.

Both indexes swooned as the industry's financial statements failed to show demonstrable progress, dimming the initial tide of enthusiasm. The reality of the drug discovery and distribution process sobered biotech investors, while Internet expectations for Internet enthusiasts were tempered by the dubious traction of new business models. However, for most investors the Internet "mania" is a more vivid example of excess not only because it was more recent, but also because its rise came faster and its fall came harder than previous boom/busts.

Figure 6
Valuation of Biotech and Internet Industry



Source: CSFB analysis.

Pundits often deride the boom/bust phenomenon as "wasteful" and speculative even though it provides the necessary platform for future growth.[13] Business failure and consolidation is the result of companies unable to keep pace with an accelerated pace of technological change. However, at the end of the process a handful of super competitors emerge, which continue to dominate the industry. For example, both the disk drive and personal computer saw brutal competition as they matured, but the select few that managed to survive went on to create satisfactory, if not significant, shareholder value.[14]

Leading companies emerge from the crucible of intense competition equipped with products and processes that can keep them a step ahead of their competition. These companies often prosper for many years following the critical point in the industry shakeout.

Survivors—Shareholder Benefit

Investors are wise to look around for survivors at the end of a bust, because it is possible to generate attractive shareholder returns by holding a portfolio of surviving companies.

For instance, an investment in the twelve hard disk drive original equipment manufacturers that survived at the beginning of 1985 (after the first drop-off in competitors), held until June of 2000, resulted in an annual compound return of 11%. In 1994 many thought that disk drive companies were the untouchables of the investment world.[15] Although not a market beating performance, the stocks achieved the return despite the fact that only 25% of the 12 firms survived in their original form over the investment period!

Figure 7
Disk Drive Survivors

Company	Market Capitalization (000) 12/31/84	6/30/00	History
Miniscribe	$51,720		Bankrupt assets purchased by Maxtor
Masstor	$51,786		Bankrupt
Rodime	$53,095		Licensing patents only
Iomega	$106,068	$1,100,000	Ongoing
Cipher Data	$298,056		Acquired by Archive Corporation
Computer Memories	$35,685		Acquired by investory group
Onyx + IMI	$14,399		Acquired by Corvus Systems Inc.
Seagate	$220,795	12,000,000	Ongoing
Quantum	$199,836		Split into two tracking stocks
DSS (Quantum)		$1,400,000	Ongoing
HDD (Quantum)		$888,000	Ongoing
Micropolis	$43,826		Purchased by Singapore Technologies
Priam	$77,682		Bankrupt assets purchased
Tandon	$304,710		Assets purchased by Western Digital
Total	**$1,457,658**	**$15,388,000**	

Source: "Capital Market Excesses and Competitive Strength," Journal of Applied Corporate Finance.

Further, despite the brutal competition in an industry with little sustainable competitive advantage, investors would have generated a 21% compounded annual if they had sold their "winners" at peak prices. (See Figure 7).

A less extreme example is the personal computer industry. Notwithstanding a steep decline in the number of competitors by the end of the 1980's, see Figure 4, a basket of public company "survivors" yielded a compound return of 12% since 1989 (see Figure 8).[16] Selling the winners at their peak would have resulted in a 23% compound annual return. Again, this return is in the face of enormous change, with many firms changing hands or exiting the computer manufacturing business.

Figure 8
Personal Computer Survivors

Company	Market Capitalization (000,000) 1/1/89	1/1/00	History
IBM	$72,166	$149,122	IBM
Tandem Computers	$1,610	$4,044	bought by Compaq
Sun Microsystems	$1,194	$89,712	SUNW
Apollo Computer	$311	$469	bought by Hewlett Packard
Prime Computer	$894	$237	bought by JH Whitney formed company
Hewlett-Packard	$12,526	$62,431	HWP
MAI Basic Four	$74	$3	changed to MAI Systems Corp. AMEX: NOW
Digital Equipment	$12,473	$8,357	DEC was bought by CPQ
Wang Laboratories	$1,385	$1,370	Chapter 11 reorganization in 1993
Compaq	$2,327	$25,585	CPQ
Cray Research	$1,861	$618	sold to Silicon Graphics
Apple Computer	$4,967	$4,996	AAPL
Intergraph	$1,167	$297	INGR
Unisys	$4,441	$4,578	UIS
Dell	$133	$62,600	DELL
Total	**$117,528**	**$414,419**	

Source: Interactive Data & CSFB analysis.

The essential point for investors is that even in industries with enormous ongoing competitive pressures, buying companies that have survived a major extinction event increases the odds of investment success.

