

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

Can Amazon.com be valued?

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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 February 2000, when the stock was trading at \$84 per share. You can download the spreadsheet with the entire valuation from this site:

[Amazon2000.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 noisy¹, 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, we 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.

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

¹ By noisy, I am referring to information that is not only erroneous, but subject to wide differences in interpretation.

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,

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

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

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 rate² 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.

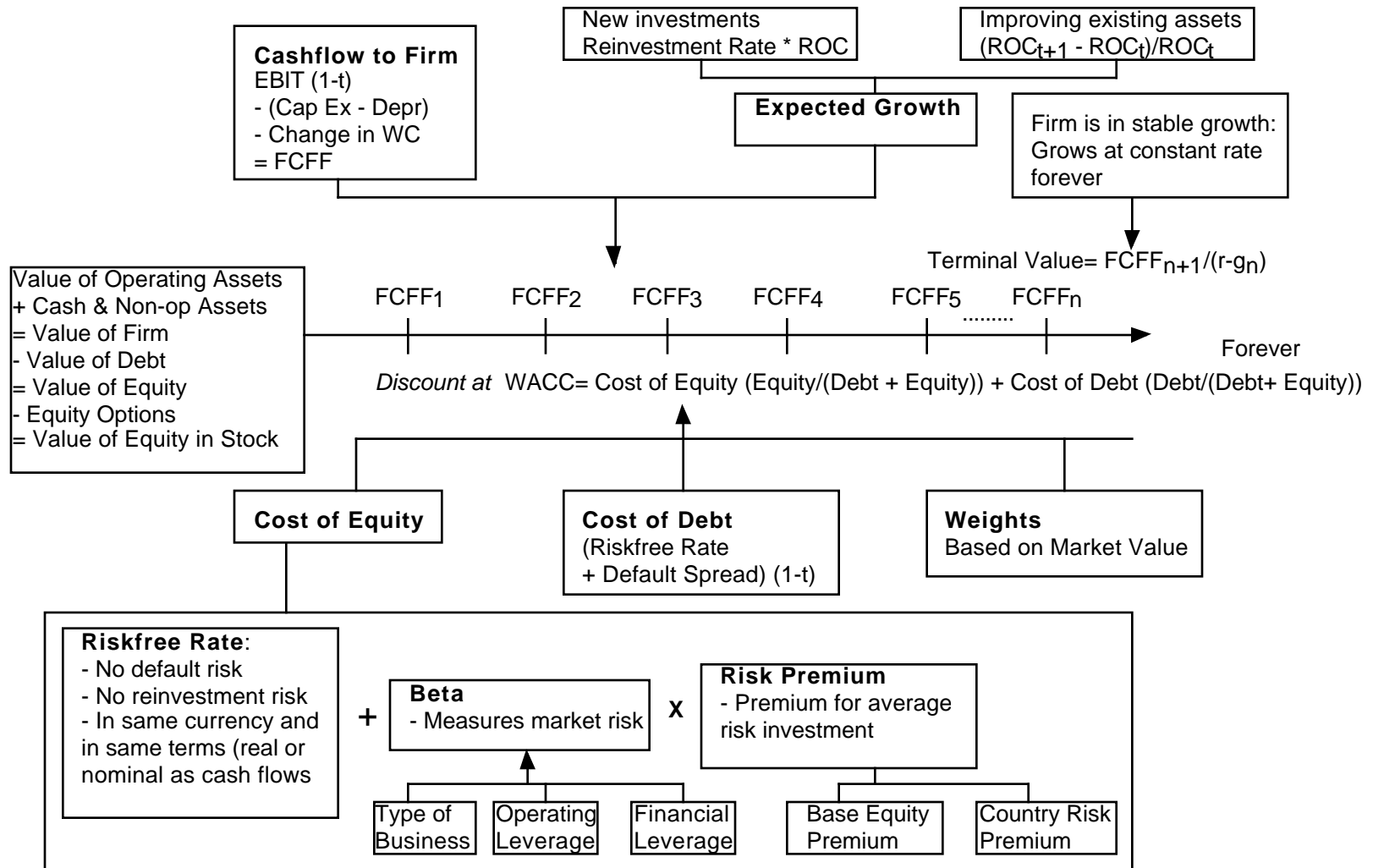
There is one final mopping-up steps in valuation. The first is to add the value of cash, marketable securities and other non-operating assets to the value estimated above. We would include any assets, the operating income from which is not included in the operating income of the firm, in non-operating assets. Thus, we would consider minority holdings in other firms as non-operating assets, since the income from these holdings are not consolidated with those of the firm.

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. Once we

² For a review of basic present value, you can look at “A Primer on Time Value of Money” available on my web site.

have valued the firm, we can estimate the value of equity by subtracting the outstanding debt from firm value. To get to value of equity per share, we subtract the value of equity options issued by the firm (to managers, warrant holders and convertible bond holders) and then divide by the actual number of shares outstanding. Figure 1 summarizes the process and the inputs in a discounted cash flow model.

FIGURE 1: DISCOUNTED CASHFLOW VALUATION



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:

- *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 improved its earnings position 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 information³ 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 rate⁴ will not be available or meaningful.

³ 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.

⁴ While growth rates will not be available, estimates of EPS in future periods might be available.

- A third approach to estimating earnings growth is to use fundamentals and estimate the growth rate as follows:

$$\text{Expected growth rate in EBIT} = \text{Return on Capital} * \text{Reinvestment Rate}$$

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.

- *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, when valuing firms with negative earnings, we have to keep track of the net operating losses and remember to use them to shield income in future periods from taxes.

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

- 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.
- 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.

- 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 Comparable Firms

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, if they occur in isolation.

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.

- Normalize Earnings: In this approach, we replace the current earnings that are negative with a “normalized earnings” that is positive. Clearly, this approach pre-supposes 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.

- Revenues and Margins: The second approach is to base projections on revenues, which should never be negative, and estimate operating or net 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.
- 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 earn 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.
2. 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.

3. 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	=	3,287 Mil 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 rate⁵ of 30%.

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

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

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

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

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:

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

⁵ 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.

Netting out the debt yields a market value of \$52,701 million for equity. Like all firm valuations, there is an element of circular reasoning⁶ 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.

- **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 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.
- **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 the difference is due to economies of scale, the

⁶ 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.

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 analysis⁷, 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 to 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

⁷ 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.

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.

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:

Year	Pre-tax (Pre-depreciation) Margin
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 assume⁸ 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 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

⁸ 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:

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

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 capital⁹ to be the following:

	1	2	3	4	5
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.

