

Lecture Text

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Know Your Worth: Critical Valuation Errors to Avoid

(edited for clarity)

Introduction

Welcome. I'm particularly delighted to see you here today because the title of my talk, "Valuation Errors," describes my collection. Other people collect stamps, knickknacks, antiques; I collect valuation errors. The collection has been forming for about twenty years. Things come in and things come out depending on what's new and interesting that I see. These are things I've picked up through about twenty years of teaching and case development and research, with a little bit of consulting on the side. All of these errors are real. They're also all anonymous. I will hold the identity of all participants confidential in hope that you may make some contributions through time.

Now, I want to say that I'm going to go through the errors not so much to make fun of the people who make them, although that's pretty good, but mainly because I think that when we learn how the system gets stressed, we see the errors. We see how to avoid errors in the future and how to improve practice.

The Major Components of Valuation

I've organized this talk roughly around the major components of valuation: forecasting the cash flows; getting some notion of terminal value; discounting; and then combining it in a reasonable way to come up with value. And we'll go through errors in each one of those. But before we do that, I wanted to just talk about a big picture item.

One of the things that always strikes me is that valuation seems so simple, right? As we've just talked about, there are only four components. We'll talk about errors in each component, but it's only four components. So you wonder how people goof it up so much, right? I mean, it seems so simple. The only analogy that I can make that resonates to me is golf. Do any of you people play golf? If you think about golf, it's really simple, right? Now, I don't play golf. I ran out of clubs. I tried, but when you think of a sport, what could be simpler than golf? First of all, the ball doesn't move, right? It's not like you have to hit a moving ball, something the Red Sox are having trouble doing these days, catching or throwing it as well. But the ball just sits there. The hole doesn't move, either. Right? And it's not that you have to somehow optimize your swing for each particular course or each particular situation or weather conditions. After all, you only play golf when the weather's good. So why is golf hard? I think we'll all admit it's about the most frustrating sport in the world, but it seems like it should be very simple. And I would argue that it's because of little things, it's the little things that drive you crazy in golf. Are you having evil thoughts? I see your ear is twitching while you swing; you really need to work on that. The little things drive you crazy in golf.

And I would contend that in valuation it's often the same thing. It's little things that often don't matter, but sometimes they matter a lot. And I think you'll see that theme in some of these errors; sometimes it's not that you got a big thing wrong, but that just a little thing is enough to drive you crazy.

Forecasted Cash Flows

But we'll start off with a big thing, which is forecasting cash flows. I think we all agree that it's just about the most important thing you can do in terms of financial management. The most important case, the most important thing in corporate finance, I think, is forecasting cash flows and making some sense of whether they're reasonable.

Error #1: Forecasts

So here's the first error. Do you remember the case method? What do you think? This is a manufacturing entity. I'll tell you a little bit about it. They manufacture stuff. They've engaged in a major capital expenditure program to update a factory and they anticipate future sales growth. What do you think? Does that look like a good forecast to you? How do you tell? Does this forecast have an unusual shape? How many of you guys have seen forecasts that look like this? Every forecast looks like the one I've got on the board, right? So how do you tell? Some go up more rapidly. We'll see some of those in a little bit. Some have that famous kind of hockey stick look, right? But how do you tell? How do you tell if this is reasonable? Is this a common problem? Yes. So what do you think? How do you tell?

___: A couple ways. One, you look to the past—have they been able to meet their projections? Are they establishing capacity to produce that? How is the market growing? What is the industry like?

PROFESSOR RUBACK: Great questions.

___: Is this the telecom industry of several years ago where Northern Telecom, Cisco, and AT&T were each going to achieve 100 percent of the business?

