

Equity Research
North America

Industry

Technology and Internet

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Industry Overview

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Technology & the Economy: An Attempt at Pattern Recognition

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Internet Consulting & Application Services:

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This report is a reprint of a section from *The Technology & Internet IPO Yearbook: 7th Edition -- 21 Years of Tech Investing...* (published on 4/5/01). In this report, in an effort to determine how long the current across-the-board downturn in technology momentum may last, we drill down on historical data/patterns related to IT spending and inventory growth; technology and telecommunication services financing; and stock market performance. Morgan Stanley economist Richard Berner's report: *The IT Crash: How Big? How Long?*, published 2/27/01, is included beginning on page 22 of this report.

- IT spending growth is tied to the economy (and visa versa) and while **we believe that IT spending growth could be below GDP growth in 2001**, we believe it should go back to a more normal trend of growing faster than GDP growth in 2002 or 2003. **Over the past forty years, when IT spending growth has fallen below GDP growth it has taken, on average one-to-two years for it to again exceed GDP growth.**
- 'Excess' IT spending from 1998-2000, based on a forty-year trend line analysis of IT spending, may have accounted for 1% of total IT spending and 9% of the increase in annualized IT spending. Specifically for 2000, 'excess' IT spending may have accounted for 6% of total IT spending and 35% of the increase in annualized IT spending.
- 'Excess' IT spending from 1998-2000 related to technology and telecom services 'overfinancing,' may have accounted for 2.5% of total IT spending and 16% of the increase in annualized IT spending. Specifically for 2000, 'excess' IT spending related to technology and telecom services 'overfinancing' may have accounted for 4% of total IT spending and 21% of the increase in annualized IT spending.
- It appears that the direct impact of the recent powerful technology and telecom services financing cycle on U.S. IT spending, while significant, is not as high as many believe. We have concluded that the biggest booster to IT spending in 2000 and 1999 was, simply, enthusiasm (translated into spending) from businesses about the positive prospects for new technology deployments.
- We believe in pattern recognition and our review of historical data leads us to believe that **it may take two-to-six quarters to recover from the downcycle for IT spending. Shares of the leading technology companies will likely begin to discount a recovery two quarters before it occurs.**

Technology & the Economy: An Attempt at Pattern Recognition

So...What Are You About to Read?

In this section we look at lots of historical data related to U.S. IT spending and inventory growth; technology and telecommunication services financing; and stock market performance to attempt to glean lessons from the past that may apply to the present and future. Technology-related companies, and in fact, most companies, are going through a very difficult period right now and there's a huge amount of finger pointing going on as part of an effort to determine what caused the current problems.

Our point of view continues to be quite simple — the IPO of Netscape and the commercial launch of the Web browser in 1995 provided the catalyst for the fastest and most significant period of technology innovation (focused on ubiquitous communication) and wealth creation in history, and likely in our lifetimes. And history has proven that things that are this profound always bring many good things, and many bad things.

We had grown tired of hearing about all the great things the Internet could do, and we had grown tired of hearing about yet another flawed idea for a start-up. And now we have grown tired of all of the Internet gloom and doom.

To us, the evolution of the Internet is still in its infancy and we believe that this difficult environment we are living through should pass but it may take two-to-six quarters to cycle through.

And we believe the benefits of the innovation borne out of the period we have just lived through will be with us for a long time.

There's a lot of stuff in this section that we have never seen in one place before. We find it useful...and we hope you do. As always, we welcome your comments. Note that, for the most part, our data are U.S.-centric.

For additional analysis on the current excess in IT present in the economy, we recommend reading Morgan Stanley economist Richard Berner's report *The IT Crash: How Big? How Long?*, published February 27, 2001.

A Look at the Capital Markets Stats for 1999 and 2000 Illustrates What We Just Lived Through (Exhibits 1 and 2)

We remember, going back in time, that by most measures, 1997 and 1998 were considered to be robust years for public market financing for technology and telecommunication services companies. But then along came 1999 — the supply, and the demand, for new issues increased substantially. In fact, dollars invested in public technology offerings in 1999 were over three times higher than the level in 1998...and then the volume in CQ1:00 was comparable to the level for full-year 1999. The stats for Internet offerings are even more pronounced. And then...it stopped... (Exhibits 1 and 2).

Everyone knows the capital markets were robust, and in this section of the report, we endeavor to measure the impact of this robust financing cycle on IT spending...No easy task...

Exhibit 1

A Capital Markets Anomaly — U.S. Tech Equity Offering Amounts for IPOs Between 1980 - 2000, 1997-2000 **CQ1:00 \cong C1999...C1999 \cong 3x C1998**

	1997	1998	1999	CQ1:00	CQ2:00	CQ3:00	CQ4:00
Total Offering Amount (\$MM)	\$14,417	\$16,028	\$56,472	\$44,755	\$14,316	\$15,753	\$5,568
Total IPO Offering Amount (\$MM)	\$5,551	\$4,982	\$26,563	\$14,027	\$6,873	\$9,689	\$1,769
Number of IPOs	136	90	318	87	58	77	14
Average IPO Offering Amount (\$MM)	\$41	\$55	\$84	\$161	\$119	\$126	\$126
Total Follow-on Offering Amount (\$MM)	\$8,866	\$11,046	\$29,909	\$30,728	\$7,443	\$6,064	\$3,799
Number of Follow-ons	108	86	128	80	24	19	14
Average Follow-on Amount (\$MM)	\$82	\$128	\$234	\$384	\$310	\$319	\$271

Data indicates equity offering amounts for technology companies that went public between 1980-2000 in U.S. markets only. Includes Internet offering data.
Source: Securities Data Corporation, Morgan Stanley Technology Research

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Please refer to important disclosures at the end of this report.

Exhibit 2

A Capital Markets Anomaly — U.S. Internet Equity Offering Amounts for IPOs Between 1980 - 2000, 1997-2000
CQ1:00 ≅ 2/3 x C1999 ... C1999 ≅ 8x C1998

	1997	1998	1999	CQ1:00	CQ2:00	CQ3:00	CQ4:00
Total Offering Amount (\$MM)	\$1,460	\$4,124	\$34,223	\$23,602	\$3,877	\$4,157	\$510
Total IPO Offering Amount (\$MM)	\$633	\$1,519	\$21,248	\$6,089	\$3,236	\$2,581	\$439
Number of IPOs	17	31	250	58	26	30	1
Average IPO Offering Amount (\$MM)	\$37	\$49	\$85	\$105	\$125	\$86	\$439
Total Follow-on Offering Amount (\$MM)	\$827	\$2,604	\$12,975	\$17,514	\$641	\$1,576	\$71
Number of Follow-ons	8	20	49	41	4	6	1
Average Follow-on Amount (\$MM)	\$103	\$130	\$265	\$427	\$160	\$263	\$71

Data indicates equity offering amounts for Internet companies that went public between 1980-2000 in U.S. markets only.
 Source: Securities Data Corporation, Morgan Stanley Technology Research

We have Entered a New Zone...One that's Unfamiliar to Us...Can you Say - Economic Light Switch - OFF?...
 (Exhibit 3)

We have never been in an economic slowdown when technology accounted for such a large portion of spending, subsequently, technology spending has clearly become more susceptible to economic conditions AND economic conditions have become more susceptible to technology spending.

Forecasts for GDP growth have been declining steadily since CQ2:00 (Exhibit 3) and Mr. Market has been in steady decline during the same period. While it's easy to say 1999 and 2000 were crazy years, in oh so many ways, it certainly feels better, for most of us, to be optimistic rather than pessimistic...and while one can argue that Mr. Market has simply erased his euphoric gains and is back to his 'normal' 1998 ways — note that NASDAQ, as of

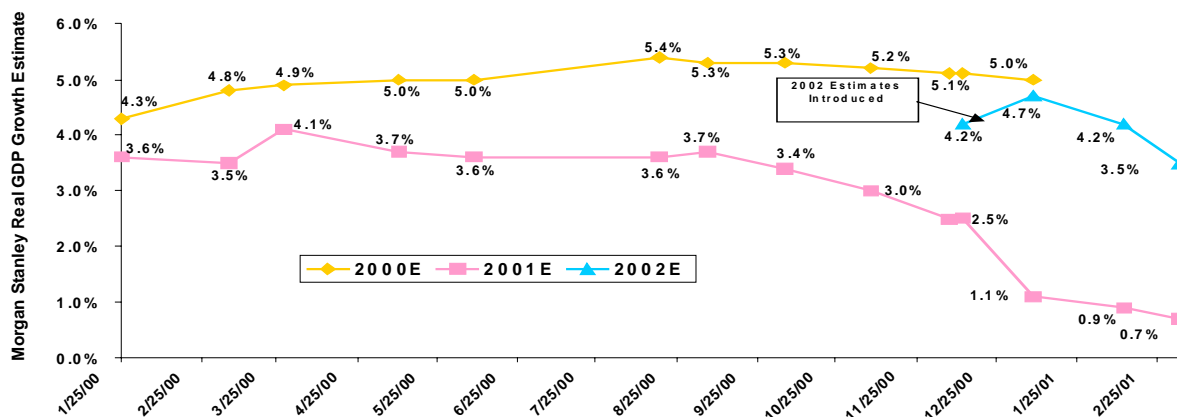
3/26/01, was at 1,929; 62% below its 3/10/00 peak of 5,049 and was near levels not seen since 11/20/98 when it was trading at 1,928.

So far, market/economic psychology/sentiment/confidence aren't improving and the news flow from companies just keeps getting worse (Morgan Stanley's data networking and Internet infrastructure analyst, Chris Stix, lowered his Cisco estimates on 3/26/01 and noted that this was his sixth estimate cut for Cisco in twelve weeks) when it comes to earnings forecasting we are struggling with determining what the appropriate base case revenue estimates for the tech leaders should be. It seems as though we are dealing with 'lost years' — do we go back to revenue levels for 2000, 1999, or perhaps, 1998? And then, do we re-build from there?

Bottom line, it's ugly out there. Here, we try to step back in order to move forward.

Exhibit 3

Morgan Stanley GDP Growth Rate Forecasts, 2000-2001YTD



GDP estimates from Richard Berner, Morgan Stanley economist.
 Source: Morgan Stanley Economic Research: Date as of 03/05/0

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Please refer to important disclosures at the end of this report.

Highlights of this Section...

- **For the year 2000, U.S. IT spending hit a record \$532 billion (up 23% year over year), accounting for 51% of capital equipment spending.** The prior record was set in 1999 when spending was \$433 billion (up 18% Y/Y to 47% of capital equipment spending). To get a sense of how these powerful growth rates in recent years compare with the past, it's notable that there have been only three years since 1960 when annual IT spending growth exceeded or equaled 23%, with all instances occurring prior to 1980 (off of a much smaller spending base).
- **IT spending growth is tied to the economy (and visa versa), and while we believe that IT spending growth could be below GDP growth in 2001, we believe it should go back to a more normal trend of growing faster than GDP growth in 2002 or 2003.** Why? It's simple, in our view, rising technology-related connectivity is an irreversible secular trend and this should allow the appropriate, but far from all, boats to rise. The wildcards are measuring the degree of oversupply in the market and determining when the economy rebounds.

Note that over the past forty years, when IT spending growth has fallen below GDP growth, it has taken, on average, one to two years for IT spending growth to again exceed GDP growth.

- There's a lot of discussion about 'inventory corrections' — the reality here is that too many companies bought too much too fast (or in many cases, were sold too much too fast during a period of 'easy money' — in part, it was, hello...vendor financing...or, in the case of Yahoo! the company sold too much too fast). This is a classic, though severe, supply and demand problem — the cost of capital was uniquely low and too many companies bought/built too much stuff. **For CH2:99 and 2000, we went through a period of above trend line growth and could now be going into a period of below trend line growth.**
- The key question is, if IT growth dips below trend line growth, how long does it take to work through this period and get back to trend line growth? In general, organic secular demand is strong in many sectors but both demand and supply got ahead of themselves and now we are going through a period of slowing demand combined with aggressive price cutting from too many companies.
- Before diving into the specifics of IT 'excess,' we drilldown on tech capital markets stats. Specifically, in the capital markets space, aggregate technology financing

in U.S. markets (venture, IPO and follow-on) from 1998-2000 was an unprecedented high \$319 billion while aggregate telecom services financing in U.S. markets (venture, IPO, follow-on, convertible and high-yield) from 1998-2000 was \$47 billion.

