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## Special Edition: Valuation



### The Weekly Global Tech Journey Valuing Tech: Parental Supervision Release 73.0

- Four factors we watch in tech likely to positively align by mid-July.
- Market at 33x 2002 P/E. The historical range for tech: 20x to 44x forward estimated earnings.
- The assumptions, caveats and data behind DCF, P/S, P/E, EV/EBITDA and PEG.
- Historical troughs and peaks for Comm Equip, PCs, Semis and Software.
- Solvency issues, survivorship and the “stress test”

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**UBS Warburg**

## Node Two: Valuation and Technology

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*"One only need think of the weather, in which case the prediction even for a few days ahead is impossible. Nevertheless, no one doubts that we are confronted with a causal connection whose causal components are in the main known to us. Occurrences in this domain are beyond the reach of exact prediction because of a variety of factors in operation, not because of any lack of order in nature."*

- Albert Einstein

that 96% of priceline.com's value at that time was derived from cash generated in years eight and out. So if you get a data point that suggests there is 25% growth versus 20% growth, it's a *big deal*.

How is tech the same? Hmm... We go under the presumption that the value of any company - tech or non-tech - can be found by discounting its future cash flows. We were raised on, or perhaps warped by, discounted cash flow methodology. We believe all eventually winds up there. But that doesn't make the applicability to tech any easier.

## Discounted Cash Flow

**The logic behind DCF is flawless**

The value of a stock is the present value of expected future cash flows generated by that company and discounted back using a composite cost of capital. That's the heart of the discounted cash flow analysis. In theory, it sounds like a fail-proof way to value any company.

There's a difference between DCF and the other methods we use. A DCF analysis assumes that there *is* a right price, that the markets are efficient, and that the market will adjust to this *right* price immediately.

Well, it feels doable when you're valuing companies with long performance histories, positive earnings and predictable, slow growth rates. Unfortunately, those three factors almost all go flying out the window when dealing with technology companies.

**How many times have we seen analysts switch discount rates *only* to justify fresh price targets?**

Nevertheless, discounted cash flow is a more comprehensive approach to valuation than multiple comparisons, otherwise known as *short cuts*. Does comprehensive connote accurate? Is DCF always the "right" way to go when valuing tech companies? Probably not. While theoretically, a DCF model *could capture* the present value of a company, applying the theory often results in massive sensitivities, especially with tech companies. How many times have we seen analysts simply switch discount rates at the turn of a dime to justify a fresh target price?

**For the extra-conscientious, we can apply a five-stage DCF and adjust WACC each year**

When valuing tech companies, investors often apply a three-stage DCF model. Some zealots may go so far as to apply a four or five-stage model to accommodate young companies growing at rapid rates that may require many additional segments to analyze (extremely high growth, high growth, growth.). The level of complexity you choose to attach to your DCF model can be expanded without limits. Want to adjust your WACC each year? Sure, that's possible too, for the supremely conscientious.

If no one else ever bothers to be so precise, will it benefit to do so? Not sure. Again, we aren't religious. We want to play into models that others will use to buy our shares at much higher prices than we pay today.

## Case Study of Check Point Software - the Underlying Assumptions

We use the three-stage DCF model introduced by the Stephen Cooper, Sean Debow and Gillian Sutherland. Some may argue that since Check Point still has more than two years left in its high growth period, maybe a four-stage DCF analysis is warranted. For the purposes of this example, we'll stick with three. (Fine line here between sanity and insanity, huh?)

Let's take Check Point's closing price from May 23, \$60.55. What are the implicit assumptions already priced into its current share price? How would the assumptions have to change for a targeted 50% return on the stock from this level?

### Justifying Current Share Price

These are the underlying assumptions to justify Check Point's *current* share price at \$60.55....

- **Given:** Medium-term growth period = 10 years.
- **Given:** Weighted average cost of capital = 15%.
- **Given:** Terminal growth = 7%.
- **Plug: Medium-term growth rate = 38.7%.**

**Can Check Point grow at a rate of 32% a year for eight years?**

You may disagree with the value drivers we have selected. For example, you may believe that the discount rate is higher than 13%, or perhaps you're a little more bullish regarding Check Point's growth rate over the medium term since it is currently experiencing explosive growth rates. There are many variables here to adjust and tinker with.

### Justifying 50% Targeted Return

What would we have to believe to argue that Check Point deserves a fair price much higher... one with 50% upside from current levels?

- **Given:** Medium-term growth period = 10 years.
- **Given:** Weighted average cost of capital = 15%.
- **Given:** Terminal growth = 7%.
- **Plug: Medium-term growth rate = 45.8%.**

**What about 40% per annum?**

Is this growth possible? Your call. Stephen Cooper and Gillian Sutherland provide easy tools to perform sensitivity analyses. We've chosen to set a couple elements as fixed, such as potential stock return (here 50%) to determine across a host of companies what assumptions appear most reasonable.

### Caveat: Sensitivity

What do the sensitivities look like with Check Point? Below we take a look at two variables - WACC and medium-term growth rate - leaving all other factors fixed, i.e., medium-term period of 10 years, terminal value of 7%. What happens when we jiggle the growth rate or adjust the WACC?

We label the changes in growth rate on the top x-axis, the changes in WACC down the left y-axis....

**Table 6: Check Point Sensitivity Matrix**

		MEDIUM TERM GROWTH RATES						
		42%	43%	44%	45%	46%	47%	48%
	10%	182.1	194.0	206.7	220.2	234.4	249.5	265.6
	11%	140.0	148.9	158.4	168.5	179.1	190.4	202.3
	12%	114.0	121.1	128.6	136.6	145.0	154.0	163.4
W	13%	96.2	102.0	108.2	114.8	121.7	129.1	136.9
A	14%	83.1	88.0	93.2	98.8	104.7	110.9	117.4
C	15%	72.9	77.2	81.7	86.5	91.5	96.8	102.5
C	16%	64.9	68.6	72.5	76.7	81.1	85.7	90.6
	17%	58.3	61.5	65.0	68.7	72.5	76.6	80.9
	18%	52.7	55.6	58.7	62.0	65.4	69.0	72.8
	19%	48.0	50.6	53.4	56.3	59.4	62.6	66.0
	20%	44.0	46.3	48.8	51.4	54.2	57.1	60.1

Source: UBS Warburg LLC.