PROFESSOR RUBACK: Of the market, right. Well, let me tell you a little bit about it. This isn't nearly as exciting as telecommunications, just a manufacturing business. The one thing that's interesting, though, is if you look in their history and you look through this period, obviously you can see some sales growth in here. You can also see a lot of margin growth. Do you know what I mean by that? They have their profit margins growing throughout the time. Now, tell me, what do you think is easier to get, sales growth or margin growth? Sales growth is pretty easy. Is it hard to get sales growth *and* margin growth? If you don't care what profits are, it's pretty easy to get sales growth, right? I mean, you just give it away, right? So a reasonable question, I think, would start by saying, well, what would it look like if you achieved your sales growth but not your margin growth? Not a bad place to start. That's the next slide here. Some distance here, huh? These crimson bars are the forecast you would get growing sales but keeping margins the same. Now, if you focused in on the details of the situation you know that when the CFO saw this, he said, "No, that's cheating because you know we're in the middle of making a huge capital expenditure." And why do we do cap ex? What's the purpose of cap ex? Reduce costs. So if I reduce costs, what's going to happen to margins? They're going to go up.

So the gap here is the productivity of our capital expenditures. How do you gauge that? Larry had some suggestions looking in the past, right? Most companies, this one included, have a long history of making capital expenditures on these kinds of plans. And so to get a gauge of this we said, "Well, why don't you show us your best cap ex over the last five years?" We took their best capital expenditure, assumed that growth and profitability per dollar invested, took the dollar invested. So we're just going to say, let's imagine you get as much margin improvement on your new cap ex as you got on all your cap ex in the past, or you got on your best cap ex in the past. And when you do that, you add those light blue bars to the forecast.

There's still a lot of distance here, right? And you wonder where that comes from. Interestingly, when I presented these forecasts, I was told that they had really done two forecasts: the one they showed me and then another one, their conservative forecast. So what this company really had was a best-case forecast and a conservative forecast. Now, they were looking at valuing the enterprise based on the best case forecast.

It is one of the most shocking things that happen, I think, when I talk to people about how they do valuation and go through particular cases. I ask them, "Oh, that was a great forecast, very detailed. Thank you, it's perfect. Terrific, I really appreciate it. Great, great, good job, good job." I say, "Now, I have a question. In this best case, can things get any better?" "Oh, no, this is as good as it can get." "So in the worst case, in the conservative case, could they get any worse?" "Oh, yes. They can get a lot worse. No, our conservative case assumes we meet all our targets." "What's your downside?" "Well, you know..." That's bad. But I think it's really common management practice.

What you'd like in your cash flow forecasting are some measures of expected cash flows. Not the most likely, but some probabilistic, expected value of your cash flow. The way to get that is sometimes to predict an upside and predict a downside, maybe even predict a mid-case. But they have to be reasonable. The downside has to be a real downside, not "I still meet all my targets and get my bonuses," right? Because things do get worse than that on occasion and that should be reflected. So this is the first of my valuation errors. It's these over-optimistic valuations together with no real reality check of the forecasts.

Error#2: Cycles

Next one. You're going to love this. This is one of my all-time favorites. This is the cash flow forecast beginning in '96. They're a building-materials manufacturer, like drywall, roofing shingles—stuff you use to build houses. This was the forecast the CFO gave me. What do you think about that forecast? No cycles, right? Now, I gave you a hint about cycles. You probably would have picked it up anyway, right? But that's the forecast. Now enjoy this. This is the forecast. You'd think it depends on housing starts. This is the history of housing starts and yet this is the forecast they give, right? So you got this. Results? Underlying data. Does that make sense to you? Doesn't make sense to me. So I asked the CFO, "Why don't you build in these cycles? I mean, I don't know much about the housing business but I see there are cycles. Why don't you build in cycles?" You know what the CFO said? "We don't know when they'll occur. It's not that we don't believe they'll never occur. We don't know when they'll occur."

So you pick a date and you present a cyclical cash flow that comes down here, or something like that. What's going to happen when you present that to the board? What are they going to spend all their time doing? Arguing about whether that's the right date. So the CFO said, "Every time I present a cyclical forecast, they argue with me. So I'm just going to present a flat one."

It's really remarkable. So this prompted me to think about the question, couldn't you do it better? It's easy to make fun of the CFO, but could you actually do it better? And you notice there's some regularity to these cycles, right? You notice that they sort of look like people. You know, tall and skinny, short and fat. And if you focus on it, it looks like—and maybe I focus too much on it—but if you look at it, you can see that it's like the area under those curves is all the same, right? Doesn't it look like that? That some cycles are short and steep, short in duration and steep, and some cycles are long but less steep in duration. But the total effect seems equal. And it turns out that that's roughly true.

