A Commentary on Teaching Finance in a World of Certainty Versus Uncertainty

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This commentary discusses the problem that finance text books and even cases present finance in a world of certainty in which many or all of the input variables used in the various analytical techniques we teach are provided. However, in the real world of uncertainty, the difficulty is estimating (forecasting) the input variables.

Over my university teaching career, which exceeds 35 years, I have taught various finance courses using different teaching methods at both the undergraduate and graduate levels. Early in my career, I used popular finance textbooks and taught the material presented in most of the chapters. However, because the finance textbooks (and related test banks) I was using were more often than not oriented toward rote memorization of terms, concepts, formulas, and predictable end-of-chapter problems. I eventually made a transition to focusing more on cases, even in my introductory undergraduate finance course.

I believe that finance textbooks and even cases present finance in a world of certainty in which many or all of the input variables are provided. Technically-oriented students, who are adept in filling in the blanks of problems that conveniently specify the input variables, often fall short of gaining the skills needed to solve the unstructured problems faced in the actual practice of finance which takes place in a world of uncertainty where the input variables are not provided and must be estimated (forecasted) often over periods as much as five or ten years into the future.

An Example: Sales Forecasting

Sales is arguably the most important variable a financial forecast. Most of other variables in forecasted income statements and balance sheets are directly or indirectly related to sales, certainly in the long run. However, in chapters of textbooks that present financial forecasting, the sales forecast is provided. Yet, in the real world of uncertainly, sales forecasts have to be developed. Textbooks may provide a general discussion of sales forecasting methods, such as extrapolating past trends (time series analysis), management's estimates, or statistical forecasting models, but students are not provided much insight into the difficulties in forecasting sales. In executive seminars, I often ask executives how far into the future they are comfortable forecasting sales and they smile and say "maybe two weeks."

Even if a statistical model of a company's sales using multiple regression is developed, there is a major problem. For example, consider the residential furniture industry. Students could obtain past data on likely variables that affect a furniture company's sales such as new home construction, real disposal income, interest rates, lumber prices, and so forth and develop a multiple regression model that statistically quantifies the relationship between the dependent variable (sales) and the independent variables. Even if a high index of determination (R^2) of say 0.92 is obtained, which indicates that the resulting regression equation "statistically explains" 92% of the variability of sales, it only pertains to past variability of sales. In order to use the regression equation to forecast future sales, forecasts need to be developed (or obtained) for each of the independent variables (new home construction, real disposal income, interest rates, lumber prices, and so forth). This can be a daunting task even in the best of times. Forecasted sales using a regression equation is only as accurate as the forecasted independent variables regardless of the statistical significance of the regression analysis. Garbage in, garbage out.

In today's world, we don't have to be reminded that unpredictable geopolitical and economic events, such as the terrorist attack of September 11, 2001, the 2007-08 global financial crisis, the Covid-19 pandemic and subsequent supply chain shortages, the Russian invasion of Ukraine, and escalating oil prices can have significant effects on the economy and company sales.

Another Example: Company Valuation

Company valuation provides another example. In the real world, the difficulty is not the formula or model. It's an open-book world, often with easy access to prewritten EXCEL templates developed for this purpose. Again, the real difficulty is estimating (forecasting) the input variables. To value a company using discounted cash flow analysis (DCF) model, forecasts have to be made of future company sales, expenses, depreciation, net working capital, capital expenditures, and the growth of cash flows beyond the forecasting horizon, and so forth. The appropriate discount rate (minimum acceptable rate of return) also has to be estimated which itself can be a difficult task.

Again, in the real world, the difficulty is estimating the input variables which can be quite difficult when the forecasting horizon five or ten years. Yet students are relieved of having to do so by being provided with most or all of the input variables. Students only have to organize

them into a cash flow format and calculate the present value of the expected free cash flows at the conveniently assumed discount rate.

One of the significant practical problems with DCF valuation is the terminal value, which is the value of the company at the end of the forecasting horizon. This is can be a challenge since it requires estimating the value of company at the end of five, ten or fifteen years into the future. One method illustrated in textbooks and used in practice is the perpetual growth model in which the constant growth rate of free cash flows beyond the forecasting horizon must be estimated. Again, the growth rate is provided (assumed) in a textbook, but in practice it is quite difficult to determine beyond an arbitrary estimate. A sobering reality is that the present value of the terminal value can be more than half of the calculated value of a company, even when the forecasting horizon is ten years. An analyst could spend weeks forecasting detailed free cash flows for each of the individual years of the forecasting horizon only to find that the terminal value is the largest yet most uncertain number in the analysis. Another sobering reality is that varying the growth rate by only 1 percent can significantly change the company valuation, a concern about the DCF method often expressed by practitioners. There are other methods used to estimate terminal values including forecasted market values based on multiples of earnings or cash flows, but they cannot be estimated with the precision needed to be comfortable with the resulting valuation.