The sensitivities here are notable. Okay, they're wild, treacherous, crazy, cuckoo, nutty. At a 45% growth rate and WACC of 15%, we find Check Point valued at a "fair" price of approximately \$87. Shift the growth rate to 43% and WACC to 17%, and we arrive at a targeted price of about \$62.

Let's move to the other side. Growth rate of 47% and WACC of 13% brings us to nearly \$130.

DCF is the right *logical* model, our suspicions and disillusionment with beta left aside. Absolute measures generated by DCF analysis are extremely subjective to each analyst and to each investor.

Importantly, if you begin with even a hint of bias as to what the output should look like... look out. All the measures we discussed have inherent framing problems. It is difficult to think outside the box. Price target ranges tend to get suffocated by the price already appearing on our computer screens. This partially explains why target prices generated by sell-side analysts tend not to deviate wildly from the current share price.

Now, this is not an argument for giving up forecasting earnings and cash flows. The more "right" we get tech forecasts, perhaps the more money there is to be made. We may be able to make better decisions in understanding what the market

The sensitivities are wild, crazy, cuckoo

Price target ranges tend to get suffocated by the price already appearing on our computer screens

implicitly believes today. We can come from a context of how these implicit assumptions might change. But will DCF provide all the answers? No way.

## Short Cuts

**“Maybe instead of wasting my time with DCF, I should use some short cuts....”**

Some investors think, "DCF won't cut it, so why waste the time? Show me some efficient short cuts, please." We look at four different multiples in Short Cuts – price to sales (P/S), price to earnings (P/E), enterprise value to EBITDA (EV/EBITDA) and P/E to growth (PEG). Did we miss other key valuation techniques? Definitely. But we started here. We aim to dig even deeper in the future, likely with a focus on regional preferences for various valuation metrics.

Here we go....

### Short Cut #1: Price to Sales Ratio

**P/S may best be used for immature companies**

As Stephen Cooper points out, the price to sales (P/S) ratio is most often used for immature companies, those with negative or break-even earnings or negative cash flow. Valuation sticklers generally prefer methodologies that incorporate a measure of profitability and the cash flow derived from earnings when valuing companies. If there is an immature cash flow level, or no earnings today, we might default to top-line measures.

Although the P/S metric takes into account that a company may currently have zero or negative margins, it is still vital to consider what *future* margins may be when applying this methodology. If we believe the future margins will be higher than average, we should logically be willing to pay a higher P/S multiple.

**At the height of the “Bubble,” P/S gave way to price to PR, price to eyeballs....**

Back at the height of what many now deem the "Internet Bubble," analysts and investors alike used the P/S ratio and its many variant forms - price to click through, price to eyeballs, etc. - to justify the lofty valuations of Internet companies that had yet to post any profits. Needless to say, many of these companies had no plan on how to continue down a path to profitability.

### Break: Doonesbury

Anthony Perkins quotes *Doonesbury* cartoons in *The Internet Bubble*. This particular column seemed appropriate at this juncture....

Mikim, Inc. does its quarterly math.

Kimbolina, colleague: “So how’re we doing?”

Mike, President and CEO: “Well, on line sales are steady.... Of course, ramping up accelerated our burn rate, costs are outstripping revenues by over \$37,000 a week!”

Mike: “Amazing... only 18 months in business, and our investors are already in the hole almost \$2 million!”

Kimbolina: “Another Internet success story!”

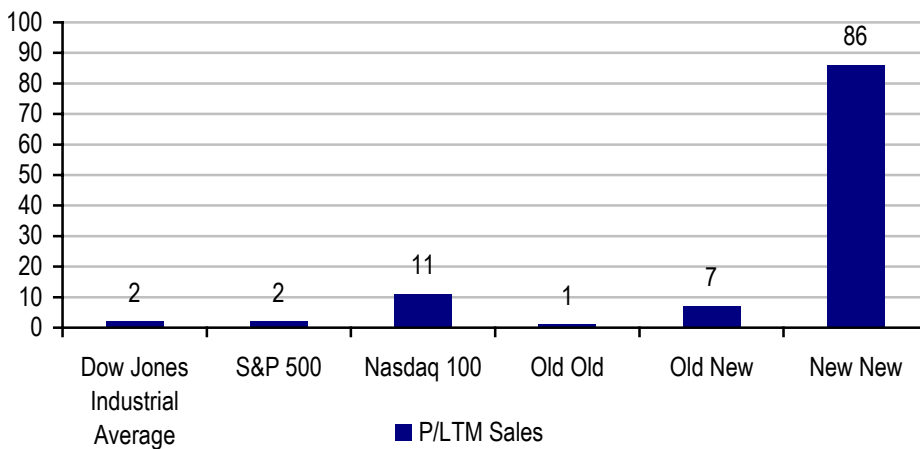
Mike: “Just think what we must be worth!”

**Back to Work....**

**New New Economy stocks traded at an average 86x P/S on March 10, 2000**

As Ed Kerschner points out, on March 10, 2000, the Old Old Economy stocks (which include names such as Caterpillar and Deere) were awarded an average P/S ratio of 1x, while New Old Economy stocks (which include names like America Online, Cisco and Microsoft) were awarded an average 7x P/S and New New Economy stocks (Akamai, Amazon, Ariba, etc.) received an *average 86x P/S*. A clear divergence.

**Chart 9: Price/ Trailing Sales Ratios from Old Economy to New Economy on March 10, 2000**



Source: Compustat and UBS Warburg LLC.

\* Old Old constituents: Air Product and Chemicals, Alcan Aluminum, Alcoa, Caterpillar, Champion, Deere & Co., Dover, Dow Chemical, Du Pont, Ford, General Motors, Georgia-Pacific, Illinois Tool Works, Ingersoll-Rand, International Paper, PPG Industries, Praxair, Rohm & Haas, Union Carbide and Weyerhaeuser.

\* Old New constituents: America Online, Applied Materials, AT&T, Cisco, Compaq, Dell, EMC, Hewlett-Packard, Intel, IBM, Lucent, MCI Worldcom, Microsoft, Motorola, Nextel, Nortel, Oracle, Qualcomm, Sun Microsystems and Texas Instruments.