And so it turns out that if you plot these instead of on time but as a fraction of the cycle, you get this enormous regularity. So that means what you could do is just splice this cycle onto the cash flow data that you had, right? Just splice it; just tie it together. Which is what you see in the next slide.

Now, what's going to give you a higher value, this orange line with the splice or the yellow line?

___: The yellow line.

PROFESSOR RUBACK: A little bit or a lot?

___: A lot.

PROFESSOR RUBACK: A lot!

___: More area under the curve.

PROFESSOR RUBACK: Yes, there's much more area under the yellow curve, right? This is a big deal. You know, so yes, they touch every once in a while but that's not really what the game is. Now, of course the forecaster came back and said, "No, you don't understand. We think that there's going to be enough housing cycles so that the yellow line goes through the middle of the cycle." Interesting hypothesis. It turns out that because you know how many housing starts lead to particular sales, you can actually infer how many housing starts you need to make this yellow line go through the middle of the orange line. It's kind of funny. Here it is. This is the housing starts data that you saw before, and these are the housing starts you'd need. So you'd need to sort of double the amount of housing in the United States to make this work. A little bit crazy.

Before we leave these cyclical cash flows, I want to talk a little bit about the valuation effects. Steve pointed out the reason why this CFO didn't want to put in the cycle is because the CFO didn't know when the cycle would begin. And so it's hard to get precise valuation. To get a sense of the impact of the cycles, though, what I did was I just said, "Well, suppose it starts in '96. Suppose it starts in '97." Just give it a whole different year. Give ten years of supposing that's the first year of cyclical downturn. And what you see is that even if you assume you can postpone the cyclical downturn for ten years, you get half the value that you got ignoring the cycles. Half the value. So this notion that "we don't know what it is, so I think we'll ignore it" has just massive valuation consequences.

And if you look at some other industries, for example the auto industry, you'll find that people complain about these large cash savings and they make these big projections and say, "Well, the auto industry is only selling at a four or five times multiple. Why is that?" Well, one reasonable explanation is that the marketplace understands that it's a pretty cyclical business and that when they're working at 95 percent capacity, they make a ton of money. But when they don't, they lose a ton of money. So that's number two.

Error #3: Consistent forecasts

Number three. This is a different kind of company. This company manufactures and delivers food. Think about it as a food distributor, frozen foods. And the question here is about forecasting again. They needed to do a forecast for the future, for planning purposes and valuation purposes. I just wanted you to pause and see if these were the things we taught you to do at the Harvard Business School. Revenues—they said we're going to project historical growth tempered by current market conditions. Tempered meaning they flattened

them a little bit. Seem OK? You guys all get Butler Lumber at some point in your life or some other case like that? Seems about right. All right, number two, cost of goods sold. Historical margin based on sales. Some fixed fraction of sales. Seem right? Did I tell you that these cash flow forecasts resulted in wildly optimistic values? Working capital, constant percent of sales: How does that feel? Sounds right. Cap ex, historical levels.

___: No. Sales are increasing; your cap ex would probably get bigger.

PROFESSOR RUBACK: Cap ex would probably get bigger. What about the business? What kind of business is it in? Distributes food. What do you need to distribute food? Trucks. Distribution centers, right? If you distribute more food, do you need the same amount of trucks or more trucks? More trucks. So you'd be surprised if assets weren't closely related to sales, right? And here's some data. I love data. This was the company's history and this was the company's forecast. So as they've increased sales, historically they've had to increase cap ex, but in their projections, they kept it . . .

___: First two data points are good.

PROFESSOR RUBACK: First two data points are good and then it really flattens. Well, do they? Shouldn't it be over here? I mean, that matters a lot, too, right?

___: Oh, they're on the same scale.

PROFESSOR RUBACK: Yes, same scale. So thinking I quickly understood the issue here, I called them up and I said, "Nyah, nyah, I know what you did wrong." And I said, "Don't you know that your cap ex should be proportional to sales? You have to keep net assets roughly constant as a fraction of sales." Isn't that right? And the person said, "Yes, that's exactly the assumption we made." And then they sent me this model. They sent me an Excel model that basically had this formula in it—this is how they got to cap ex. They said, "We're holding our net fixed asset to sales ratio constant and then we're multiplying it by sales. That's telling us how many assets we need. We subtract out our existing assets and we add in our depreciation. That gives us cap ex. That's what we learned in business school."