- On technology financing:

70% of technology venture capital financing in the U.S. over the past twenty-one years occurred in 1999 and 2000 (\$172 billion).

56% of technology IPO financing in the U.S. over the past twenty-one years occurred in 1999 and 2000 (\$66 billion).

54% of technology follow-on financing in the U.S. over the past twenty-one years occurred in 1999 and 2000 (\$50 billion).

62% of technology mergers and acquisitions (dollar volume) in the U.S. over the past twenty-one years occurred in 1999 and 2000 (\$780 billion in deal volume).

- We've looked at our estimates of above-trend line IT spending and financing and determined what we believe may be appropriate levels of 'excess' IT spending over the past three years based on both above trend line analysis and on 'overspending' resulting from 'overfinancing' analysis. The results follow:

'Excess' IT spending from 1998-2000, based on a forty-year trend line analysis, may have been near \$19 billion (or 1% of the total and 9% of the increase in annualized IT spending for the period).

Specifically for 2000, 'excess' IT spending may have been near \$34 billion (or 6% of the total and 35% of the increase in annualized IT spending for the period).

'Excess' IT spending related to technology and telecom services 'overfinancing' from 1998-2000 may have been near \$34 billion (or 2.5% of the total and 16% of the increase in annualized IT spending for the period).

Specifically for 2000, 'excess' IT spending related to technology and telecom services 'overfinancing' may have been near \$20 billion (or 4% of the total and 21% of the increase in annualized IT spending for the period).

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- It is important to note that while the 1998-2000 data demonstrate excess in IT spending over the three-year period, they also show that the peak of the excess clearly occurred in 2000, with the year accounting for a outsized portion of the money spent on IT in the period.
 - **A key thing that strikes us about the data in this report is that the direct impact (assuming our methodology is fair) of the recent powerful tech/telecom services financing cycle on U.S. IT spending, while significant, is not as high as many believe. In fact, as we have analyzed the data we have concluded that the biggest booster to IT spending in 2000 and 1999 was, simply, enthusiasm (translated into spending) from businesses about the positive prospects for new technology deployments.**
 - We believe in **pattern recognition and our review of the historical data in this report** (related to IT spending and inventory growth; technology and telecommunication services financing; and stock market performance) **leads us to believe, again, that while this down cycle is ugly, we could be out of it in two-to-six quarters. Shares of leading technology companies will begin to discount a recovery two quarters before it occurs.**
 - **First, we need to anniversary the beginnings of the bad quarters and then many companies need to fold, and then the leaders will likely prosper, again.**

CQ4:00 was a Record Quarter for IT Spending...Note that IT Spending Began to Accelerate and Decouple From Non-IT Spending Growth in CQ1:99

(Exhibits 4-6)

As of CQ4:00, nominal business spending dedicated to information technology (computers, telecommunications equipment, and the like) accounted for 53% (or \$557 billion annualized) of capital equipment spending by US businesses, up from 45% (or \$382 billion annualized) in CQ4:98 (Exhibit 4). Note that the IT spending mentioned in this report excludes salary based expenses, which may, in recent years, have accelerated IT spending growth due to a tight IT labor market. This impact is not reflected in the data of this section. Based on a forty-year (1960-2000) linear regression, the trend line implies that the level for

CQ4:00 should have been near 48%, implying that IT spending was 500 basis points (or \$52 billion annualized) above its trend line level in CQ4:00; this compares with 52% (or \$549 billion and \$38 billion annualized above trend line) in CQ3:00 and 48% (\$461 billion and \$9 billion annualized above trend line) in CQ4:99 (Exhibit 5).

The rate of quarterly IT spending began to accelerate and decouple from non-IT spending growth in CQ4:98 (Exhibit 6). This trend remained in place for six quarters and in CQ3:00, the growth rate for both IT and non-IT spending began to slow.

The data help us frame the question: ‘Did we have one or two years of overspending for technology?’

Our answer? Somewhere between the two...

Exhibit 4

U.S. Business Capital Equipment Spending - Information Technology (IT) Spending vs Non-IT Spending, Qrly 1996-2000

Quarter	Annualized Capital Equipment Spending (\$B)	Capital Equipment Spending (Q/Q Change)	Annualized IT Spending (\$B)	IT Spending (Y/Y Change)	IT Spending (Q/Q Change)	IT % of Capital Equipment Spending	Annualized Non-IT Spending (\$B)	Non-IT Spending (Y/Y Change)	Non-IT Spending (Q/Q Change)	Non-IT % of Capital Equipment Spending	GDP (Q/Q change)	Differential Factor (IT to Non-IT Change)	Differential Factor (IT to GDP Change)
CQ4:00	\$1,043	(1.6%)	\$557	21%	1.5%	53%	\$487	-1%	(4.9%)	47%	0.9%	(0.3)	1.8
CQ3:00	1,061	1.6	549	23	4.0	52	512	4	(0.9)	48	0.9	(4.4)	4.2
CQ2:00	1,044	4.5	527	25	6.5	51	517	7	2.4	49	2.0	2.7	3.3
CQ1:00	1,000	5.0	495	23	7.3	50	504	6	2.8	50	2.0	2.6	3.6
CQ4:99	952	1.7	461	21	3.6	48	490	4	0.1	52	2.3	48.6	1.5
CQ3:99	936	3.5	446	20	5.2	48	490	8	1.9	52	1.6	2.7	3.2
CQ2:99	904	3.0	424	17	5.4	47	481	5	0.9	53	1.0	6.1	5.7
CQ1:99	878	2.9	402	14	5.2	46	476	7	1.1	54	1.4	4.7	3.6
CQ4:98	853	3.2	382	12	2.8	45	471	11	3.5	55	1.7	0.8	1.7
CQ3:98	827	0.9	371	11	2.3	45	455	6	(0.3)	55	1.2	(8.1)	1.9
CQ2:98	819	2.7	363	14	2.6	44	457	9	2.8	56	1.0	1.0	2.6
CQ1:98	798	4.4	354	15	4.1	44	444	11	4.7	56	1.8	0.9	2.3
CQ4:97	764	(0.2)	339	15	1.2	44	425	7	(1.3)	56	1.0	(0.9)	1.1
CQ3:97	765	3.9	335	15	5.2	44	430	8	3.0	56	1.3	1.7	3.8
CQ2:97	737	3.9	319	13	3.9	43	418	9	4.0	57	1.9	1.0	2.0
CQ1:97	709	2.2	307	10	4.1	43	402	8	0.8	57	1.8	5.4	2.3
CQ4:96	693	0.9	295	--	1.3	43	399	--	0.5	57	1.6	2.5	0.9
CQ3:96	687	3.3	291	--	2.6	42	396	--	3.8	58	1.0	0.7	2.7
CQ2:96	665	2.1	283	--	1.2	43	382	--	2.8	57	2.0	0.4	0.6
CQ1:96	652	2.6	280	--	2.5	43	372	--	2.7	57	1.3	0.9	1.9
Mean	--	2.6%	--	--	3.6%	--	--	--	1.8%	--	1.5%	3.4%	2.5%
Median	--	2.8%	--	--	3.7%	--	--	--	2.2%	--	1.5%	1.0%	2.3%

Indicates an IT Spending Growth to Non-IT Spending Growth differential factor *greater than* 2.0.

Indicates an IT Spending Growth to Non-IT Spending Growth differential factor *less than* 1.0.

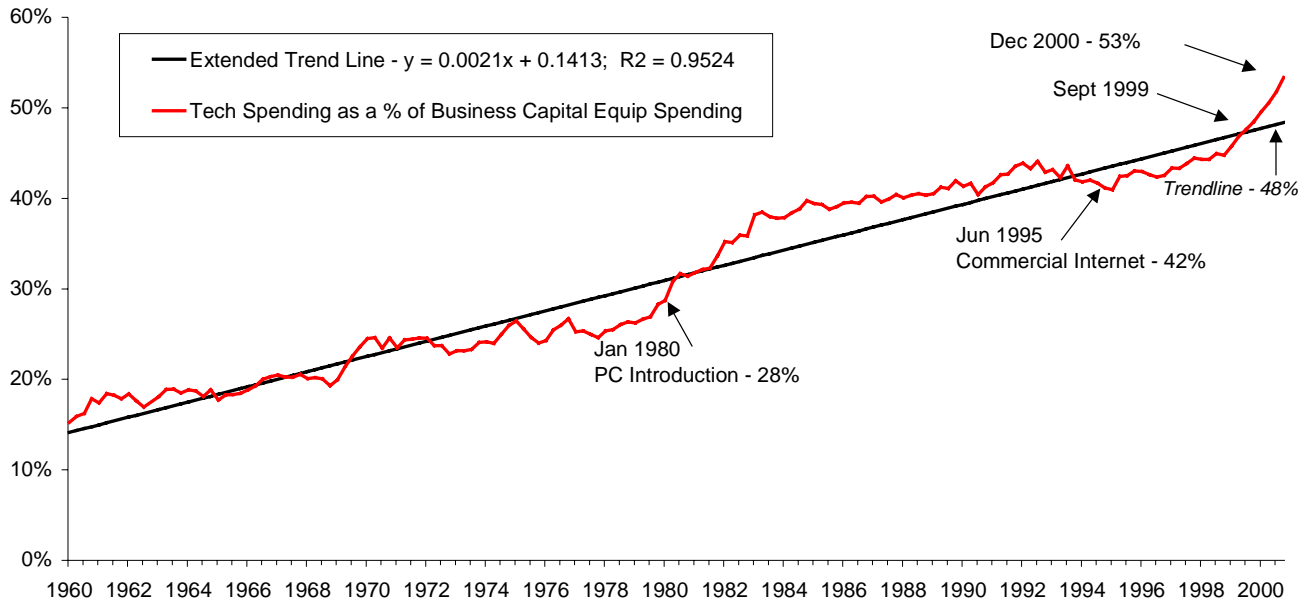
Growth figures are calculated from nominal values.

Note that quarterly data is annualized, as reported by the Bureau of Economic Analysis

Source: Bureau of Economic Analysis, Morgan Stanley Equity Research.

Exhibit 5

U.S.-based Information Technology as a % of Nominal Business Capital Equipment Spending, 1960-2000

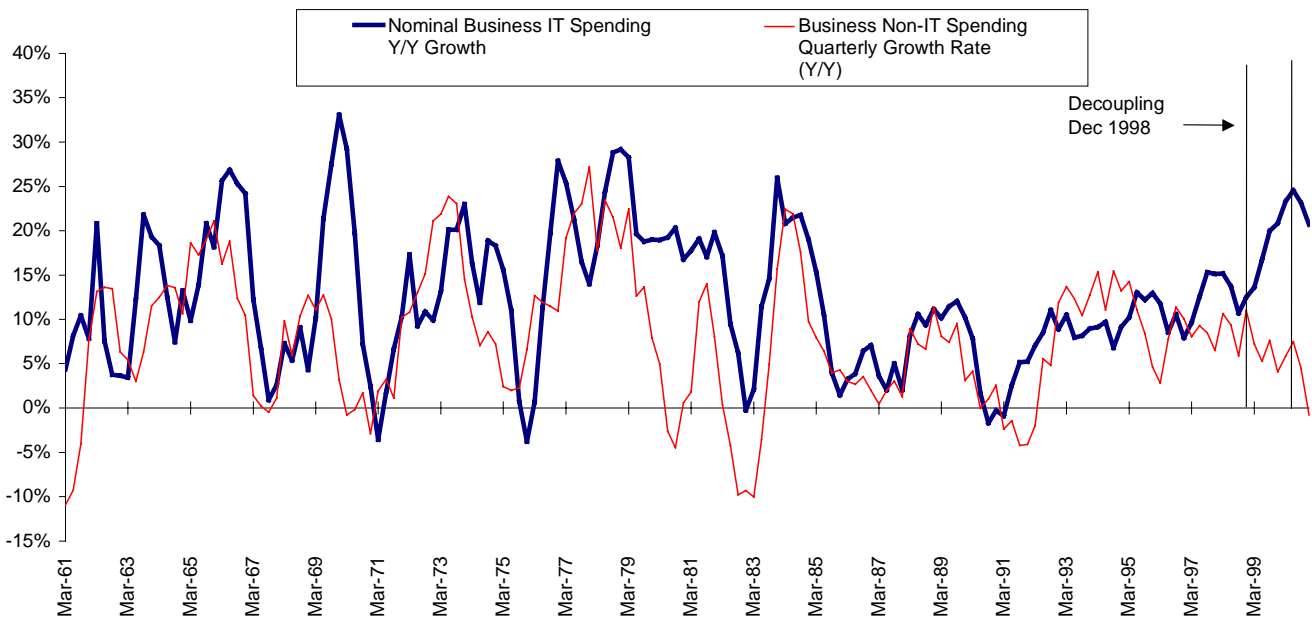


Source: Bureau of Economic Analysis, Morgan Stanley Technology Research

Exhibit 6

IT vs. Non-IT Spending Growth, 1960-2000

Business IT Spending Qtrly Growth Rates (Y/Y) vs. Business Non-IT Spending Qtrly Growth Rates (Y/Y)



Growth rates are calculated from nominal values.