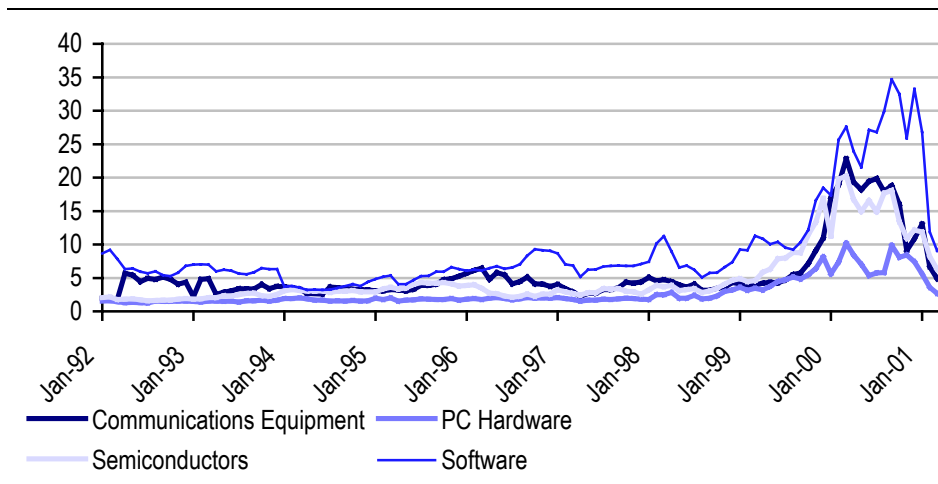
\* New New constituents: Akamai, Amazon, Ariba, Broadcom, Broadvision, Ciena, Echostar, E-Tek, Ebay, Exodus, i2, Infospace, Internet Capital Group, Juniper, Level 3 Communications, Metromedia Fiber, Siebel, Sycamore, TIBCO, Verisign.

With the help of Ely Klepfish in the quantitative team, we examined historical P/S ratios across four broad sectors in tech: Communications Equipment, PC Hardware, Semiconductors and Software. A quick note on methodology: the constituents of our "index" of sorts are determined by the Dow Jones Global Indices classifications, from 1992 to present. We took a monthly time series of the market cap and divided this value by the last reported full-year sales as our proxy. We suspect that it will provide a reasonable historical, apples-to-apples comparative roadmap.

**Guess when P/S ratios were the highest, as calculated by our quant team?**

Each segment experienced a balloon in P/S ratios, peaking sometime in 2000. PC Hardware only rose slightly in comparison, topping out at 10x sales at the end of March 2000. Comm Equip valuation, on the other hand, jumped to over 22x sales in the same month, while Semis peaked at 20x. The Software segment rose sharply in early 2000, although the highs in this sector were not reached until the end of 2000, when P/S broke through 34x. We will look at the historical P/S trend in more detail in the next section of the report.

**Chart 10: Historical Price to Last Reported Sales across Four Segments of Tech**



Source: Compustat, IBES, Worldscope and UBS Warburg LLC.

**Case Study of Three Companies - the Underlying Assumptions**

Let's take a look at P/S multiples in action when valuing three companies: Check Point, IBM and Transwitch. Any specific reason why we chose these three? Well, we wanted representation from more than one segment; consequently, we have Hardware, Software and Semis. In addition, we wanted to select companies at different stages of maturity, ranging from IBM, who's seemingly been around since the beginning of time, to Check Point and Transwitch, an upstart (and possibly struggling) semi name. (For details on the models for each of these companies, please see the *Models* section in the Appendix.)

**What would we need to believe in if we thought the stock could return 50% over 12 months?**

Before we begin writing about the necessary multiple expansion for each stock to return 50% over 12-months, we want to talk about *why* we chose 50%. Tech carries a high degree of risk, which necessitates a high return. A 50% return, for that part, sounds reasonable. Of course, you can switch it to whatever you want. For the purposes of this report, we stuck with 50%. On we go....

Check Point currently trades at 18x forecast 2001 sales (as opposed to the backward figures we were citing earlier), the highest in the group, with IBM at 2.3x and Transwitch at 10x. We fix returns as given at 50% over a 12-month horizon. What would we have to believe in, in order to justify a 50% upside to the current stock price?

**Can Check Point trade at 18x 2002 sales? Or IBM at 3x?**

**Table 7: Current and Potential Valuation**

	Price (5/23/01)	Current Share Price 2001 P/S	Targeted Return	Necessary 2002 P/S
Check Point Software	\$60.57	18.2x	50%	27.0x
IBM	\$117.86	2.3x	50%	3.1x
Transwitch	\$16.36	9.6x	50%	11.0x

Source: UBS Warburg LLC.

For Check Point, the multiple would have to expand from 18x 2001 sales to 27x 2002 sales, in the high end of the 5x to 32x historical range for Software. IBM's looks ridiculously more achievable in comparison - an extension from 2.3x 2001 sales to 3.1x 2002 sales, a little above the average for the PC Hardware P/S over the past nine years. Transwitch's needed expansion from 10x 2002 sales to 11x looks much more reasonable as well. The average P/S for the Semi segment from 1992 to present is a touch over 5x (without removing the Internet Bubble).

### **Caveat: Wrong Valuation Tool**

**Why focus on the top line when we can obsess over the bottom line?**

But what's wrong here? The three companies we used in our case study are reasonably mature and likely near their mature operating margins, with the possible exception of Transwitch. Is a P/S measure even useful here? Some investors look at Check Point and point to its P/S ratio as alarmingly high, at 18x. What many fail to consider is, when you have operating margins and earnings, why not utilize other valuation tactics? Who cares about top line valuation tools? Who cares when you can forecast the bottom line?

A P/S ratio doesn't take into account margins or profits. Still, P/S may serve as the only valuation technique when analyzing young companies with no earnings or companies undergoing abnormal times with abnormal earnings.

P/S is far further up the valuation food chain than P/press release. Why? They all are valuation strictly from the top line. P/S at least incorporates the top line today while the others only *hope* to get such clarity. Is P/press release a leading indicator of P/S which is perhaps a leader for P/E? Maybe... no guarantees.