Is that right? That's right. I don't want to strain anybody's recollection of accounting. That is right. So what's wrong? What did they goof up?

___: Depreciation.

PROFESSOR RUBACK: Depreciation. Very good. How'd you know that so easily?

___: One of four.

PROFESSOR RUBACK: One of four. Actually one of two, right, because it's hard to believe they goofed up sales, right? Required assets comes out of this. They could have calculated that wrong, but they didn't. They could have misestimated existing assets, but they didn't. That's just coming off the last audited financial statement, so it's depreciation. How could you goof up depreciation? Accelerate it? What happens if you accelerate it? Gets—?

___: Small, but they would do the inverse.

PROFESSOR RUBACK: Right, they would do the inverse, but how would you do the inverse? What does it mean to do the inverse? Decelerate your depreciation. How do you get a set of assumptions that lead to decelerating depreciation? You assume a greater life,

exactly. They said, "You know, we've decided that those trucks that only last us seven years are really going to last us fifteen." So as soon as you make that assumption, what happens to your existing assets? Suddenly you have a lot of them because they're depreciating less slowly. You don't need any cap ex. It's a beautiful thing. In fact, you can plot value as function of asset life. The longer you assume for the life of the asset means the less annual depreciation you need, the more value.

Now having said that, one of the things I find in looking at lots of forecasts is that underestimating cap ex seems to be number two or three on the hit parade of big errors. I don't know why that is, but it's something about capital expenditures—you assume some efficiency in capital that you've never been able to realize. It's like when I do my daily planner and I always work out for a twenty-seven-hour day. And I say, I'm forty-nine years old; you'd think I'd figure it out. Why do I always have twice as many things on my to-do list as I can actually get done? And I think that's pretty common for all of us. I think this is kind of the corporate equivalent of that. You always assume you'll get by with less cap ex than you do, but it just doesn't work.

Avoiding cash flow errors

Here are some overall hints on how to avoid cash flow errors. Test for reasonableness, of course. Using consistent assumptions is a big deal and something that you could work on to get the system right. Following the money is a useful way of trying to make sure you haven't left a significant cash flow out. And experiment with value drivers. By value drivers I mean, what's the underlying economics of the business? What if industry factors change? What if underlying demand changes? What if manufacturing opportunities change? Those are important things to do and it's odd how rarely they happen. And then lastly, my favorite: Please don't value your best outcomes; it's just crazy.

Terminal Value

I believe terminal value is the source of most mischief in valuation. As you know, terminal values account for somewhere between 50 and 70 percent of the value of most industrial companies. If you look at high-tech companies, of course it's over 100 percent of value because they have negative earnings and so future sales price is everything. And because of that, you'll see a lot of the interesting manipulations in errors.

Error #4: Terminal value timing

Terminal value timing is a pretty common one. This is my favorite example of that. This was an LBO of a company. Again, these are all anonymous, but maybe I can say that later on this LBO became known as the Texas chain store massacre. Here's what they did in the valuation of this case. They took earnings per share forecast over four years. They took the ending earnings per share, \$7.06, multiplied it by 17, and got \$120. Present valued it at the cost of equity, so that's \$84 a share. What's wrong with that? Forget about the mechanics here, if you will, of getting the cost of equity right. What do you think? Yes?

___: The multiple suggests a very high growth rate from that point forward.

PROFESSOR RUBACK: Growth rate? Yes, we'll get to that in a second. Fair enough. What about from here to here? What do you notice about this line? Slope changes.

___: The valuation of the near-term earnings.

PROFESSOR RUBACK: Yes? But what are the fourth-year earnings doing? Spiking up, right? So what effect does that have on the terminal value? Huge. Hey, do you believe that there's something about the management plan that causes earnings to spike up in the year

you do the terminal value calculations? What a coincidence. And you can see, if you look at the values, that they depend very much on how you've timed the terminal value here because you have those values growing at greater than the cost of equity in that last year because you've got the spike. There's no basis for the spike other than it leads to better values.

