

Web Appendix II

Estimating Valuation Ranges with Detailed Example

As we have seen, there are usually only three and at most four drivers of value for a company. If revenues increase at some rate, the company converts those revenues into profits at a certain proportion, the excess profits are invested in such a way to allow cash flows to grow at a certain rate for a certain amount of time, and cash flows grow in the years after that according to a structural growth pattern, the calculation of the fair value of the firm is simple to determine.

The factor that makes valuation difficult—in addition to our behavioral biases that cause us to make it more difficult than it should be—is that none of the drivers of value can be known with certainty ahead of time.

Most analysts and investors try to pick the single “right” future outcomes of a company, but in my opinion, most of the time, those that forecast correctly are more likely to be lucky than skillful. Modern publicly-listed companies are enormously complex, geographically sprawling entities, and it is devilishly hard to get an accurate view of the present state of a company, let alone trying to accurately forecast its future state. Also, as much as we like to deny it, random chance—or what fancy financial theorists like to call “stochastic variability”—has an enormous effect on companies in the same way it has on human lives. This implies that even if we understand the present situation of a company with perfect accuracy (which is impossible anyway), we will likely not be any more accurate with our forecasts of the future.

Because of the enormous difficulties in making an accurate forecast—either of future conditions or of value—I believe it is more sensible, effective, and honest approach is to approach valuation from the standpoint of best- and worst-case scenarios for each of the valuation drivers, as we created in the preceding Appendix.

When one hears the phrase “worst-case scenario,” pessimists will imagine a 5-mile wide asteroid striking the earth and wiping out all plant and animal life, while optimists will imagine a low-single revenue growth rate next year for their favorite company. While both of these scenarios have some probability of occurring, using extremes like these is not terribly useful for valuing companies, so let’s define terms a bit.

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When creating valuation scenarios, we want to determine high and low scenarios for each of our drivers such that the actual value should lie somewhere in between with a chance of roughly two out of three. To determine these scenarios, we must understand the historical and present context for each of the valuation drivers, but we in fact do not need to sweat the details too much.

For example, assume we have thought about revenue scenarios for a company and have decided that over the next five years, about the best we can expect is 7% per year and about the worst we can expect is 0%. You make the investment three months before the country goes into a recession that lasts for three quarters. Revenues at the company fall by 5% as clients decide to put off making purchases. The important thing to realize is that because you did not predict a recession occurring or a year of recession-driven revenue slowdowns does not mean your original revenue range was wrong. Let's say that the year after the recession, sales rebound at a strong rate of 10% driven by pent-up demand, then at a constant rate of 4% for the three years after that as shown in the following table.

<i>Year</i>	<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Revenues	100	95	105	109	113	118
Change		-5%	10%	4%	4%	4%

Even though years 1 and 2 are both well outside of the original range, the overall compound annual growth rate for these series is a little over 3 percent—well within our original 0%-7% range.

This is not to say that holding this stock during the first year will not be psychologically stressful, since it is almost guaranteed to be. Most market participants “value” companies by applying some multiple to a financial statement quantity like EBIT or EBITDA (e.g., “This company should trade for 9.7 times trailing twelve-month EBITDA.”). EBIT and EBITDA will certainly drop in the recession and it is likely that the multiple will also shrink as well. As such, the stock price is bound to go down. While psychologically painful, as long as you keep your head and do not realize a loss out of fear (and even consider buying some more of the stock when the price is lower if you have some cash on hand), if your long term projection for the other drivers are shown over time to be correct, your investment will move toward the valuation range you originally calculated.

Confident that we can usually assess companies’ operational dynamics well enough to generate ranges for our valuation drivers that are generally about right most of the time, we can start to create valuation ranges.

In this appendix, we will discuss two types of ranges—simple and complex. The former is often good enough—especially for companies with lightly levered companies with modest amounts of revenue uncertainty—but the latter is more useful in that it gives us a view at valuation nuances that the simple range cannot express.

Generating Valuation Ranges

We conclude the appendix with a continuation of the example valuation of Oracle begun in the preceding appendix.