If a company produces bottom-line results, we don't get too hung up on top-line valuation metrics.

### **Short Cut #2: Price to Earnings Ratio**

**P/Es, unlike their cousins P/S ratios, take into account margins and earnings**

The price to forward earnings estimates ratio (P/E) takes into account the future profitability of a company, but cannot fully account for future cash flows. In addition, it is just as short-term focused as the P/S methodology mentioned above. Still, this may serve as a more reliable valuation technique than a P/S analysis.

P/E, if earnings equals cash flow in its most ridiculous and unrealistically simple form, is a growing annuity (if earnings equals cash flow). So we start....

$$\frac{P}{E} = \frac{1}{r - g}$$

(As a footnote, Julie Hudson and Kenneth Liew have recently poked deeply at this formula in the May issue of Global Equity Investor. They also address in great detail how inflation affects P/E ratios.)

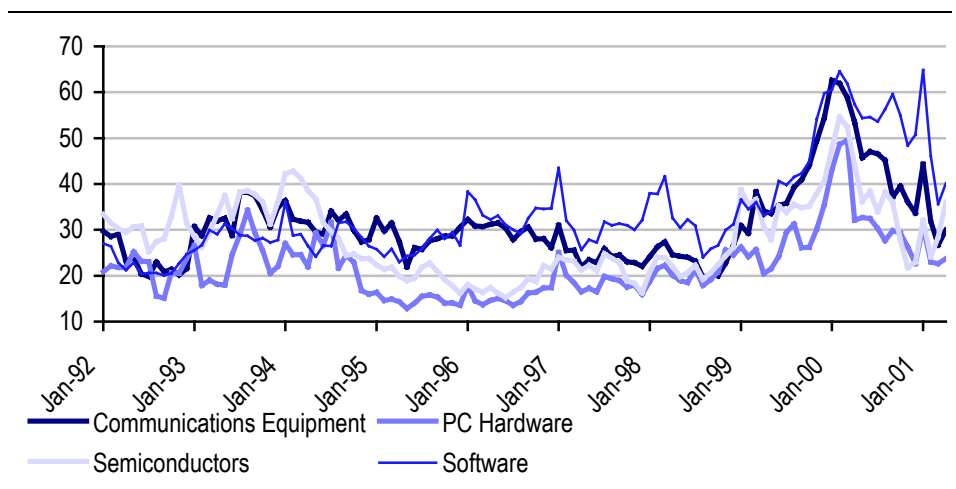
**Is this a time saver or an irresponsible way to capture the knowledge of DCF without the work?**

So what P/E is "right"? With  $r$  (interest rate plus risk premium) and  $g$  (growth rate) as the only variables, we just have to get those two right. But wait: figuring out the  $r$  and the  $g$ , isn't that just figuring out the discount rate or WACC again as well as the growth rate? This *is* a short cut. What a time saver, or... what a silly, irresponsible, clandestine way to attempt to capture the knowledge of DCF without doing any *real* work.

Or... if everyone else uses it, P/E, to make decisions, it might become self-fulfilling. That is, it makes sense to do it, because everyone's doing it. Our job is not to be religious about a particular valuation methodology, but to understand what could be going through a buyer's mind who'd be willing to pay 50% more someday for a stock in the future that we'd buy today.

The P/E for the average global tech stock, as tracked by Qi Wang, is approximately 33x 2002 estimates, calculated on an equal-weighted basis. We examine below the historical P/E trends across four broad sectors in tech, as classified by the Dow Jones Global Indices.

**Chart 11: Historical Price to Forward Earnings Estimates across Four Segments of Tech**



Source: Compustat, IBES, Worldscope and UBS Warburg LLC.

**Guess when P/E ratios peaked for tech stocks?**

On average, P/E ratios peaked at the end of the month in February 2000. At that time, Comm Equip was trading in the low 60s, PCs and Enterprise Hardware in the upper 40s, Semis in the mid-50s and Software in the upper 60s. All those figures have since trended down, although most sectors spiked at the end of January this year, likely because many forecast E's dropped dramatically.

**Case Study of Three Companies - the Underlying Assumptions**

We took our examination of the assumptions under the P/E ratio to three companies: Check Point Software, IBM and Transwitch. We used forward earnings estimates to latch our metrics to. Here we attempt to unravel potential valuations in order to achieve a 50% 12-month return on each stock, somewhat like applying a P/E metric to achieve a price target. So what do we need to be thinking in a year?

Transwitch's multiple would need to *contract* from 66.2x 2001 to 47.5x 2002, if an earnings recover is in store

**Table 8: Current and Potential Valuation**

	Price (5/23/01)	Current Share Price 2001 P/E	Targeted Return	Multiple over S&P 500	Necessary 2002E P/E
Check Point Software	\$60.57	44.7x	50%	230%	48.6x
IBM	\$117.86	23.6x	50%	158%	32.3x
Transwitch	\$16.36	62.5x	50%	215%	45.4x

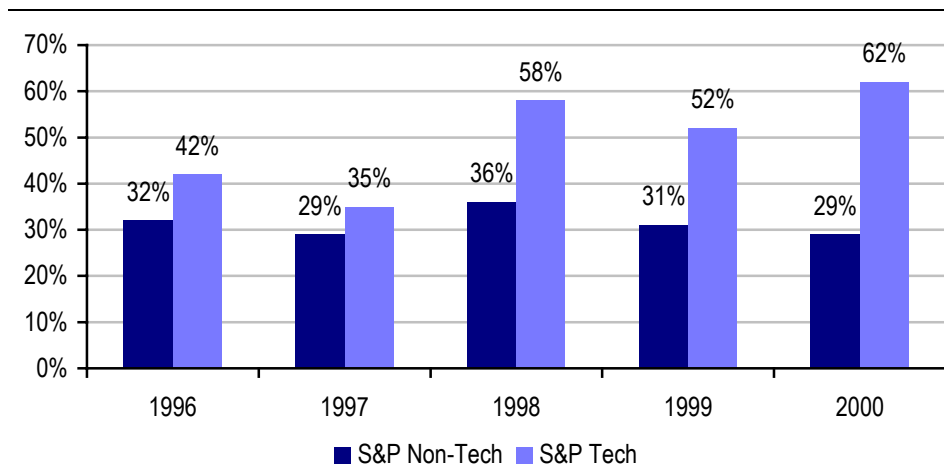
Source: UBS Warburg LLC.