Source: Bureau of Economic Analysis, Morgan Stanley Technology Research

Exhibit 7

U.S. Business Capital Equipment Spending -- Information Technology (IT) Spending vs. Non-IT Spending, 1960-2000

Year	Capital Equipment Spending (B)	Capital Equipment Spending (Y/Y Change)	IT Spending (B)	IT Spending (Y/Y Change)	IT % of Capital Equipment Spending	Non-IT Spending (B)	Non-IT Spending (Y/Y Change)	Non-IT % of Capital Equipment Spending	GDP (Y/Y change)	Differential Factor (IT to Non-IT Change)	Differential Factor (IT to GDP Change)
2000	\$1,037	13%	\$532	23%	51%	\$505	4%	49%	7%	5.4	3.2
1999	917	11	433	18	47	484	6	53	6	3.0	3.1
1998	824	11	367	13	45	457	9	55	6	1.4	2.3
1997	744	10	325	13	44	418	8	56	6	1.6	2.0
1996	674	9	287	10	43	387	8	57	6	1.2	1.7
1995	620	11	262	12	42	358	9	58	5	1.3	2.5
1994	561	12	234	9	42	327	14	58	6	0.6	1.4
1993	503	11	215	9	43	288	12	57	5	0.7	1.7
1992	454	7	197	9	44	256	5	56	6	1.8	1.6
1991	425	(1)	181	3	43	244	(3)	57	3	2.0	1.0
1990	428	2	176	2	41	252	2	59	6	0.9	0.3
1989	420	9	173	11	41	247	7	59	7	1.6	1.5
1988	387	9	156	10	40	231	9	60	8	1.2	1.3
1987	355	2	142	3	40	213	2	60	7	1.9	0.5
1986	347	4	138	5	40	209	3	60	6	1.8	0.9
1985	334	6	131	8	39	203	6	61	7	1.3	1.1
1984	314	19	122	21	39	193	18	61	11	1.2	1.8
1983	265	6	101	13	38	164	2	62	8	8.8	1.6
1982	250	(1)	89	8	36	161	(6)	64	4	2.4	1.9
1981	254	12	82	18	32	171	9	68	12	2.1	1.5
1980	227	5	70	19	31	157	(0.4)	69	9	45.0	2.1
1979	217	16	59	21	27	158	14	73	12	1.5	1.8
1978	187	21	48	25	26	139	20	74	13	1.3	1.9
1977	154	22	39	19	25	116	23	75	11	0.8	1.7
1976	126	13	32	15	26	94	12	74	12	1.3	1.3
1975	112	4	28	5	25	84	3	75	9	1.6	0.6
1974	108	10	27	16	25	81	8	75	8	2.0	2.0
1973	98	20	23	19	23	75	21	77	12	0.9	1.6
1972	82	14	19	12	24	62	15	76	10	0.8	1.2
1971	71	4	17	4	24	54	4	76	9	0.9	0.4
1970	69	3	17	14	24	52	(0.5)	76	6	27.3	2.5
1969	67	12	15	23	22	52	9	78	8	2.5	2.9
1968	60	9	12	6	20	48	10	80	9	0.7	0.7
1967	55	2	11	5	20	44	1	80	6	9.4	1.0
1966	54	16	11	25	20	43	14	80	10	1.8	2.6
1965	46	18	8	16	18	38	19	82	8	0.8	1.9
1964	39	13	7	13	19	32	13	81	7	1.0	1.7
1963	35	8	6	14	19	28	7	81	5	2.1	2.6
1962	32	11	6	9	18	27	12	82	7	0.7	1.1
1961	29	(2)	5	8	18	24	(4)	82	3	2.8	2.2
1960	30	--	5	--	16	25	--	84	4	--	--
Mean	--	9%	--	13%	--	--	8%	--	8%	3.7	1.7
Median	--	10%	--	12%	--	--	8%	--	7%	1.5	1.7

Indicates an IT Spending Growth to Non-IT Spending Growth differential factor *greater than* 2.0.

Indicates an IT Spending Growth to Non-IT Spending Growth differential factor *less than* 1.0.

Growth figures are calculated from nominal values.

Source: Bureau of Economic Analysis, Morgan Stanley Equity Research

2000 was a Record Year for IT Spending

(Exhibit 7)

For the year 2000, U.S. IT spending hit a record \$532 billion (up 23% Y/Y), accounting for 51% of capital equipment spending. The prior record was set in 1999 when spending was \$433 billion (up 18% Y/Y to 47% of capital equipment spending). To get a sense of how these powerful growth rates in recent years compare with the past, it's notable that there have been only three years since 1960 when annual IT spending growth exceeded or equaled 23%, with all instances occurring prior to 1980 (off a much smaller spending base) (Exhibit 7). Also note that over the past forty years, when IT spending growth has fallen below GDP growth, it has taken, on average, one to two years for IT spending to again exceed GDP growth.

IT Spending Has, on Average, Outpaced GDP Growth by 1.7x over the Past Forty Years

Over the past forty years, business spending on IT grew at an average 13%, exceeding the growth rates of both non-IT business spending and nominal GDP (both with 8% average growth rates over the period).

The median differential factor in Y/Y growth for IT-to-Non-IT growth has been 1.5x while the mean has been 3.7x. It's notable that in thirteen (33%) of the past forty years IT spending outpaced non-IT spending by more than 2x (by an average of 3.7x); in seventeen (43%) of the years, IT spending outpaced non-IT spending by between 1.0-2.0x; and that in ten (25%) of the years, non-IT spending outpaced IT spending.

Ultimately, of course, given the law of large numbers we expect the linkage between IT spending growth and GDP to come closer to convergence. As such, our guess is that down the road technology spending could become more economically sensitive and not less so. In the meantime, however, technology should remain the most obvious source of real growth in the market.

Hear it Roar, IT Spending Has Become Too Big to Ignore...Aggregate IT Spending from 1998-2000 Was \$1.3 Trillion

IT spending, in general, has become the largest line item in corporate capital spending budgets, demonstrating the commitment to the productivity bets related to technology purchases. And we can debate all day long about the what's

and how's of productivity gains, but the reality is that the ability to leverage technology is only as good as the people trying to leverage it. So, it works for many, but not for all.

What's Next?

While the zillion dollar question these days is "when will the economy rebound," the trillion dollar question seems to be "is tech over and how severely will it be affected by a slowing economy?"

Our point of view is simple, technology spending growth is tied to the economy (and visa versa), and while we believe that tech spending growth could be below GDP growth in 2001, we believe it should go back to a more normal trend of growing faster than GDP growth in 2002 or 2003. Why? It's simple, in our view, rising technology-related connectivity is an irreversible secular trend and this should allow the appropriate, but far from all, boats to rise. The wildcards are measuring the degree of oversupply in the market and determining when the economy rebounds.

There's a lot of discussion about 'inventory corrections' — the reality here is that too many companies bought too much too fast (or in many cases, were sold too much too fast during a period of 'easy money' — in part, it was, hello...vendor financing...or, in the case of Yahoo! the company sold too much too fast). This is a classic, though severe, supply and demand problem — the cost of capital was low and too many companies bought/built too much stuff. We went through a period of above trend line growth and now we are going through a period of below trend line growth.

The key question is how long does it take to work through this period and get back to trend line growth? In general, organic secular demand is strong in many sectors but both demand and supply got ahead of themselves and now we are going through a period of slowing demand combined with aggressive price cutting from too many companies.

While this is a sketchy way to do analysis, we are going to try something new here. The primary thread of *The Technology and Internet IPO Yearbook* focuses on public market financing trends for technology companies. **We have just discussed the fact that technology spending levels have been at record highs. In addition, technology financing levels have been at record highs. Let's look at specific trends for the past three years.**

We Endeavor to Determine the Degree of 'Excess' Tech Spending in Recent Years

(Exhibit 8)

'Excess' IT spending from 1998-2000, based on a forty-year trend line analysis of IT spending, may have been near \$19 billion (or 1% of total IT spending and 9% of the increase in annualized IT spending over the 1998-2000 period).

Specifically for 2000, 'excess' IT spending may have been near \$34 billion (or 6% of total IT spending and 35% of the increase in annualized IT spending for the period).

First, let's assume that Y/Y IT spending in 1998, 1999 and 2000 should have only grown at trend line growth of 14% (the trend line estimate is based on forty years of data) rather than 18% over the three period. Based on this, aggregate 'overspending' for the three-year period was \$19 billion. The drill down data for each year is: 2000E - 'overspend' of \$34 billion; 1999E - neutral; 1998E - 'underspend' of \$15 billion (Exhibit 8).

Over Forty Years, When IT Spending Growth has Fallen Below GDP Growth, it Has Taken, on Average, One to Two Years for IT Spending to Recover

Let's take a step back in time to determine how long the 'correction' in tech spending might last. We look at the historical mechanics of the IT spending cycle to see how long it has taken for IT spending to recover when it has fallen below the growth in GDP. The data indicate that there have been five times over the past forty years that Y/Y IT spending growth has dipped below Y/Y GDP growth.

The average recovery time for the IT growth rate to again exceed that of GDP was one to two years. The five instances are:

- 1967 — IT spending growth was 5% Y/Y (down from 25% in 1966 and below GDP growth of 6%), and in 1968, the growth rate was 6% (below GDP growth of 9%). IT spending growth rate rebounded above the GDP growth rate in 1969, growing 23% — **marking two years of slow growth.**
- 1971 — IT spending growth was 4% Y/Y (down from 14% in 1970 and below GDP growth of 9%). IT spending growth rate accelerated above the GDP growth rate in 1972, growing 12% — **marking one year of slow growth.**
- 1975 — IT spending growth was 5% Y/Y (down from 16% in 1974 and below GDP growth of 9%). IT spending growth rate rebounded one year later in 1976 to 15% Y/Y — **marking one year of slow growth.**
- 1986 — IT spending growth was 5% Y/Y (down from 8% in 1985 and below GDP growth of 6%). IT spending growth rate continued to fall in 1987 to 3% (below GDP growth of 7%), rebounding two years later to 10% in 1988 — **marking two years of slow growth.**
- 1990 — IT growth rate was 2% Y/Y (down from 11% in 1989 and below GDP growth of 6%). IT spending growth rate was 3% (compared to GDP growth of 3%) in 1991, rebounding two years later to 9% in 1992 — **marking two years of slow growth.**

Exhibit 8

'Excess' IT Spending Calculation Estimates, 1998-2000

	1998	1999	2000	1998-2000
Capital Equipment Spending (\$B)	\$824	\$917	\$1,037	\$2,779
Y/Y Change	11%	11%	13%	--
IT Spending as % of Capital Equipment Spending	44.6%	47.2%	51.3%	48.0%
Actual IT Spending (\$B)	\$367	\$433	\$532	\$1,332
Y/Y Change	13%	18%	23%	--
Implied IT Spending per Trend line as % of Capital Equipment Spending	46.4%	47.2%	48.0%	47.2%
Implied IT Spending per Trend line (\$B)	\$382	\$433	\$498	\$1,314
Y/Y Change	13%	13%	15%	--
'Excess' IT Spending (\$B)	(\$15)	(\$0)	\$34	\$19

Source: Bureau of Economic Analysis, Morgan Stanley Technology Research

We Endeavor to Measure the Ebullience of Technology Capital Markets

(Exhibits 9 and 10)

Aggregate technology financing in U.S. markets (venture, IPO and follow-on) from 1998-2000 was an unprecedented high \$319 billion while aggregate telecom services financing in U.S. markets (venture, IPO, follow-on, convertible and high yield) from 1998-2000 was \$47 billion.