1. 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

⁹ The cumulated cost of capital reflects the changing rates over time. Thus, the discount factor for year 2 = (1.1319)(1.1281)

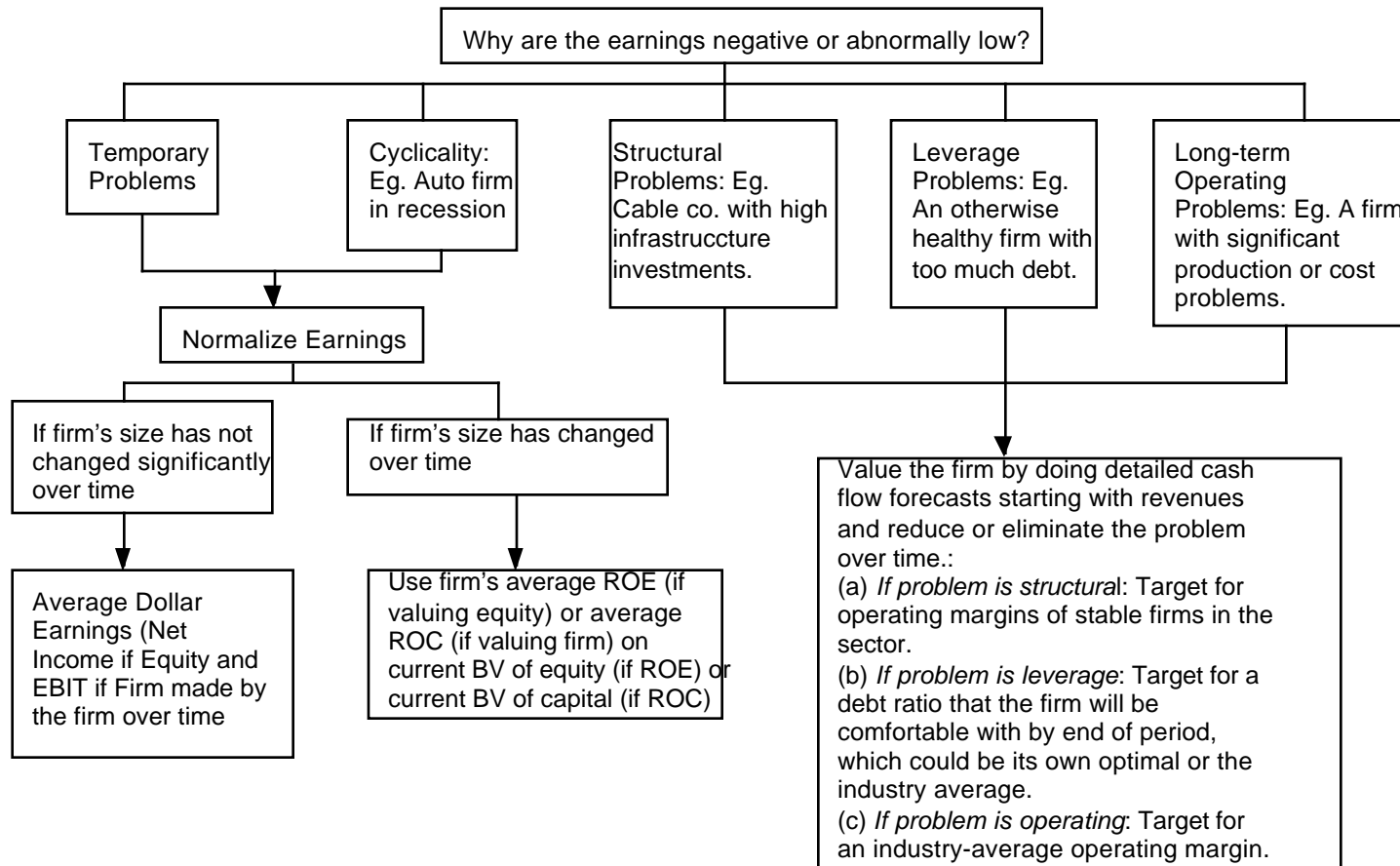
provide an appropriate remedy for cyclical firms that report negative earnings during a recession; earnings at these firms tend to recover quickly to normalized levels once the recession ends. How we normalize earnings will depend upon the characteristics of the firm being valued. If it has a long history 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.

2. 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.
3. 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 comparable firms.

When we talk about using information from comparable firms, it is worth noting that the number of comparable firms 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 listed, 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 comparable firms 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. Updated Information

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 estimates¹⁰ for these inputs and valuing firms with more recent data.

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 (1998)	Trailing 12 months (Last quarter of 1998 and first 3 quarters of 1999)
Revenues	\$610 million	\$ 1,117 million
Operating Income (Loss)	- \$125 million	- \$ 410 million

Revenue in 1997 was only \$148 million, and the firm lost \$30 million in that year. While using updated information is a good idea in all valuations, it becomes critical in valuations of young companies that are changing rapidly over time.

2. Expected Revenue Growth

This is a key input in these valuations and we would suggest drawing on a number of sources.

1. 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.

¹⁰ 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.

Thus, a firm that grew 300% two years ago and 200% last year is likely to grow a lower rate this year.

2. 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.
3. 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, and has also made a transition from being a book retailer to a specialty retailer. 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. 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:

<i>Year</i>	<i>Expected Growth Rate</i>	<i>Dollar Revenues</i>	<i>Change in Revenues</i>
Current		\$1,117	
1	150.00%	\$2,793	\$1,676
2	100.00%	\$5,585	\$2,793
3	75.00%	\$9,774	\$4,189
4	50.00%	\$14,661	\$4,887
5	30.00%	\$19,059	\$4,398
6	25.20%	\$23,862	\$4,803
7	20.40%	\$28,729	\$4,868
8	15.60%	\$33,211	\$4,482
9	10.80%	\$36,798	\$3,587
10	6.00%	\$39,006	\$2,208
11-	6.00%		

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 \$39 billion would make it one of the largest specialty retailers in the market. To provide a contrast, the firm with the

largest market share of the book retailing market at the moment, Barnes and Noble, had operating income of \$237 million on revenues of \$2.984 billion in 1998.

3. Sustainable Operating Margin

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 comparable firms, 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 retailer, specializing in books and electronics. At least from the perspective of margins, it seems reasonable to argue that Amazon's margins will approach those of other specialty 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 -35 and -40% of revenues. As it matures, these margins will surely improve, but to what level? The average pre-tax operating margins for established specialty retailers is approximately 10%. 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 retailers, we do not agree for two reasons. The first is that Amazon also has lower prices and hopes to generate revenue 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 competition¹¹ coming from the latter, pushing margins towards convergence.

¹¹ 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.

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>Operating Margin</i>
Current	-36.71%
1	-13.35%
2	-1.68%
3	4.16%
4	7.08%
5	8.54%
6	9.27%
7	9.64%
8	9.82%
9	9.91%
10	9.95%
After year 10	10.00%

It should be noted that the value is relatively insensitive to the actual path chosen, and that the sustainable margin of 10% is the more critical assumption.

