

BUSINESS FINANCE AND FINANCIAL CALCULATORS

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Abstract

Financial Calculators are well established as an important tool in the teaching of Business Finance. However, this was not always true. Reasonably priced financial calculators were introduced in the mid-70s. About a decade later in the mid-80s, financial calculators started being discussed in Business Finance textbooks. In this paper, a brief review of the history of financial calculators is given. Next, a discussion of how financial calculators are currently used in Business Finance classes is given.

Introduction

It goes without saying that financial calculators are an important part of any finance class, especially Business Finance. However, this was not always true. Some that are currently teaching finance can remember when finance was taught without financial calculators, or, for that matter, without microcomputers. Actually, it was not that long ago. The author first taught Business Finance in the spring of 1974. The textbook used in the class was *Essentials of Managerial Finance*, 2nd edition, by Weston and Brigham. This was the leading undergraduate Business Finance book at that time. Time value of money problems were worked with the interest rate tables that came with the textbook. Calculations were made by hand. However, reasonably priced handheld financial calculators were just around the corner.

The first part of the paper will present some historical notes on the use of the financial calculator in Business Finance. In the second section of the article, some observations are given on how financial calculators are currently used in Business Finance. The paper ends with some concluding remarks.

Some Historical Notes

The author's first experience with reasonably priced handheld calculators was the TI-30 by Texas Instruments (TI). The TI-30 was one of the first fairly cheap scientific handheld calculators when it came out in 1976. It cost around \$25. However, it was not long before TI came out with one of the first cheap (around \$40) handheld financial calculators, the Money Manager. This calculator was impressive for the money. For example, you could solve all the time value of money problems quite easily without tables. In addition, linear regression could be done with the calculator. The author used the Money Manager for several years (until around 1980). In the late 70s the Money Manager became the Business Analysts (BA) I. Then, in the early 80s, TI came out with the BA 35. During this period of time, students were instructed on how to use a financial calculator in Business Finance classes but were not required to have one for the Business Finance class (Taylor, 1983). In 1980, the author purchased a Hewlett-Packard (HP) 38C financial calculator. This was an amazing calculator for the money (about \$75). The

38C would not only do everything the BA I would do but much more. For example, the NPV and IRR could be calculated for uneven cash flows. Another useful feature of this calculator was that it was programmable. Programs could be written to solve some fairly complicated financial formulas. For example, the author wrote some programs that could solve the Black-Scholes option model and the Molodovsky three-phase stock valuation model. The 38C was one of the first calculators with continuous memory. This meant that the calculator could be turned-off and the information stored in the calculator's memory would not be lost as long as the battery was charged. With the Money Manager (or BA I) when you turned the calculator off all the stored information was lost.

HP came out with the HP-12C in 1983. This slim line calculator was a replacement for the fatter 38C. The 12C would easily fit in one's shirt pocket. The 12C was very popular with the financial community. As a matter of fact, it is still used today. TI updated the 12C in 2003 with the 12C Platinum. It is one of the calculators that can be used on the current Chartered Financial Analyst (CFA) exam. Since the 12C is programmable like the 38C, some complicated finance formulas can be made easy to solve with the calculator. For example, the Molodovsky three phase stock valuation model can be solved with the 12C (Taylor, 1984). In addition, the Black-Scholes option model can be calculated with the 12C (Taylor, 1987).

During the mid-80s financial calculators were first introduced in Business Finance textbooks. Brigham introduced financial calculators with the 4th edition of *Financial Management: Theory and Practice* when it came out in 1985. This is one of the leading Business Finance textbooks at the MBA level. In the Preface (p. x) to this edition the following statement about financial calculators is made:

In the third edition, we offered only the traditional approach to time value of money. In this edition, we have expanded that discussion to show how financial calculators can be used to solve most compound interest problems.

The following comment was also made at the beginning of the time value of money chapter, Chapter 4 (p. 90):

This chapter and indeed the entire book, is written on the assumption that many students do not have financial calculators. The cost of these calculators is falling rapidly, however, so the assumption is becoming increasingly questionable. As a result, financial calculator solutions are set forth in footnotes to each of the major sections. Students are urged to obtain financial calculators and learn how to use them, for they—and not clumsy rounded and incomplete tables—are used exclusively in well run, efficient businesses.