Over the past three years, technology financing, of all types, experienced a huge spike (Exhibits 9 and 10).

70% of technology venture capital financing in U.S. markets over the past twenty-one years occurred in 1999 and 2000.

Specifically, in 2000, \$115 billion (up 98% Y/Y) was invested in 6,012 technology companies and in 1999, \$58 billion (up 202% Y/Y) was invested in 3,515 technology companies. For comparison, in 1998, \$19 billion (up 69% Y/Y) was invested in 2,173 technology companies.

56% of technology IPO financing in U.S. markets over the past twenty-one years occurred in 1999 and 2000.

Specifically, in 2000, \$38 billion (up 34% Y/Y) was raised for 236 companies and in 1999, \$28 billion (up 402% Y/Y) was raised for 318 companies. For comparison, in 1998, \$6 billion (down 11% Y/Y) was raised for 90 companies.

It's also notable that the ratio for each year of venture dollars invested in technology companies compared with IPO proceeds was out-of-whack in period of 1998 through 2000. The median ratio of yearly venture funding to IPO proceeds in the 1990s was 1.0 (with a mean of 1.5). In 2000 this ratio was 3.0; in 1999 it was 2.1 and in 1998 it was 3.4. This implies that the venture business will likely

go through a rougher shakeout than the public markets have. We believe that, given the especially poor performance of tech IPOs in 1999 and 2000 and the rapid time to public market that many newly financed venture companies experienced, the market, in effect, robbed some of the IPO prospects from 2001 and 2002 — both by taking companies public before their time and by creating a financing environment where it will likely remain more difficult for new companies/ideas to get financing.

54% of technology follow-on financing in U.S. markets over the past twenty-one years occurred in 1999 and 2000.

Specifically, in 2000, \$32 billion (up 84% Y/Y) were raised for 137 companies and in 1999, \$18 billion (up 201% Y/Y) were raised for 128 companies. For comparison, in 1998, \$6 billion (up 17% Y/Y) were raised for 86 companies.

Note that over time there's a close link between technology IPO proceeds and follow-on proceeds. Specifically, over the past twenty years, IPO proceeds and follow-on proceeds have shown a correlation coefficient of 0.97, indicating that the two variables are coincident indicators.

62% of technology mergers and acquisitions in the U.S. (based on dollar volume) over the past twenty-one years occurred in 1999 and 2000.

Specifically, in 2000, \$518 billion (up 97% Y/Y) in deal volume occurred for 529 mergers and in 1999, \$263 billion (up 104% Y/Y) in deal volume occurred for 312 mergers. For comparison, in 1998, \$129 billion (up 68% Y/Y) in deal volume occurred for 191 mergers.

Exhibit 9

U.S. Technology Venture Capital and IPO Financing, 1980-2000

	Venture Financing Data						IPO Financing Data					
	Number of Tech Companies Receiving Funding	% of 1980-2000 Total Companies	Estimated Venture Financing (\$MM)	% of 1980-2000 Total Venture Financings	Venture Funding Y/Y Change	Average Financing per Company (\$MM)	Number of Tech IPOs	% of 1980-2000 Total IPOs	Tech IPO Proceeds (\$MM)	% of 1980-2000 Total IPO Proceeds	IPO Y/Y Change	Average IPO Deal Size (\$MM)
2000	6,012	23%	114,513	47%	98%	19	236	14%	37,547	32%	34%	159
1999	3,515	14%	57,956	24%	202%	16	318	18%	28,094	24%	402%	88
1998	2,173	8%	19,204	8%	69%	9	90	5%	5,592	5%	-11%	62
1997	1,730	7%	11,396	5%	47%	7	136	8%	6,278	5%	-48%	46
1996	1,364	5%	7,745	3%	66%	6	214	12%	11,995	10%	54%	56
1995	798	3%	4,666	2%	86%	6	152	9%	7,795	7%	187%	51
1994	637	2%	2,512	1%	-20%	4	82	5%	2,715	2%	-15%	33
1993	600	2%	3,136	1%	19%	5	98	6%	3,212	3%	-16%	33
1992	674	3%	2,631	1%	111%	4	60	3%	3,818	3%	129%	64
1991	580	2%	1,247	1%	-39%	2	46	3%	1,671	1%	180%	36
1990	653	3%	2,037	1%	-7%	3	23	1%	596	1%	-14%	26
1989	768	3%	2,197	1%	-12%	3	27	2%	694	1%	90%	26
1988	779	3%	2,495	1%	13%	3	17	1%	366	0%	-55%	22
1987	853	3%	2,207	1%	-13%	3	33	2%	822	1%	3%	25
1986	829	3%	2,528	1%	9%	3	36	2%	797	1%	277%	22
1985	826	3%	2,314	1%	-2%	3	13	1%	211	0%	-52%	16
1984	892	3%	2,351	1%	4%	3	23	1%	441	0%	-81%	19
1983	776	3%	2,263	1%	94%	3	82	5%	2,361	2%	437%	29
1982	561	2%	1,166	0%	57%	2	12	1%	440	0%	-28%	37
1981	391	2%	741	0%	138%	2	34	2%	611	1%	101%	18
1980	216	1%	311	0%	--	1	13	1%	304	0%	--	23
Total 1980-1998	16,100		73,148				1,191		50,716			
Total 1980-2000	25,627		245,618				1,745		116,357			

Sources: Venture Economics/National Venture Capital, Securities Data Corp, and Morgan Stanley Technology Research

Exhibit 10

U.S. Technology Follow-on Financing and M&A Activity, 1980-2000

	Secondary Financing Data						M&A Data					
	Number of Tech Follow-on Offerings	% of 1980-2000 Total Tech Follow-Ons	Tech Follow-on Proceeds (\$MM)	% of 1980-2000 Total Tech Follow-On Proceeds	Follow On Y/Y Change	Average Follow On Deal Size (\$MM)	Number of Tech M&A Deals	% of 1980-2000 Total Tech M&A Deals	Tech M&A Deal Volume (\$MM)	% of 1980-2000 Total Tech M&A Deal Volume	M&A Y/Y Change	Average M&A Deal Size (\$MM)
2000	137	10%	32,446	35%	84%	237	529	30%	517,534	41%	97%	978
1999	128	9%	17,589	19%	201%	137	312	18%	262,912	21%	104%	843
1998	86	6%	5,849	6%	17%	68	191	11%	128,751	10%	68%	674
1997	108	8%	4,980	5%	23%	46	175	10%	76,825	6%	80%	439
1996	99	7%	4,062	4%	-48%	41	106	6%	42,587	3%	-55%	402
1995	143	10%	7,856	9%	142%	55	87	5%	93,990	7%	273%	1,080
1994	68	5%	3,243	4%	2%	48	57	3%	25,198	2%	128%	442
1993	89	6%	3,189	3%	180%	36	33	2%	11,032	1%	2%	334
1992	44	3%	1,138	1%	-32%	26	30	2%	10,807	1%	-27%	360
1991	48	3%	1,685	2%	162%	35	42	2%	14,863	1%	-30%	354
1990	16	1%	643	1%	39%	40	30	2%	21,284	2%	56%	709
1989	20	1%	462	0%	70%	23	45	3%	13,645	1%	-12%	303
1988	15	1%	272	0%	-74%	18	45	3%	15,427	1%	51%	343
1987	36	3%	1,047	1%	-14%	29	31	2%	10,190	1%	-12%	329
1986	37	3%	1,221	1%	76%	33	22	1%	11,543	1%	222%	525
1985	33	2%	694	1%	69%	21	16	1%	3,586	0%	-42%	224
1984	26	2%	411	0%	-85%	16	15	1%	6,177	0%	1000%	412
1983	102	7%	2,709	3%	268%	27	3	0%	562	0%	-33%	187
1982	44	3%	736	1%	-21%	17	1	0%	834	0%	-49%	834
1981	45	3%	931	1%	-21%	21	6	0%	1,650	0%	301%	275
1980	52	4%	1,183	1%	--	23	2	0%	412	0%	--	206
Total 1980-1998	1,111		42,311				937		489,360			
Total 1980-2000	1,376		92,347				1,778		1,269,805			

Sources: Securities Data Corp, Thompson Financial Securities Data, and Morgan Stanley Technology Research

Exhibit 11

Tech and Telecom Services Venture Capital U.S. IT 'Overspending' Calculation Estimates (\$MM), 1998-2000

	Tech VC Proceeds	Telecom Services VC Proceeds	Tech VC 'Overfinancing'	Telecom Services VC 'Overfinancing'	'Excess' IT Spending from Tech VC	'Excess' IT Spending from Telecom Services VC	'Excess' IT Spending from VC
1998	\$19,204	\$1,192	\$9,602	\$596	\$1,920	\$119	\$2,040
1999	57,956	4,302	28,978	2,151	5,796	430	6,226
Y/Y Growth	202%	261%	202%	261%	202%	261%	205%
2000	114,513	6,852	57,257	3,426	11,451	685	12,137
Y/Y Growth	98%	59%	98%	59%	98%	59%	68%
Total	191,674	12,347	95,837	6,173	19,167	1,235	20,402

Assumes 50% of VC financing for both tech and telecom services companies in three year period was excessive, and that 20% of financing went into IT spending.

Sources: Venture Economics/National Venture Capital, Morgan Stanley Technology Research

Exhibit 12

Tech and Telecom Services IPO U.S. IT 'Overspending' Calculation Estimates (\$MM), 1998-2000

	Tech IPO Proceeds	Telecom Services IPO Proceeds	Tech IPO 'Overfinancing'	Telecom Services IPO 'Overfinancing'	'Excess' IT Spending from Tech IPOs	'Excess' IT Spending from Telecom Services IPOs	'Excess' IT Spending from IPOs
1998	\$5,592	\$1,080	(\$17)	\$489	(\$63)	\$98	\$35
1999	28,094	3,241	14,842	1,590	2,968	318	3,286
Y/Y Change	402%	200%	--	225%	--	225%	9289%
2000	37,547	4,949	21,253	4,388	4,251	878	5,128
Y/Y Change	34%	53%	43%	176%	43%	176%	56%
Total	71,233	9,270	35,778	6,467	7,156	1,293	8,449

Assumes 53% long term IPO success rate for both tech and telecom services companies in three year period, and that 20% of financing went into IT spending. Actual success rate for tech IPOs for 1998, 1999 and 2000 was 56%, 25% and 23% and for telecom services IPOs was 29%, 27% and 6%, respectively. The IPO 'overfinancing' is calculated by finding what percentage of companies should have gone public to make the successful number of companies equal 53% of the IPOs (bringing-in 53% of the proceeds).

Note that we are making a few assumptions in this math: 1) Proceeds were evenly distributed to all tech companies. Clearly, this wasn't the case. And the argument could be made that the more successful companies received more of the proceeds. But the directional significance remains; 2) The IPO success rates for the class of 2000 won't change significantly going forward. Given that 2000 was a bear market year for technology stocks, this too is a conservative assumption. Simple point here is that, if anything, we're overestimating the amount of technology 'overfinancing.'

Note that we are defining success for a tech IPO is whether or not the IPO is trading above its IPO market cap, while success for a telecom services IPO is whether the IPO is trading above its IPO price.