Vocabulary introduced in this appendix is as follows:

Expected Value

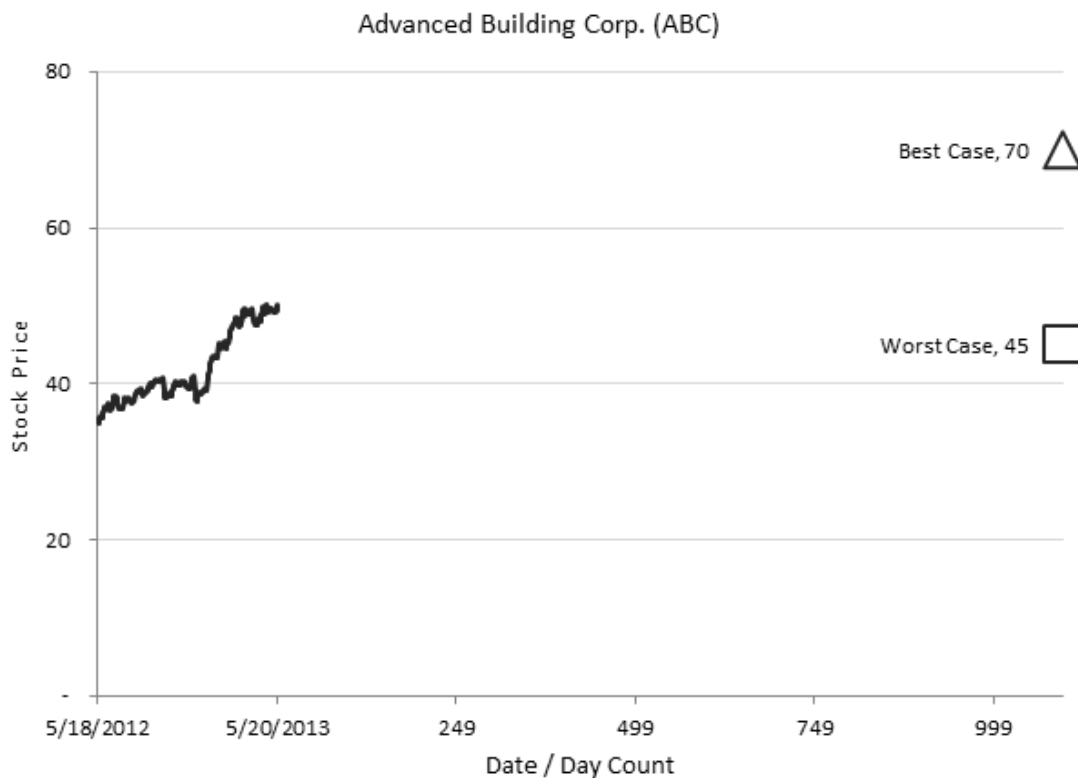
Margin of safety

The Simple Valuation Range

Simple valuation ranges contain only two values, derived by assuming the valuation drivers will all be best-case (for the upper end of the range) and worst-case (for the lower end).

Revenues	Profits	Medium-Term Growth	Valuation Projection
Best	Best	Best	High
Worst	Worst	Worst	Low

Calculating these fair value ranges and overlaying them on an historical price chart, we get something that looks like this:



I always plot my valuation range at three years in the future. No listed option tenors extend out that long, but placing my markers here allows me to remind myself to keep a longer-term investment horizon.

The width of the range should tell us something about how great the uncertainty is underlying the business. If the firm has operational or financial leverage, or if its revenues or medium-term growth prospects are very uncertain, this range should be pretty wide. A mature company with predictable revenue growth and low to moderate amounts of operational and financial leverage should have a much narrower valuation range.

The nice thing about using a range approach to investing is that it helps in decision making after you make the initial investment and you start receiving operational data from the company.

For example, if you projected economic profitability margin to be, worst case, around 4% and, best case, around 8% per year, as more and more quarters of operating data come in, you can compare your worst and best case profitability scenarios with the actual numbers. Of course, this can and should be done for each valuation driver as well on a periodic basis—let's say quarterly or semiannually. Doing this—framing one's valuation in terms of a range and evaluating it on that basis—actually helps people conquer the behavioral biases I discuss in Chapter 6.

If, as new data comes in and one compares actual results to one's projection, it should start to become clear whether the results are:

- 1) Closer to the worst case scenario
- 2) Closer to the best case scenario
- 3) Materially different from either of the two scenarios

Each of these possibilities has different implications—the most serious one being the third. If you are receiving information that is materially different than your projections, you must go back to your analysis and figure out the root cause of the discrepancy. Financial projections are a reflection of the analyst's understanding of the company and its economic environment, so if one's projections are materially out of line with the performance, one must understand the factors that lead to the discrepancy.

Let's return now to our analysis of the fair value range diagram above. This chart uses made-up data points, but even from this manufactured example, a clear picture of potential risk and reward begins to emerge by looking at this graph. The worst case valuation is \$45 per share—10% below the present stock price. The best case valuation, on the other hand, is \$70 per share—40% above the present stock price. Depending on how likely you think either scenario is, the balance point between the two—our expected value in the statistical sense—shifts up or down according to the probability-weighted average price.