4. Reinvestment Needs

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:

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

There are three alternatives to using this formulation:

- a. We can assume that the firm's existing reinvestments (in the form on net capital expenditures and non-cash working capital) will grow at the same rate as revenues. Implicitly, we are assuming that the existing reinvestments represent a reasonable base value. Building of existing reinvestments can be dangerous in young firms, since reinvestments tend to be volatile and change substantially from year to year. This effect can also be exaggerated when firms grow through acquisitions, since a large acquisition in one year can be followed by a couple of years with not acquisitions. We are also assuming that growth occurs in the year of the reinvestment, rather than in subsequent years. This, however, can be dealt with fairly simply by introducing a lag between growth in reinvestment and a growth in

revenue. For instance, a 100% growth in reinvestment this year will lead to a 100% growth in revenue two years later.

b. We can assume that the firm's reinvestment rate will approach that of the industry. For instance, we can measure the reinvestments as a percent of revenues. For high growth firms, this is likely to be a high number. As the firm's growth declines, it should become lower and approach typical numbers for the industry. For this approach to work, however, capital expenditure has to be defined consistently across the industry (and include acquisitions and other external reinvestment) and the industry has to include mature firms.

c. There is a variation of the fundamental growth formula that can be put to use to estimate reinvestments in future years. While the return on capital and reinvestment rate will be negative for firms with negative earnings, we can compute the typical payoff in revenues that we get for a given dollar reinvestment in the form of a sales to capital ratio:

Sales to Capital Ratio = Revenues/ Capital Invested

A sales to capital ratio of 2 would indicate that a dollar invested in new capital (which can take the form of internal capital expenditures, acquisitions or working capital) creates two dollars in revenues. The dollar reinvestment needed each year can then be estimated based upon the expected dollar revenue change each year and the sales to capital ratio.

$$\text{Dollar reinvestment in year } n = \frac{\text{Change in Dollar Revenues in year } n}{(\text{Sales/Capital})}$$

The higher the sales to capital ratio, the lower the reinvestment needs for any given revenue growth and the higher the value of the firm. How can we estimate this ratio? We can look at the company's own limited history, and look at its marginal sales to capital ratio (change in revenues/change in capital) in prior years. Alternatively, we can look at the sector and the average sales to capital ratio for the sector. The advantage of using this approach as opposed to the other two is that growth and reinvestment are tied together. Increasing one will increase the other. Thus, we reduce the potential for mischief in valuation, where growth rates are increased and reinvestment needs are decreased simultaneously.

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 internal capital expenditures. The firm does make significant acquisitions, and we counted these as external capital expenditures. Cumulatively, the firm had \$ 243 million in capital expenditures in the trailing 4 quarters and \$ 31 million in depreciation. Non-cash working capital decreased during the year by \$ 80 million, but we do not believe that this is a sustainable source of cash flows. However, 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 3% of revenues over time. This is significantly lower than the 8-10% working capital investment that the traditional booksellers have to make.

Ignoring the non-cash working capital change, the marginal sales to capital ratio in 1999 can be estimated as follows:

$$\begin{aligned} \text{Sales to Capital Ratio} &= \text{Change in revenues}^{12}: 1998 \text{ to } 1999 / (\text{Cap ex} - \text{depreciation}) \\ &= (1117-474)/(243-31) = 3.03 \end{aligned}$$

The average sales to capital ratio, in January 2000, for specialty retailers was 3.46 and the average for retail stores was 2.99. We will use a sales to capital ratio of 3.00 for the next decade. Given the changes in revenues that we estimated in illustration 5, we estimate Amazon's reinvestment needs to be:

<i>Year</i>	<i>Change in Revenue</i>	<i>Sales/Capital</i>	<i>Reinvestment</i>
1	\$1,676	3.00	\$559
2	\$2,793	3.00	\$931
3	\$4,189	3.00	\$1,396
4	\$4,887	3.00	\$1,629
5	\$4,398	3.00	\$1,466
6	\$4,803	3.00	\$1,601
7	\$4,868	3.00	\$1,623
8	\$4,482	3.00	\$1,494
9	\$3,587	3.00	\$1,196
10	\$2,208	3.00	\$736

Since the average sales to capital ratio for the sector, which includes more mature firms, is about 3.00, we did not lower the sales to capital ratio as the firm grew. The reinvestment includes acquisitions and working capital investments.

As a final check, we computed the returns on capital that would result from using this sales to capital ratio. We computed the capital invested each year, based upon the

¹² I compared the earnings from the fourth quarter of 1998 to the third quarter of 1999 to the preceding twelve months (fourth quarter of 1997 to third quarter of 1998)

capital at the beginning of the year and the reinvestment during the year. We summarize the returns on capital to be as follows:

<i>Year</i>	<i>Revenues</i>	<i>Operating Margin</i>	<i>EBIT</i>	<i>EBIT(1-t)</i>	<i>Capital Invested^a</i>	ROC
1	\$2,793	-13.35%	-\$373	-\$373	\$487	-76.62%
2	\$5,585	-1.68%	-\$94	-\$94	\$1,045	-8.96%
3	\$9,774	4.16%	\$407	\$407	\$1,976	20.59%
4	\$14,661	7.08%	\$1,038	\$871	\$3,372	25.82%
5	\$19,059	8.54%	\$1,628	\$1,058	\$5,001	21.16%
6	\$23,862	9.27%	\$2,212	\$1,438	\$6,467	22.23%
7	\$28,729	9.64%	\$2,768	\$1,799	\$8,068	22.30%
8	\$33,211	9.82%	\$3,261	\$2,119	\$9,691	21.87%
9	\$36,798	9.91%	\$3,646	\$2,370	\$11,185	21.19%
10	\$39,006	9.95%	\$3,883	\$2,524	\$12,380	20.39%

^aCapital invested in year 1 = Capital invested in year 0 + Reinvestment in year 1

The return on capital of 20.39% is lower than the average return on capital for the specialty retail sector (28.49%) and retail stores (23.76%), but it is higher than Amazon's cost of capital. Consequently, the sales to capital ratio of 3.00 seems to be a reasonable one.

5. Risk Parameters and Discount Rates

Since we have little historical data, we cannot use the conventional approaches¹³ to estimate risk parameters. In fact, the regression beta estimates for firms that have a limited history tend to have substantial error associated with them. 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 characteristics¹⁴ of the firm – the volatility in earnings, their size, cash flow characteristics and financial leverage. These risk parameters should not be left 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.