Given our modelling assumption, in order to warrant a 50% return over the next year, Check Point's multiple would have to expand from its current 45x estimated 2001 EPS to 49x estimated 2002 EPS. This is a premium of 230% over the current S&P 500 multiple of approximately 21x for next year. For IBM, the multiple would have to expand from 24x 2001 earnings to 32x 2002. For Transwitch, multiples could *contract* from 63x 2001 earnings to 45x 2002. This is because earnings for the semi company are expected to be extraordinarily low this year compared to next, as a result of the inventory correction within the comm-IC space. Of course, this assumes that estimates are right, when we know that earnings forecasts in tech are always subject to massive change.

**Caveat: We Can't Forecast Earnings**

Can we count on tech company managements as well as sell-side analysts to offer up good E's for us to latch onto? The chart below details just *how bad* we are at forecasting earnings, especially in the tech space.

**Chart 12: We Can't Forecast Earnings**



Source: Factset and UBS Warburg.

We're awful at year one, and oh yeah, DCF builds around year one as well

Okay, so what does this chart illustrate? Let's say, for example, that on January 1, 2000 the sell-side community estimated that the average company would turn in an EPS of \$1.00. Freeze those estimates. Roll the tape forward to the end of 2000. *Sixty-two percent of the time actual results did not come within 20% of the original estimate.* This means that 62% of the time, actual earnings came in at either under \$0.80 or over \$1.20. Pretty wide margin of error. Oh yeah, our DCF analysis builds around year one, as well. Good luck. If we can't year one right, can DCF or the P/E short cut be all that trustworthy?

Does this mean that valuing stocks on a P/E basis is consequently worthless and stupid? Nope. But although it's a short cut from the DCF, it comes with its own huge bag of uncertainties. Discouragingly, this evidence may mean we are doomed regardless of valuation techniques, if we take estimates too seriously. Qi Wang developed a 66-page download for our internal use. Our goal to figure out *how* these numbers are wrong.

### Short Cut #3: Enterprise Value to EBITDA Ratio

**Valuations based on EV and EBITDA allow for the mitigation of accounting and capital structure differences**

Stephen Cooper argues in *Navigating the i-Valuation Jungle* (May 2000) that using enterprise value-based valuations produces more meaningful comparisons than those using equity. For example, we could have used EV/sales earlier in the report, but opted instead for P/S because young companies usually don't carry debt. Valuations based on EV and EBITDA also allow for the mitigation of accounting and capital structure differences between global marketplaces. In almost every other global sector, EV-based calculations are the mainstay of global comparison.

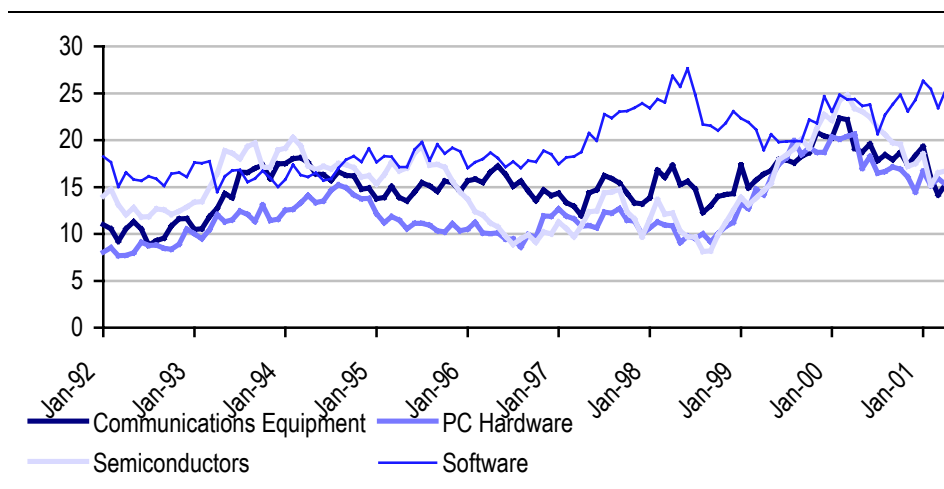
Enterprise value is not the predominant methodology for tech valuation in the US, although in Asia and Europe, it is much more popular. This is perfectly acceptable where the difference between equity and enterprise value is not material, as it is for many technology stocks that operate with predominantly equity financing and cash on the books. However, as businesses mature and leverage increases, the use of enterprise value becomes more important.

**When we turn away from P/E to some inclusion of cash, it's a sign of trouble**

We rarely credit companies for piles of cash on their balance sheets. When arguments turn away from P/E to some inclusion of cash, it is generally some sign that we are on the road to trouble. And we're on our way to discussing solvency. No thanks.

Stephen Cooper suggests that dividing enterprise value by EBITDA is useful for relative valuations within sectors where companies face similar capital intensity.

**Chart 13: Historical Enterprise Value to Last Reported EBITDA across Four Segments of Tech**



Source: Compustat, IBES, Worldscope and UBS Warburg LLC.

Once again, Ely Klepfish was indispensable in helping us track historical EV/EBITDA ratios. Given the limitations in the database, we followed a monthly time series of enterprise value for tech companies and divided that by the most recent reported fiscal year EBITDA value.

We wouldn't suggest that hobbyists attempt at home to perform what Ely does for a living. Tracking tech data back ten years while accounting for the numerous apples-to-oranges comparisons is extremely painful and frustrating.

**Software has commanded the highest EV/EBITDA ratios across tech**

Since 1992, EV/EBITDA ratios for the four tech sectors have climbed from an average of 14x peaking at the end of March 2000 at over 22x. Historically, Software has commanded the highest EV/EBITDA ratios across tech. Not surprising, since it is often the most highly valued segment in technology. Software's overall high topped the chart at over 27x in June 1998, and the sector still trades at a premium today over Comm Equip, PC Hardware and Semis.

**Case Study of Three Companies - the Underlying Assumptions**

Now let's return once again to Check Point, IBM and Transwitch. What are their current multiples and how much would these multiples have to expand to bring us a 50% one-year return?

