

Equity Research

Americas

U.S. Investment Strategy

April 5, 2000

Fill and Kill

Succeeding with Survivors is Nothing New

Michael Mauboussin
1 212 325 3108
michael.mauboussin@csfb.com

Alexander Schay
1 212 325 4466
alexander.schay@csfb.com



- 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.

Table of Contents

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.”

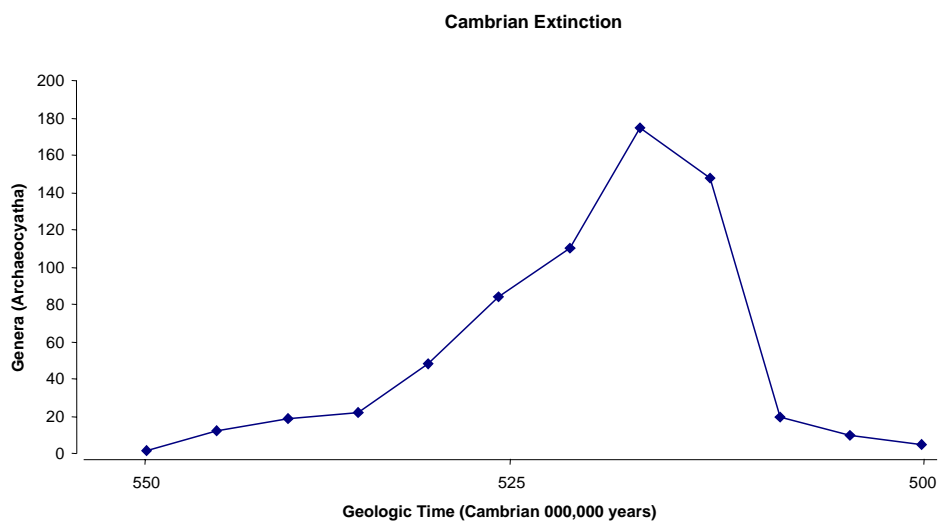
-Jeff Bezos²

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 take over, and

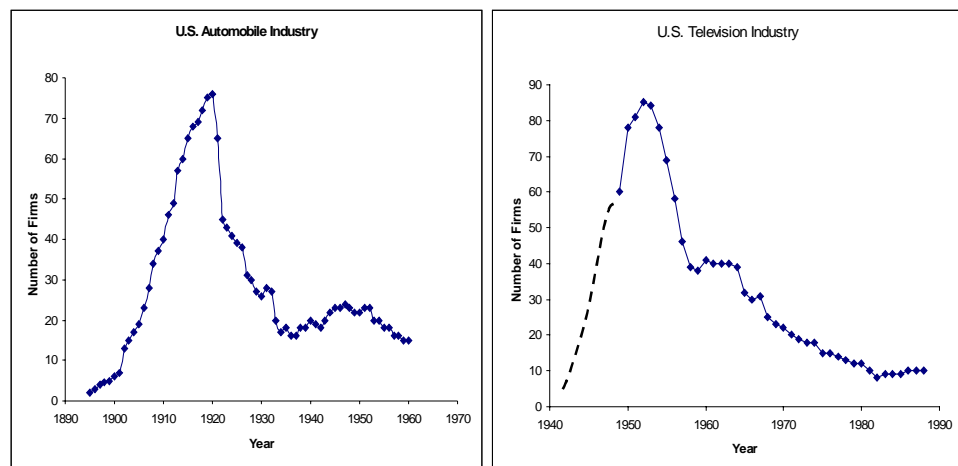
winnow down the successful species based on a combination of fitness and happenstance.⁶ Is it bad genes or bad luck? It is undoubtedly a bit of both.⁷

