

The Dark Side of Valuation: Firms with no Earnings, no History and no

Comparables

Can Amazon.com be valued?

Aswath Damodaran

Stern School of Business

44 West Fourth Street

New York, NY 10012

adamodar@stern.nyu.edu

Abstract

In traditional valuation models, we begin by forecasting earnings and cash flows and discount these cash flows back at an appropriate discount rate to arrive at the value of a firm or asset. This task is simpler when valuing firms with positive earnings, a long history of performance and a large number of comparable firms. In this paper, we look at valuation when one or more of these conditions does not hold. We begin by looking ways of dealing with firms with negative earnings, and note that the process will vary depending upon the reasons for the losses. In the second part of the paper, we look at how to value young firms, often a year or two from start-up, with negative earnings, small or negligible revenues and few comparables. We will argue that while estimation of cash flows and discount rates is more difficult for these firms, the fundamentals of valuation continue to apply. Finally, we look at how best to do relative valuation for young firms with negative earnings and few comparables.

The valuation of Amazon.com presented in this paper was done in December 1998, when the stock was trading at \$300 per share. Shortly thereafter, the firm announced a three-for-one stock split. To compare the valuation to current prices, therefore, the per-share value reported in the paper for Amazon has to be adjusted (divided by three). You can download the spreadsheet with the entire valuation from this site:

[Amazon.xls](#)

The value of a firm is the present value of expected cash flows generated by it, discounted back at a composite cost of capital that reflects both the sources and costs of financing used by it. This general statement applies no matter what kind of firm we look at, but the ease with which cash flows and discount rates can be estimated can vary widely across firms. At one end of the continuum, we have firms with a long history, positive earnings and predictable growth, where growth rates in earnings can be estimated easily and used to forecast future earnings. The task is made simpler still if the firm has comparable firms, where by “comparable” we mean firms in the same line of business, with similar characteristics. The information on these firms can then be used to estimate risk parameters and discount rates. All too often, when illustrating valuation principles, we tend to use these firms for our analyses.

The real test of valuation is at the other end of the continuum, where you have young firms with negative earnings and limited, and noisy, information. Often, the problem is compounded because these are firms in sectors where there are either no comparable firms, or the comparable firms are at the same stage in the life cycle as the firm being valued. Here, the estimation of cash flows and discount rates becomes difficult, to put it mildly, and valuation often seems to be a stab in the dark. All too often, analysts give up and assume that these are firms that cannot be valued using valuation models. In this paper, we focus on firms that do not lend themselves easily to valuation, either because they have negative earnings, or because they have a short history or because they have no comparable firms.

A Primer on Valuation

The value of any asset is a function of the cash flows generated by that asset, the life of the asset, the expected growth in the cash flows and the riskiness associated with the cash flows. Building on one of the first principles in finance, the value of an asset can be viewed as the present value of the expected cash flows on that asset.

$$\text{Value of Asset} = \sum_{t=1}^{t=N} \frac{E(\text{Cash Flow}_t)}{(1+r)^t}$$

where the asset has a life of N years and r is the discount rate that reflects both the riskiness of the cash flows and financing mix used to acquire it. If we view a firm as a collection of assets, this approach can be extended to value a firm, using cash flows to the firm over its life and a discount rate that reflects the collective risk of the firm's assets.

The cash flow to the firm that we would like to estimate should be both after taxes and after all reinvestment needs have been met. Since a firm has both debt and equity investors, the cash flow to the firm should be before interest and principal payments on debt. The cash flow to the firm can be measured in two ways. One is to add up the cash flows to all of the different claim holders in the firm. Thus, the cash flows to equity investors (which take the form of dividends or stock buybacks) are added to the cash flows to debt holders (interest and net debt payments) to arrive at the cash flow. The other approach to estimating cash flow to the firm, which should yield equivalent results, is to estimate the cash flows to the firm prior to debt payments but after reinvestment needs have been met:

$$\begin{aligned} & \text{EBIT (1 - tax rate)} \\ & - (\text{Capital Expenditures - Depreciation}) \\ & - \text{Change in Non-cash Working Capital} \\ & = \text{Free Cash Flow to the Firm} \end{aligned}$$

The difference between capital expenditures and depreciation (net capital expenditures) and the increase in non-cash working capital represent the reinvestment made by the firm to generate future or contemporaneous growth.

In valuation, it is the expected future cash flows that determine value. While the definition of the cash flow, described above, still holds, it is the forecasts of earnings, net capital expenditures and working capital that will yield these cash flows. One of the most

significant inputs into any valuation is the expected growth rate in operating income. While one could use past growth or consider analyst forecasts to make this estimate, the fundamentals that drive growth are simple. The expected growth in operating income is a product of a firm's reinvestment rate, i.e., the proportion of the after-tax operating income that is invested in net capital expenditures and changes in non-cash working capital, and the quality of these reinvestments, measured as the return on the capital invested.

$$\text{Expected Growth}_{\text{EBIT}} = \text{Reinvestment Rate} * \text{Return on Capital}$$

where,

$$\text{Reinvestment Rate} = \frac{\text{Capital Expenditure} - \text{Depreciation} + \text{Non-cash W}}{\text{EBIT} (1 - \text{tax rate})}$$

$$\text{Return on Capital} = \text{EBIT} (1-t) / \text{Capital Invested}$$

Both measures should be forward looking, and the return on capital should represent the expected return on capital on future investments.

The expected cashflows need to be discounted back at a rate that reflects the cost of financing these assets. The cost of capital is a composite cost of financing that reflects the costs of both debt and equity, and their relative weights in the financing structure:

$$\text{Cost of Capital} = k_{\text{equity}} (\text{Equity}/(\text{Debt}+\text{Equity})) + k_{\text{debt}} (\text{Debt}/(\text{Debt} + \text{Equity}))$$

Here, the cost of equity represents the rate of return required by equity investors in the firm, and the cost of debt measures the current cost of borrowing, adjusted for the tax benefits of borrowing. The weights on debt and equity have to be market value weights.

Publicly traded firms do not have finite lives. Given that we cannot estimate cash flows forever, we generally impose closure in valuation models by stopping our estimation of cash flows sometime in the future and then computing a terminal value that reflects all cash flows beyond that point. A number of different approaches exist for computing the terminal value, including the use of multiples. The approach that is most consistent with a discounted cash flow model is one where we assume that cash flows,

beyond the terminal year, will grow at a constant rate¹ forever, in which case the terminal value in year n can be estimated as follows:

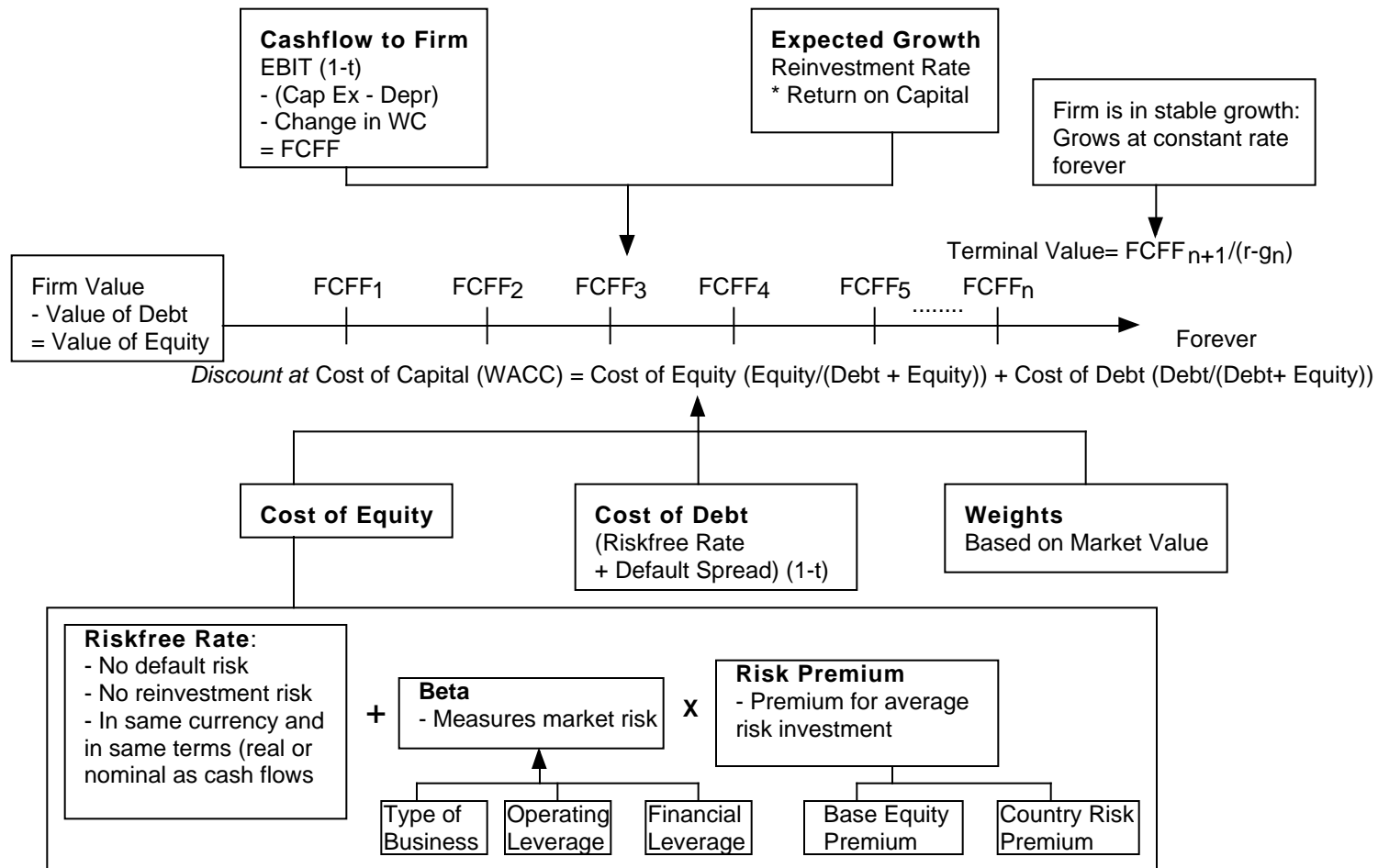
$$\text{Terminal value}_n = \text{FCFF}_{n+1} / (\text{Cost of Capital}_{n+1} - g_n)$$

where the cost of capital and the growth rate in the model are sustainable forever. It is this fact, i.e., that they are constant forever, that allows us to put some reasonable constraints on them. Since no firm can grow forever at a rate higher than the growth rate of the economy in which it operates, the stable growth rate cannot be greater than the overall growth rate of the economy. In the same vein, stable growth firms should be of average risk .