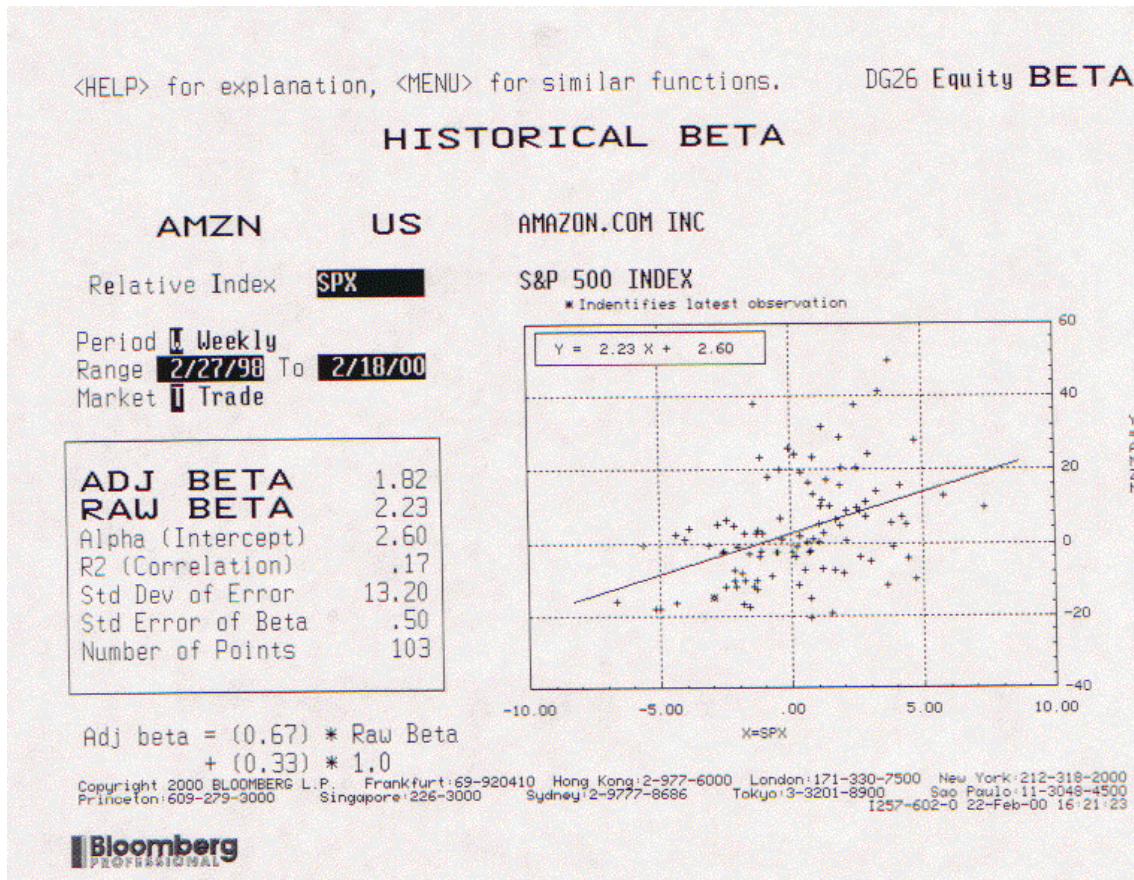
In addition to estimating the cost of equity for these firms, we have to estimate how leverage will change over time. Again, targeting an industry-average or an optimal debt ratio for this firm (as it will look in steady state) should yield reasonable estimates for the cost of capital over time.

¹³ 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.

¹⁴ For a description of this approach, refer to “Estimating Risk Parameters” available on my web site at <http://www.stern.nyu.edu/~adamodar>.

Illustration 8: Estimating Risk Parameters and Discount Rates: Amazon.com

We begin by presenting the regression beta for Amazon.com. This beta calculation, extracted from Bloomberg, uses two years of weekly returns:



Though the beta is estimated to be 2.29, the standard error in the estimate is 0.50.

To estimate the current beta for the firm, we had a choice between using the average beta of retailers (which is close to one) and the average beta of internet firms (which is closer to 1.60). 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 1.60 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	1.60
2	1.60
3	1.60
4	1.60

5	1.60
6	1.48
7	1.36
8	1.24
9	1.12
10	1.00

In addition, we assume that Amazon.com will remain at its existing debt ratio of 1.20% for the next 5 years, and that it will move to the average debt to capital ratio of 15% of traditional retailers 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:

The cost of debt for Amazon can be estimated based upon its current bon rating. However, this rating will change over time. To estimate a cost of debt for Amazon, we estimated¹⁵ an average bond rating of BBB for the next 5 years, which is higher than the current rating. This rating yields a cost of debt of 8%, based upon a treasury bond rate of 6.5% and a default spread of 1.5% (based upon the BBB rating). The cost of capital for the Amazon over the next 10 years can then be estimated as follows:

<i>Year</i>	<i>Beta</i>	<i>Cost of Equity</i>	<i>Pre-tax Cost of Debt</i>	<i>Tax Rate</i>	<i>After-tax Cost of Debt</i>	<i>Debt Ratio</i>	<i>Cost of Capital</i>
1	1.60	12.90%	8.00%	0.00%	8.00%	1.20%	12.84%
2	1.60	12.90%	8.00%	0.00%	8.00%	1.20%	12.84%
3	1.60	12.90%	8.00%	0.00%	8.00%	1.20%	12.84%
4	1.60	12.90%	8.00%	16.13%	6.71%	1.20%	12.83%
5	1.60	12.90%	8.00%	35.00%	5.20%	1.20%	12.81%
6	1.48	12.42%	7.80%	35.00%	5.07%	3.96%	12.13%
7	1.36	11.94%	7.75%	35.00%	5.04%	4.65%	11.62%
8	1.24	11.46%	7.67%	35.00%	4.98%	5.80%	11.08%
9	1.12	10.98%	7.50%	35.00%	4.88%	8.10%	10.49%
10	1.00	10.50%	7.00%	35.00%	4.55%	15.00%	9.61%
After	1.00	10.50%	7.00%	35.00%	4.55%	15.00%	9.61%

The tax rate is 0% for the next 3 years, as the firm loses money and uses net operating losses to offset other income, increases to 16.13% in year 4 and to 35% thereafter. The details of the tax calculations are contained in table 1, towards the end of this section that summarizes earnings and cash flows for Amazon.

¹⁵ We estimated a bond rating based upon the average interest coverage ratio over the first 5 years. The ratings/interest coverage ratio table is contained in the spreadsheet titled “ratings.xls” on my web site.

6. Firm Valuation and Equity Valuation

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.

To estimate the terminal value of the firm, we first estimate the reinvestment rate in perpetuity. To make this assumption, we assume that the return on capital in perpetuity will be 20%. While this is higher than the cost of capital, we believe that the competitive advantages generated by Amazon in the first 10 years will continue to generate excess returns for a long period, if not forever. It is also consistent with our estimate of the return on capital in year 10 of 20.39% that we estimated for Amazon, based upon reinvestment and sales growth. With a stable growth rate of 6%, we can then assume a stable reinvestment rate of 60%.

$$\text{Stable Reinvestment Rate} = \text{Stable Growth Rate} / \text{Return on Capital} = 6\% / 20\% = 30\%$$

The free cash flow to the firm in year 11 can then be estimated as follows:

$$\begin{aligned} \text{FCFF}_{11} &= \text{EBIT (1- tax rate)} - \text{Reinvestments} = \$ 2,688 \text{ million} - 0.3 (\$2,688) \\ &= \$ 1,881 \text{ million} \end{aligned}$$

The terminal value can then be estimated using the stable growth cost of capital of 9.61% that we estimated in perpetuity in the previous illustration.

$$\begin{aligned} \text{Terminal Value}_{10} &= \text{FCFF}_{10} / (\text{Cost of Capital} - \text{Stable Growth Rate}) \\ &= 1881 / (.0961 - .06) = \$ 52,148 \text{ million} \end{aligned}$$