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

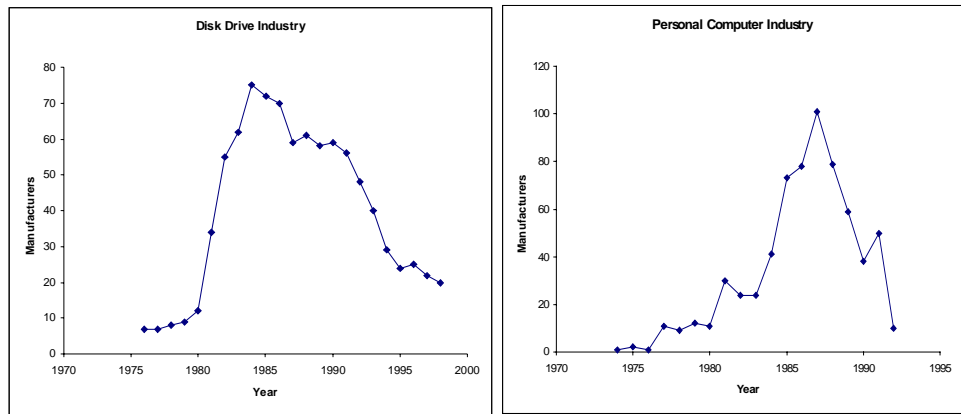
Figure 2
The Decline of Firms



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

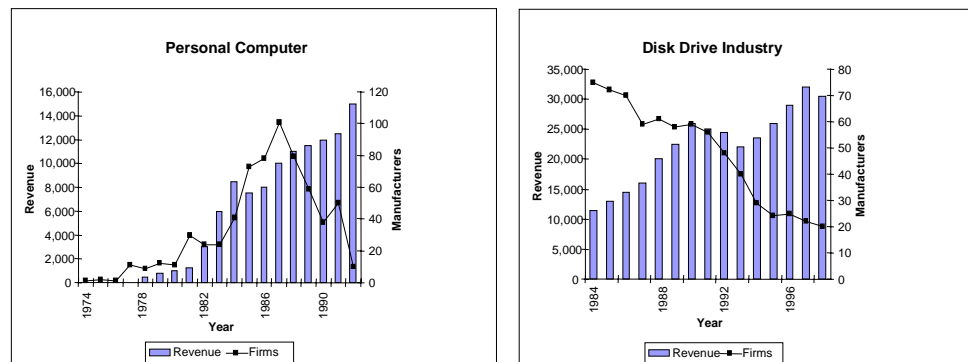
**Figure 3
More Decline**



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**

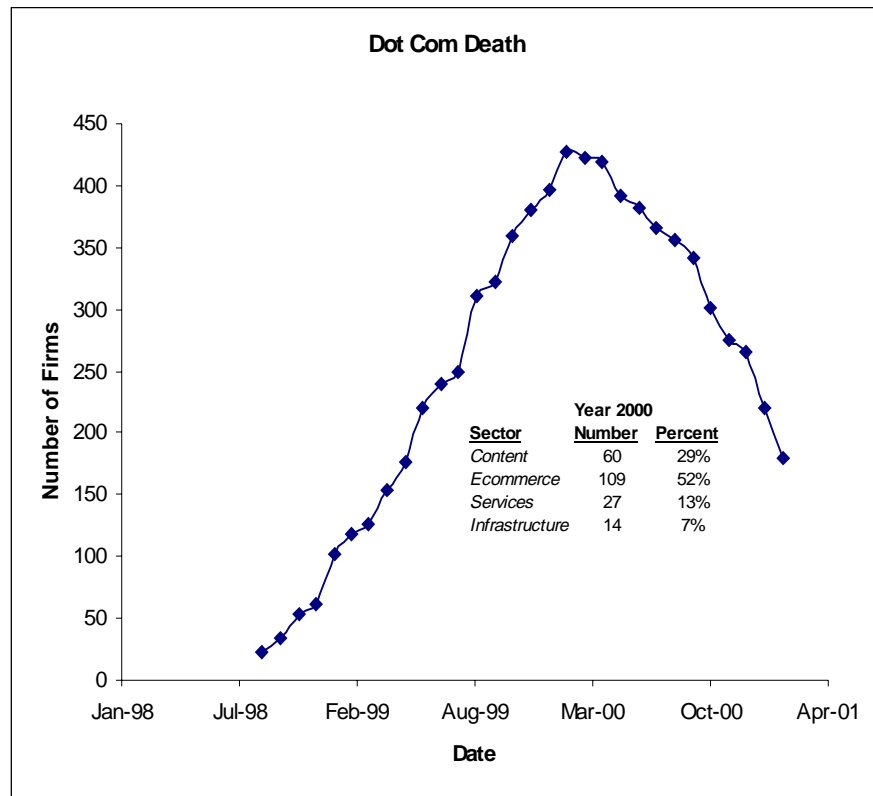


Source: DISK/TREND reports and *Management Science*.

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



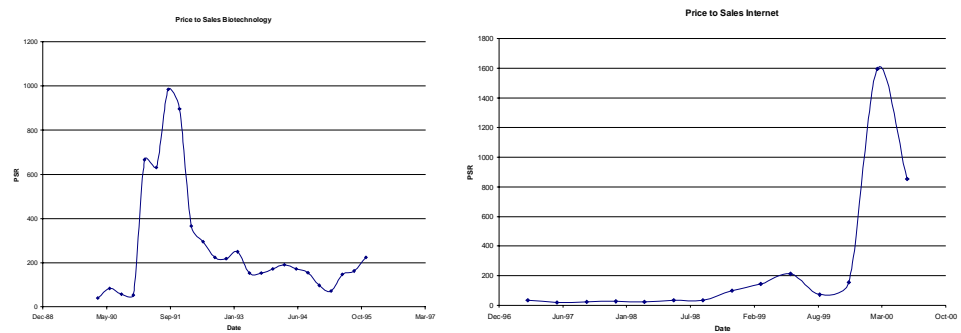
Source: WebMergers.com, CommScan and CSFB analysis.