In summary, then, to value any firm, we begin by estimating how long high growth will last, how high the growth rate will be during that period and the cash flows during the period. We end by estimating a terminal value and discounting all of the cash flows, including the terminal value, back to the present to estimate the value of the firm. Figure 1 summarizes the process and the inputs in a discounted cash flow model.

¹ For a review of basic present value, you can look at “A Primer on Time Value of Money” available on my web site.

Figure 1: Firm Value



Stumbling Blocks in Valuation

Using the framework described in the previous section, we will consider some of the problems that we run into when valuing young companies with negative earnings and no or few comparable firms.

Negative Earnings

Firms that are losing money currently create several problems for the analysts who are attempting to value them. While none of these problems are conceptual, they are significant from a measurement standpoint:

1. *Earnings growth rates cannot be estimated or used in valuation:* The first and most obvious problem is that we can no longer estimate an expected growth rate to earnings and apply it to current earnings to estimate future earnings. When current earnings are negative, applying a growth rate will just make it more negative. In fact, even estimating an earnings growth rate becomes problematic, whether one uses historical growth, analyst projections or fundamentals.

- Estimating historical growth when current earnings are negative is difficult, and the numbers, even if estimated, often are meaningless. To see why, assume that a firm's earnings per share have gone from -\$ 2.00 last year to -\$1.00 in the current year. The traditional historical growth formula yields the following:

$$\text{Earnings growth rate} = \text{EPS}_{\text{today}} / \text{EPS}_{\text{last year}} - 1 = (-1 / -2) - 1 = -50\%$$

This clearly does not make sense since this firm has increased earnings over the period.

- An alternative approach to estimating earnings growth is to use analyst estimates of projected growth in earnings, especially over the next 5 years. The consensus estimate of this growth rate, across all analysts following a stock, is

generally available as public information² for many US companies and is often used as the expected growth rate in valuation. For firms with negative earnings in the current period, this estimate of a growth rate³ will not be available or meaningful.

➤ A third approach to estimating earnings growth is to use fundamentals. This approach is also difficult to apply for firms that have negative earnings, since the two fundamental inputs – the return made on investments (return on equity or capital) and the reinvestment rate (or retention ratio) are usually computed using current earnings. When current earnings are negative, both these inputs become meaningless from the perspective of estimating expected growth.

2. *Tax computation becomes more complicated:* The standard approach to estimating taxes is to apply the marginal tax rate on the pre-tax operating income to arrive at the after-tax operating income:

$$\text{After-tax Operating Income} = \text{Pre-tax Operating Income} (1 - \text{tax rate})$$

This computation assumes that earnings create tax liabilities in the current period. While this is generally true, firms that are losing money have the option to carry these losses forward in time and apply them to earnings in future periods. Thus, analysts valuing firms with negative earnings have to keep track of the net operating losses and remember to use them to shield income in future periods from taxes.

3. *The Going Concern Assumption:* The final problem associated with valuing companies that have negative earnings is the very real possibility that these firms will

² Zacks, IBES and First Call all provide this service. The consensus estimates of expected growth, for instance, for an individual firm can also be obtained from traditional data sources like Morningstar and Value Line.

³ While growth rates will not be available, estimates of EPS in future periods might be available.

go bankrupt if earnings stay negative, and that the assumption of infinite lives that underlies the estimation of terminal value may not apply in these cases.

Absence of Historical Data

In valuation, we often use data from years prior to the current year to estimate inputs more precisely. Consider the following areas in valuation where past data is useful:

1. In estimating risk parameters, such as betas, we use stock returns from past periods. Many regression services use 5 years of data for beta estimates, and most services require, at the minimum, two years of data for reliable estimates. When a firm has been listed for a period less than 2 years, it may still be possible to estimate betas, but the betas are unlikely to be reliable.
2. For estimating variables that vary significantly from year to year, we often look at averages over longer periods. A typical example is working capital, a number that tends to increase dramatically in some years and drop significantly in others. In valuing firms, we often get better estimates of expected working capital changes over time by looking at the average working capital as a percent of revenues over the last few years.
3. Even analysts who do not use historical growth rates to estimate future growth measure their estimates of expected growth against past growth to check for reasonability. Thus, an analyst who estimates growth of 40% for a firm over the next 5 years may modify that estimate after finding out that the firm has reported earnings growth of 5% over the last 5 years.

In conclusion, having a long history of prices and earnings on a firm allows us access to more information than is available in the current year, and increases the comfort zone on estimates.

Absence of Comparables

In addition to using data from past periods, analysts use information on comparable firms frequently in valuation. Thus, the beta of a firm may be estimated by looking at firms of similar size in the same business. Estimates of capital expenditure requirements and working capital needs are often based upon the averages for comparable firms in the same business.

The use of comparable firm data becomes much easier when there are a significant number of comparable firms in the same business as the firm being valued. When the firm being valued is unique or if the other firms in the sector are different in their fundamental business characteristics, it is far more difficult to use cross-sectional information in valuation.

Dealing with the Problems

In the last section, we looked at some of the problems that are created for analysts doing valuations when firms have negative earnings, insufficient historical information or no/few comparable firms. In this section, we will examine some of the prescriptions for these problems.

Negative Earnings

The basic problem with valuing firms with negative earnings is that projections cannot be based upon a base number that is negative. There are three options available to an analyst valuing a firm with negative earnings.

1. Normalize Earnings: In this approach, we replace the current earnings that are negative with a “normalized earnings” that is positive. Clearly, this approach presupposes that the negative earnings in the current year is an aberration and that the firm will revert back to positive earnings in a normal year.
2. Revenues and Margins: The second approach is to base projections on revenues, which should never be negative, and estimate margins over time. As the financial

health of the firm improves, the margins should increase from the current levels (which are negative) to a more sustainable positive number. The projected revenues, in conjunction with the margins, can be used to estimate earnings. Once earnings turn positive and margins stabilize, valuation becomes more routine. An alternative and related approach is to estimate capital invested for future years and returns on capital over time, to arrive at estimates of earnings in future periods.

3. Reduce Leverage: In the special case where a firm reports negative equity earnings because it has too much debt, and not because it has operating problems, the simplest way to adjust earnings over time is to reduce the leverage of the firm. As the firm operations grow over time, and financing charges are lowered (as leverage is reduced), the equity earnings will become positive.

Normalizing Earnings

When normalizing earnings for a firm with negative earnings, we are simply trying to answer the question: “What would this firm ear in a normal year?” Implicit in this statement is the assumption that the current year is not a normal year, and that the firm will normalize earnings quickly. There are a number of ways in which earnings can be normalized:

1. Average the firm’s dollar earnings over prior periods: The simplest way to normalize earnings is to use the average earnings over prior periods. While this approach is simple, it is best suited for firms that have a long history of earnings and that have not changed in scale (or size) over the period. If it is applied to a firm that has become larger or smaller (in terms of the number of units it sells or total revenues) over time, it will result in a normalized estimate that is incorrect.
4. Average the firm’s return on capital or equity (or profit margins) over prior periods: This approach is similar to the first one, but the averaging is done on scaled earnings instead of dollar earnings. The advantage of the approach is that it allows the

normalized earnings estimate to reflect the current scale of the firm. Thus, a firm with an average return on capital of 12% over prior periods, and a current capital invested of \$1,000 million would have normalized operating income of \$120 million. Using average return on equity and book value of equity yields normalized net income. A close variant of this approach is to estimate the average operating or net margin in prior periods and apply this margin to current revenues to arrive at normalized operating or net income.

5. Use current return on capital or equity (or margin) of comparable firms: The first two approaches require a firm to have a substantial earnings history and an underlying stability in terms of its business mix. When one or both of these conditions do not hold, the normalized earnings can be estimated by looking at what comparable firms are earning, with the profitability measured either in terms of capital invested or revenues.

There is one final question that we have to deal with when normalizing earnings, and it relates to when earnings will be normalized. Replacing current earnings with normalized earnings essentially is equivalent to assuming that normalization will occur instantaneously (i.e., in the very first time period of the valuation). If earnings will be normalized over several periods, the value obtained by normalizing current earnings will be too high. A simple correction that can be applied is to discount the value back by the number of periods it will take to normalize earnings.

Illustration 1: Normalizing Earnings for a Cyclical Firm in a Recession

In 1992, towards the end of the last recession in the United States, Ford Motor Company reported earnings per share of -\$0.73. To value the firm, we first had to normalize earnings. We used Ford's average return on equity from 1988 to 1992 of

11.05% as a measure of the normal return on equity, and applied it to Ford's book value of equity in 1992 of \$11.60 to estimate normalized earnings per share:

$$\text{Normalized EPS in 1992} = \$11.60 * .1105 = \$1.28$$

To value the equity per share, we assumed that Ford was in stable growth, a reasonable assumption given its size and the competitive nature of the automobile industry. In addition, we anticipated that net capital expenditures would be about \$0.20 per share in 1993. Using a stable growth rate of 6% and a cost of equity of 12%, we estimated the value of equity per share:

$$\text{Expected FCFE in 1993} = \$1.28 - \$0.20 = \$1.08$$

$$\text{Value of Equity per share} = \$1.08 / (.12 - .06) = \$18.00$$

The stock was trading at about \$ 25 at the end of 1992. Implicitly, we are assuming that Ford's earnings will rebound quickly to normalized levels and that the recession will end in the very near future.

Illustration 2: Normalizing Earnings for a Firm after a Poor Year

In 1995, Daimler Benz reported earnings before interest and taxes of minus DM 2,016 million, and a net loss of DM 5,674 million. Much of the loss could be attributed to firm-specific problems. To estimate normalized earnings at Daimler Benz, we used the average pre-tax return on capital at European automobile firms in 1995, which was 18%. We applied this return on capital to Daimler's book value of capital of 33,209 million DM.

$$\text{Normalized EBIT} = 33.209 (.18) = 5,978 \text{ Million DM}$$

To complete the valuation, we made the following additional assumptions:

- Revenues at Daimler had been growing 3-5% a year prior to 1995, and we anticipated that the long term growth rate would be 5%.

- The capital expenditures in 1995 were 8.0 billion DM, while the depreciation in that year was 7.4 billion DM.
- Working capital was expected to remain at 5% of revenues (Total revenues were 106.747 Bil DM in 1995).
- The firm's tax rate is 30%.

With these assumptions, we were able to compute Daimler' free cash flows in 1996:

EBIT (1-t)	= 5,978 (1-.3) =	4,184 Mil DM
- (Capital Exp – Deprec'n)	= (8000-7400)(1.05)=	630 Mil DM
- Change in Working Capital	= 106,747 (.05)(.05) =	267 Mil DM
Free Cash Flow to Firm	=	3,287Mil DM

Note that working capital is 5% of revenues and revenues are expected to grow 5% in the next period.