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 value¹⁶ of the terminal value:

Year	FCFF	Terminal Value	Cost of Capital	Compounded Cost of Capital ^a	Present Value
1	-\$931		12.84%	112.84%	-\$825
2	-\$1,024		12.84%	127.33%	-\$805
3	-\$989		12.84%	143.68%	-\$689
4	-\$758		12.83%	162.11%	-\$468
5	-\$408		12.81%	182.87%	-\$223
6	-\$163		12.13%	205.05%	-\$80
7	\$177		11.62%	228.88%	\$77
8	\$625		11.08%	254.25%	\$246
9	\$1,174		10.49%	280.90%	\$418
10	\$1,788	\$52,148	9.61%	307.89%	\$17,518
Value of Operating Assets of the firm =					\$ 15,170
Value of Cash and Non-operating assets =					\$ 26
Value of Firm =					\$ 15,196
- Value of Outstanding Debt =					\$ 349
Value of Equity =					\$14,847

^a The compounded cost of capital is computed based upon the changing discount rates. For instance, the compounded cost of capital in year 5 is estimated as follows:

$$\text{Compounded cost of capital in year 5} = (1.1284)^3 (1.1283) (1.1281) = 1.8287$$

The value of Amazon's operating assets is \$ 15,170 million. We add to this the value of the cash and marketable securities owned by Amazon (\$ 26 million) to estimate the value of Amazon as a firm. Subtracting the debt of \$ 349 million from this yields a value for Amazon's equity of \$14,847 million.

¹⁶ 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>Base</i>	<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>
Revenue Growth Rate		150.00%	100.00%	75.00%	50.00%	30.00%	25.20%	20.40%	15.60%	10.80%	6.00%
Revenues	\$ 1,117	\$ 2,793	\$ 5,585	\$ 9,774	\$ 14,661	\$ 19,059	\$ 23,862	\$ 28,729	\$ 33,211	\$ 36,798	\$ 39,006
Operating Margin	-36.71%	-13.35%	-1.68%	4.16%	7.08%	8.54%	9.27%	9.64%	9.82%	9.91%	9.95%
EBIT	-\$410	-\$373	-\$94	\$407	\$1,038	\$1,628	\$2,212	\$2,768	\$3,261	\$3,646	\$3,883
Taxes	\$0	\$0	\$0	\$0	\$167	\$570	\$774	\$969	\$1,141	\$1,276	\$1,359
EBIT(1-t)	-\$410	-\$373	-\$94	\$407	\$871	\$1,058	\$1,438	\$1,799	\$2,119	\$2,370	\$2,524
+ Depreciation	\$31	\$46	\$60	\$75	\$90	\$104	\$115	\$122	\$130	\$138	\$146
- Capital Expenditures	\$243	\$554	\$907	\$1,345	\$1,572	\$1,438	\$1,572	\$1,599	\$1,489	\$1,226	\$815
- Chg WC	-\$80	\$50	\$84	\$126	\$147	\$132	\$144	\$146	\$134	\$108	\$66
FCFF	-\$543	-\$931	-\$1,024	-\$989	-\$758	-\$408	-\$163	\$177	\$625	\$1,174	\$1,788
NOL	\$500	\$873	\$967	\$560	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cost of Capital Calculations											
Tax Rate	0.00%	0.00%	0.00%	0.00%	16.13%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Debt Ratio	1.20%	1.20%	1.20%	1.20%	1.20%	1.20%	3.96%	4.65%	5.80%	8.10%	15.00%
Beta	1.60	1.60	1.60	1.60	1.60	1.60	1.48	1.36	1.24	1.12	1.00
Cost of Equity	12.90%	12.90%	12.90%	12.90%	12.90%	12.90%	12.42%	11.94%	11.46%	10.98%	10.50%
Cost of Debt	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	7.80%	7.75%	7.67%	7.50%	7.00%
After-tax cost of debt	8.00%	8.00%	8.00%	8.00%	6.71%	5.20%	5.07%	5.04%	4.98%	4.88%	4.55%
Cost of Capital	12.84%	12.84%	12.84%	12.84%	12.83%	12.81%	12.13%	11.62%	11.08%	10.49%	9.61%

7. *Valuation of 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 report¹⁷ the number of options that they have granted, the average strike price on these options and the average maturity, simple option pricing models¹⁸ can be used to value these options.

$$\begin{aligned}
 & \text{Value of Firm} \\
 & - \text{Value of Debt} \\
 & = \text{Value of Equity} \\
 & \text{Value of Options granted to Employees} \\
 & = \text{Value of Equity in Common Stock} \\
 & / \text{Number of Shares outstanding} \\
 & = \text{Value per Share}
 \end{aligned}$$

This approach contrasts with a much more widely used “treasury stock approach”, 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.

Illustration 10: Valuing Equity per Share: Amazon.com

Having estimated the value of Amazon.com (and its equity) to be \$14,847 million, we can estimate the value of equity per share. As of December 1998, the firm had options outstanding on 38 million shares, with a weighted average life of 8.4 years and a weighted exercise price of \$ 13.375. Using a standard deviation in the stock price of 50% and the

¹⁷ The information is contained as a footnote to the financial statements (10-K and annual report)

¹⁸ 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.

current stock price¹⁹ of \$ 84, we estimated the value of these options, allowing for dilution to be \$ 2,892 million.

The value of equity in common stock was computed then, as follows:

Value of Equity =	\$ 14,847 million
1. Value of Equity in Options Outstanding =	- \$ 2,892 million
= Value of Equity in Common Stock	\$ 11,955 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	\$ 11,955 million
/ Number of Shares outstanding	340.79 million
= Value of Equity per Share	\$ 35.08

In contrast, if we applied the treasury stock approach to valuing equity per share in Amazon.com, we would have estimated the value as follows:

Value of Equity per share (Treasury stock approach)
 $= (\text{Value of Equity from DCF Valuation} + \text{Exercise Price} * \text{Number of Options}) / (\text{Number of Shares} + \text{Number of Options}) = (14,847 + 13.375 * 38) / (340.79 + 38) = \$ 40.54$

Note that the value per share is higher, because we are ignoring the time premium on the options. Figure 3 summarizes the inputs to the valuation of a high growth firm, with negative earnings, while figure 4 provides a picture of the Amazon valuation presented in this paper.

¹⁹ There may be a potential inconsistency in assuming that the current stock price is right in this part of the valuation and then estimating a value per share, based upon it. We could re-estimate the value of these options using our estimated value per share, instead of the market price, but that would require iterating back.