Sources: Securities Data Corporation, Morgan Stanley Technology Research

Exhibit 13

Tech & Telecom Services Follow-on Offering and Non-IPO Public Financing U.S. IT 'Overspending' Calculation Estimates (\$MM), 1998-2000

	Tech Follow-on Proceeds	Telecom Services Other Proceeds*	Tech Follow-on 'Overfinancing'	Telecom Services Other 'Overfinancing'	'Excess' IT Spending from Tech Follow-ons	'Excess' IT Spending from Telecom Services Other	'Excess' IT Spending from Secondary
1998	\$5,849	\$4,142	\$1,755	\$1,243	\$351	\$249	\$599
1999	17,589	13,206	5,277	3,962	1,055	792	1,848
Y/Y Change	201%	218%	201%	218%	201%	218%	208%
2000	32,446	8,400	9,734	2,520	1,947	504	2,451
Y/Y Change	84%	(36%)	84%	(36%)	84%	(36%)	33%
Total	55,884	25,748	16,765	7,725	3,353	1,545	4,898

*Other proceeds includes secondary equity offerings, debt and preferred stock convertibles.

Assumes 30% of follow-on and convertible financing for tech and telecom services companies in three year period was excessive, and that 20% of financing went into IT spending.

Note that we chose to include convertible and high-yield funding into the telecom services portion of the excessive IT spending calculation because telecom services companies relied heavily on these markets than equity markets for their funding. On the other hand, we chose to exclude non-equity funding from the technology portion of the equation because we felt it would not impact the result significantly.

Sources: Securities Data Corporation, Morgan Stanley Technology Research

We Endeavor to Determine the Role of Ebullient Capital Markets on 'Excess' Tech Spending in Recent Years

(Exhibits 11-14)

'Excess' IT spending related to technology and telecom services 'overfinancing' from 1998-2000 may have been near \$34 billion (or 2.5% of total IT spending in the period and 16% of the increase in annualized IT spending for the period).

Specifically for 2000, 'excess' IT spending related to technology and telecom services 'overfinancing' may have been near \$20 billion (or 4% of total IT spending and 21% of the increase in annualized IT spending for the period).

Let's assume that **50%** of all tech and telecom services companies funded to the tune of \$204 billion in venture capital funding from 1998-2000 should not have been funded. This implies that 'overfinancing' of tech and telecom services companies in the period was \$102 billion. Let's also assume that **20%** of all venture capital proceeds received by these companies were directed toward IT spending. If we were to remove the theoretical IT spending from the **50%** of companies that should not have been funded, we would remove **\$20 billion in 'excess' IT spending from 1998-2000 as a result of the robust abundance of venture capital in the period** (Exhibit 11).

Note that our 20% IT spending estimate for telecom services companies may be underestimated owing to the usage of vendor financing as a method to purchase network infrastructure products by these companies.

Next, let's assume that the successful tech and telecom services IPOs in 1998-2000 represented **53%** (in line with historical success rates) of the total tech and telecom services IPOs in the period, instead of a 56%, 25% and 23% in 1998, 1999, and 2000 for tech, and 29%, 27% and 6% for telecom services, respectively. Assuming that financing was equally divided amongst all companies, the 1998-2000 period saw tech and telecom services IPO 'overfinancing' of \$42 billion. Next, assuming that **20%** of tech and telecom services IPO funding goes into IT, we derive that **\$8 billion in 'excess' IT spending from 1998-2000 occurred because of the unusually hot IPO market environment** (Exhibit 12).

Finally, let's assume that **30%** of all tech equity follow-on proceeds and telecom services equity follow-on, convertible debt, convertible preferred stock and high yield proceeds in the 1998-2000 period were excessive, going to companies that would not be able to receive the funding under normal market conditions. This would imply a follow-on and convertible 'overfinancing' for the period of \$24 billion. Next, assuming that **20%** of tech and telecom services follow-on and convertible funding goes into IT, we derive that **\$5 billion in 'excess' IT spending from 1998-2000 occurred because of the unusually hot follow-on and convertible market environment** (Exhibit 13).

Summing the excesses in IT spending resulting from venture capital, IPO and other public markets, we find that the **'excess' IT spending resulting from 'overfinancing' in the past three years may have been around \$34 billion** (Exhibit 14).

Exhibit 14

Total Tech and Telecom Services U.S. IT 'Overspending' Calculation Estimates (\$MM), 1998-2000

	Tech Proceeds	Telecom Services Proceeds*	Tech Follow-on 'Overfinancing'	Telecom Services Other 'Overfinancing'	'Excess' IT Spending from Tech Follow-ons	'Excess' IT Spending from Telecom Services Other	'Excess' IT Spending from Secondary
VC	\$191,674	\$12,347	\$95,837	\$6,173	\$19,167	\$1,235	\$20,402
IPO	71,233	9,270	35,778	6,467	7,156	1,293	8,449
Follow-on	55,884	25,748	16,765	7,725	3,353	1,545	4,898
Total	318,791	47,365	148,380	20,365	29,676	4,073	33,749

Sources: Venture Economics/National Venture Capital, Securities Data Corporation, and Morgan Stanley Technology Research

Pattern Recognition Works when Comparing IT Spending Trends versus NASDAQ Returns

(Exhibit 15)

There appears to be a correlation between IT spending trends and NASDAQ performance. In Exhibit 23 we look at six-month quarterly growth data from 1994-2000. While one can argue whether there is a lead/lag effect here, it's clear that there's a correlation.

Over the seven year period, we can see that there are three distinct business cycles (measured from peak to peak) that the NASDAQ went through:

- *September 1995-September 1997* — Business cycle lasted for two years.
- *September 1997-March 1999* — Business cycle lasted for 1.5 years.

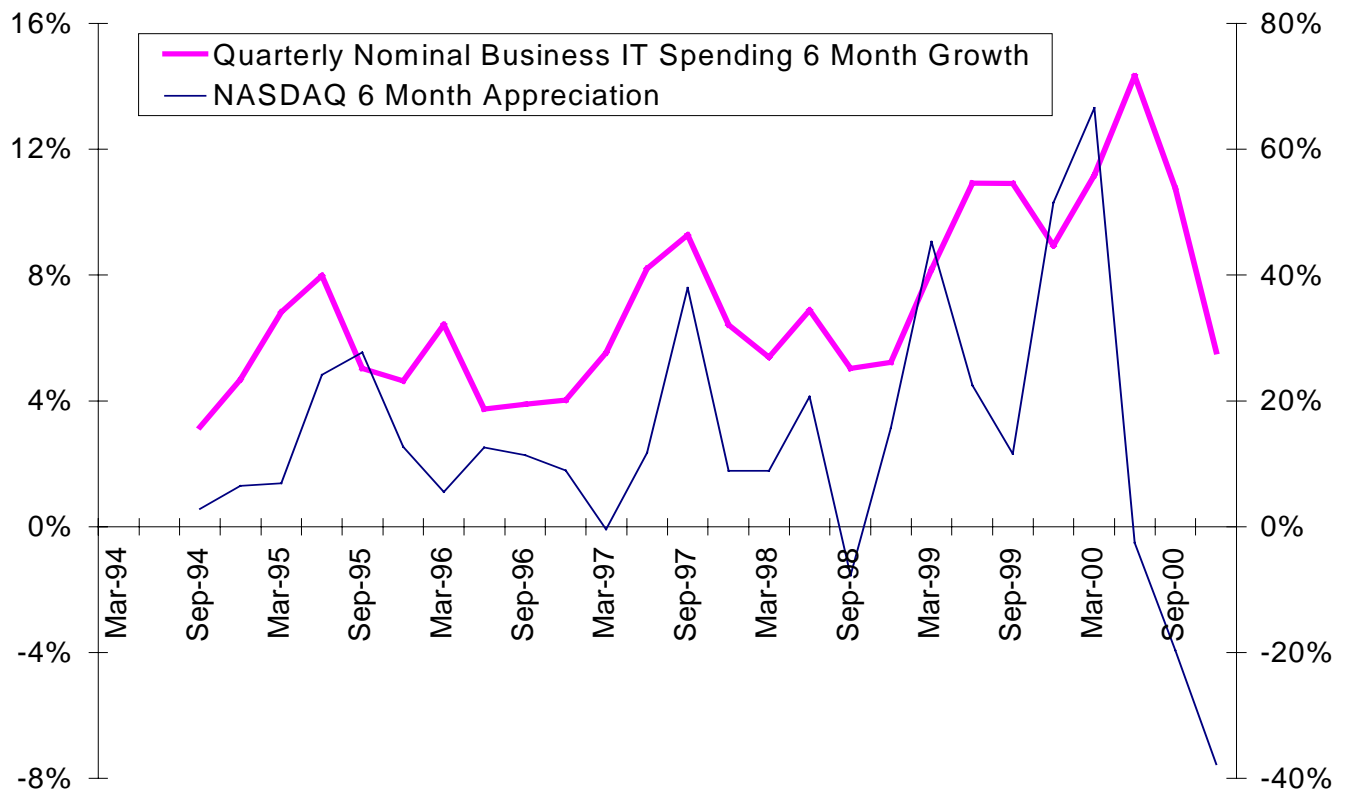
- *March 1999-March 2000* — Business cycle lasted for one year.

In two out of the three business cycles, the direction of IT spending tracked that of the NASDAQ within three to six months (Exhibit 23). The only period where this relationship broke down was during the last business cycle from March 1999-March 2000, the shortest cycle, during which IT spending continued to rise.

Based on the average cycle, we can expect a seasonal uptick to occur about every one to two years. Applying this observation to the March 2000 downturn in IT spending (and subsequent June 2000 drop in the NASDAQ), we can expect to see a seasonal uptick in IT spending within one to two years.

Exhibit 15

IT Spending Growth Compared with NASDAQ Six-Month Performance



LEFT AXIS = U.S. IT Spending Growth

RIGHT AXIS = NASDAQ Performance

Source: Bureau of Economic Analysis, FactSet, and Morgan Stanley Internet Research

Technology and Internet – April 5, 2001

Please refer to important disclosures at the end of this report.

Pattern Recognition Works when Comparing IT Inventory Growth versus IT Spending Growth

(Exhibit 16)

Our analysis that IT Industries Quarterly Manufacturers Inventory and Quarterly Nominal Business IT Spending have a high degree of correlation with an R-squared coefficient of 0.81, showing that the changes in IT spending frequently move in tandem with changes in IT inventory (Exhibit 16).

Over the thirty-year period, we find that IT industries manufacturers' inventory quarterly growth (where inventory is the value of IT manufacturers' finished goods, work in progress goods, and raw materials that are unsold) moved in tandem quarterly nominal business IT spending growth 70% of the time (both variables grew or receded simultaneously).

In addition, a notable point is that IT spending growth exceeded IT inventory growth 68% of the time, indicating faster growth in spending than inventory.

A notable phenomenon happened in December 2000, as IT inventory growth exceeded IT spending growth by 4.5%, an occurrence that has happened only three times since 1969.