To compute the cost of capital to apply to this cash flow, we assumed that the beta for the stock would be 1.00. The long term bond rate in Germany was 6%, whereas Daimler Benz could borrow long term at 6.1%. The market value of equity was 50,000 Mil DM, and there was 26,281 Mil DM in debt outstanding at the end of 1995. We also used a corporate tax rate⁴ of 30%.

$$\text{Cost of Equity} = 6\% + 1.00(.5.5\%) = 11.5\%$$

$$\text{Cost of Debt} = 6.1\% (1-.3) = 4.27\%$$

$$\text{Debt Ratio} = 26,281 / (50,000 + 26,281) = 32.34\%$$

$$\text{Cost of Capital} = 11.5\% (.6766) + 4.27\% (.3234) = 9.16\%$$

⁴ Germany has a particularly complicated tax structure since it has different tax rates for retained earnings and dividends, which makes the tax rate a function of a firm's dividend policy.

Note that all of the costs are computed in DM terms, to be consistent with our cash flows. The firm value can now be computed, if we assume that earnings and cash flows will grow at 5% a year in perpetuity:

$$\text{Firm Value} = 3,287 / (.0916 - .05) = \$ 78,982 \text{ million}$$

Netting out the debt yields a market value of \$52,701 million for equity. Like all firm valuations, there is an element of circular reasoning⁵ involved in this valuation.

This valuation is based upon the assumption that Daimler will normalize earnings in the very first period. To the extent that this is not true, the value will be overstated. A simple adjustment that can be made to this value to allow for longer periods to normalization is to discount the firm value. For instance, if Daimler is anticipated to take three years to normalize earnings;

$$\text{Firm Value} = \$78,982 / 1.0916^3 = \$60,721 \text{ million}$$

This is an approximation because it assumes cash flows over the first three years, while Daimler normalizes earnings, will be zero.

Revenue/Margin Projections

There are two key inputs that we need to use this approach in valuing a firm with negative earnings.

2. **Sustainable Margin**: The first is the estimate of the “sustainable margin” that the firm will have, when it reaches financial health. To estimate this margin, we can again draw on two sources. One is the past history of the firm. If there have been prior periods, where the firm has been financially healthy, the margins from those periods

⁵ The circular reasoning comes in because we use the current market value of equity and debt to compute the cost of capital. We then use the cost of capital to estimate the value of equity and debt. If this is unacceptable, the process can be iterated, with the cost of capital being recomputed using the estimated values of debt and equity, and continued until there is convergence.

can be used to estimate a sustainable margin. This approach suffers from the limitation that product markets change, new competitors enter and past margins may not be indicative of future margins, even assuming financial health. The other approach is to use the average margin of comparable firms as the sustainable margin. For this approach to work, the firm with negative earnings should be the outlier in the sector, and other firms in the sector must be financially healthy. If all firms in a sector are losing money, this approach clearly is not going to yield a meaningful sustainable margin.

3. Adjustment Period: In addition to estimating a sustainable margin, we need to estimate how long it will take for current margins, which are negative, to adjust to the targeted sustainable margin. There are a number of factors that will go into the decision. It will depend upon how far the current margin is from the sustainable margin. Generally, the greater the difference, the longer the adjustment period should be. It will also depend upon the reasons for the difference. If it is due to economies of scale, the length of the adjustment period will depend upon how fast revenues at the firm are expected to grow; faster growth should lead to shorter adjustment periods. If it is due to investment in infrastructure, it will depend upon the gestation period before the investment will pay off. As a practical matter, while value will be affected by the decision on how long the adjustment period should be, this effect will be dominated by the effect of changes in the sustainable margin.

Adjust Leverage

Some firms take on more debt than they can sustain, given current operations. This can be attributed to a number of reasons. First, firms with significant infrastructure investments and long gestation periods, such as those in the cable and cellular sector, have to use large amounts of debt to finance these investments. Even after these investments start to pay off, there will be a period where the financing charges are much

higher than the operating income. Second, firms are sometimes acquired using disproportionate amounts of debt, largely because it is the only way in which the acquirer can raise funds for the acquisition. In the immediate aftermath of these levered acquisitions, firms will often report negative earnings.

In cases such as these, the negative earnings cannot be attributed to poor margins or returns on capital and are more the result of too much debt. In valuing these firms, we have to estimate how much debt the firm can afford to carry, given its operating income and cash flows, and reduce its debt burden accordingly. There are two practical questions that we have to confront.

1. Optimal Debt Level: The first is determining how much debt a firm can carry. This can be done either through a traditional cost of capital analysis⁶, or by looking at industry averages. Thus, a firm with a debt ratio of 60% in a sector where the average debt ratio is 30% can be viewed as over levered, and the debt ratio, over time, can be adjusted to the industry average.
2. How to Adjust Leverage: The second question relates to how a firm can reduce its debt burden, if it is losing money. There are a number of possible options. One is to delay capital expenditures and use the cash generated by depreciation to pay off debt; this approach carries a cost since it might put future growth in jeopardy. Another is allow growth in revenues and operating income to push up the value of the firm; if firm value increases as debt stays constant, the debt ratio will decrease. The final option is to issue equity and retire debt. While this may look unattractive to a company losing money, it may be the only option available to firms whose survival is put at risk by excessive debt.

⁶ In a traditional cost of capital analysis, the cost of capital is computed at different debt ratios. The optimal debt ratio is the one at which the cost of capital is minimized.

Illustration 3: Valuing a Firm with Changing Margins and Leverage

In 1998, Boston Chicken was a firm beset with financial problems. After a high-flying beginning, the firm ran into problems controlling costs. In 1997, the firm had an operating loss of \$ 34 million on revenues of \$ 462 million. In the same year, the firm had capital expenditures of \$ 44 million and depreciation of \$ 35 million. To value Boston Chicken, we made the following assumptions:

- The firm would continue to lose money over the next 3 years, but its pre-tax (and pre-depreciation) operating margins will converge on the industry average of 17% , for fast-food restaurants, by the end of the fifth year. The expected margins over the next 5 years are as follows:

<i>Year</i>	<i>Pre-tax (Pre-depreciation) Margin</i>
Current	-5%
1	-2%
2	2%
3	7%
4	12%
5 -	17%

- The firm's revenues will grow 10% a year for the next five years and 5% a year thereafter.
- Capital expenditures will grow 5% a year forever, but depreciation (reflecting past capital expenditures) will grow 10% a year for the next 4 years, and 5% thereafter.
- Working capital is expected to remain at 2% of revenues, which reflect the average for the sector.

The following table projects expected operating income and cash flows at Boston Chicken for the next 5 years. In the course of estimating after-tax cash flows, note that we

assume that there will be no taxes paid in years 4 and 5, because the firm will have accumulated operating losses to carry forward to those years. In the terminal year, we assume⁷ that the marginal tax rate will be 35%.

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>Terminal Year</i>
Revenues	\$508.20	\$559.02	\$614.92	\$676.41	\$744.06	\$781.26
- COGS	\$518.36	\$547.84	\$571.88	\$595.24	\$617.57	\$648.44
- Depreciation	\$38.50	\$42.35	\$46.59	\$51.24	\$53.81	\$56.50
EBIT	(\$48.66)	(\$31.17)	(\$3.54)	\$29.93	\$72.68	\$76.32
- EBIT*t						\$26.71
EBIT (1-t)	(\$48.66)	(\$31.17)	(\$3.54)	\$29.93	\$72.68	\$49.61
+ Depreciation	\$38.50	\$42.35	\$46.59	\$51.24	\$53.81	\$56.50
- Capital Spending	\$46.20	\$48.51	\$50.94	\$53.48	\$56.16	\$62.15
- Chg. Working Capital	\$0.92	\$1.02	\$1.12	\$1.23	\$1.35	\$0.74
Free CF to Firm	(\$57.29)	(\$38.35)	(\$9.01)	\$26.46	\$68.98	\$43.21

To compute the present value of these cash flows, we had to estimate the cost of capital for the firm. Here again, Boston Chicken's recent problems have had an impact. The drop in its stock price has pushed the market debt to capital ratio to 83.18%. Concurrently, the beta of the stock, estimated using the unlevered beta of 0.82 for the restaurant industry and the current market debt to equity ratio has risen to 3.46. The high default risk in the

⁷ Note that there will still be net operating losses in year 6. We cannot however assume a zero tax-rate in perpetuity. A simple way of incorporating the residual tax benefit is to take the present value of the tax savings from the net operating loss:

$$PV \text{ of Tax Benefit from NOL} = \text{NOL} (\text{Tax Rate}) / (1+r)^n$$

firm has caused the cost of borrowing to increase to 11%; the absence of a tax benefit has the secondary impact of keeping the after-tax cost of debt at the same level. As we project earnings and cash flow improvements over the next 5 years, the consistent assumption to make is that all of these parameters will adjust over time; the debt ratio will move towards 50%, the beta towards one and the borrowing rate towards 7% in the terminal year. The following table lays out our assumptions about each of these components:

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>Terminal Year</i>
Beta	3.46	2.97	2.47	1.98	1.49	1.00
Cost of Equity	24.01%	21.31%	18.61%	15.90%	13.20%	10.50%
Debt Ratio	83.18%	76.55%	69.91%	63.27%	56.64%	50%
Cost of Debt	11.00%	10.20%	9.40%	8.60%	7.80%	7.00%
After-tax Cost of Debt	11.00%	10.20%	9.40%	8.60%	7.80%	4.55%
Cost of Capital =	13.19%	12.81%	12.17%	11.28%	10.14%	7.53%

The terminal value can be estimated using the cash flows in the terminal year (year 6), the cost of capital in year 6 and the assumption of stable growth of 5% thereafter:

$$\begin{aligned} \text{Terminal Value}_5 &= \text{FCFF}_6 / (\text{WACC}_6 - g_{\text{stable}}) \\ &= 43.21 / (.0753 - .05) = \$1711 \text{ million} \end{aligned}$$

The present value of the cash flows can be computed using the cumulated cost of capital⁸ to be the following:

	1	2	3	4	5

⁸ The cumulated cost of capital reflects the changing rates over time. Thus, the discount factor for year 2 = (1.1319)(1.1281)

Free CF to Firm	(\$57.29)	(\$38.35)	(\$9.01)	\$26.46	\$68.98
Terminal Value					\$1711.41
Discount Factor	1.1319	1.2768	1.4322	1.5938	1.7554
Present Value	(\$50.61)	(\$30.03)	(\$6.29)	\$16.60	\$1014.20

The cumulated present value of the cash flows is \$943.87. Netting out the outstanding debt of \$763 million yields a value for the equity of \$ 180.87 million. Dividing by the number of shares outstanding provides an estimate of value of \$2.34 per share.