Figure 3: Discounted Cash Flow Valuation: High Growth with Negative Earnings

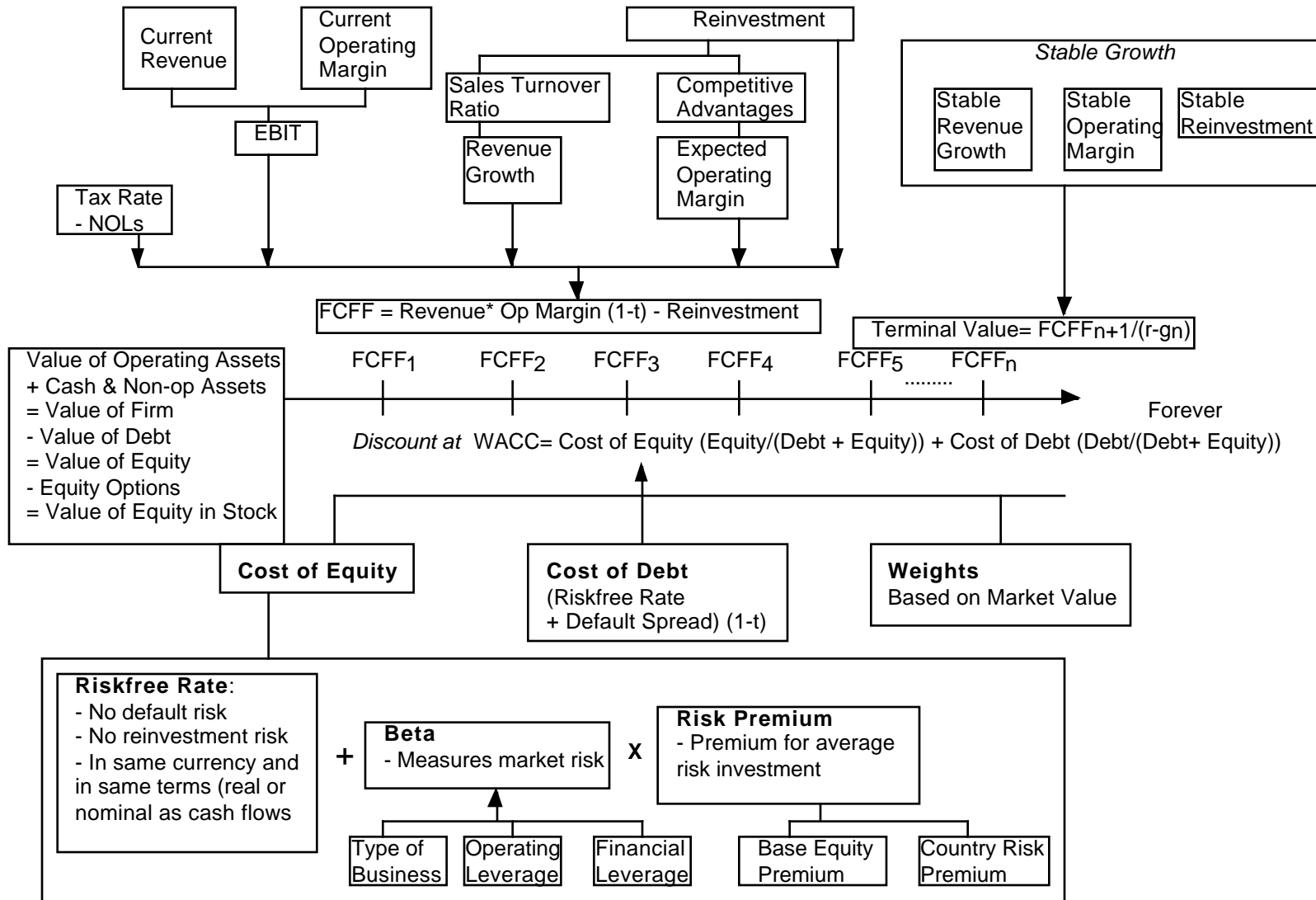
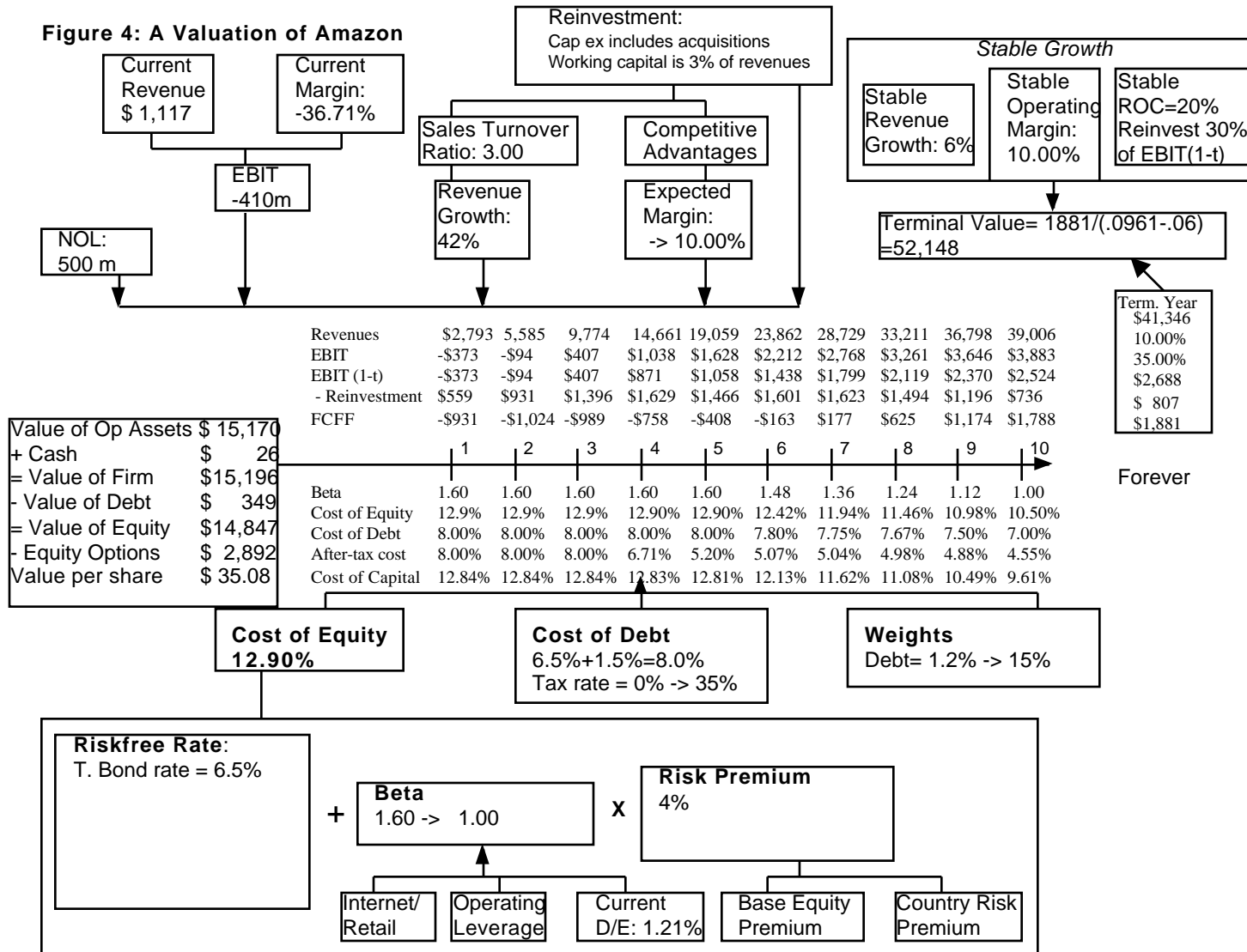


Figure 4: A Valuation of Amazon



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.