- *June 1974* — IT inventory growth exceed IT spending growth by 5.1% (divergence took two quarters to correct) (as defined by the number of consecutive

quarters in which IT inventory growth exceeded IT spending growth)

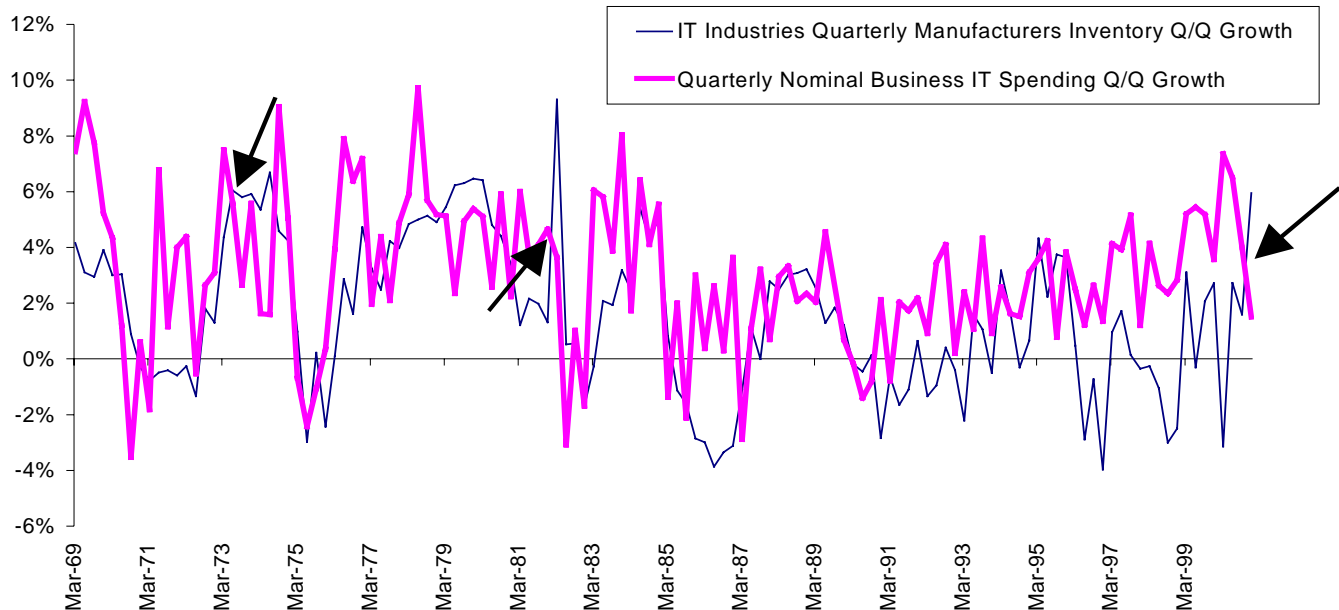
- *March 1982* — IT inventory growth exceed IT spending growth by 5.6% (divergence took two quarters to correct)
- *December 2000* — IT inventory growth exceed IT spending growth by 4.5%

In our view, this instance highlights one of the most significant problems currently plaguing the economy and the tech sector. Production overcapacity created by the surge in IT spending, assisted by the aggressive tech financing boom which allowed companies to easily raise capital and spend money on technology capital goods, is now facing a rapidly slowing economic environment. The resulting drop in IT spending leads to a pile-up of inventory throughout the technology channel, which is further exacerbated by the re-surfacing of semi-new equipment that failing companies are now making available in the secondary market for pennies on the dollar.

The data illustrate an excess in IT capacity that the economy will have to overcome. We believe an important gauge to the severity of this excess will be the availability of March numbers for the two data sets, which may show an exacerbation of the trend. We will monitor this closely.

Exhibit 16

IT Inventory Growth vs. Nominal Business Spending Growth



Arrows highlight time when IT Inventory growth first exceeded IT spending growth leading to above-noted periods of divergence.

Source: Bureau of Economic Analysis, Morgan Stanley Technology Research

Technology and Internet – April 5, 2001

Please refer to important disclosures at the end of this report.

Pattern Recognition Works when Looking at Tech Financing Trends (Venture, IPO, Follow-On, M&A)

(Exhibits 17-19)

There is definitively a business cycle for tech financing. If we drill down on the aggregate of venture funding, tech IPO proceeds, and tech follow-on proceeds, we see that there are four instances during the past twenty years when we saw a spike in the Y/Y growth of tech financing followed by a dip, which usually lasted for a year, followed a subsequent revival of Y/Y growth. The four instances are as follows:

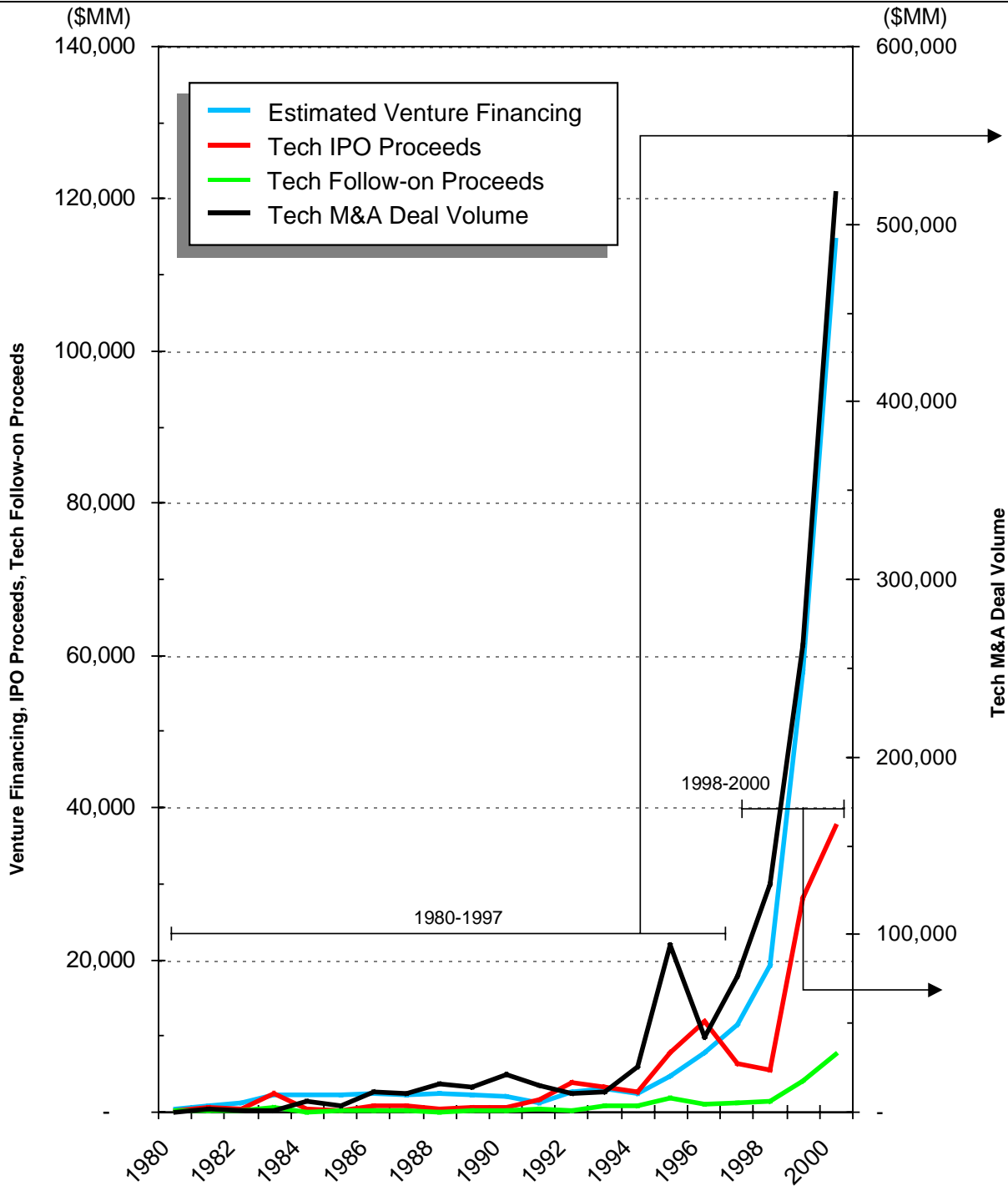
- *1983* — Y/Y total financing growth was 213%, followed by a 56% Y/Y decline in 1984. This was followed by a rebound in 1985 and 1986, when Y/Y financing grew 1% and then 41%, respectively.
- *1986* — Y/Y total financing growth was 41%, followed by a 10% Y/Y decline in 1987, and then a 23% decline in 1988. This was followed by a 7% rise in 1989.

- *1992* — Y/Y total financing growth was 65%, followed by 26% Y/Y growth in 1993. This was followed by an 11% decline in 1994, and a subsequent jump of 140% in 1995.
- *1995* — Y/Y total financing growth was 140%, followed by 17% Y/Y growth in 1996. This was followed by a 5% decline in 1997, and a subsequent jump of 35% in 1998.

Where do we go from here? We believe we are coming off of a peak growth period, beginning in 1999 with 238% Y/Y growth, followed by strong 78% growth in 2000. Based on historical trends, we were due for a financing correction, and precedent shows us that it should last for about one year (with the exception of the two consecutive declines in 1987 and 1998, which is when we had the stock market crash).

Exhibit 17

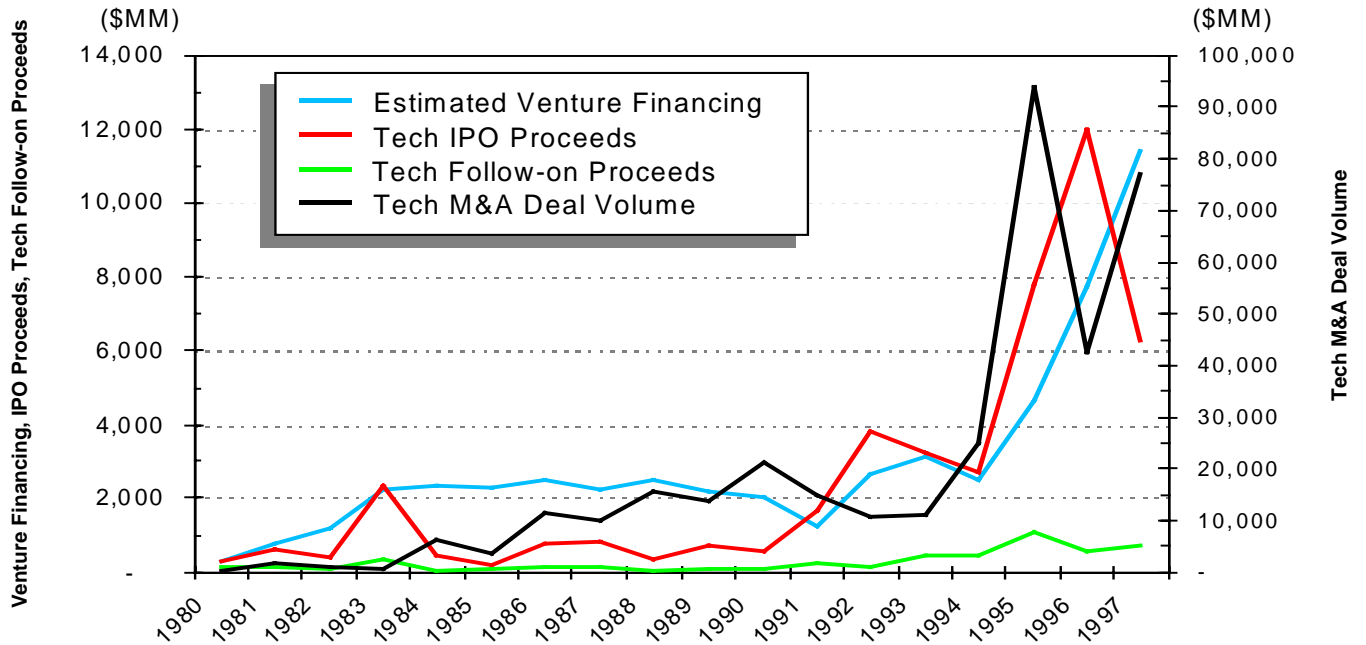
Technology Funding Trends, 1980 - 2000



Sources: Securities Data Corp, Thompson Financial Securities Data, and Morgan Stanley Technology Research