Choosing Between the Different Approaches

In choosing between the different approaches – normalizing earnings in the current period, adjusting margins over time and reducing leverage – to deal with negative earnings, there is a simple framework that can be used to make the right choice. It requires an understanding of why the earnings are negative in the first place.

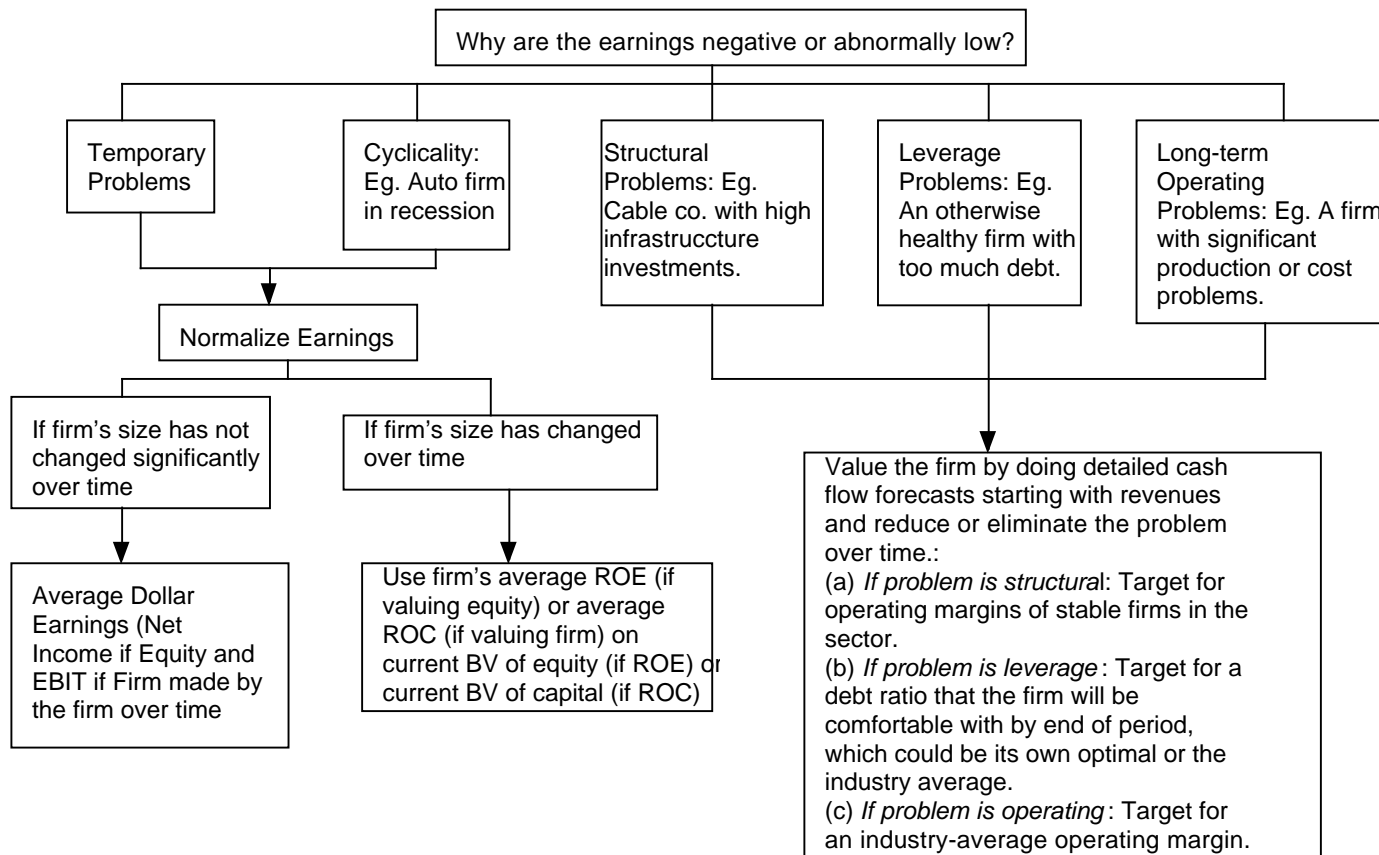
- If the earnings are negative either because of transient phenomena, such as a sudden and unanticipated shift in exchange rates or some other one-time loss, a strong argument can be made for normalizing earnings. Similarly, normalized earnings provide an appropriate remedy for cyclical firms that report negative earnings during a recession; earnings at these firms tend to recover quickly to normalized levels once the recession ends. How we normalize earnings will depend upon the characteristics of the firm being valued. If it has a long history and has not changed scale (or size), the average earnings over prior periods can be used as the normal earnings. If it has a long history, but has changed scale over time, the average profitability measures (return on equity or capital, margins) can be used to compute the normal earnings. If the sector itself has changed over time, and the historical data is limited, earnings can be normalized using average returns and profitability measure for the sector.

- If the earnings are negative due to long-term operational problems at the specific firm being valued, rather than being sector-wide, adjusting margins over time towards sustainable levels, in conjunction with revenue growth seems to be a much better solution. Whether the adjustment is towards an industry average or the firm's past margins will depend upon whether the sector has changed over time; if it has, using the industry average is more prudent.
- If the earnings are negative due to structural problems, either because the firm has a significant infra-structure investment with a long gestation period or because of economies of scale, adjusting margins over time towards those of the larger and more stable firms in the sector should yield the best estimates.

There is one final scenario that we have not considered in this section. This, of course, is the firm that has negative earnings that remain negative for long periods. How much is equity in such a firm worth? While the answer from a discounted cash flow model may be that it should be worth nothing, the equity in such a firm can still have value because of the constraints imposed by limited liability. Since equity investors claim any surplus over debt due, and are limited on the downside to losing only their investment in the firm, equity in a firm with negative earnings with substantial debt has value over and above the discounted cash flow value. This additional value can be estimated using an option pricing model.

In summary, figure 2 summarizes the estimation responses to negative earnings, using the framework developed in this section:

A Framework for Analyzing Companies with Negative or Abnormally Low Earnings



No History or Comparables

We considered some of the problems that arise when a firm has little or no financial history, and when it has few or no comparable firms in the last section. In this section, we will argue that these two sources of information – historical data on the firm being valued and contemporaneous data on comparable firms – can substitute for each other. In other words, valuing a firm with limited history can be made easier by the presence of a significant number of firms in the same line of business. This is why pricing an initial public offering of a specialty retailer or a software firm is relatively straightforward; there are a significant number of established firms with substantial amounts of information on them in each of these sectors. To a lesser extent, having a long history of information on the firm that you are valuing may compensate for the absence of comparables.

When we talk about using information from comparable firms, it is worth noting that the number of comparables is not the only dimension that we are looking at. There are three additional considerations. The first is the similarity in the businesses that these comparables operate in; firms in the same sector do not always produce products that cater to the same market. The second is the richness of information available on each of the comparable firms and the stability of the firms. To illustrate, while there are fewer automobile firms than internet companies, the information available on the former is far deeper than information on the latter. The third is the degree to which the comparable firms are at different stages in their life cycles. Optimally, when valuing a firm we would like to see the characteristics of other firms in the same business at different stages in the life cycle (from high growth to stability). To the extent that there are a large number of comparable firms, but all of them are in high growth, there might be little information

that can be used to estimate parameters when growth starts declining and approaches stable levels.

The No-Earnings, No-History, No-Comparables Firms

As noted in the section that we just concluded, it is when both historical data and meaningful comparables are absent that we are faced with the most daunting challenges in valuation. In this section, we will consider how best to approach valuation when firms have high growth (at least in revenues), negative earnings, little or no historical data and little information can be extracted from comparable firms.

A General Framework for Analysis

To value firms with negative earnings, little or no historical data and few comparables, we should consider approaching valuation using the following steps:

1. Obtain the most updated financial data on the firm being valued: It is conventional, when valuing firms, to use data from the most recent financial year to obtain the current year's inputs. For firms with negative earnings and high growth in revenues, the numbers tend to change dramatically from period to period. Consequently, it makes more sense to look at the most recent information that one can obtain, at least on revenues and earnings, for firms that are growing at very high rates. Using the revenues and earnings from the trailing twelve months, for instance, will provide a much better estimate of value than using earnings from the last financial year. It is true that some items, such as capital expenditures and depreciation, may not be updated as frequently. Even so, we would argue for using estimates⁹ for these inputs and valuing firms with more recent data.

⁹ One simple approach is to scale all of the inputs to reflect the growth in revenues that has occurred between the last financial year and the trailing twelve months.

Illustration 4: Amazon.com: Last Financial Year versus Trailing 12 Months

Amazon.com provides an interesting illustration of how different the trailing 12-month numbers can be from the same numbers in the last financial year.

	Last Financial Year (1997)	Trailing 12 months (Includes 1998 fourth quarter estimate)
Revenues	\$148 million	\$ 667 million
Operating Income (Loss)	- \$30 million	- \$ 80 million
Capital Expenditures	\$ 15 million	\$ 30 million
Depreciation	\$ 5 million	\$ 15 million

Revenue in 1996 was only \$15.7 million, and the firm lost \$5.8 million in that year.

2. Estimate expected growth in revenues over time: This is a key input in these valuations and we would suggest drawing on a number of sources.

- Past growth rate in revenues at the firm itself: Since the firm increases in scale as it grows, it will become more and more difficult to maintain very high growth rates. Thus, a firm that grew 300% two years ago and 200% last year is likely to grow a lower rate this year.
- Growth rate in the overall market that the firm serves: It is far easier for firms to maintain high growth rates in markets that are themselves growing at high rates than it is for them to do so in stable markets.
- Barriers to Entry and Competitive Advantages possessed by the firm: For a firm to be able to sustain high growth rates, it has to have some sustainable competitive advantage. This may come from legal protection (as is the case with a patent), a superior product or service, brand name and from being the first mover into a market. If the competitive advantage looks sustainable, high growth is much more likely to last for a long period. If it is not, it will taper off much faster.