Although there are important differences between disk drive firms, computer manufacturers, and Internet companies, we think the above analysis is informative. Often when the capital markets greet an innovation, there is a period of euphoria—"the Next Big Thing." After an inevitable reversal, the hard work phase settles in. With respect to Internet related businesses we have entered the hard work stage where investors are in "show me" mode. Now that the Internet industry has imploded, history and analogy suggest that it is time to sift through the rubble and place bets on the survivors.

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AMSTERDAM 31 20 5754 890
ATLANTA.....1 404 656 9500
AUCKLAND 64 9 302 5500
BALTIMORE 1 410 223 3000
BEIJING 86 10 6410 6611
BOSTON 1 617 556 5500
BUDAPEST.....36 1 202 2188
BUENOS AIRES 54 11 4394 3100
CHICAGO.....1 312 750 3000
FRANKFURT.....49 69 75 38 0
GENEVA.....41 22 394 70 00
HOUSTON.....1 713 220 6700
HONG KONG 852 2101 6000
LONDON.....44 20 7888 8888
MADRID.....34 91 423 16 00
MELBOURNE 61 3 9280 1666
MEXICO 52 5 283 89 00
MILAN.....39 02 7702 1
MOSCOW 7 501 967 8200
MUMBAI.....91 22 230 6333
NEW YORK.....1 212 325 2000
PALO ALTO.....1 650 614 5000
PARIS 33 1 40 76 8888
PASADENA 1 626 395 5100
PHILADELPHIA.....1 215 851 1000
PRAGUE.....420 2 210 83111
SAN FRANCISCO... 1 415 836 7600
SÃO PAULO 55 11 3841 6000
SEOUL 82 2 3707 3700
SHANGHAI..... 86 21 6881 8418
SINGAPORE 65 538 6322
SYDNEY 61 2 8205 4400
TAIPEI 886 2 2715 6388
TOKYO 81 3 5404 9000
TORONTO..... 1 416 352 4500
VIENNA 43 1 512 3023
WARSAW..... 48 22 695 0050
WELLINGTON..... 64 4 474 4400
ZUG 41 41 727 97 00
ZURICH 41 1 333 55 55

[1] Michael E. Porter, "The Internet and Strategy", Harvard Business Review, February 2001.
[2] Jeff Bezos at the 1999 Internet Summit, quoted in Julie Rawe, "*Doom Stalks the Dotcoms*," Time, April 17, 2000.
[3] See *Extinction: Bad Genes or Bad Luck* by David M. Raup, W.W. Norton, 1991, pp. 32-33.
[4] See *Signs of Life* by Ricard Sole and Brian Goodwin, Basic Books, 2000, pp. 275.
[5] As we know from a mountain of growing research, nature is a self-organizing system. It is never truly in "balance" but is organized in a poised state —the critical state— where nonlinear outcomes are the norm. Nonlinearity simply means that effect is not proportional to cause. Such a system is not optimal in terms of resource allocation, as evidenced by the sheer number of phyla that emerged during the Cambrian period. In similar fashion, the economy is a self-organizing system.
[6] See *Biodiversity Dynamics* by M. Mckinney and J. Drake, Columbia University Press, 1998.
[7] See "*Species, Speciation and the Environment,"* by Niles Eldredge: http://www.actionbioscience.org/evolution/eldredge.html. Although not specifically addressed by Eldredge, one interesting consequence of the self-organized criticality seen in nature is that catastrophes (including massive extinction) can occur for no reason whatsoever.
[8] Detroit began to manufacture all steel enclosed bodies and large color picture tubes were the catalyst for the demise of many competitors in the television business.
[9] See "*Innovation and Markets*," by Michael Mauboussin and Alex Schay, Credit Suisse First Boston, December, 2000.
[10] See Webmergers.com "*Webmergers Special Report IIX-Dot Com Shutdowns*," January 3, 2001.
[11] See *Mastering the Dynamics of Innovation* by James M. Utterback, Harvard Business School Press, 1996.
[12] A Factset biotechnology database was employed consisting of 224 companies; a Factset Internet database was employed consisting of 724 companies.
[13] See "*It's a Manic, Manic World*," by Jerry Useem, Fortune, December 18, 2000.
[14] See "*An Analysis of Product Lifetimes in a Technologically Dynamic Industry*," by Barry Bayus, Management Science, June 1998.
[15] See "*Capital Market Excesses and Competitive Strength: The Case of the Hard Disk Drive Industry 1984-2000*," by William D. Bygrave, Julian E. Lange, J. R. Roedel, Gary Wu, Journal of Applied Corporate Finance
[16] Public minicomputer manufacturers from the Electronic Business Magazine annual survey of 1989 were taken (Computer Industry Almanac 1990) and total returns were calculated. In 1989 a significant industry shakeout had occurred (see Figure 4) as manufacturers solidified their designs.