**Table 9: Current and Potential Valuation**

	Price (5/23/01)	Current Share Price 2001 EV/EBITDA	Return	Necessary 2002 EV/EBITDA
Check Point Software	\$60.57	29.7x	50%	41.0x
IBM	\$117.86	12.5x	50%	16.5x
Transwitch	\$16.36	40.4x	50%	31.0x

Source: UBS Warburg LLC.

To say that there is 50% potential upside to Check Point's current stock price, we would have to argue that the stock deserves to trade at an EV/EBITDA ratio of 41x 2002 earnings, in the next 12 months. This would fall in the upper reaches of historical EV/EBITDA ratios, even for the Software segment. IBM, in contrast, would need multiple expansion from nearly 13x to just under 17x, while the average EV/EBITDA ratio in the PC and Enterprise Hardware space is approximately 15x. Transwitch, on the other hand, could experience a one-year contraction from approximately 40x to 31x, once again because earnings this year are considerably lower than earnings projected for 2002. The Semi segment currently commands an average of nearly 17x EV/EBITDA. Given that Transwitch already trades at a premium to the semi sector, we find that this multiple expansion would be rather unlikely, unless fundamentals at the company were to improve dramatically.

**Caveat: Closer but No Cigar**

EBITDA is a demented form of cash flow, but it doesn't include changes in working capital and doesn't recognize cash outflows for the purchase of fixed assets, or capex on new investments. Capex is a key component for cash flows, and a company that needs to spend more to maintain a given growth rate should have a lower value than one that doesn't. EV/EBITDA isn't able to capture this.

**What do you need to believe over the next 12 months?**

**EBITDA leaves out still critical cash outflows like capex or increases in working capital**

Therefore, it's a rather useless metric when you're not comparing companies with similar capital intensity.

### Short Cut #4: P/E to Growth Ratio

*"A price earnings ratio divided by the average growth in earnings per share. EPS growth is usually taken over a three-year period from the last reported year to the 3rd year forecast."*

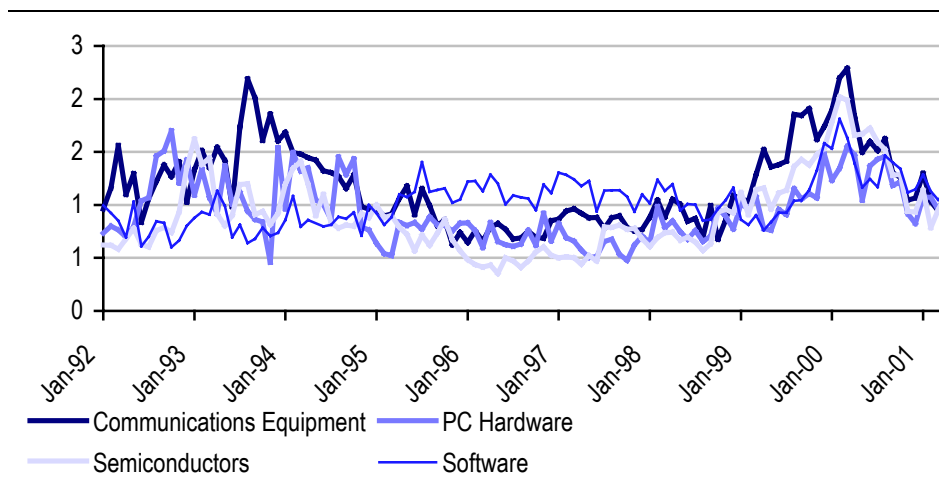
We lifted this definition directly from Stephen Cooper and Gillian Sutherland.

#### Is the "G" arbitrary?

Okay, so we got P/E and G. Well, we addressed P/E in Short Cut #2. Now, the growth plug "G" is described by Stephen Cooper above. However, experience has shown that when sell-side analysts take a short cut approach to valuation with little or no cash flow forecasts, the income statement is rarely projected out three years at a time. In tech, three years is wild guessing anyway. Remember that in 2000, we couldn't come within 20% of the right answers 62% of the time.

So what makes up the "G" growth plug in the PEG? Usually an analyst's best guess. How many times have you heard, "Hmmm... well, this company is a 25% grower." ...Very little science to the "methodology."

**Chart 14: Historical P/E to Growth across Four Segments in Tech**



Source: Compustat, IBES, Worldscope and UBS Warburg LLC.

With all that...

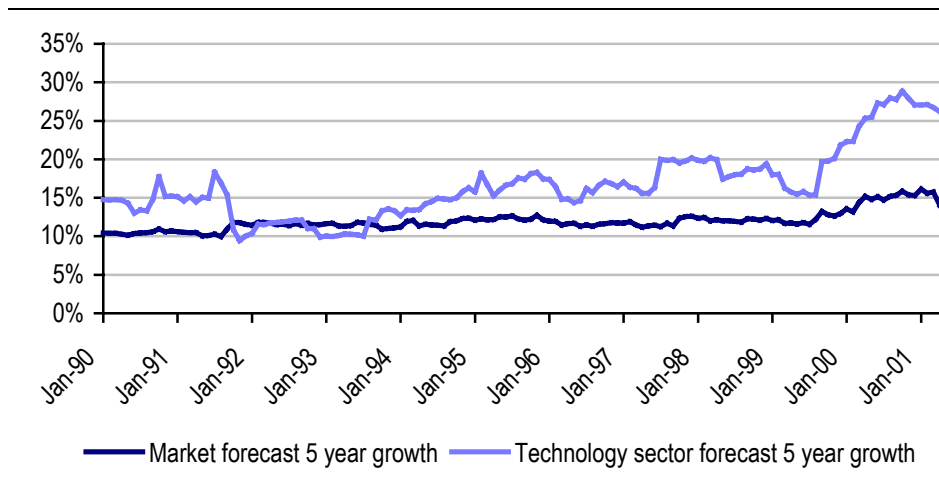
#### The spike in the early 1990s was probably due to a low growth plug

The PEG ratio for the Comm Equip group spiked at well over 2x in mid-1993 to early 1994, likely as many transitions began to take place in the carrier space, especially deregulation of the telecom business. The prospect of the Bell Atlantic/TCI deal captured our imagination as to what might be possible. Furthermore, the move from analog to digital signalling spurred valuations at this time. The spike experienced in other sectors, for example Software, Semis and PC Hardware, was likely due to slower growth plugs. However, all segments peaked in the end of February to end of March 2000, when valuations had skyrocketed. The average PEG as calculated by Ely Klepfish for this period was approximately 1.86x. Since then, all are trading at approximately 1x PEG.