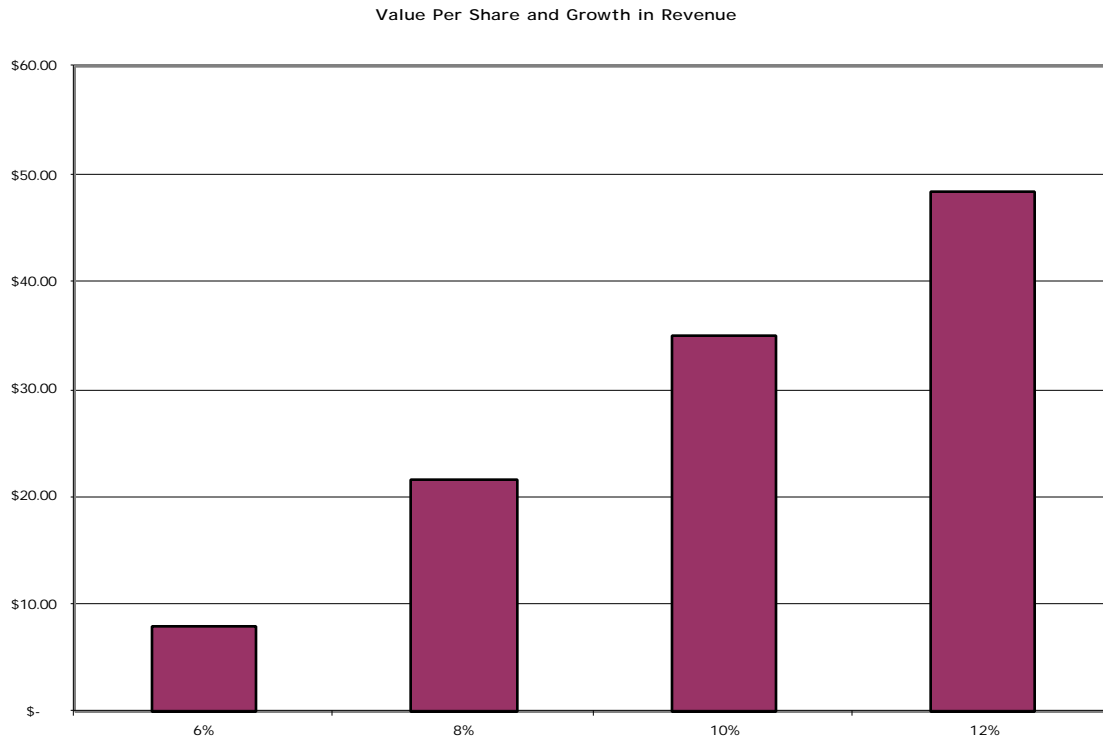
In practical terms, the bulk of the value of these firms is derived from the terminal value. While this will trouble some, it mirrors how an investor makes returns in these firms. The payoff to these investors takes the form of price appreciation rather than dividends or stock buybacks. Another way of 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.

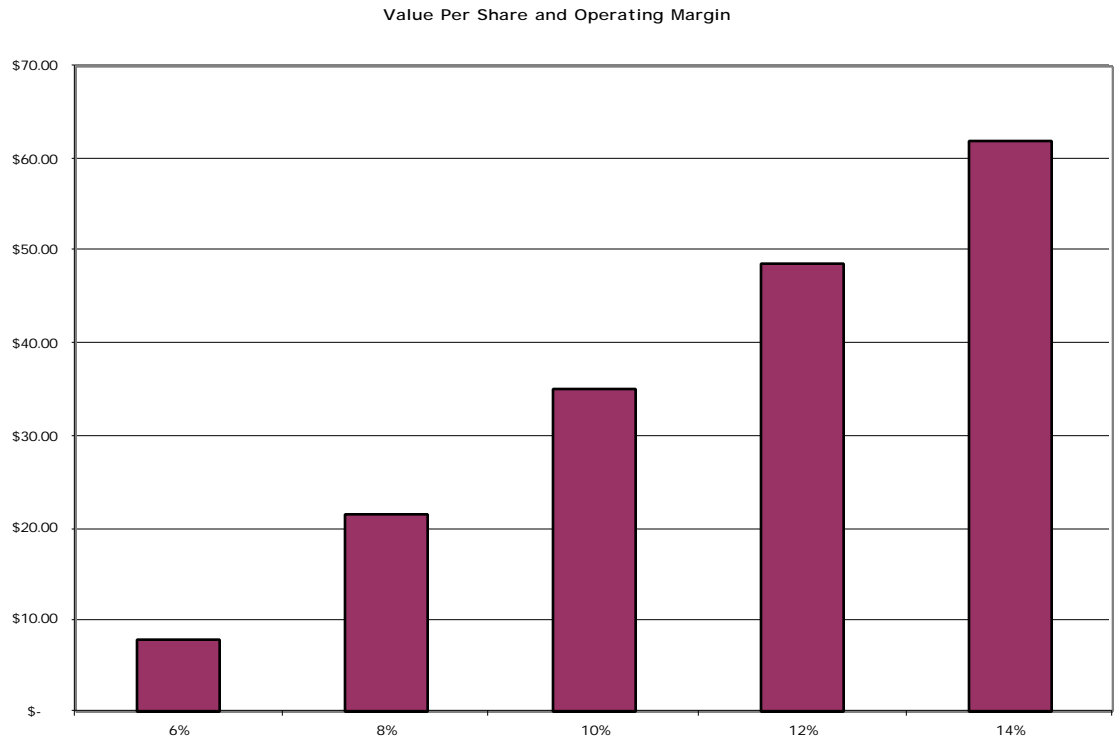
Illustration 11: Value Drivers for Amazon.com

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:



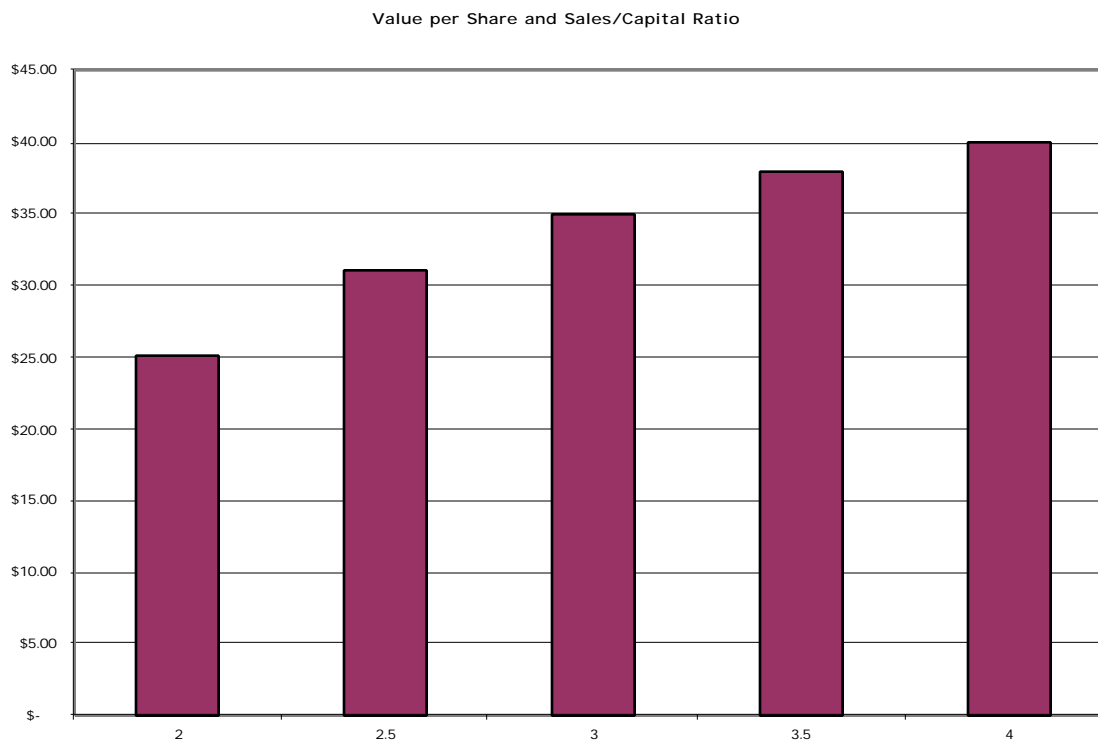
Note, though, that we are talking about compounded growth. At a 50% compounded growth rate, the value per share would be in excess of \$ 60, but revenues in year 10 would have to be \$ 64 billion. This is in contrast to our base case assumption where revenues grow to \$ 38 billion in year 10. If compounded revenue growth were only 30%, the value per share would be only \$ 20.

The second is the sustainable operating margin. We assumed that it would converge on the industry average of 10%. The value per share is extremely sensitive to this assumption:



If the pre-tax operating margin were to be 14% instead of 10%, the value per share would increase to \$ 60. 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 10%, the value per share will drop significantly.

The final input that we were interested in analyzing was the assumption that reinvestment requirements would be based upon a sales to capital ratio of 3. Changing this assumption can affect value significantly:



Our assumptions about reinvestment rates had a smaller effect on the value per share at Amazon.com. The sensitivity would increase if we changed the return on capital in stable growth from the 20% that we use in the base case.

In conclusion, it is worth noting that we can justify Amazon's price per share (of \$ 84 at the time of this analysis) under certain circumstances, just as we can justify the market price of any security. The table below summarizes the value per share, as a function of expected operating margin in stable growth and compounded revenue growth over the next 10 years.

	<i>Pre-tax Operating Margin</i>				
	<i>6%</i>	<i>8%</i>	<i>10%</i>	<i>12%</i>	<i>14%</i>
30%	\$ (1.94)	\$ 2.95	\$ 7.84	\$ 12.71	\$ 17.57
35%	\$ 1.41	\$ 8.37	\$ 15.33	\$ 22.27	\$ 29.21
40%	\$ 6.10	\$ 15.93	\$ 25.74	\$ 35.54	\$ 45.34
45%	\$ 12.59	\$ 26.34	\$ 40.05	\$ 53.77	\$ 67.48
50%	\$ 21.47	\$ 40.50	\$ 59.52	\$ 78.53	\$ 97.54
55%	\$ 33.47	\$ 59.60	\$ 85.72	\$ 111.84	\$ 137.95
60%	\$ 49.53	\$ 85.10	\$ 120.66	\$ 156.22	\$ 191.77

The shaded areas represent the combination of assumptions that would give us a value greater than \$ 84 per share. 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 portfolio²⁰ 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.

²⁰ 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.

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 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	Market Value of	Revenues	PS Ratio
--------------	-----------------	----------	----------

	Equity		
America Online	40111.236	\$ 2,937	13.66
CNET	902.02	\$ 48	18.94
EarthWeb	317.975	\$ 2	138.30
Excite	2525.304	\$ 117	21.66
IDT Corp	641.478	\$ 335	1.91
Infoseek	1072.89	\$ 63	17.07
Lycos	2188.9	\$ 56	38.98
MindSpring Enterprises	1678.56	\$ 92	18.15
Periphonics Corp	150.255	\$ 125	1.20
PSINET	971.25	\$ 201	4.84
Spyglass	326.65	\$ 21	15.89
Sterling Commerce	3320.5	\$ 490	6.77
Sykes Enterprises	795.825	\$ 385	2.07
Yahoo!	18950.4	\$ 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.

Problems in Comparison

Differences in price to sales ratios (or any other multiple) can usually be explained by differences in the fundamentals of firms within a sector. Thus, in the software sector, differences in price earnings ratios can be explained by differences in expected growth rates across these firms. In the financial services sector, differences in price to book value ratios can be explained by differences in returns on equity across firms. In the retail sector, differences in price to sales ratios can be explained by differences in net profit margins. However, differences in multiples across young firms with significant growth potential cannot be easily explained by looking at differences in current profitability or risk measures. This is because these firms are being priced by the market based upon expected profitability and growth in the future, rather than current profitability. There are two solutions to this problem:

- Compare a multiple across firms but control for differences in variables that are likely to be correlated with future profitability and growth. This may include qualitative variables, such as whether a firm has a patent or other barrier to entry, and quantitative variables such as how much cash a firm possesses. (Firms with more cash are more likely to survive and become profitable in the future)
- Apply a multiple, estimated by looking at more stable firms in the business, to future revenues, earnings or cash flows, to derive a future value for the firm. This future value can then be discounted back to the present to yield a current value of the firm. In fact, if the firm is expected to have negative cash flows, between now and the future value, the present value of these cash flows can be estimated and subtracted from the present value of the multiple-based estimate.

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 year²¹)

²¹ 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.

- 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 alternative approach to valuing Amazon is to apply the value to sales ratio of specialty retailers to Amazon's expected revenues in year 5. We chose year 5 because Amazon is a more stable firm in year 5, with lower growth and positive operating margins.

$$\begin{aligned} \text{Expected Value in year 5} &= \text{Expected Revenue in year 5} * \text{Value/Sales Ratio for retailers} \\ &= \$ 19,059 \text{ million} * 1.15 = \$ 11,980 \text{ million} \end{aligned}$$

The value of Amazon as a firm is \$ 11,980 million²². Adding the value of cash and marketable securities (\$ 26 million), subtracting the value of debt (\$ 349 million) and the value of equity options (\$2,892 million) yields a value for equity of \$8,765 million and a value per share of \$ 25.72.

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 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

²² We could add the present value of our estimated free cash flows from years 1 to 5 to this, but that would take away from the prime reason for using multiples in the first place- simplicity.

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.