If you think the best case is moderately more likely than the worst case, you could weigh the two values as follows:

Generating Valuation Ranges

$$\text{Expected Value} = 40\% \times \$45 + 60\% \times \$70 = \$60 / \text{share}$$

With a present market price of \$50 a share, we are left with a potential investment with the following characteristics:

Scenario	Return
Worst Case	-10%
Best Case	+40%
Expected Case	+20%

While the return to the best case looks attractive, the return to our worst case scenario generates a loss and our return to the expected case is not very large. Depending on the underlying uncertainty of the business, this might be a reasonable bet to make, but it doesn't strike me as a very compelling prospect.

Complete Valuation Range

In the simple range, we used only the following:

Revenues	Profits	Medium-Term Growth	Valuation Projection
Best	Best	Best	High
Worst	Worst	Worst	Low

However, because we have three drivers, we should be able to mix best- and worst-case values for each of the drivers to create intermediate valuations, bounded by the best and worst case scenarios of the simple valuation range.

Since we have two scenarios applied to three drivers, we have $3^2 = 8$ scenarios in total, as follows:

Revenues	Profits	Medium-Term Growth	Valuation Projection
Best	Best	Best	Highest
Best	Best	Worst	Intermediate
Best	Worst	Best	Intermediate
Best	Worst	Worst	Intermediate
Worst	Best	Best	Intermediate
Worst	Best	Worst	Intermediate
Worst	Worst	Best	Intermediate
Worst	Worst	Worst	Lowest

While it helps to calculate the fair values under each of the scenario combinations, doing so without a spreadsheet application can test one's patience and open oneself to simple calculation errors. On the

Intelligent Option Investor's [IOI Tools website](#), we have a valuation tool that has the functionality to create this type of complete valuation range, so please feel free to use that in your own analysis.

The big advantage of these intermediate valuations is that in making them, one must think of the reasonability of each combination and also how likely each one seems. Assessing reasonability involves comparing your projections under each scenario to historical results. If the two are very different (for instance, you notice that your best case profitability scenario has an average profitability over five years that is 300 basis points higher than any other five-year period in its operating history), you may want to go back and adjust your valuation drivers (or simply be aware that this case is making a big assumption regarding the firm's ability to increase profit and have a sound reason why such a thing might be possible).

Looking at each scenario individually also allows one to assess how likely the particular combination of drivers is, given one's understanding of how the company works. For example, let's say that we are modeling a company that has already been growing its revenues at a quick pace for an entire 12-year business cycle, then some. Competition is increasing and you know that they will either have to drop prices to try to spur customer demand and future revenue growth, or they will accept lower revenue growth while trying to preserve their profit levels. Clearly, in this case, best case revenues and best case profits do not make sense given what you know about the competitive environment. As such, you should throw that scenario away and chose the next highest valuation as the best case valuation.

Going through each of the scenarios one by one—assessing the reasonability of each driver input value vis-à-vis historical values and thinking about the reasonability of specific combination of these drivers—will give you a much richer, and probably more accurate valuation range in the end.

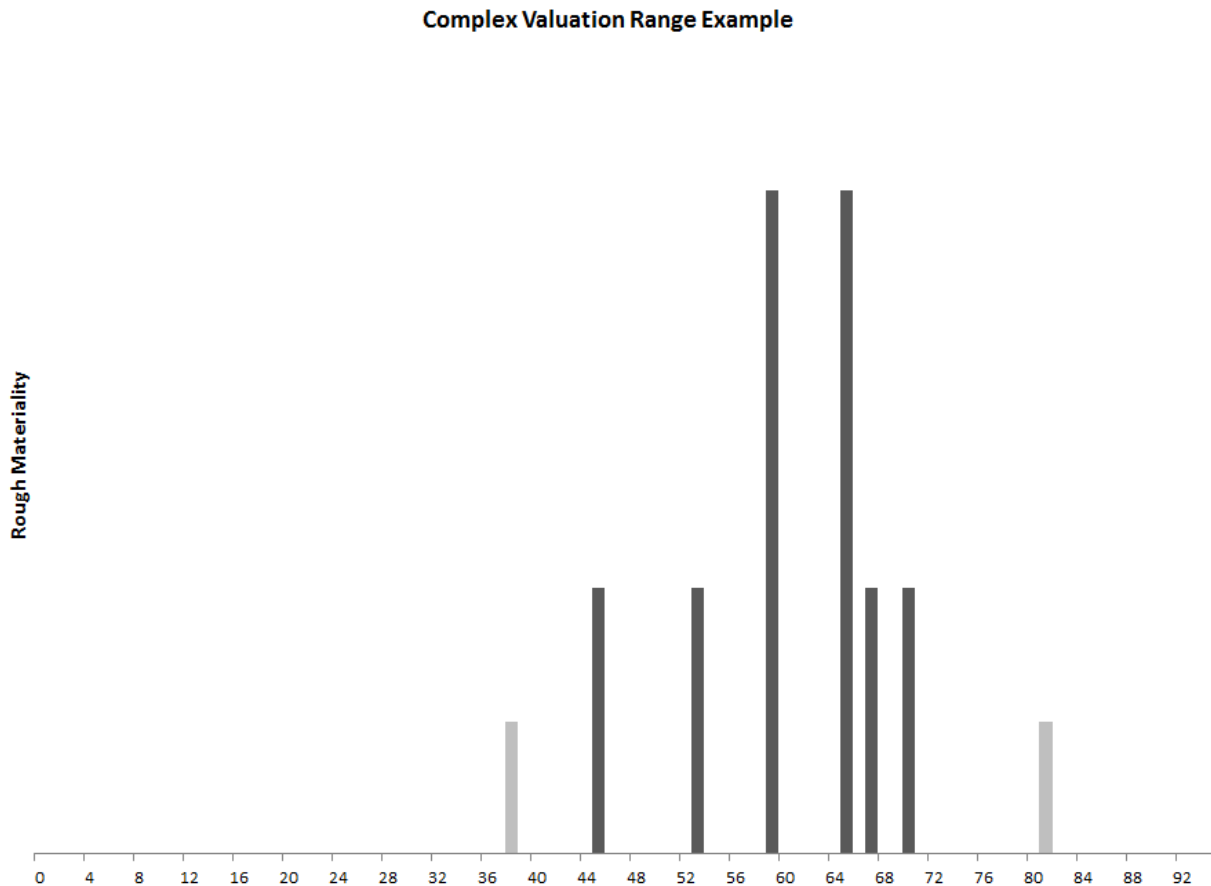
In general, the process of valuation is iterative and requires, at each step, some consideration and insight. It would be nice if one could simply input a few numbers, press a button, and voila, know what the correct value for a company is, but unfortunately, valuation is not so simple-minded a process as just pushing a button (don't trust anyone who says it is).