### A Little More on "G"

We mentioned earlier that there is little science to how the sell-side selects its "G" or growth plugs. Gavin White has examined the historical range of five-year growth assumptions in Europe. How have they changed over time?

**Chart 15: Historical Five-Year Growth Assumptions**



Source: IBES and UBS Warburg LLC.

Analysts had estimated that tech's five-year growth rate was between 15% to 18% for much of the 1990s, with the exception of the lows from 1992 through 1994. However, we see that long-term growth assumptions spiked dramatically in late 1999 and early 2000 (the Internet Bubble) to more than 25% growth.

What long-term growth assumption should we be using now? Should the figure be lower than 26%? Tech has traded around at 1x PEG since April. If we lower the growth plug, valuations would likely appear a bit more stretched.

Here's the catch. If tech's secular three-to-five year outlook has changed as dramatically as the chart reflects, there's no logical inconsistency. If, instead, we get fooled into extrapolating a faster secular growth rate following a year or two of tremendous growth, we may be overstating "G". All PEGs would then be artificially low. The opposite could certainly occur as well. It just doesn't apply to the recent past.

### Case Study of Three Companies - the Underlying Assumptions

Back to Check Point, IBM and Transwitch.. Again, we fix the 12-month targeted return at 50% and see what pops out. Check Point currently trades at a 2001 PEG of 1.12x. We would need to believe that the multiple can expand to 1.22x 2002 PEG, off of the 2002 P/E. This would be at the upper end of the Software PEG valuation range. IBM would need to expand its 2001 PEG of 1.82x to 2.50x 2002 PEG, well above the normal range for PC and Enterprise Hardware stocks, as tracked by Ely. What about Transwitch? In this case, you could get the 50% return while watching the P/E shrink from the current 63x to 45x, once the 2002 earnings are factored into the equation. The PEG ratio could contract from 1.64x to 1.19x 2002 EPS, presuming the earnings in 2002 do recover dramatically.

**Check Point would need to trade at a PEG at the upper reaches of historical Software PEGs**

**Table 10: Current and Potential Valuation**

	Price (5/23/01)	3-5 Year Growth Rate	Current Share Price 2001 PEG	Targeted Return	Potential 2002 PEG
Check Point Software	\$60.57	40%	1.12x	50%	1.22x
IBM	\$117.86	13%	1.82x	50%	2.50x
Transwitch	\$16.36	38%	1.64x	50%	1.19x

Source: UBS Warburg LLC.

**Caveat: Is All Growth Created Equal?**

**Sustainable growth is more valuable than recovery growth**

PEGs are used as a simple method of comparing multiples where there are differences in growth. The main problem is that they assume that all sources of growth have the same value and that value is proportional to the growth rate. For example sustainable growth is worth more than recovery growth, for the same rate the former should attract a higher P/E and therefore would correctly trade on a higher PEG. Also, growth from acquisition is generally worth less than organic growth, etc ... These are differences that say DCF can capture explicitly but have to be incorporated more into the subjective judgement about multiples.

**Is There a Best Valuation Tactic?**

Well, is there?

*No.*

**Each valuation tactic lacks, in some way, full intellectual integrity**

Every methodology we mentioned has its benefits and its drawbacks. In spite of the difficulties with execution and fashioning projections, whether short-term or long-term, there are other elements that make valuation as a standalone metric useless. Each lacks, in some way, full intellectual integrity.

Nevertheless, there is a pecking order, as identified by the Global Valuation Group, to valuation tactics. Some have higher predictive power than others. Some border on worthless. (Stephen Cooper relays war stories about a valuation tactic that based the potential value of an Internet company on the type of car the CEO had bought.)

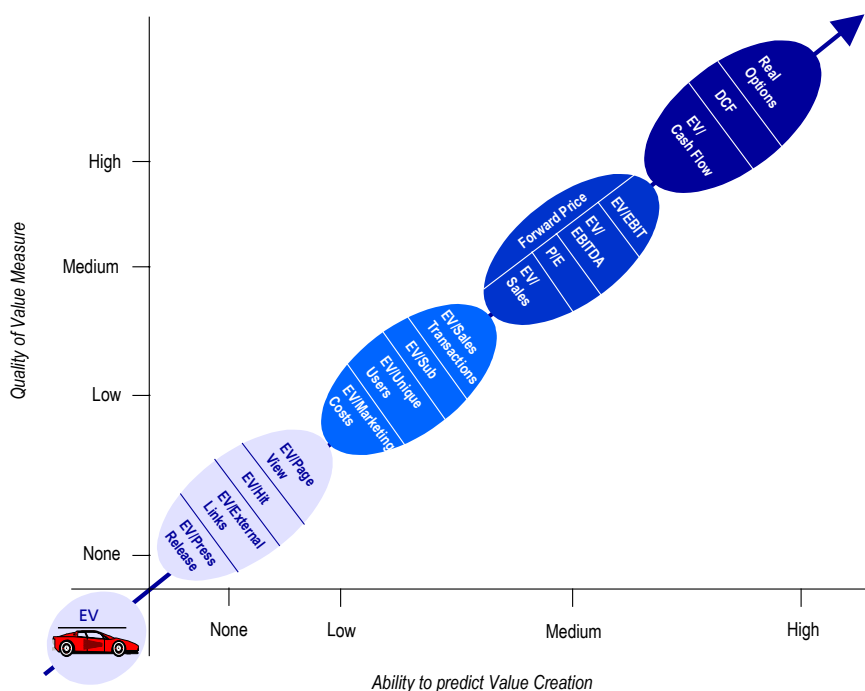
**Play It Again, Sam**

**IS EV/EBITDA a better predictor of value than P/E?**

Having pored over this report, we're almost afraid to beat a dead horse. We'll risk it, though, because we think Stephen Cooper's chart is very important. Across the valuation food chain, we find that some tactics or metrics have higher predictive value than others. For example, while P/S may be a good place to start, this metric does not take into account company maturity, margins or profitability. Perhaps P/E would be a better metric? Relative to P/S, yes, because it does account for earnings and margins. Still, perhaps PEG may be better than P/E because it takes into account how quickly a company is growing. Shouldn't faster growing companies be rewarded higher multiples? Ahh, how about EV/EBITDA? EBITDA is certainly closer to cash flow, albeit distorted, than earnings alone. It is still not true cash flow. We're getting there, though.