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

<u>Company</u>	<u>Market Capitalization (000)</u>		<u>History</u>
	<u>12/31/84</u>	<u>6/30/00</u>	
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

<u>Company</u>	<u>Market Capitalization (000,000)</u>		<u>History</u>
	<u>1/1/89</u>	<u>1/1/00</u>	
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.

N.B.: CREDIT SUISSE FIRST BOSTON CORPORATION may have, within the last three years, served as a manager or co-manager of a public offering of securities for or makes a primary market in issues of any or all of the companies mentioned.

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

Copyright Credit Suisse First Boston, and its subsidiaries and affiliates, 2000. All rights reserved.

This report is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or which would subject Credit Suisse First Boston or its subsidiaries or affiliates (collectively "CSFB") to any registration or licensing requirement within such jurisdiction. All material presented in this report, unless specifically indicated otherwise, is under copyright to CSFB. None of the material, nor its content, nor any copy of it, may be altered in any way, transmitted to, or distributed to any other party, without the prior express written permission of CSFB. All trademarks, service marks and logos used in this report are trademarks or service marks or registered trademarks or service marks of CSFB.

The information, tools and material presented in this report are provided to you for information purposes only and are not to be used or considered as an offer or the solicitation of an offer to sell or to buy or subscribe for securities or other financial instruments. CSFB has not taken any steps to ensure that the securities referred to in this report are suitable for any particular investor.

Information and opinions presented in this report have been obtained or derived from sources believed by CSFB to be reliable, but CSFB makes no representation as to their accuracy or completeness and CSFB accepts no liability for loss arising from the use of the material presented in this report where permitted by law and/or regulation. This report is not to be relied upon in substitution for the exercise of independent judgment. CSFB may have issued other reports that are inconsistent with, and reach different conclusions from, the information presented in this report. Those reports reflect the different assumptions, views and analytical methods of the analysts who prepared them.

CSFB may, to the extent permitted by law, participate or invest in financing transactions with the issuer(s) of the securities referred to in this report, perform services for or solicit business from such issuers, and/or have a position or effect transactions in the securities or options thereon. In addition, it may make markets in the securities mentioned in the material presented in this report. CSFB may, to the extent permitted by law, act upon or use the information or opinions presented herein, or the research or analysis on which they are based, before the material is published. CSFB may have, within the last three years, served as manager or co-manager of a public offering of securities for, or currently may make a primary market in issues of, any or all of the companies mentioned in this report. Additional information is available on request.

Past performance should not be taken as an indication or guarantee of future performance, and no representation or warranty, express or implied, is made regarding future performance. Information, opinions and estimates contained in this report reflect a judgment at its original date of publication by CSFB and are subject to change. The value and income of any of the securities or financial instruments mentioned in this report can fall as well as rise, and is subject to exchange rate fluctuation that may have a positive or adverse effect on the price or income of such securities or financial instruments. Investors in securities such as ADRs, the values of which are influenced by currency fluctuation, effectively assume this risk.

Structured securities are complex instruments, typically involve a high degree of risk and are intended for sale only to sophisticated investors who are capable of understanding and assuming the risks involved. The market value of any structured security may be affected by changes in economic, financial and political factors (including, but not limited to, spot and forward interest and exchange rates), time to maturity, market conditions and volatility, and the credit quality of any issuer or reference issuer. Any investor interested in purchasing a structured product should conduct its own investigation and analysis of the product and consult with its own professional advisers as to the risks involved in making such a purchase.

This report is distributed in Europe by Credit Suisse First Boston (Europe) Limited, which is regulated in the United Kingdom by The Securities and Futures Authority ("SFA"). It is not for distribution to private customers as defined by the rules of The SFA. This report is distributed in the United States by Credit Suisse First Boston Corporation; in Canada by Credit Suisse First Boston Securities Canada, Inc.; in Brazil by Banco de Investimentos Credit Suisse First Boston Garantia S.A.; in Japan by Credit Suisse First Boston Securities (Japan) Limited; elsewhere in Asia/Pacific by Credit Suisse First Boston (Hong Kong) Limited; Credit Suisse First Boston Australia Equities Limited; Credit Suisse First Boston NZ Securities Limited, Credit Suisse First Boston Singapore Branch and elsewhere in the world by an authorized affiliate.

In jurisdictions where CSFB is not already registered or licensed to trade in securities, transactions will only be effected in accordance with applicable securities legislation, which will vary from jurisdiction to jurisdiction and may require that the trade be made in accordance with applicable exemptions from registration or licensing requirements. Non-U.S. customers wishing to effect a transaction should contact a CSFB entity in their local jurisdiction unless governing law permits otherwise. U.S. customers wishing to effect a transaction should do so only by contacting a representative at Credit Suisse First Boston Corporation in the U.S.

- 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.