Once we run each of the eight scenarios, we end up with a table like the one below:

Revenue Case	Profit Case	Med-term Growth Case	Valuation Projection
Best	Best	Best	\$81
Best	Best	Worst	\$70
Best	Worst	Best	\$67
Best	Worst	Worst	\$65
Worst	Best	Best	\$58
Worst	Best	Worst	\$53
Worst	Worst	Best	\$45
Worst	Worst	Worst	\$38

Generating Valuation Ranges

This tabular display is fine, but it is also nice to have some graphical representation to give your X-System something to work on. In my own work, I like to use the BSM cone graphs of simple range above when I am considering different option investment strategies. However, to develop a better understanding of the valuation itself, I use a graphic version of the table above that looks like this: (a tool to create this type of graph is also included on our website):



Let's say that I have already analyzed the scenarios and decided that I thought the scenarios that generated values of \$58 and \$65 / share were most likely, that the valuations at each of the shorter blue bars, and that there were two scenarios that didn't make any sense to me from an economic standpoint (\$38 and \$81 / share).

Note that this graph gives me the same range of \$45-\$70, but that the valuation I am expecting is tending toward the higher end of the range—from \$59 to \$70 / share. The two scenarios that after careful consideration I believe to be the most likely ones are at \$59 and \$65 / share, giving an expected value of \$62 (assuming an equal weighting between the two likely scenarios).

Note that through all of this, I am not trying to get overly (and likely mistakenly) precise by assigning some probability to each scenario. I really have no way of assessing that or knowing whether one scenario