Exhibit 18

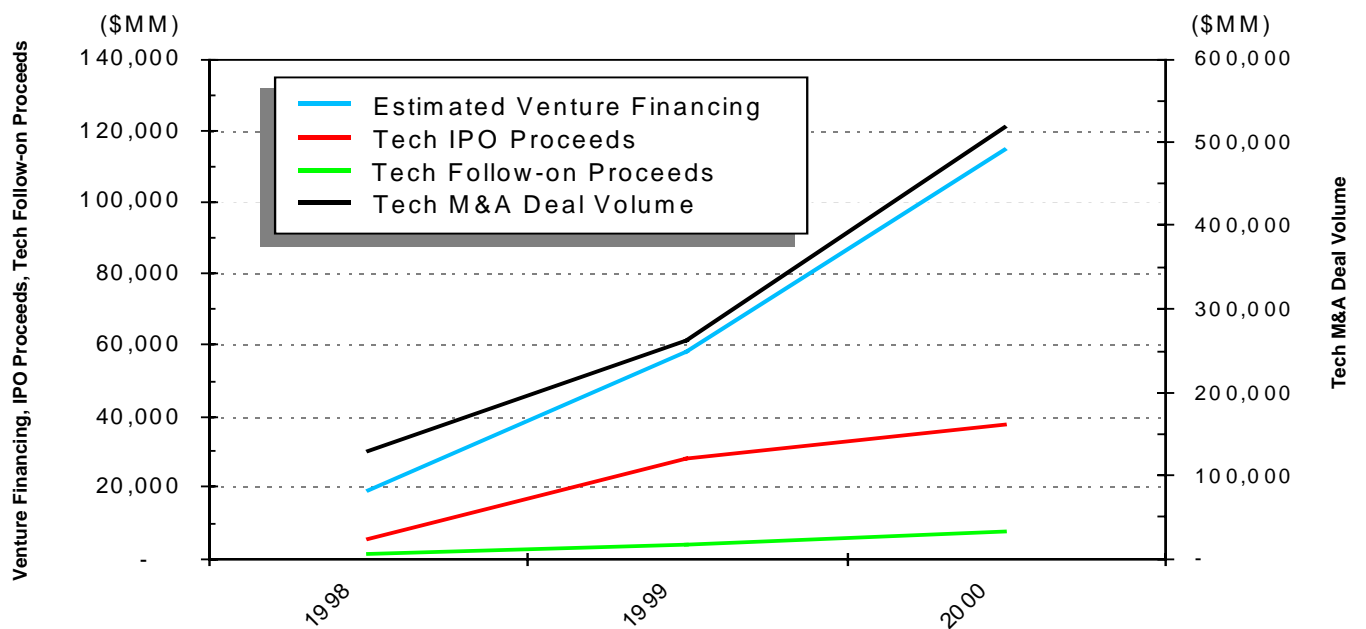
Technology Funding Trends, 1980 - 1997



Sources: Securities Data Corp, Thompson Financial Securities Data, and Morgan Stanley Technology Research

Exhibit 19

Technology Funding Trends, 1998 - 2000



Sources: Securities Data Corp, Thompson Financial Securities Data, and Morgan Stanley Technology Research

Drilling Down on Company Specific Data. No Surprise, Based on our Quarterly Analysis of 450 Technology Companies, Revenue Growth Rates Have Been Slowing and Earnings Deliverability Has Declined

(Exhibits 20-22)

As of 3/21/01, 91% of the Morgan Stanley Technology Universe had reported revenue data. CQ4:00 revenue grew 18% Y/Y, which was only slightly higher than 1999's 16% figure, and the highest level since we began tracking this data back in CQ4 1995.

In comparison, CQ4:00 revenue was up only 6% Q/Q. This is the slowest CQ4 Q/Q growth rate since we began our revenue study in CQ1 1995. For comparison, in CQ4:99, the Q/Q growth rate was 8%.

Sectors with the highest Y/Y growth in CQ4 were: Wireless Data Services (up 586% vs. 347% in CQ4:99); Communications Software (80% vs. 63%); and Electronics Manufacturing Services (73% vs. 37%). Sectors with the slowest Y/Y growth in CQ4 were: Enterprise Software Infrastructure (down 35% vs. 24% growth in CQ4:99); Imaging Technologies (down 9% vs. 1% growth); and Enterprise Software: Distributed & High Availability (flat vs. 1% growth).

As of 3/21/01, while 91% of the 450 companies in the Morgan Stanley Technology Universe had reported earnings, 57%, or 234, had announced positive earnings surprises. This metric has been decreasing since CQ2:00's high of 76%.

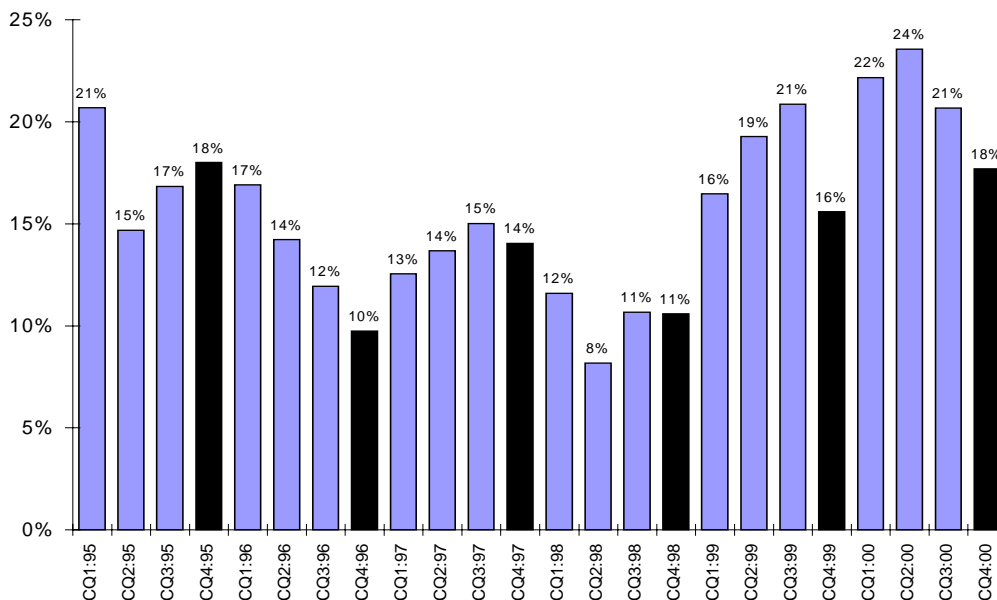
Conversely, 17% had reported in-line earnings results as of 3/21/01, while 26% of the companies had reported earnings disappointments, the highest level we have seen since CQ3:98. For 19 rolling quarters (ending CQ3:00) the average miss rate was 25% while in CQ4:00 the miss rate was 16%.

Sectors with the highest upside surprise rates have been: Telecom Software (100% vs. 100% in CQ4:99); Wireless Data Services (100% vs. 0%); Enterprise Software: Distributed & High Availability (86% vs. 100%). Sectors with the highest "miss rate" have been: Imaging Technologies (56% vs. 0% in CQ4:99); Semiconductors (47% vs. 12%); PC Hardware/Data Storage & Internet Devices (42% vs. 33%).

As the early reads from CQ1:01 results imply...CQ1:01 and CQ2:01 could deliver more of the same.

Exhibit 20

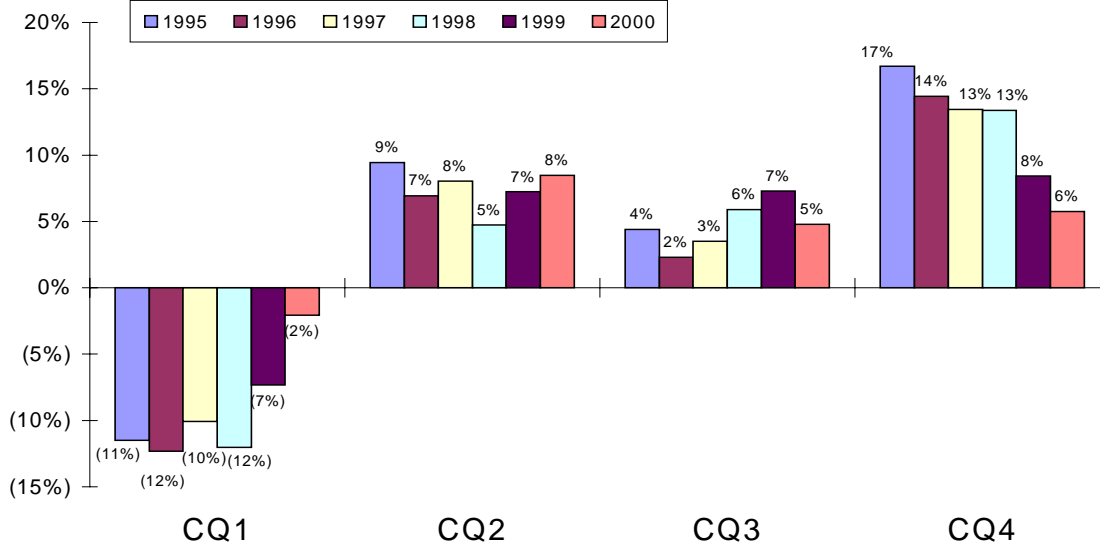
Year-Over-Year Tech Revenue Up 18% in CQ4:00
(Year-Over-Year Percentage Change)



Source: FactSet, Morgan Stanley Technology Research, Data as of 3/21/01

Exhibit 21

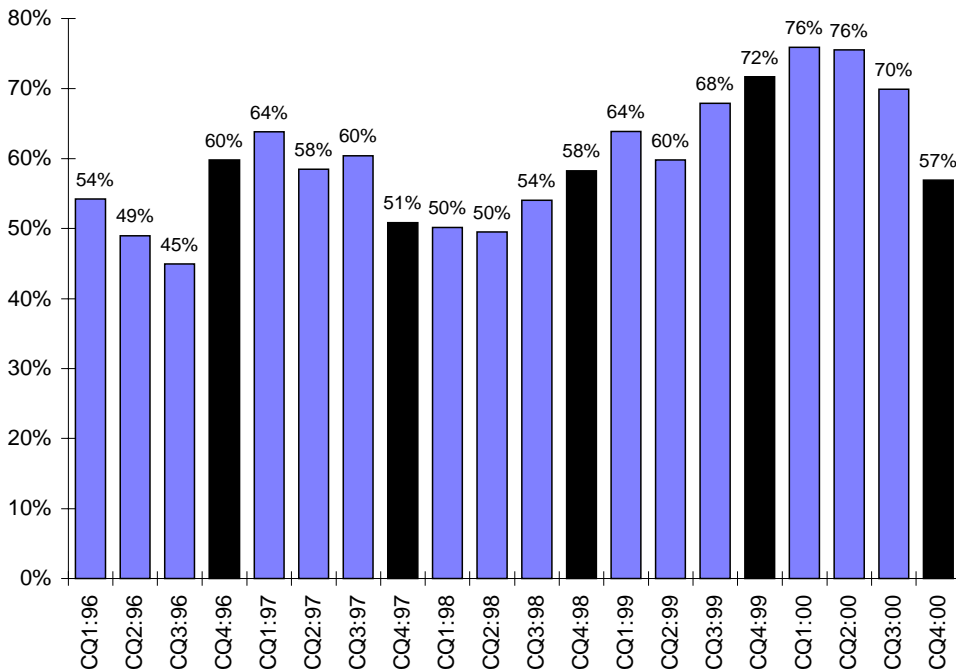
Quarter-Over-Quarter Tech Revenue Up 6% in CQ4:00
 (Quarter-Over-Quarter Percentage Change)



Source: FactSet, Morgan Stanley Technology Research, Data as of 3/21/01

Exhibit 22

Percentage of Technology Companies Reporting Above-Consensus Earnings by Quarter



Source: FactSet, Morgan Stanley Technology Research, Data as of 3/21/01

The IT Crash: How Big? How Long?

by Richard Berner

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212-761-3398

Published on 2/27/01

- **Retrenchment in IT**

Fundamentals and incoming data both point to retrenchment in capital spending in information technology, but the depth and duration of the downturn are still highly uncertain. Yet the qualitative message is clear: A rebound in IT investment next year is still likely, but it may fall short of current optimistic expectations.

- **Deteriorating fundamentals, worse data**

A slowing economy, a significant profit squeeze, and less favorable financial conditions add up to depressing fundamentals. Both tech company reports and a sharp slide in IT orders confirm that retrenchment is underway.

- **IT excess**

Calibrating excess isn't simple. Merely measuring the scope of the prior boom relative to past investment cycles isn't adequate. A look at so-called capital output ratios offers insight, but is still far from conclusive.