Illustration 5: Amazon.com: Estimating Revenue Growth

This is a difficult input to make for a company that posted growth rates in revenues of 800% from 1996 to 1997 and then another 400% from 1997 to 1998. To make estimates for the future, we allowed for the continuing momentum of high growth, but lowered our estimates over time to allow for the increase in the firm's overall revenues. We also considered the overall size of the book market and the size of larger competitors in the market such as Barnes and Noble. The following table summarizes our estimates of revenue growth for Amazon, the dollar increase in revenues in each year and the total revenues after the growth:

Year	Growth Rate in Revenues	Dollar Revenues	Increase in Revenue
Current		\$667	
1	150.00%	\$1,668	\$1,001
2	100.00%	\$3,335	\$1,668
3	75.00%	\$5,836	\$2,501
4	50.00%	\$8,754	\$2,918
5	30.00%	\$11,381	\$2,626
6	25.20%	\$14,249	\$2,868
7	20.40%	\$17,155	\$2,907
8	15.60%	\$19,832	\$2,676
9	10.80%	\$21,973	\$2,142
10	6.00%	\$23,292	\$1,318

Note first that all projections are based upon the trailing 12-month revenues, rather than revenues last year. Note also that while the growth rate in revenues is expected to decline over time, the dollar increase in revenues each year is larger than the previous year until we get to year 7. By the end of the tenth year, Amazon's revenues of \$23.29 billion

would make it, by far, the largest single retailer in the market for retailing books. To provide a contrast, the firm with the largest market share at the moment, Barnes and Noble, had operating income of \$237 million on revenues of \$2.984 billion in 1998.

3. Estimate the sustainable margin that the firm will have in stable growth: In many ways the true test of these valuations is being able to visualize what a young, high-growth firm will look like when growth stabilizes. In the absence of comparables, the difficulty of this task is magnified. Again, a few guidelines help:

- Looking at the underlying business that this firm is in, consider its true competitors. For instance, while Amazon.com is considered to be an internet firm, it is ultimately a book retailer. At least from the perspective of margins, it seems reasonable to argue that Amazon's margins will approach those of other book retailers.
- Deconstruct the firm's current income statement to get a truer measure of its operating margin. Many young start-up firms that report negative earnings do so, not because their operating expenses from generating current revenues are large, but because accounting convention requires them to report research, development and other investment expenses as operating expenses. Since research and development expenses are separated from other operating expenses in income statements, estimating margins and profitability prior to these expenses is a useful exercise in figuring out how profitable a company's products truly are.

Illustration 6: Estimating Sustainable Margin and Path to Margin: Amazon.com

Amazon.com currently has an operating margin of between -15 and -20% of revenues. As it matures, these margins will surely improve, but to what level? The average pre-tax operating margins of established booksellers (Barnes & Noble, Border's) is approximately 8%. We assumed that Amazon's margins would reach this level by year

10. While there are some who argue that Amazon, as an online retailer, will have higher margins, because it does not have the same cost structure as traditional booksellers, we do not agree for two reasons. The first is that Amazon also has lower prices and hopes to generate growth because of these prices. The second is that as long as anticipated margins in online selling are higher than they are for traditional competitors, there will be increasing competition¹⁰ coming from the latter, pushing margins towards convergence.

To move from current margins to the sustainable margins, we assumed fairly significant improvements in the first two or three years and slower improvements thereafter.

<i>Year</i>	<i>Pre-tax Margin</i>
Current	-15%
1	-10%
2	-5%
3	0%
4	2%
5	2%
6	3%
7	4%
8	6%
9	7%
10	8%

¹⁰ Barnes and Noble recently entered into a partnership with Bertlesman to sell books online both in the US and Europe. Meanwhile, Borders is also expanding its online presence.

It should be noted that the value is relatively insensitive to the actual path chosen, and that the sustainable margin of 8% is the more critical assumption.

4. Estimate the reinvestment needs that the firm will need to maintain growth: In the first part of this paper, we noted that growth in operating income ultimately is a function of how much a firm reinvests and how well it reinvests (measured by the return on capital). This formulation cannot be used to estimate reinvestment needs for start-up firms that are losing money, especially in the years of transition. In steady state, however, the reinvestment needs can be computed using the expected growth rate and the expected return on capital:

$$\text{Expected Reinvestment Rate}_{\text{stable}} = \text{Expected Growth}_{\text{stable}} / \text{ROC}_{\text{stable}}$$

An alternative approach is to use the industry-average reinvestment rates (broken up into capital expenditures and working capital needs) to estimate cash flows.

Illustration 7: Estimating Reinvestment Needs: Amazon.com

Amazon.com, unlike manufacturing firms, does not have large investments in plant and equipment. Its largest reinvestment is in technology and development, and these investments are currently being expensed. In 1998, the firm is expected to have \$ 15 million in depreciation and \$ 30 million in capital expenditures. We assumed that these items would continue to grow, that the growth in capital expenditures would lead growth in revenues by two years and that depreciation would lag capital expenditures growth by a year.

Year	Growth Rate in Revenue	Growth Rate in Capital Spending	Growth Rate in Depreciation
1	150.00%	75%	100%
2	100.00%	50%	75%
3	75.00%	30%	50%

4	50.00%	25%	30%
5	30.00%	20%	25%
6	25.20%	16%	20%
7	20.40%	11%	16%
8	15.60%	6%	11%
9	10.80%	6%	6%
10	6.00%	6%	6%

When the firm reaches stable growth, capital expenditures are assumed to be 110% of depreciation in perpetuity.

The larger issue for Amazon is the estimation of working capital. It has been argued that internet based retailers can get away with lower inventory and smaller working capital investments. We agree with this, and we assume that working capital will be 5% of revenues over time. This is significantly lower than the 8-10% working capital investment that the traditional booksellers have to make.

5. Estimate risk parameters and discount rates for the valuation period: Since we have little historical data, we cannot use the conventional approaches¹¹ to estimate risk parameters. If there are comparable firms that have been listed for two or more years, the current risk parameters for the firm can be estimated by looking at the averages for these firms. If such firms do not exist, risk parameters can be estimated using the financial characteristics¹² of the firm – the volatility in earnings, their size, cash flow characteristics and financial leverage. These risk parameters should not be left

¹¹ The conventional approach is to regress returns on a stock against returns on a market index over a past period, say two to five years.

¹² For a description of this approach, refer to “Estimating Risk Parameters” available on my web site at <http://www.stern.nyu.edu/~adamodar>.

unchanged over the estimation period. As the firm matures and moves towards its sustainable margin and stable growth, the risk parameters should also approach those of an average firm.

In addition to estimating the cost of equity for these firms, we have to estimate how leverage will change over time. Again, targeting an industry-average or an optimal debt ratio for this firm (as it will look in steady state) should yield reasonable estimates for the cost of capital over time.

Illustration 8: Estimating Risk Parameters: Amazon.com

Amazon.com does not have sufficient historical data for us to estimate risk parameters with any degree of accuracy. To estimate the current beta for the firm, we had a choice between using the average beta of booksellers (which is close to one) and the average beta of internet firms (which is closer to 1.80). At the moment, Amazon's fundamental characteristics seem to reflect the latter more than the former; its growth potential is tied to the success of web commerce more than any increase in the potential book market. We therefore chose to use a beta of 1.80 to estimate the current cost of equity.

As the firm matures, we feel that its risk will approach those of other booksellers and that its beta will converge on the market beta of 1.00. The following table summarizes the beta estimates for Amazon, by year:

Year	Beta
1	1.80
2	1.80
3	1.80
4	1.80
5	1.80

6	1.64
7	1.48
8	1.32
9	1.16
10	1.00

Note that the beta declines linearly from the current level in year 5 to 1.00 in year 10.

In addition, we assume that Amazon.com will remain debt free for the next 5 years, and that it will move to the average debt to capital ratio of 15% of traditional book sellers in stable growth. We assume that the movement occurs gradually from years 6 through 10. This debt is assumed to have a cost of 8% in pre-tax terms in that year. This will cause the cost of capital, which is currently equal to the cost of equity, to drop gradually from years 6 through 10, partly because of the decline in beta and partly because of the increase in leverage:

<i>Year</i>	<i>Beta</i>	<i>Cost of Equity</i>	<i>E/(D+E)</i>	<i>Cost of Debt</i>	<i>D/(D+E)</i>	<i>Cost of Capital</i>
1	1.80	14.90%	100.00%	5.12%	0.00%	14.90%
2	1.80	14.90%	100.00%	5.12%	0.00%	14.90%
3	1.80	14.90%	100.00%	5.12%	0.00%	14.90%
4	1.80	14.90%	100.00%	5.12%	0.00%	14.90%
5	1.80	14.90%	100.00%	5.12%	0.00%	14.90%
6	1.64	14.02%	97.00%	5.12%	3.00%	13.75%
7	1.48	13.14%	94.00%	5.12%	6.00%	12.66%
8	1.32	12.26%	91.00%	5.12%	9.00%	11.62%
9	1.16	11.38%	88.00%	5.12%	12.00%	10.63%
10	1.00	10.50%	85.00%	5.12%	15.00%	9.69%

The cost of debt reported is the after-tax cost of debt, based upon the borrowing rate of 8% and Amazon's estimated marginal tax rate¹³ of 36%.

6. Value the firm and equity: With the inputs on earnings, reinvestment rates and risk parameters over time, this valuation becomes much more conventional. In many cases, the cash flows in the early years will be negative, in keeping with the negative earnings, but turn positive in later years as margins improve. The bulk of the value will generally be in the terminal value. Consequently, our assumptions about what the firm will look like in stable growth are significant.

Illustration 9: Estimating Firm and Equity Value: Amazon.com

Having estimated the cash flows and the discount rates, we are now in a position to estimate the firm and equity value for Amazon as a firm. While estimating cash flows, we consider the fact that they will have net operating losses to carry forward and that this will reduce their tax burden when they initially start making money. Table 1 summarizes the cash flows to the firm after reinvestment needs for each of the next 10 years and the discount rate applied to these cash flows.

There is one very significant cash flow that is not reported on this table, and that is the terminal value of the firm. To estimate the terminal value, at the end of year 10, we first estimated the free cash flow to the firm in year 11:

Revenues	\$24,689.29
- COGS	\$22,714.15
- Depreciation	\$235.42
EBIT	\$1,739.73

¹³ The marginal tax rate for the first five years is actually 0% since the firm has losses carried forward, but the firm uses no debt in those years.

- EBIT*t	\$626.30
EBIT (1-t)	\$1,113.42
+ Depreciation	\$235.42
- Capital Spending	\$258.96
- Chg. Working Capital	\$69.88
Free CF to Firm	\$1,020.01

We use this free cash flow, in conjunction with the cost of capital of 9.69% in year 11 and our assumption that earnings and cash flows will grow at 6%, in nominal terms, after year 10, to estimate the terminal value:

$$\text{Terminal Value} = \$ 1,020.01 / (.0969 - .06) = \$27,620 \text{ million}$$

The value of Amazon as a firm can then be estimated by summing up the present values of the cash flows for each of the next 10 years, and the present value¹⁴ of the terminal value:

Present Value of FCFF in high growth phase =	(\$64.61)
Present Value of Terminal Value of Firm =	\$7,945.42
Value of the firm =	\$7,880.81

Based upon our assumptions, then, the value of Amazon.com is \$7.88 billion. Since the firm has no debt outstanding, the entire value can be attributed to equity.