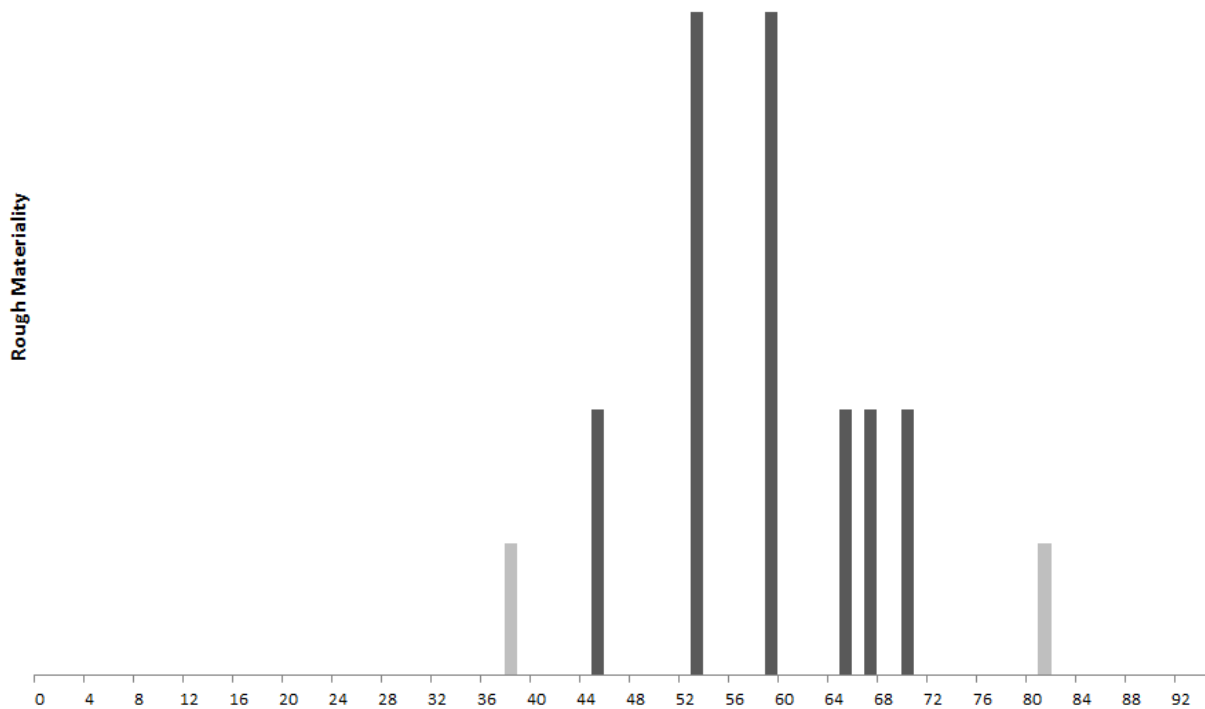
has 27% chance of coming true or 32% or whatever. I am just trying to identify the valuations that have some material chance of occurring, which ones I think are most likely among those material chances, and which ones are not likely, given what I know about the company and its situation.

So if we were to use this complete valuation range diagram, we would get a slightly different picture of the risk / reward trade-off for this investment. Our table summarizing the investment would look like this:

Scenario	Return
Worst Case	-10%
Best Case	+40%
Expected Case	+24%

Worst and Best Cases haven't changed at all, but the margin of safety looks better. It still doesn't strike me as that compelling of an investment, but it is a lot more compelling than this one:

Complex Valuation Range Example



Here, the range is the same—\$45 to \$70—but the most likely values are tending toward the low end of the range. Also the two valuations identified as being most likely—the ones at \$53 and \$59—imply a most likely value of \$56. If we were to redo our overview table with these scenarios, we would get:

Generating Valuation Ranges

Scenario	Return
Worst Case	-10%
Best Case	+40%
Expected Case	+12%

If the previous investment was not that compelling, this one is certainly one we should pass up as it looks like it has roughly an equal chance of falling 10% as it does rising by about the same amount. This is not an investment but a bet on a roulette wheel!

Obviously, as countless value investors have pointed out before me, we want as large of a margin of safety as we can find before making an investment.

If we can, in addition, find an investment opportunity whose worst case still gives us at least a 0% return and a best case that might give us a return of say 75%, we would certainly want to commit capital to it. This is the essence of tilting the risk / reward odds in one's favor, and is the summum bonum of Intelligent Option Investing.