- **Adjustment scenarios**

Reckoning the size and duration of the adjustment needed to trim any excess is complex. Our baseline involves a sharp correction followed by a healthy snapback in 2002. A second alternative would lengthen the correction and mute the rebound, halving the projected growth of equipment outlays next year.

- **Implications for growth and earnings**

The differences in overall economic and earnings growth between these two scenarios would be significant: The more muted pace of investment in the alternative would pare 0.9 percentage points from real economic growth in 2002, and nearly 6 percentage points from the advance in after tax corporate profits.

The stream of disappointing sales and earnings announcements from technology companies has turned into a torrent in the past two weeks, confirming that the information technology (IT) boom of the late 1990s is turning into a new-millennium bust. We have long warned of the perils of retrenchment in both high- and low-tech capital spending and their implications for growth. But

both the fundamentals and incoming evidence point to the possibility of a deeper and longer period of decline than we've expected, especially in IT. How bad will it be and how long will it last?

Gauging the magnitude of any shortfall is pure guesswork, because in the current uncertain climate, metrics for calibrating the potential depth and duration of the downturn are hard to come by. Has there been excess and if so, how much? How fast will companies attempt to work it off? In this essay, I attempt first to summarize current fundamentals and the message in incoming data, then develop some admittedly crude benchmarks for gauging the magnitude of past excess, and finally illustrate the consequences for growth and earnings of eliminating it. The quantitative analysis is still clouded with uncertainty, but the qualitative message is clear: A rebound in IT investment next year is still likely, but it may fall short of current optimistic expectations.

What makes the current environment so challenging analytically is that the fundamentals underpinning IT outlays are deteriorating and incoming data are sinking fast, but calibrating just how fast is difficult. Let's start with the fundamentals. In my view, three factors that had underpinned capital spending for most of the past five years have now all turned negative, and decidedly so. First, the economy has decelerated rapidly, putting quickly in reverse the so-called "accelerator" effects that boost investment outlays when growth is rising. Second, a significant profit squeeze — the product of rising energy costs, a strong dollar, the economic slowdown and the interplay between high operating and financial leverage in Corporate America — has sapped companies of the internally-generated wherewithal to sustain the pace of investment spending. That squeeze likely will hurt outlays despite the secular imperatives to deploy e-commerce initiatives, to build out the broadband network, and to improve operating efficiency in manufacturing and services businesses alike. Finally, with financial conditions for many companies turning less favorable, the rising cost of capital probably will be a major barrier to spending growth.

In my view, the evidence for each of these factors points to ongoing retrenchment in IT spending. Lately, the free-fall in growth that characterized November and December of last year seems to have ended, as vehicle sales and housing activity exceeded expectations in January. But it is still far from clear how much further the deceleration has to go. Inventories are still well above desired levels, and factory orders are weakening. Higher energy prices are compressing consumer spendable income, and sinking stock prices are weighing on consumer confidence. As for profits, my colleague Brian Rauscher reports that with 88% of the companies in the S&P 500 reporting, and using consensus estimates for the remaining 12%, earnings are up 4.6% from a year ago. But excluding energy, profits are down 2.3%. And judging from the pre-announcements, there was little respite for profits or margins in the first quarter.

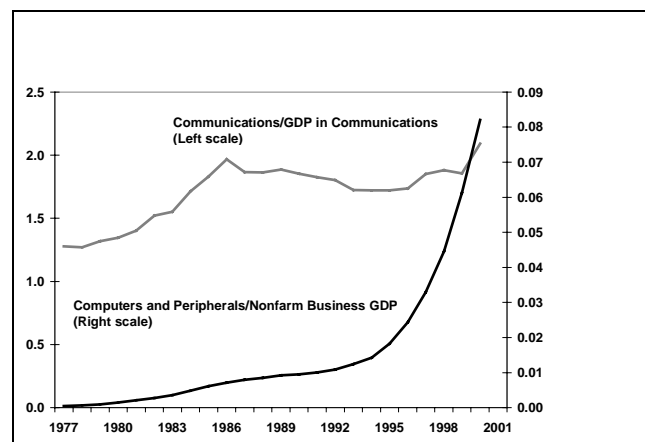
Finally, financial conditions have improved noticeably in debt markets over the past month, as credit spreads have narrowed by 40 to 50 basis points. But spreads are still wide, banks are still reluctant lenders, and the equity cost of capital continues to rise. Most important, however, both a sharp slide in IT orders and technology company reports confirm that retrenchment is underway. Commerce Department data show IT orders falling at a 13% annual rate in the six months ended in December, the latest reading available. To be sure, no company is yet willing to admit that top line revenues are contracting. But the recent anecdotal evidence of order cancellations, returns of equipment still in original boxes, and layoffs in technology companies hardly bespeaks stability, much less improvement.

How much IT excess, if any, must companies work off? Calibrating any overshoot isn't simple. Although IT spending as a share of GDP has doubled in the past five years, merely measuring the scope of the boom of the past several years relative to past investment cycles or to GDP isn't adequate. So-called capital-output ratios offer a better metric. It is the capital stock, not the flow of investment, that will best reflect the cumulative excess of investment spending over the past few years, and the capital stock in relation to output measures the economy's capacity to produce.

In IT, however, analyzing capital-output ratios is fraught with peril. Courtesy of rapid innovation, especially in computers and peripheral equipment, prices of IT capital goods have plummeted in the past several years, giving

companies a strong incentive to increase the "optimal" IT capital-output ratio. But in computers alone, that ratio soared fourfold in five years, compared with a mere doubling in the previous half-decade. While the ratio is still only about 8% (in terms of nonfarm business GDP), this increase in my view hints at excess. In communications, interpreting the capital-output ratio, currently about 200% (in terms of GDP in communications) is even more difficult. It probably should be falling even as the broadband network is built out, because the legacy of regulations left a bloated communications "rate base" or capital stock that is still depreciating. The significant jump in this ratio over the past three years also smacks of the excess in telecommunications.

Exhibit 1

Capital Output Ratios: Signs of Excess?

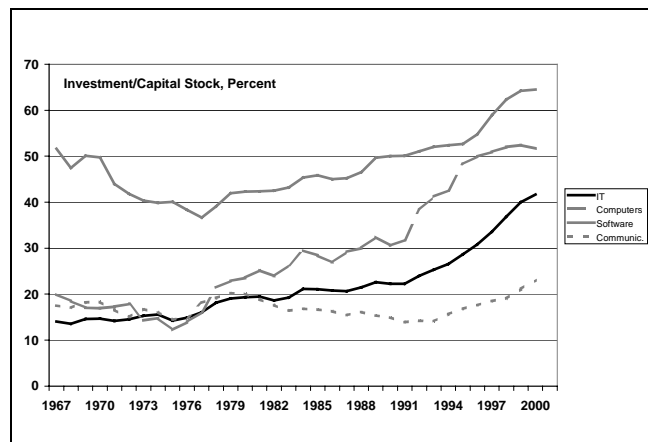
Source: Bureau of Economic Analysis, MSDW estimates

Depreciation itself further complicates analysis because assumed depreciation rates may skew the measurement of capital stocks. IT capital becomes obsolete quickly. In estimating capital stocks, the Commerce Department reasonably reckons that IT capital depreciates about three times as fast as other kinds of equipment (31% annually vs. 10%-12%). But how should one calculate the depreciation of software, which accounts for 43% of IT spending? Commerce uses a depreciation rate of about 57%, implying less than a two-year life. That's not unreasonable for packaged software that is routinely upgraded to release 6.3. But until the remediation of many systems for Y2K, many companies were still using code written in the 1960s. Many firms apparently used the Y2K remediation exercise to overhaul these software dinosaurs, freshening the software capital stock, and likely reducing the need for

new investment. But this event does not seem to have affected official capital stock measures.

Despite these measurement issues, I believe that such ratios are helpful. They confirm what common sense and industry analysis tells us, namely, that the buildup of IT capital in relation to a booming economy probably went beyond any optimal level.

Exhibit 2
Rapid Depreciation Requires Massive Investment



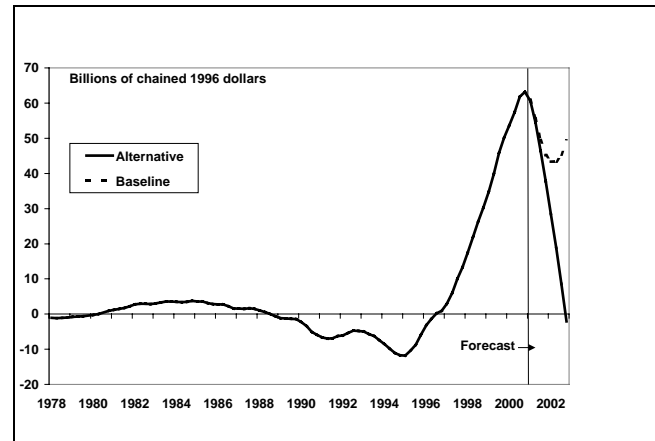
Source: Bureau of Economic Analysis, MSDW estimates

Statistical relationships designed to predict investment outlays may also provide insight, especially if they include a notion of the long-term optimal capital-output ratio given the cost of capital. Such a notion is especially important for gauging excess in the current environment, because I believe that whatever the other incentives to invest heavily in IT, the era of low cost capital encouraged excess. It is fair to say that the cost of capital for many companies has gone effectively from zero to prohibitive in the space of six months. Sure enough, such relationships have consistently underpredicted IT spending over the past five years, even allowing for falling IT prices and a favorable financing climate, hinting at excess.

Cumulating the errors from such relationships analogous to a capital stock yields a crude measure of the overhang. Macroeconomic Advisers suggests that the excess for computers and software alone might amount to about \$60 billion in real terms, or about 6% of the outstanding stock. While that's only about 0.7% of GDP, working off that \$60 billion would entail a significant slowdown in IT spending. To eliminate the excess in a year would cut roughly 13 percentage points from the growth in computer and software outlays. And that estimate ignores the spillover

impact that such a growth shortfall would have on tech stock prices or on job growth, and thus on overall consumer net worth and consumer spending.

Exhibit 3
Two Adjustment Scenarios for IT Capital



Source: Macroeconomic Advisers, MSDW estimates

As that crude benchmark suggests, determining the size and duration of the adjustment needed to reduce or eliminate any excess is complex. First, the good news. The rapid depreciation inherent to IT capital will temper the duration of the required adjustment, because a sharp falloff in investment will allow the stock to dwindle quickly. I've repeatedly made this point to suggest that a prolonged U.S. capital-spending bust in the manner of Japan is highly unlikely.

But there are two pieces of bad news. First and most obviously, because the share of IT spending in GDP has doubled in five years (to 5.5% of GDP), IT shortfalls will have a bigger impact on overall economic growth than in the past. Second, unfavorable fundamentals — such as tighter financial conditions or shrinking profit margins — may mean that IT spending overshoots on the downside just as it seems to have overshoot in the way up.

Scenarios may illustrate the range of possibilities. One scenario involves a sharp but shallow correction followed by a healthy snapback in 2002. That is essentially what is built into our baseline forecast, but current fundamentals hint that a bigger adjustment may be needed, calling such a snapback into question. A larger adjustment that would eliminate the excess by the end of next year is a second, albeit far more draconian, alternative. By lengthening the correction and muting the rebound, this more rapid adjustment would halve the projected growth of equipment

outlays next year. And the differences in overall economic and earnings growth between these two scenarios would be significant: The more muted pace of investment would pare 0.9 percentage points from real economic growth in 2002, and nearly 6 percentage points from the advance in after tax corporate profits. Thus, instead of a 10% rebound in 2002 earnings, under this scenario, the gain would be closer to 4%.

Many are proclaiming that the worst is over for the economy in general and capital spending in particular. The

news that nondefense capital goods orders excluding aircraft jumped 6.5% in January was a welcome sign that capital spending — both low-tech and high-tech — might not be as weak as feared. But the potential for a crash in IT spending may elongate the recession that I believe is under way, and likely rules out a V-shaped recovery in both the economy and earnings in the second half of 2001.

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