Interesting negotiating tool that I've tried a couple times, that always seems to work reasonably well, is to take the cash flow forecast that they've given you, shorten it by a year or extend it a year, and see if you get different values. If you've done everything consistently you should get the same values. Most of the time you do not. You get lower values, which leads to an interesting conversation.

Error #5: Inconsistent assumptions

This is another estimation of terminal value. Projected growth. Take the P/E ratio. So we have growth from 2002 to 2006. We take the P/E ratio in '02; we multiply it by the earnings in '06 to get the terminal value.

___: But what if it's a business that wasn't mature in 2002?

PROFESSOR RUBACK: Well, it wasn't, right, because it's got rapid growth there.

___: If it's mature by 2006. . . Lets say it's got a very high market share by then. Its growth rate has to diminish, and so the P/E multiple should come down.

PROFESSOR RUBACK: Right. And so by using that P/E multiple, what are you doing?

___: You're implying too high a value.

PROFESSOR RUBACK: Yes, you're implying too high a value. Sort of doubling up on your growth, maybe more, right?

___: You're assuming continued growth.

PROFESSOR RUBACK: At that rapid rate. This is one more on these terminal values almost by way of checking to see what we taught you when you were here, because some of us taught different things. Most people do a terminal value by taking a bunch of cash flows, so they project five years of cash flows and then they're going to do some kind of calculation based on that ending-period cash flow, like a perpetuity or like a P/E multiple or something like that, or an EBITDA (earnings before interest, taxes, depreciation, and amortization) multiple, or something like that. So I pose the question, how should you measure that last-year cash flow? What would you do? Should you use EBIAT, earnings before interest, after tax? Should you use cash flow? Or should you use some normalized cash flow? Or does it not matter? Normalized cash flow. Yes, because that sounds right. Has to sound right, yes? It's the longest one up there, so it has to be right.

The problem is of course that all this depends on what you're assuming about growth in the terminal value. If you're assuming that in, say, years four to five, the growth rate was the same as you're going to predict in your terminal value, that's OK and you can use almost any of this stuff as long as you do it consistently. But most of the time, that point of the terminal value is the point when you have some discrete change in the growth rate. You've been growing at 10 percent; you assume it's going to grow at 5 thereafter. If you do that, then you have to come up with a cash flow forecast that adjusts capital expenditures,

working capital, and depreciation for the new level of growth. So that would lead to a normalized cash flow.

Error #6: Long-term growth rates

Another thing in the terminal value calculations that creates havoc is picking the growth rates. These are some old data on baseball. It turns out that if you look at the price of baseball franchises from 1978 to 1992, they grew at an average compound real rate of 9 percent. Is that true of your businesses? That's pretty good. Nine percent real growth is pretty good, right? That's really amazingly good. So what do you think? Think it's reasonable in your terminal value to assume that values will grow at 9 percent real? If you do that, by the way, every year, what's going to happen to value?

It's going to be huge, right? So is that OK? Is that right? Is that reasonable? Ten years of history, fifteen years of history. Does that feel good, though? You feel bad about that, right?

___: Well, there are lots of things that have happened since that didn't happen during or right at that historical time period: free agency for the players, the cost of salaries, of compensation, and all that changed.

PROFESSOR RUBACK: This hasn't been constant. In fact, if you look at the chart, break it up into two equal-length periods, you find out that in the early part of this time, '78 to '84 or '85, values grew at about 18 percent and then after that fell to 2 percent. So what do you think? Should we just put in 2 percent? It's safer because it's more reasonable. It's lower. Do you really feel better about that?

___: It's representative.

PROFESSOR RUBACK: It's representative. What's troubling about all this? Where are these numbers coming from?

___: You have very few actual events.

PROFESSOR RUBACK: Well, we're just pulling them out of the air, right?

___: Well, there are some sales, but they're very few.

PROFESSOR RUBACK: So 2 percent? Now what's troubling about all this? What troubles me is we're just making it up, right? What would you really like to know? Michael, what would you like to know?

___: Well, you can't use the past to predict the future. You need to try to look at what the future conditions are going to be: industry, overcapacity, the media's done all they can do, it's getting saturated on TV—all those types of things.