Finally, DCF. Sure, the logic is perfect. The execution is challenging. Does it have more implicit authority than P/S? Yeah, if you can forecast even year one right, not to mention all the way to terminal growth.

Chart 16: Prediction Power of Valuation Methods



Source: UBS Warburg LLC.

But... back to the original question at hand. *Is there a best valuation technique?* The chart above may be misleading. It seems to point out that DCF is indeed a better valuation tactic than EV/Sales. It makes greater logical sense, but traditional logic shouldn't get in the way of "illogical" valuations in the real world.

**It's not the logic or the ease of execution....**

The point is not so much the logic or the predictive capability. Execution matters too. But more importantly than that, we are much less focused on sticking with a straight valuation method. We're much more interested in figuring out which methods are currently popular with the market. Well, really...what methods will be popular tomorrow.

**Fama and French had it all figured out... but maybe it was the old religion?**

A famed paper by the legendary Eugene Fama and Kenneth French was published nearly 10 years ago: *The Cross-Section of Expected Stock Returns*, which was featured in the *Journal of Finance*. The paper concluded that stock returns aren't explained by beta but rather by "two easily measured variables, size and book-to-market equity." Their study was based on nearly thirty years of data - an analysis of US stock returns from 1963 to 1990. The basic premise was, buy big companies with low price-to-book values. So, here are intellectual heavyweights, who have found the truth through crunching reams of data flawlessly through, one could envision a crazed super-computer. They finished. They immaculately presented the new religion.... Or was it the old religion?

Portfolio managers applying that strict price-to-book discipline would have severely underperformed for the seven years after the article was published.

**Investors shift around what they're willing to pay for**

So what are we saying? The point is not to denigrate the Fama and French study. The point is that investors shift around what they're willing to pay for. There's no steadfastness in the way valuation tactics are chosen and utilized. We just have to be cognizant of what practices are currently popular and which will soon fall out of favor.

We aim to recognize relative historical multiples. We aim to combine diligence in valuation with a comprehensive understanding of the models we are evaluating. We overlay parental supervision. We need to get the fundamentals right.

### **The Undiscovered Country: Real Options**

**"Real options" allow for clear, logical thinking of how to assess the value of a firm...**

On the one end of the spectrum, we find DCF absolute in its outcome and necessary inputs. But we realize that such crispness masks the uncertainty of what inputs are appropriate, and DCF analyses fail to broadcast sensitivity to the slightest changes. At the other end of the spectrum, "real options" allow for extremely clear, logical thinking of how we would ascertain the value of the firm, but there are limitations to this approach as well.

**Table 11: DCF vs. Real Options**

	DCF	Real Options
<b>Logic</b>	Good	Flawless
<b>Execution</b>	Mediocre	Impossible

Source: UBS Warburg LLC.

What is this "real options" tactic? The Global Valuation Group introduced it last year in *Navigating the i-Valuation Jungle*. This methodology is generally based upon DCF but suggests that the "true value" should be in excess of what is derived from standard DCF analysis. Okay, what does that *mean* exactly?

Let's catch our breath before we go forward.

**... but is almost impossible to quantify**

Stephen Cooper suggests that a potentially useful tool when analyzing companies should take into account fundamental business "options." Real options attempt to "account" for the value of future investment opportunities that expand existing business operations. A real example? Cisco in 1995 bought switching companies Kalpana and Grand Junction. There was a need for Cisco to catch up with switching technology, and they couldn't do it in-house fast enough. They had already built perhaps a 70% share in the routing market. They had a large installed base. A DCF model could not have taken in the potential for Cisco to successfully enter the switching market through acquisitions, leveraging their installed base and channel. A strict DCF would have simply modelled slowing growth in the routing market. Real options, fuzzy as it is quantitatively, takes into account a company's future... well, options.

Some investors inherently accept the "real options" logic and travel the world meeting as many management teams as possible. Perhaps all the face time could provide better clues as to what the "real options" might be. Perhaps by conducting thousands of interviews each year it is possible to develop a mental database to

more successfully forecast the likely fundamental outcomes and what real options actually exist.

Why so much focus on management meetings? Do they provide all the answers? No, but managements are at the controls. They heavily influence a company's ability to nurture and exploit real options.

**Two types of management teams: Variety A and Variety B**

Great management teams are liable to create and exploit these real options. Mediocre managements fail to exploit such opportunities and, in fact, require large amounts of cash simply being dropped in their laps in their attempt to make numbers quarter after quarter, year after year. One could imagine two extreme managements: Variety A (great management teams) and Variety B (mediocre management teams). Investors want to meet with managements to see what variety they're dealing with.

If we can marry that expertise with valuation tools that allow flexibility and facilitate the process of sensitivity analysis in an intelligent fashion, we think the odds of out performance should rise significantly.

**Caveat: The Frustration of Real Options**

**Unfortunately, great logic without hard numbers may not get us anywhere**

The logic of DCF is excellent. The logic of real options is even better. Unfortunately, great logic without hard numbers may not get us anywhere. We can assume that the value created through real options will normally be larger than the value described by a DCF model. But by how much? Good luck.

So, if you get the chance to watch a real options expert talk, and there are many of them, watch the stages of audience reaction.

- **Stage One: Confusion** - "What is she saying?"
- **Stage Two: The Light Bulb** - "Aaah, I get it."
- **Stage Three: Consumption** - "Tell me more, please."
- **Stage Four: Quest for Deep Insight** - "How do you calculate this?"
- **Stage Five: Disillusionment** – "You can't calculate it?"
- **Stage Six: Anger** - "Get off the stage!!"