¹⁴ Since the cost of capital changes each year, the present value factor is a compounded factor. Thus the present value factor for year 7 = $(1.1149)^5(1.1375)(1.1266)$. The factors are reported in Table 1. The terminal value has to be discounted using the present value factor for year 10.

Table 1: Amazon.com: Estimated Cash Flows

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
Revenues	\$1,667.50	\$3,335.00	\$5,836.25	\$8,754.38	\$11,380.69	\$14,248.62	\$17,155.34	\$19,831.57	\$21,973.38	\$23,291.79
- COGS	\$1,834.25	\$3,501.75	\$5,836.25	\$8,579.29	\$11,153.07	\$13,792.66	\$16,400.50	\$18,958.98	\$20,742.87	\$21,707.94
- Depreciation	\$30.00	\$52.50	\$78.75	\$102.38	\$128.17	\$154.32	\$178.39	\$197.66	\$209.52	\$222.09
EBIT	(\$196.75)	(\$219.25)	(\$78.75)	\$72.71	\$99.44	\$301.63	\$576.44	\$674.93	\$1,020.99	\$1,361.75
- EBIT*t							\$156.77	\$242.97	\$367.56	\$490.23
EBIT (1-t)	(\$196.75)	(\$219.25)	(\$78.75)	\$72.71	\$99.44	\$301.63	\$419.67	\$431.95	\$653.43	\$871.52
+ Depreciation	\$30.00	\$52.50	\$78.75	\$102.38	\$128.17	\$154.32	\$178.39	\$197.66	\$209.52	\$222.09
- Capital Spending	\$52.50	\$78.75	\$102.38	\$128.17	\$154.32	\$178.39	\$197.66	\$209.52	\$222.09	\$235.42
- Wkg Capital	\$50.03	\$83.38	\$125.06	\$145.91	\$131.32	\$143.40	\$145.34	\$133.81	\$107.09	\$65.92
Free CF to Firm	(\$269.28)	(\$328.88)	(\$227.44)	(\$98.99)	(\$58.02)	\$134.16	\$255.07	\$286.28	\$533.77	\$792.27
Present Value	(\$234.36)	(\$249.11)	(\$149.93)	(\$56.80)	(\$28.97)	\$58.89	\$99.39	\$99.94	\$168.43	\$227.91
NOL	\$316.75	\$536.00	\$614.75	\$542.04	\$442.60	\$140.96				
Cost of Capital Computation										
Beta	1.80	1.80	1.80	1.80	1.80	1.64	1.48	1.32	1.16	1.00
Cost of Equity	14.90%	14.90%	14.90%	14.90%	14.90%	14.02%	13.14%	12.26%	11.38%	10.50%
Cost of Debt	5.12%	5.12%	5.12%	5.12%	5.12%	5.12%	5.12%	5.12%	5.12%	5.12%
Debt Ratio						3.00%	6.00%	9.00%	12.00%	15.00%
Cost of Capital	14.90%	14.90%	14.90%	14.90%	14.90%	13.75%	12.66%	11.62%	10.63%	9.69%

7. Value equity per share: The conventional way to estimate value per share is to divide the equity value by the number of shares outstanding. For high-growth, start-up firms, especially in the United States, there is one significant consideration. These firms often reward their employees, not with cash bonuses (they cannot afford them) but with options on the stock. Over time, these option grants can amount to a significant portion of the outstanding equity in the firm. To get to the value per share, we need to net out the estimated value of these options from the equity value. Since firms in the U.S. are required to report¹⁵ the number of options that they have granted, the average strike price on these options and the average maturity, simple option pricing models¹⁶ can be used to value these options.

Value of Firm

- Value of Debt

= Value of Equity

- Value of Options granted to Employees

= Value of Equity in Common Stock

/ Number of Shares outstanding

= Value per Share

This approach contrasts with a much more widely used one, where the exercise value of the options is added to the value of the equity, and the total value is divided by the fully diluted number of shares. That approach will understate the value of the options, because they do not consider the time value of the options. If the options outstanding are deep in the money, this approach should give very similar results.

¹⁵ The information is contained as a footnote to the financial statements (10-K and annual report)

¹⁶ The objective is to obtain an approximate estimate of value. In doing the valuation, note that these options will result in dilution and be worth less than listed options with the same characteristics.

Illustration 10: Valuing Equity per Share: Amazon.com

Having estimated the value of Amazon.com (and its equity) to be \$7,881 million, we can estimate the value of equity per share. As of December 1997, the firm had options outstanding on 4.51 million shares, with a weighted average life of 8.2 years and a weighted exercise price of \$8.95. A two-for-one stock split in the middle of 1998 reduced the effective exercise price to \$ 4.975.

The firm did issue options during 1998, but the data was not available at the time of this valuation. Since the firm had net issues of options on 1.5 million shares, primarily at the prevailing stock price, during 1996 and 1997, we assumed that they issued a similar number of options in 1998 at an average exercise price of \$ 60 (which was the average price in 1998). Cumulating these options with those already outstanding provides us with an estimate of options outstanding on 6.01 million shares, with a weighted average life of 8 years and a weighted¹⁷ exercise price of \$18.71.

Using a Black-Scholes option pricing model, allowing for dilution, the value of these options were computed using Amazon's market price of \$ 300 per share as of December 1998. The total value of the options outstanding was estimated to be \$1,721 million. The value of equity in common stock was computed then, as follows:

Value of Equity =	\$7,881 million
- Value of Equity in Options Outstanding =	- \$1,721 million
= Value of Equity in Common Stock	\$6,160 million

Amazon had 52.76 million shares outstanding as of December 1998, leading to a per share value of

Value of Equity in Common Stock	\$6,160 million
---------------------------------	-----------------

¹⁷ Weighted average price = $(4.51 * 4.975 + 1.50 * 60) / 6.01 = \18.71

/ Number of Shares outstanding	52.76 million
= Value of Equity per Share	\$116.75

Value Drivers

What are the key inputs that determine the value of a young, high-growth firm with negative earnings? In general, the inputs that have the greatest impact on value are the estimates of sustainable margins and revenue growth. To a lesser extent, assumptions about how long it will take the firm to reach a sustainable margin and reinvestment needs in stable growth have an impact on value, as well.

In practical terms, the bulk of the value of these firms is derived from the terminal value. While this will trouble some, it mirrors how an investor makes returns in these firms. The payoff to these investors takes the form of price appreciation rather than dividends or stock buybacks. Another way of explaining the dependence on terminal value and the importance of the sustainable growth assumption is in terms of assets in place and future growth. The value of any firm can be written as the sum of the two:

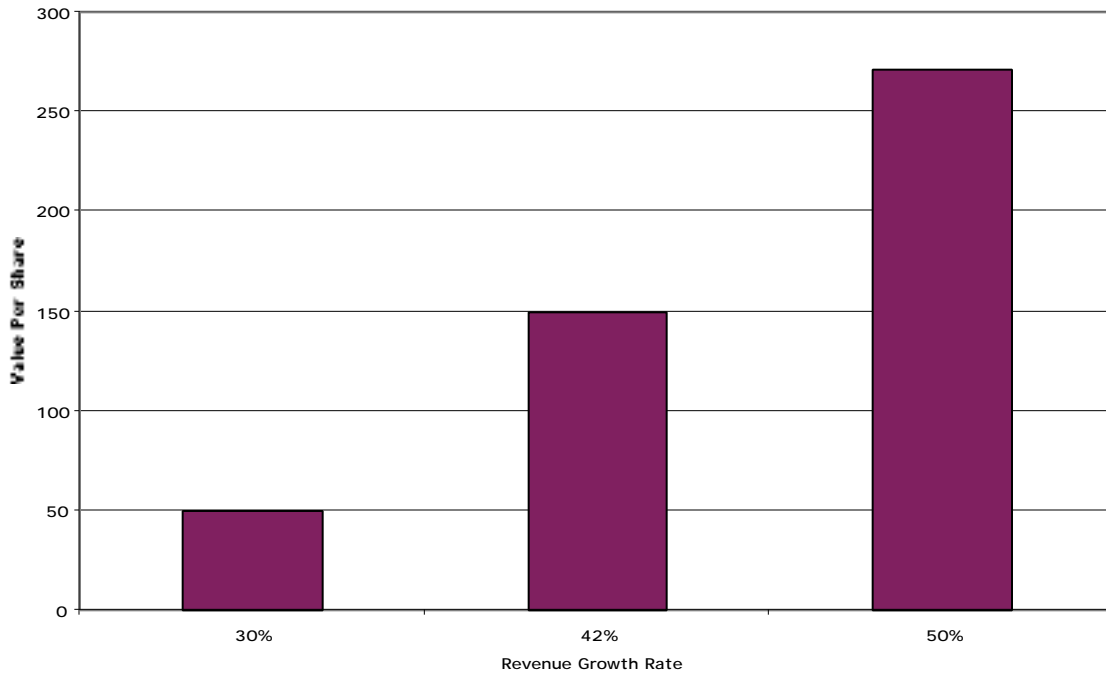
$$\text{Value of Firm} = \text{Value of Assets in Place} + \text{Value of Growth Potential}$$

For start-up firms with negative earnings, almost all of the value can be attributed to the second component. Not surprisingly, the firm value is determined by assumptions about the latter.