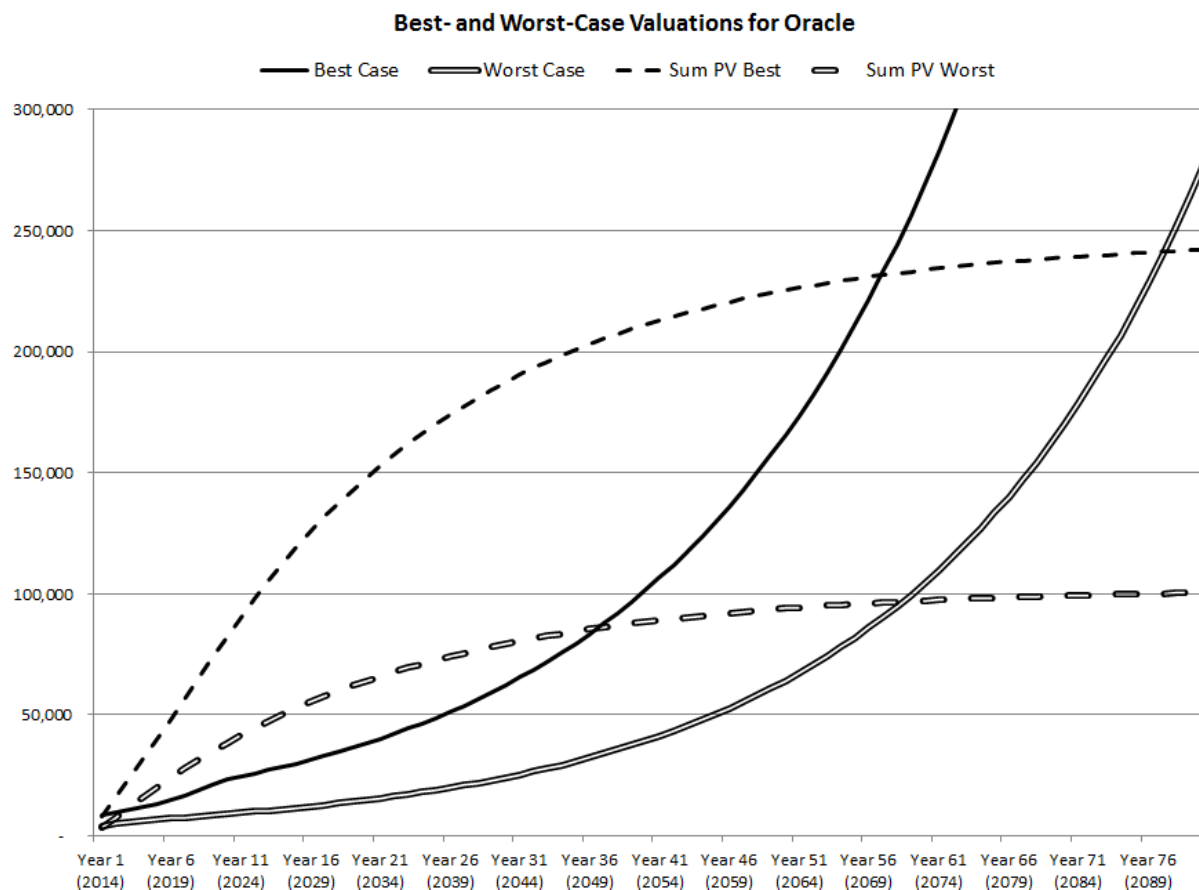
Valuation Ranges for Oracle

With this theoretical understanding of valuation ranges, let now turn to our Oracle valuation to see how this process might work in practice.

For Oracle, we have assumed the following:

Driver	Best-Case	Worst-Case	Time Frame
Revenue Growth	8%	3%	Years 1-5
Profitability	35%	29%	Years 1-5
Investment Level % Revenues	12%	15%	Years 1-5
Medium-term FCFO Growth	12%	6%	Years 6-10

If we use the best- and worst-case assumptions and calculate FCFO over the next 80 years, then convert into graphical format, here is what we get.



The nominal value of the best-case cash flows are literally off the chart, but the net present value of the future best-case cash flows flattens out above \$250 billion if the full perpetual value formula is used. At the present-day share count, that works out to roughly \$59 per share. The net present value of the future worst-case cash flows flattens out at a value of over \$100 billion, which equates to roughly \$24. If we weight each value equally, we get an expected value of \$42 per share.

When I first started looking at Oracle as an investment opportunity, it had disappointed on quarterly earnings and the stock price had fallen to around \$30 per share. At this price, the overview graph of my prospective investment looked like this in tabular format:

Return to	Return
Best Case	97%
Worst Case	-20%
Expected Case	+40%

I don't much like the "Return to Worst" number, but the "Return to Best" looks good, and it seems like the prospective investment is skewed to the upside, which is, of course, good as well.

However, when I was thinking about the economics behind both of these cases, I decided that neither was particularly realistic in terms of Oracle's business environment. This is an important thing to consider

Generating Valuation Ranges

using a spreadsheet model or some other form of mechanical calculation: just because a model is spitting out some result according to a pre-set formula doesn't mean that that number means anything in the real world. "Garbage In, Garbage Out" is a famous saying in the world of computer science, but is too often forgotten in the world of finance.

When I ran the valuation for every driver combination, I came up with the following table:

Stage I Avg Rev. Growth	Stage I Avg EP Margin	Stage II Growth	Fair Value per Share ¹
8%	35%	12%	59
8%	35%	6%	47
8%	29%	12%	44
8%	29%	6%	35
3%	35%	12%	41
3%	35%	6%	33
3%	29%	12%	30
3%	29%	6%	24

As mentioned earlier, after thinking about the economics of Oracle's business, I concluded that the best- and worst-case valuations were unreasonable from a practical perspective. In addition, I identified two valuation scenarios as most likely—this was the one generating a value of \$35 per share and the one generating a \$41 per share fair value. Of these, I thought the \$41 value was slightly more likely, but simply weighting these two values equally, I found a fair value of \$38 per share. My revised investment summary (assuming a price of \$30 at the time) changed to this:

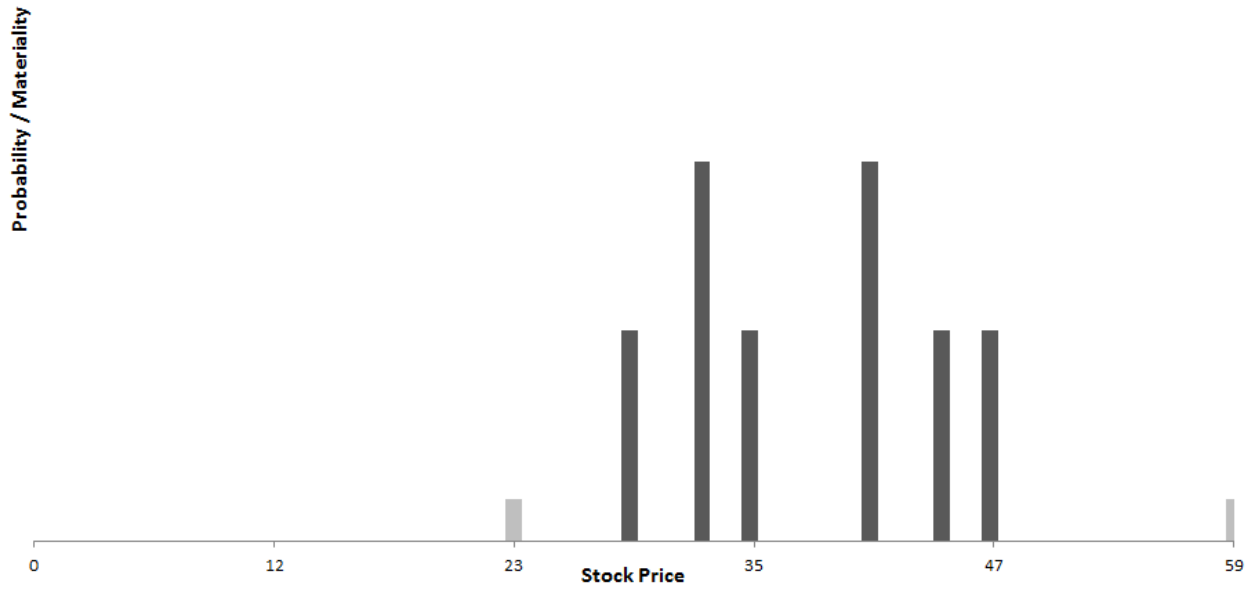
Return to	Return
Best Case	57%
Worst Case	0%
Expected Case	+27%

In other words, according to my analysis, even if Oracle faced some very negative operating conditions, I would still break even on my investment. If, on the other hand, some things went well, I would generate positive or strongly positive returns. Keep in mind that the returns above are unlevered ones. I knew that if I used modest leverage on the above on the order of -1.5 / 1.8 or so, I could probably generate a very nice profit with very little valuation risk.

Here is the graphical format of my valuation scenario table:

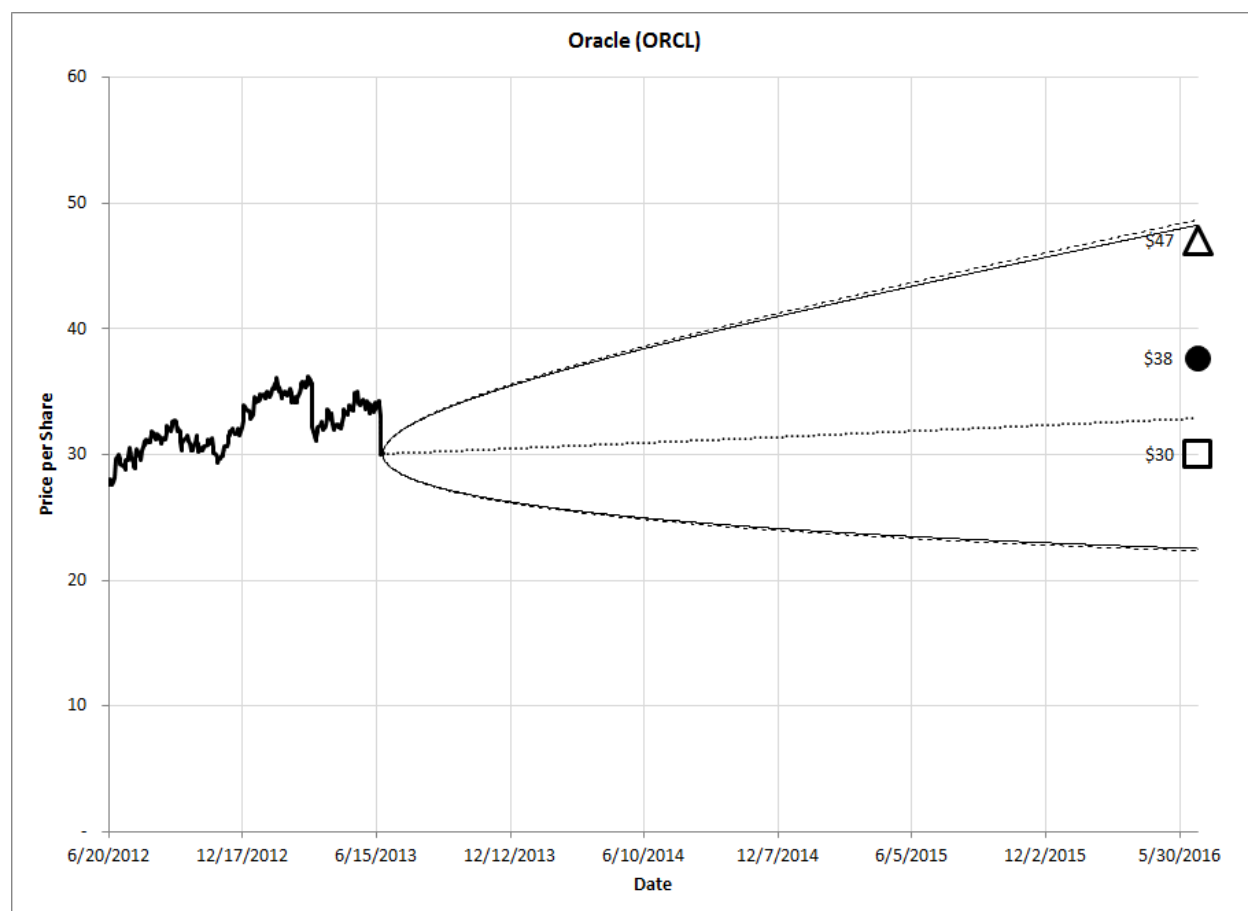
¹ Note that the best- and worst-case valuations are a little higher in this table than the prices referenced in the discussion of the simple valuation range for Oracle. That is because the earlier discussion only eyeballed the values and did not extend in perpetuity, whereas the numbers here were generated precisely using the full discounting formulas.

Complex Valuation Range for Oracle



And here is the revised BSM cone diagram:

Generating Valuation Ranges



Looking at the valuation diagram, I noticed that the scenarios tended to cluster at the upper end of the revised range, and that the analysis seemed pretty robust to fairly large differences in operating conditions (meaning even by making some pretty extreme revenue and profitability assumptions, the calculated fair value did not change by very much).

Looking at the BSM cone diagram, I noticed that there seemed to be some overvalued downside exposure, so selling put options sounded attractive to me. Even though the upper end of my range corresponded to the outer edge of the BSM cone (implying no misevaluation), my expected value was well above the 50-delta line, so I knew the upside was undervalued.

Thinking about this, I decided to enter into a three-part strategy:

1. Buy the stock at around \$30 per share.
2. Buy ITM call option LEAPS struck at \$20 per share
3. Enter into a long diagonal strategy with two-month puts struck at \$30 and call LEAPS going out about a year and a half struck at \$37 per share.

I originally only entered into a position about half the size that I considered optimal since I thought there would be an opportunity to invest more at a more favorable price. I was too smart by half, though, as after entering the position, the stock just kept moving higher.

The 30-strike puts that had subsidized my purchase of the highly levered call LEAPS expired worthless, freeing up \$3,000 worth of margin per sold put contract and made the OTM LEAPS even more highly levered (since with the put sale subsidy realized, my net realized cost for the OTM puts was practically nothing).

The stock moved up into the mid-\$36 range, and I considered closing the 37-strike puts, which had had a very handsome unrealized profit, but decided to wait a bit. Two sell-side investment bank analysts downgraded Oracle just after I decided to hold onto the position, and the stock dropped nearly 10% over a few trading sessions. The sell-side analysts had downgraded the stock before Oracle announced quarterly earnings, probably knowing that Oracle had missed expectations for a few quarterly earnings before, so wanted to get ahead of the earnings miss and look like genius heroes. A week later, Oracle surprised on its quarterly earnings (with values that were well within my forecast drivers' ranges) and it gained back all of its previous losses and then some—trading up as high as \$37 per share.

I ended up closing the 37-strike LEAPS when they were trading at 50-delta, and now, as the stock is trading up in the \$38 per share range, am considering reducing my leverage again by taking profit on the 20-strike LEAPS, but holding on to the stock for a bit longer.

My idea behind closing the 37-strike LEAPS were as follows: First, the stock price was very close to my expected value per share, and it didn't make sense to have as much exposure to the investment when my expected return was so small. Second, the 37-strike LEAPS had started out as a very highly levered investment with little time value. After increasing in price, their deltas hit 50, meaning that time value was maximized. In the spirit of buy low, sell high, I closed the position.