PROFESSOR RUBACK: Right. You have to figure out what is it that determines the value of a baseball team and then somehow build that into your analysis. OK, so what determines the value of a baseball team? Attendance and TV. It turns out that TV is really important. Now again, baseball is really interesting because in football, as you know, there's great pooling of these media contracts. In baseball, there is not. So this is an interesting chart. What I've done here is just plotted the change in franchise values against the change in media revenue. And what I think you can see is that when media revenues—those are the purple bars—go up, the red bars go up. When they go down, the red bars go down. So there's this consistent pattern, not perfect by any means, but a consistent pattern so that it

seems like what happens to media has a big impact on what happens to the value of a baseball franchise.

Now, what's really interesting is if you look at the time period that this valuation went to, the mid-1990s, what's really interesting is that it turned out that there was a media contract for the next five years. There was a baseball strike here; the prior media contract lost a lot of money. And guess what? Media revenues were actually projected to go down by 10 percent. So at a time when media projections were expected to go down relative to historical levels, does it make sense to predict growths in value and cash flows will be higher than historical levels? Absolutely not. And it's interesting, if you look at what you get, it starts ringing true. These baseballs are just the plots of sales of baseball teams. And the franchise value is here. This is about \$170 million for Baltimore right after they built the new stadium.

And what you can see is that you start getting much more reasonable values later on, much more reasonable values than you would if you assume this crazy growth rate. Just by recognizing that there's this close tie between what's happening in the business, the underlying business, and what's going to happen to future growth rates. And again, terminal value is a big part of what valuation is, and just grabbing these growth rates out of the air is, I think, a very dangerous practice.

Avoiding terminal value errors

So avoid these terminal value errors. Think about forecasting a terminal year cash flow; don't just take the last year's cash flow. Try varying the ending years. Try repeating history. This will help you with the cycles. And relevant to the baseball example, try very much to relate it to underlying economics. That will be very helpful in avoiding just crazy values.

Discount Rates

I want to talk a little bit about discount rates. Discount rates are a little bit more arcane than all these other things, but just as much fun for me. Maybe a little bit more fun for me.

Error #7: Discount rates

This is an interesting valuation question: How do you value a power plant? What's the right discount rate for valuing a power plant? Now remember that power plants are in assets for two kinds of companies, roughly: utilities, which are pretty safe; and independent power producers (IPPs), which are substantially riskier. This graph is just showing a kind of capital asset pricing model view, which is the way we now teach people to get discount rates. But basically the IPPs would come up with a discount rate of 16 percent. The utilities would come up with a discount rate of about 11 percent. It's 16 percent or 11 percent depending on the risk. But neither one is really just a power plant, right? So is it OK to use big industry, comparable to an IPP, independent power producer, to get the value of a plant? What do you think? Seem OK? Is it going to be too high or too low?

Think about what's in an IPP. You have plants that exist that are producing electricity, and then you have hopes and dreams. And what do you think? What fraction of value do you think these two things are? First of all, which one of these things do you think is riskier? Development options or existing, producing power plants that have contracts to buy fuel and sell electricity? Which do you think? Yes, development is a lot riskier.

Turns out you can get a gauge of how much value is in these two buckets. You can take just the earnings per share and discount it by the cost of capital, and that would tell you what earnings you would get from the existing assets, assuming very simply that the earnings stay as they are now forever. And then you can say everything else are these expansion

opportunities. Now, when you do that, these are just three big independent power producers, but it's still I think very interesting to see what you get. What you get is that almost half their value comes out of development opportunities. Almost half the value.

Now, in the petroleum business, you find the same kind of thing. You have integrated oil companies, which are a little bit like the utilities. You also have exploration and production companies, which focus on the development. And then you get royalty trusts. A royalty trust simply owns producing properties, and the revenue from those producing properties goes to the owners of the trust. And so it's just a pass-through for the producing oil wells. And what you find is that the relevant market-based costs of capital are about 7.5 percent for the royalty trust, but almost 16 percent for the exploration and production.

Yes, the royalty trusts have oil price risk and all this other stuff, but they don't have to look for the oil and they don't have to deal with the fact that when oil prices get low, it doesn't make sense to look for the oil. It's already there; you keep pumping it. So the risk is just lower for a developed opportunity.