Illustration 11: Value Drivers for Amazon.com

There are three value drivers that affect the value of Amazon as a firm. The first is the expected compounded growth rate in revenues. We have assumed it to be approximately 42% compounded over the next 10 years. If revenue growth were higher, the value per share would also be higher, as evidenced in the figure below:

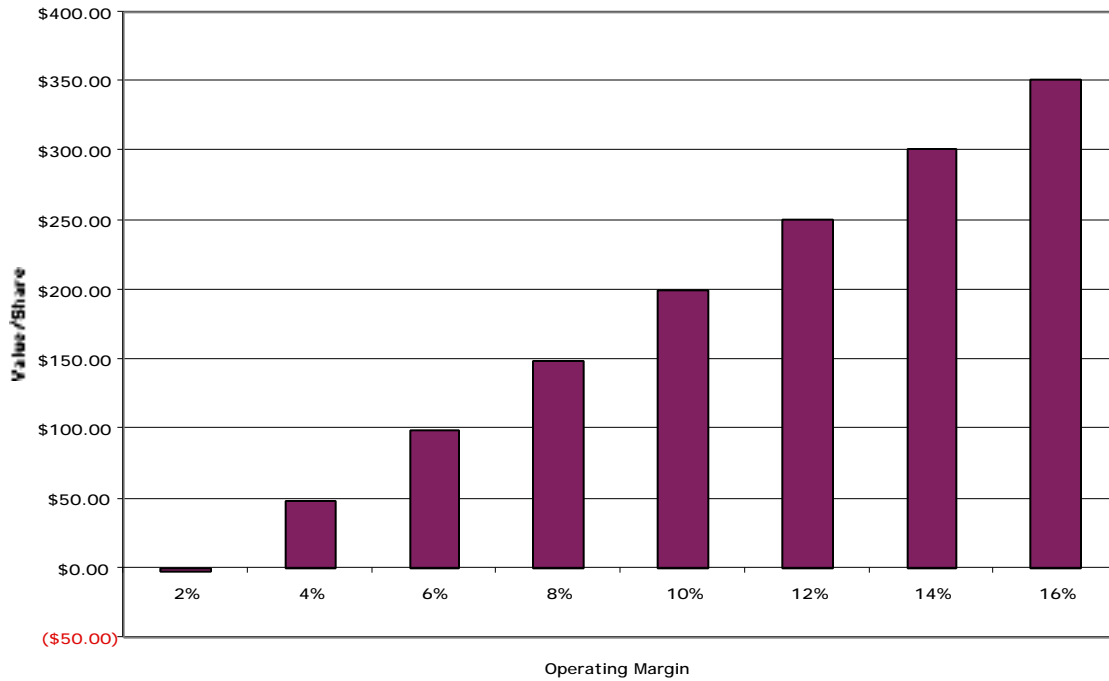
Compounded Revenue Growth



Note, though, that we are talking about compounded growth. At a 50% compounded growth rate, the value per share would be in excess of \$ 250, but revenues in year 10 would have to be \$ 40 billion. This is in contrast to our base case assumption where revenues grow to \$ 23 billion in year 10. If compounded revenue growth were only 30%, the value per share would be only \$ 50.

The second is the sustainable operating margin. We assumed that it would converge on the industry average of 8%. The value per share is extremely sensitive to this assumption:

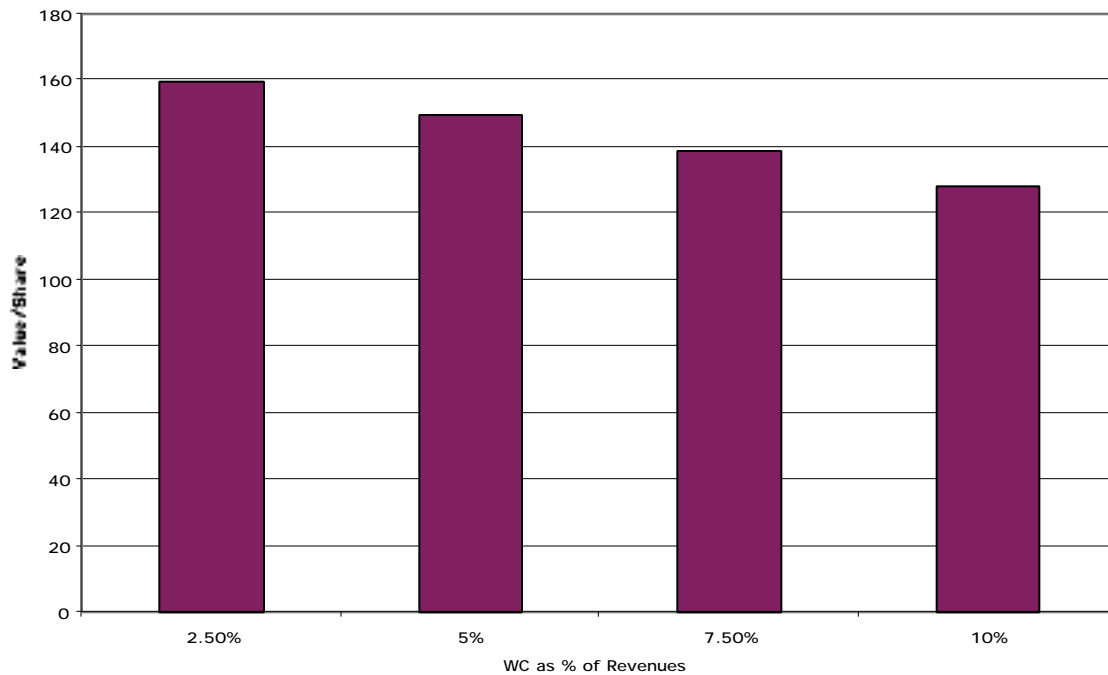
Operating Margin and Value/Share



If the pre-tax operating margin were to be 16% instead of 8%, the value per share would increase to \$ 350. For this to happen, however, the competition would essentially have to collapse. If, on the other hand, this market turns out to have fewer barriers to entry than anticipated and competition drives margins below 8%, the value per share will drop significantly.

The final input that we were interested in analyzing was the assumption that working capital would be 5% of revenues. On this assumption, we found value to be relatively unaffected by changes in our assumptions:

Working Capital and Value/Share



In fact, our assumptions about reinvestment rates had relatively little effect on value per share at Amazon.com. This reflects the fact that most of Amazon's investments for growth, i.e., investments in technology, marketing and development, are expensed rather than capitalized. For a start-up firm with a greater dependence on capital investment, the value would be sensitive to this assumption as well.

In conclusion, it is worth noting that we can justify Amazon's price per share (of \$ 300 at the time of this analysis) under certain circumstances, just as we can justify the market price of any security. For instance, assuming a compounded growth rate in revenues of 50% or higher for the next 10 years or a pre-tax operating margin of 14-16% or some combination of the two would lead us to a value of \$ 300. For any investor or analyst, the follow-up question then becomes a pragmatic one: What are the odds of such an occurrence, and if the odds are low, do you want to tie an investment decision (buying Amazon) to an optimistic scenario that has a low probability of occurrence? There is a

strong argument to be made that investments should be based on expected values and not on best-case scenarios.

Estimation Noise

The framework for valuation provided in this section should not be considered a recipe for precision. The valuation of a firm with negative earnings, high growth and limited information will always be noisy. One way to present this noise is in terms of a valuation range, and the range on the value of these firms will be large. This is often used as an excuse by analysts who do not want to go through the process of valuing such firms. It also provides critics with a simplistic argument against trusting the numbers that emerge from these models.

We have a different view. The noise in the valuation is not a reflection of the quality of the valuation model, or the analyst using it, but of the underlying real uncertainty about the future prospects of the firm. This uncertainty is a fact of life when it comes to investing in these firms. In a valuation, we attempt to grapple with this uncertainty and make our best estimates about the future. Note that those who disdain valuation models for their potential errors end up using far cruder approaches, such as comparing price/sales ratios across firms. The difference, as we see it, is that they choose to sweep the uncertainties under the rug and act as if they do not exist.

There are two other points to make about the precision in these valuations. First, even if a valuation is imprecise, it provides a powerful tool to answer the question of what has to occur for the current market price of a firm to be justified. Investors can then decide whether they are comfortable with these assumptions, and make their decisions on buying and selling stock. Second, even if individual valuations are noisy, portfolios constructed based upon these valuations will be more precisely valued. Thus, an investor who buys 40 stocks that he or she has found to be undervalued using traditional valuation models, albeit with significant noise, should find noise averaging out across the portfolio.

The ultimate performance of the portfolio then should reflect the valuation skills, or the absence of them, of the analyst.

Implications for Investors

From a valuation perspective, there are a number of useful lessons that emerge for investors in young firms with negative earnings and limited information.

- Focus on sustainable margins and survival, rather than quarter-to-quarter or even year-to-year swings in profitability. Understanding what a firm's operating margins will look like when it reaches financial health might be the single most important determinant of whether one is successful investing, in the long term, in such firms. Separating those firms that have a greater chance of surviving and reaching financial health is a closely connected second determinant. After all, most start-up firms never survive to enjoy their vaunted growth prospects.
- Earnings reports can be misleading, especially when reinvestment costs are expensed (as is the case with research, development and long-term marketing expenses). Thus, when a firm with high-growth potential and poor earnings reports a significant improvement in earnings, investors should examine the report for the reasons. If the earnings are improving because the costs of generating current revenues are coming down (due to economies of scale or pricing power), this is clearly good news. If, however, the earnings are increasing because the firm has reduced or eliminated discretionary reinvestment expenditures (such as development costs), the net effect on value can be very negative, since future growth is being put at risk.
- Diversify. This age-old rule of investing becomes even more critical when investing in stocks that derive the bulk of their value from uncertain future growth. The

antidote to estimation noise is often a more diversified portfolio¹⁸ both across firms and across sectors.

- Keep track of barriers of entry and competitive advantages; they will, in large part, determine whether the firm will continue to maintain high growth.
- Be ready to be wrong. The noise in these valuations is such that no matter how much information is brought into the process and how carefully a valuation is done, the value obtained is an estimate. Thus, investors in these stocks will be spectacularly wrong sometimes, and it is unfair to judge them on individual valuations. They will also be spectacularly right in other cases, and all that we can hope for is that with time as an ally, the successes outweigh the failures.

Relative Valuation

For much of this paper, we have focused on how best to estimate the intrinsic value of young, high-growth firms with negative earnings. A strong argument can be made that most investors who invest in these firms do not do so because of their judgements on intrinsic value, but more on their judgements of relative value. By relative valuation, we mean the value of a firm relative to how “similar” firms are valued by the market at the moment. There are three key parts to doing relative valuation. The first is to standardize prices of different securities before making comparison by using multiples such as price-earnings, price-book value, price-sales and Value/EBITDA. The second is to find the firms that are similar to the firm being valued. The final part is to compare the

¹⁸ The simple rules of diversification that suggest 20 stocks are enough may not apply here. Since these investments tend to come from the same sector, and have higher correlations with each other, and since there is so much noise in estimation, more stocks will be needed to accomplish the same degree of diversification that one would have got by buying 20 large-capitalization, mature companies.

standardized prices across these similar firms, while controlling for any differences on fundamentals.

Relevant Multiples

For most firms that we value, there are a number of different multiples that we can use, ranging from earnings multiples (PE, Value/EBIT, Value/EBITDA) to book value multiples (Price/Book, Value/Book) to revenue multiples (Price/Sales, Value/Sales). For firms with significant negative earnings, especially at the operating income level, the current earnings multiples become useless since they cannot be estimated. The book values are miniscule relative to the market value and often do not reflect the firm's most substantial asset, which is its technology. The only multiples we are left with are multiples of expected earnings in some future period (say, five years from now) and multiples of sales.