Another Example: Weighted Average Cost of Equity Capital

In textbooks, the input variables to calculate a company's weighted average cost of capital (WACC) are usually provided, preceded by "assume that . . ." For example, when the Capital Asset Pricing Model equation $r_e = r_f + \beta(r_m - r_f)$ is presented in a textbook as a method of estimating a company's cost of equity (r_e), it is illustrated by calculating r_s based on *assumed* values for the risk-free interest rate, r_f, the future return on the market (r_m), and the company's beta (β) that are provided. Homework problems at the end of the chapter give students practice calculating r_e, again based on assumed values for r_f, r_m and β. Finally, students know that there will likely be a question on a test that asks them to calculate r_e based again on *assumed* values of r_f, r_m and β. If they have memorized the formula and performed the required arithmetic, they will calculate the correct answer. But what have they really learned that they can apply? Have they learned to estimate r_f, r_m and β? Do they appreciate the difficulties of actually estimating r_f,

r_m and β? Should r_f be the current 90-day U.S. Treasury Bill rate or should it be based on long term U.S. Treasury Bonds? If the latter, should it be based on 10-year, 20-year or 30-year bonds? What market risk premium should be used? What about β? How can β be estimated if it is a privately-held company? By providing students with assumed values of r_f, r_m and β, they are simply learning how to memorize and calculate a formula in a world of certainty.

Once a company's cost of equity (r_e) is calculated, the next step is to combine it with the company's marginal cost of debt (r_d), marginal income tax rate (T), and proportions of debt (w_d) and equity (w_e) to estimate a company's weighted average cost of capital (WACC):

$$WACC = (w_d)\,(r_d)\,(1\text{-}T) + (w_e)\,(r_e)$$

Again, the input variables are usually provided. However, in the real world of uncertainty, the input variables must be estimated or forecasted. What will be interest rate on the company's future debt, its marginal cost of debt, r_d? What will be the company's marginal tax rate? What is the company's target capital structure -- the proportions of debt (w_d) and equity (w_e) that will be used to finance its future asset investments? If this is not known or provided, is it reasonable to assume that the company will finance future asset investments in the same proportions as its current debt (w_d) and equity (w_e)? If so, should the current book values or market values of its debt and equity be used to estimate w_d and w_e? Again, these input variables are usually provided in textbook discussions and problems. Students merely have to memorize the formulas and correctly calculate the company's WACC – the easy part. The devil is in the details (or input variables).

The Case Method of Learning

Well-written cases may be a step in the right direction toward teaching finance in a world of uncertainty which is why I made the transition to cases in my various finance courses. As discussed in Kester (2011), cases help students help students gain situational problem formulation skills and place finance in its corporate context. They also help students develop skills in problem identification, situational analysis, evaluation of alternatives, and decision-making. However, even in Harvard Business School cases, the important input variables are often provided and presented as "management's estimates." For example, in Cartwright Lumber Company (9-204-126), a classic HBS case that requires financial analysis and forecasting, it is

stated that: “Sales are estimated to reach $3.6 million in 2004 and may exceed this level if prices of lumber should rise substantially in the future.” Based on this sales forecast, students develop a projected income statement and balance sheet to identify the company’s financing requirement for the following year. Although this requires estimating other input variables based on historical trends and relationships, such as cost of goods sold, operating expenses, accounts receivable, inventory, accounts payable and so forth, the most important variable, sales, is conveniently provided. The case does go on to say that “projections beyond 2004 were difficult to make, but the prospects appeared good for a continued growth in the volume of Cartwright Lumber’s business over the foreseeable future” so students at least gain some appreciation of future uncertainty.

Another HBS case that comes to mind is American Chemical Corporation (9-280-102) that involves Dixon Corporation’s purchase of a sodium chlorate manufacturing plant from American Chemical Corporation. Students must determine whether the asking price of $12 million is a fair price. This requires a DCF valuation of the plant. Conveniently, students are provided with five-year projections of the plant’s revenue, expenses, assets, and liabilities. Student must merely organize this forecasted data into a DCF format and then calculate the present value of the free cash flows to determine its value. Although calculating the appropriate discount rate is less straight forward and must be based on estimating the WACC of other sodium chlorate producers, most of the forecasted data needed by students in the case is provided. In the real world, of course, it is not.

I could cite many other examples from the numerous cases I have taught over the years to illustrate the point that even challenging HBS cases provide much of the data, including future estimates of important input variables, that are needed to evaluate and make financial decisions.

Conclusion

Over the years, I have taught both students and practitioners, often presenting the same materials and cases. A significant difference I have observed between the two groups is that students, especially undergraduates, want to know if they have to memorize the formulas or will they be provided in the test or exam. Practitioners want to know how to estimate or forecast the input variables. They recognize that the various models and analytical techniques are only as good as the accuracy of the input assumptions.

So, as educators, how can we teach students how to estimate the input variables used in the formulas and analytical techniques that we teach in our finance courses? How can we teach finance in a world of uncertainty? Perhaps we cannot. Perhaps this skill can only come from experience in the real world and even then it will be a difficult skill to master if it can be mastered at all. Crystal balls are hard to come by.

When teaching finance, perhaps the best that we can do beyond cases is to least acknowledge that the difficulty in the real world is estimating the input variables, not the formulas and analytical methods that students struggle to learn in our courses. We should honestly acknowledge that we are teaching students how to perform financial analysis and make financial decisions in a world of certainty, not the world of uncertainty that they will join after graduation. It should also be pointed out that there is usually not a "right" answer. More often than not, the answer is "it depends." In the context of this commentary, it depends on the future. Welcome to the real world!

Reference

Kester, George W., "Reflections on Thirty Years of Using the Case Method to Teach Finance," *Advances in Financial Education*, Vol. 9, No. 1/2 (2011), pp. 62-80.