So, too, for these power plants, generally speaking. While they don't have all of their revenues and costs contracted out, they have a lot of them. Generally the revenues and substantial costs are fixed by contract, although not over the life of the project usually. Think about the IPP company at about 15, 16 percent. Seems reasonable that these development projects are higher, right? So what does that mean for these operating projects? It has to be less. It's interesting, most people would say what you guys said, which is to use the IPP rate and say, "Well, there are reasons why it goes one way or the other." But I think if you look at it analytically, you'd get a much lower rate.

Error #8: Changing capital structure

OK, just a couple more. Changing capital structure. This is one of my favorite examples of all time because it's written about in the great novel about this case, *Barbarians at the Gate*. Just a great book. I've got a case on RJR Nabisco, too, and RJR Nabisco just continues to be a fascinating situation. Even though it's fifteen years old or so, acquisition analysis just doesn't get more exciting.

In any event, this is kind of a small footnote to the RJR thing, but important for you when you think about valuation. When they valued RJR Nabisco, when the investment bankers valued RJR Nabisco, they said, "Well, we've got these cash flows and it's a big high one," because remember they were going to sell off assets, sell off big bunches of the food business early on. And then they took this after-tax weighted average cost of capital, 11.7 percent, and then they took present value of terminal value at \$34 billion. This was a leveraged buyout. Anything particularly wrong with that valuation? There is a \$3 billion error there.

It doesn't stay leveraged forever, exactly. Leverage is falling. The reason why the cost of capital is only 11.7 percent is because this had 80 percent debt. Because it had 80 percent debt, it had enormous tax shields on that debt. And with those enormous tax shields came a low after-tax cost of capital. Weighted average cost of capital is an after-tax rate. So 11.7 percent. But the debt in the capital structure was falling through time. The amount of debt would fall through time. And so using that same leverage rate all the way through was just out-and-out incorrect. If you did it right, you'd have the weighted average cost of capital rising through time, reflecting the decline in the debt. And as you see here, that would result in about \$3 billion less value. Now as you know, it turned out to be a terrible deal for reasons other than this. But nonetheless.

These kinds of leveraged transactions and transactions with complicated and changing capital structures are coming back. And so it's worthwhile just to put a footnote in that there are much better ways of valuing cash flow streams like those. Whenever you have an equity-based cash flow stream like a real estate development or something like that, there are better techniques than using weighted average cost of capital.

Here's one that I developed, capital cash flows, that simplifies all this valuation by just simply taking the interest tax shields out of the cost of capital and putting them into the cash flows. I can't teach it to you here, but you'll get a sense in a second that it actually works pretty well. Here's a picture of how this technique works. This is based on a study I did with Steve Kaplan, who's a professor at the University of Chicago. These dots are plots of two things: the capital cash flow value, the value using this by putting the interest tax shields in the cash flows and doing everything right; and then the market value. And if this valuation worked perfectly, what you'd see is all those dots would line the yellow line. I think you see—you know, the line's thick and the dots are big; RJR's out here—but I think you can see that it works pretty well. So those of you who get frustrated with cash flow valuation, it may be that you're trying to do it using a technique that just doesn't quite match. And so there are other cash flow techniques that can do a better job for you.

Avoiding discount rate errors

Just some ideas on discount rates. I want to make sure that we finish up on time. One is that when you're doing a discount rate calculation make sure you're matching the project characteristics. That was what that discussion about the power plant was. But that shows up in a lot of different forms inside a company. For example, lots of companies have a single cost of capital. The decisions to develop a new product line and to paint the factory are made with the same cost of capital. That just seems to me to be absolutely crazy. We know that the cost-of-capital calculation may be right on average, but that doesn't mean it's right individually, and you need to make sure that you're not investing in too many speculative projects that should have a higher cost of capital but are being assessed with an average and therefore getting through. And similarly, you want to make sure you're painting the building enough, because it's about safest investment you can get.

Avoiding Value Errors

All right. Let me just talk about a few [errors] on value.

Error #9: Control premiums

Here's one on control premiums. This is a valuation I saw by a prestigious investment banker. I just loved it. They took the cash flows before the merger, added some improvements and synergies, and got the cash flows after the merger. Present valued those, added a 40 to 60 percent control premium, and said that's the value.