Many analysts compare firms with expected high growth in revenues and negative earnings on the basis of a price/earnings ratio, with the earnings used being projected earnings in five or ten years. While this approach may yield numbers that are nominally comparable, they have to be used carefully, given the tremendous estimation errors in expected earnings.

The other multiple that is used is a revenue multiple, where firms are compared based upon their price/sales or value/sales ratios. The advantage of this multiple is that it can be computed for most firms, since few firms have no revenues and none have negative revenues. Here, again, however the key question that has to be faced is whether these sales multiples can be compared across firms with very different characteristics.

Illustration 12: Price/Sales Ratios: Internet Firms

In the following table, we summarize the price to sales ratios for firms in the internet sector.

Company Name	Price Current	Number of Shares	Market Value	Revenues	PS Ratio
America Online	\$ 87.56	40111.236	\$ 3,512,140	\$ 2,937	13.66
CNET	\$ 53.06	902.02	\$ 47,861	\$ 48	18.94
EarthWeb	\$ 40.25	317.975	\$ 12,798	\$ 2	138.30
Excite	\$ 48.94	2525.304	\$ 123,588	\$ 117	21.66
IDT Corp	\$ 19.38	641.478	\$ 12,432	\$ 335	1.91
Infoseek	\$ 34.06	1072.89	\$ 36,543	\$ 63	17.07
Lycos	\$ 59.00	2188.9	\$ 129,145	\$ 56	38.98
MindSpring Enterprises	\$ 64.56	1678.56	\$ 108,368	\$ 92	18.15
Periphonics Corp	\$ 11.13	150.255	\$ 1,672	\$ 125	1.20
PSINET	\$ 18.75	971.25	\$ 18,211	\$ 201	4.84
Spyglass	\$ 23.50	326.65	\$ 7,676	\$ 21	15.89
Sterling Commerce	\$ 36.25	3320.5	\$ 120,368	\$ 490	6.77
Sykes Enterprises	\$ 20.25	795.825	\$ 16,115	\$ 385	2.07
Yahoo!	\$ 192.00	18950.4	\$ 3,638,477	\$ 150	126.24

Note the huge differences in both market capitalization and price to sales ratios across firms in this sector. This should not be surprising, given the reality that these firms are very different in their business models, with some firms being internet service providers (like IDT), some operate search engines (such as Yahoo, Excite and Infoseek) and others providing software and support services. In fact, if we added the internet retailers to this list, the differences would become even larger.

Explaining Cross Sectional Differences

Once comparable firms have been identified, and a multiple has been chosen, the final step in the process is identifying the fundamentals that determine that multiple and controlling for differences in those fundamentals. To look under the hood, so to speak, of equity and firm value multiples, we will go back to fairly simple discounted cash flow models for equity and firm value and use them to derive our multiples. Thus, the simplest

discounted cash flow model for equity, which is a stable growth dividend discount model would suggest that the value of equity is:

$$\text{Value of Equity} = P_0 = \frac{DPS_1}{k_e - g_n}$$

where DPS_1 is the expected dividend in the next year, k_e is the cost of equity and g_n is the expected stable growth rate. Dividing both sides by the earnings, we obtain the discounted cash flow model for the PE ratio for a stable growth firm:

$$\frac{P_0}{EPS_0} = PE = \frac{\text{Payout Ratio} * (1 + g_n)}{k_e - g_n}$$

Dividing by the Sales per share, the price/sales ratio for a stable growth firm can be estimated as a function of its profit margin, payout ratio, profit margin and expected growth.

$$\frac{P_0}{Sales_0} = PS = \frac{\text{Profit Margin} * \text{Payout Ratio} * (1 + g_n)}{k_e - g_n}$$

The point of this analysis is not to suggest that we go back to using discounted cash flow valuation, but to get a sense of the variables that may cause these multiples to vary across firms in the same sector.

When making comparisons of a multiple across firms, we have to either explicitly or implicitly make assumptions about the differences in these fundamentals. To illustrate, assume that a firm has a much lower price to sales ratio than other firms in the sector. We can conclude that it is under valued only if all firms in that sector have similar risk, growth and cash flow characteristics, and similar margins. When large differences exist on these characteristics, we have to control for these differences in one of two ways:

- Subjectively, we could make adjustments to the multiple of a firm to reflect its differences from the sector. Thus, we might conclude that the firm with the lower

price to sales ratio than the rest of the sector is not under valued, because its has lower margins than the firms in its peer group.

- Quantitatively, by regressing the multiple (say, price to sales ratios) against the fundamentals for firms in a sector (say risk, growth and net margins).

In most sectors, the relationship between multiples and fundamentals tend to be strong enough to yield reasonable predictions. For firms such as those we have been discussing this paper, this may not apply, especially if the fundamentals are estimated from the current period. These firms are being priced, not based on what their existing investments make, but on what people think their future investments will make. Thus, the multiples may be better explained using predicted values for net margin rather than current values or by using proxies (such as revenue growth or firm size) for survival and eventual profitability.

As a final point, it is worth noting that not all of the fundamentals are equally important when it comes to explaining differences in multiples. For instance, while the price/sales ratio is a function of the net margin, the payout ratio, the cost of equity and the expected growth rate, the net margin is the key determinant. In sectors where firms pay little or no dividends, the payout ratio will not be a factor.

Illustration 13: Cross Sectional Comparisons: The Internet Sector

Returning to the internet sector that we analyzed in the previous illustration, consider first the relationship between price to sales ratios and net profit margins. It is an interesting exercise in futility since most of the firms are currently losing money.

<i>Company Name</i>	<i>PS Ratio</i>	<i>Net Margin</i>
America Online	13.66	5.72%
CNET	18.94	-26.05%
EarthWeb	138.30	-352.17%
Excite	21.66	-35.51%

IDT Corp	1.91	-1.91%
Infoseek	17.07	-13.35%
Lycos	38.98	-172.73%
MindSpring Enterprises	18.15	8.02%
Periphonics Corp	1.20	4.40%
PSINET	4.84	-73.37%
Spyglass	15.89	-39.02%
Sterling Commerce	6.77	-12.48%
Sykes Enterprises	2.07	-0.70%
Yahoo!	126.24	-10.86%

There is, in fact, a negative relationship between current profit margins and price to sales ratios. In fact, when we regress price to sales ratios against the net margin, we establish this clearly:

$$PS = 15.23 - 29.50 (\text{Net Margin}) \quad R^2 = 42.91\%$$

While this may seem to violate the fundamental relationship we laid out earlier, it should not be surprising. Price to sales ratios for these firms are determined not by current margins but by expectations of future margins. Furthermore, the earnings of these firms reflect not just the quality of their assets in place but also reflect reinvestments for the future. Thus, firms that are reporting very negative earnings may, in fact, be the firms that are reinvesting the most for the future.

To estimate future margins, we could use analyst projections of future earnings per share. Alternatively, we could look for other variables that are likely to be correlated with future growth and profitability. We considered three variables:

- Level of Revenues: Other things remaining equal, we would expect firms with lower revenues to grow faster in the future than firms with higher revenues. (We use $\ln(\text{Trailing Twelve-month Revenues})$ to measure revenues)

- Past Growth in Revenues: We consider the momentum created by past revenue growth, and posit that firms that had higher revenue growth in the last year will continue to record high revenue growth in the future. Furthermore, we argue, the faster revenues are growing, the sooner the firm will become profitable. (We measure revenue growth by taking revenues in the trailing twelve months and dividing by the revenues in the last year¹⁹)
- Cash Holdings: We consider this a measure of the capacity of the firm to survive. Small firms that are growing fast often run into a cash constraint that can either impede growth, or worse, threaten the firm's survival. We look at cash as a percent of the revenues in the trailing twelve months to measure this variable.

We regressed price/sales ratios against these three variables:

$$PS = 40.47 - 11.02 (\ln(\text{Revenues})) + 11.37 (\text{Revenue Growth}) + 32.24 (\text{Cash/Revenue})$$

The R-squared of this regression is 61.67% and the t statistics on the level of revenues and the cash measure variable suggest statistical significance.

The risk of the approach that we have just described is obvious. If not circumscribed, it can very quickly dissipate into data mining with a search for the variables that have the highest explanatory power. The objective is not to explain away differences in prices across stocks in the sector but to do so with fundamental measures.

The Problems with Relative Valuation

The allure of relative valuation is simple to explain. It is far simpler than relative valuation and it seems to require so much less information than discounted cash flow valuation. This is deceptive. When comparing multiples across comparable firms, we are making all of the same assumptions that we would normally make in a discounted cash

¹⁹ Most of the firms in this sample have financial years that ended in December 1997. The trailing twelve months for these firms tend to be the first three quarters of 1998 and the final quarter of 1997.

flow valuation, but they tend to be implicit rather than explicit. Worse still, we sometimes do not even realize what assumptions we are making.

The other problem with relative valuation is that it is based upon a fundamental presumption that the sector is correctly valued. In an entire sector is overvalued, the fact that a firm looks under valued on a relative basis does not mean that it is under valued on an intrinsic basis. The danger in trusting the market to be right, on average, especially in sectors where there are huge swings in expectations is large.

Conclusion

Valuation, fundamentally, remains the same no matter what type of firm one is analyzing. There are three groups of firms where the exercise of valuation becomes more difficult and estimates of value more noisy. The first group includes firms that have negative earnings. Given the dependence of most models on earnings growth to make projections for the future, analysts have to consider approaches that allow earnings to become positive, at least over time. They can do so by normalizing earnings in the current period or by adjusting margins from current levels to sustainable levels over time or by reducing leverage. The approach used will depend upon why the firm has negative earnings in the first place. The second group of firms where estimates are difficult to make are young firms, with little or no financial history. Here, information on comparable firms can substitute for historical data and allow analysts to estimate the inputs needed for valuation. The third group of firms where valuation can be difficult includes unique firms with few or no comparable firms.

If all three problems come together for the same firm – negative earnings, limited history and few comparables – the difficulty is compounded. In this essay, we have laid out a broad framework that can be used to value such firms. It should be noted again that the question is not whether these firms can be valued – they certainly can- but whether we are willing to live with noisy estimates of value. To those who argue that these

valuations are too noisy to be useful, our counter would be that much of this noise stems from real uncertainty about the future. As we see it, investors who attempt to measure and confront this uncertainty are better prepared for the volatility that comes with investing in these stocks. While some view multiples as a painless way of analyzing these firms, we have pointed out some of the inherent constraints with coming up with usable multiples and comparables for such firms, and the dangers of trusting the market to be right, on average.