Double dipping, right? Because after all, where does the premium come from? You're getting a premium because of the synergies. You don't get to count it twice. All right. This is a different version of the same thing. I take the cash flows with improvement in the first or second year of the projection period. Depending on the banker, you'll see different versions of this. I multiply it by a transaction multiple, the multiple in like transactions, and I get the value. How about that? Is that single counting or double counting?

___: That's double counting also, because typically the transactions are based on the cash flow before the improvements.

PROFESSOR RUBACK: Well, there's a trading multiple and a transaction multiple.

___: It's double counting because they put a higher multiple on it because they know they're going to get the synergistic value.

PROFESSOR RUBACK: So you have a trading multiple, what the stocks are going to trade for every day, and then you get a transaction multiple that is usually 30 percent or 40 percent higher, because in a transaction you've priced in the premium. You've priced in the premium and the premium is related to the synergy. But what do these guys do? They take both. All right? So the general rule is that you take the cash flows with improvements times a trading multiple or cash flows without improvements times a transaction multiple. You don't get to do both.

___: How does the transaction multiple work?

PROFESSOR RUBACK: You take a set of like transactions. So if it's an acquisition in the food business, you take a look at food business acquisitions.

Error #10: Multiples

Here's a last favorite error. This is also a valuation of a manufacturing entity—one with an old plant. And the investment banker comes up with these three different valuations for the company: \$600 million, \$450 million, and \$360 million. It's worth your money, don't you think? Nice tight range like that. What does this kind of range tell you about the business? What's it tell you about the comps? Are these good comps or bad comps?

___: One might be good. They can't all be good.

PROFESSOR RUBACK: This company has a low profit margin, and it turns out that there's a reason why it has a low profit margin. This company turns out to be a labor-intensive company. Everybody else has rebuilt their plants. These guys have decided they don't need to rebuild their plants. So they're running at higher labor utilization rates. Doesn't really affect value, might even be a good thing for value, but all the other multiples are going to be less. All right, so it's just that these companies aren't comparable. So even though they're in the same industry, they're pursuing very different strategies in terms of how they're producing. That makes the multiples not comparable, although you could grab something like an EBITDA multiple and say, well, that's cash flow, that's fair enough, we'll do that.

Avoiding Valuation Errors

Overall on valuation, I think you avoid problems by just following three simple rules. One: Focus on common-sense economics. And in almost every case that we've seen, think about what's going on not in the details, but in what makes sense. The most detail-oriented error we found was the depreciation with the food delivery guys. If you thought about what's happening to your cap ex, you'd know that doesn't make sense. Just simple economics, if I sell more stuff I'm going to need more trucks—that kind of level of common sense, I think, is far more important than anything else.

My experience is that if you're doing a valuation, you should do it more than one way. If you're doing it with cash flows, then do it with multiples to check on it. If you get radically different answers, one of them is wrong. If you've understood the business and you've applied the techniques consistently, you should get the same answers by doing it different ways, and if you don't, that's really important information. It's much harder in corporate finance to know when you've done something wrong than it is to do it right. It's the

information that, gee, something here doesn't make sense. We can always solve the problem when we figure out there's a problem. It's finding the problem that's hard.

And then lastly, and I speak maybe more to our recent graduates than to you guys, but there is this sense of just kind of sticking it in the Excel spreadsheet and cranking through the numbers. Things have become very mechanical. So just be aware that while I'm a big fan of analytical techniques, analytical techniques do not replace intelligence.

And I leave you with my best example of that. My best example doesn't come out of finance. It's from my now nineteen-year-old son when he was about three. I was working at home and he comes up and he hands me this sheet of paper with this on it and he says, "Daddy, I wrote you a story." And I look at it and I say, "Sam this is a great story. Thank you very much for writing me a story. I really like it. It's a good story. It's a good story." I said, "Could you read it to me?" And he looks at me with the innocence that only a three-year-old can do and he says, "Daddy, don't be silly. I know how to write, but I don't know how to read."

So may your numbers make more sense than these. That's it. Any questions? Thank you. Thank you very much. Enjoy the rest of your day.