Weston and Brigham included a discussion of financial calculators with the 7th edition of *Essentials of Managerial Finance*, which also came out in 1985. This was one of the leading undergraduate Business Finance textbooks at that time. The author started requiring students to use a financial calculator in the Business Finance classes in 1985. TI's BA-35 (Business Analyst) was the first calculator required in the classes. When the HP-10B came out in the late 80s, this financial calculator was required. Even though the 10B was \$10 more than BA-35, the 10B was worth the extra \$10. For example, the 10B would solve the NPV and the IRR for

uneven cash flows, whereas the BA-35 would not do this. When the TI BAI-PLUS came out in the early 90s, the author started requiring this financial calculator in finance classes, and the BAI-PLUS is still required today. The TI BAI-PLUS Professional is also recommended. This financial calculator came out in 2004. It is essentially the BA II-PLUS with a few more added features. For example, it will also calculate the Modified IRR, Bond Duration, regular Payback and Discounted Payback, and the future value of a series of uneven cash flows.

Current Use

One of the most widely used Business Finance textbooks at the undergraduate level is the 6th concise edition of *Fundamentals of Financial Management* by Brigham and Houston. This text strongly endorses the use of a financial calculator in teaching Business Finance. For example, the following comment was made in the syllabus of Houston's Business Finance course in the spring of 2009 (Brigham and Houston, *Instructor's Manual*, 2009, p. xiii):

“You must have a financial calculator to get through the course. Many of the exam problems involve complex arithmetic and financial calculations—and a financial calculator is necessary to solve them. . .

As you will soon see, the ability to use a financial calculator is critical to success in the class.”

Calculator applications are given throughout the text, and the authors have a textbook web page that provides instructions on how to use several financial calculators. All the major basic financial management textbooks encourage or assume that students can use a financial calculator. Most financial management textbooks have instructions on how to use financial calculators. This widespread use of financial calculators in the teaching of Business Finance is compelling evidence that they play an important role in financial education.

Which financial calculator is the most widely used in the teaching of Business Finance? White (2007) in his guide to financial calculators discusses the HP-10BII, the BAI-PLUS, and the TI-84 Plus. In her calculator guide, Pamela Hall (2000) discusses the BAI-PLUS, the HP-10B, and the HP-17BII. Based on the author's observations, the two that seem to be mentioned the most are the HP-10B or currently the HP-10BII and the BA II –PLUS. Both can be purchased for about \$30 at a Wal-Mart store.

The author favors the BAI-PLUS over the 10BII. As noted in some recent papers (Taylor, 2003, 2005), discrete probability analysis is much easier on the BAI-PLUS. In addition, the BAI-PLUS is easier to use than the 10BII and has some features that the 10BII does not have. The menu approach with the BAI-PLUS makes it easier to enter and correct data, and the bond menu of the BAI-PLUS will value bonds between interest payment dates. The BAI-PLUS (or Professional) is one of two calculators that can be used on the current CFA exam. The other calculator, as mentioned above, is the HP-12C.

A useful financial calculator described by Brigham in his web site is the HP-17BII+. This is a great calculator for the money (about \$85). It will do everything the 10BII (or 12C) will do and

a lot more. Brigham and Houston note that some students find the 17BII+ more useful than the 10BII.

One of the unique features of the 17BII+ is the equation solver. This makes solving complicated financial equations fairly easy. One can literally take every major equation used in a financial management textbook and place it in the equation solver for easy retrieval. For example, the following equations have been placed in the author's 17BII+ for easy retrieval:

- (1) 2 and 3 stage dividend discount model (Taylor and Brown, 2001)
- (2) 2 and 3 asset standard deviation
- (3) 3 phase Molodovsky stock valuation model (Taylor and Brown, 2001)
- (4) Gordon Model
- (5) Bond duration and convexity
- (6) Minimum variance for two assets
- (7) Bodie, Kane, and Marcus (2010) three asset model
- (8) Bond discount equation
- (9) Bond equivalent yield equation

To illustrate the usefulness of the equation solver, a two stage earnings model will be developed along with some examples.

A two stage earning model is given by the following equation:

$$P = \sum_{t=1}^N \frac{E(1+G1)^t(1-B1)}{(1+K)^t} + \frac{E(1+G1)^N(1+G2)(1-B2)}{K-G2(1+K)^N} \quad (1)$$

In the above model, P is the price, K is the required return, N is the number of years of above normal growth in earnings, E is the current earnings per share, G1 is the above normal earnings growth rate, G2 is the normal earnings growth rate, B1 is the retention rate for stage I, and B2 is the retention rate for stage II.

The model given by Eqs (1) can be combined into the following SOLVER equation:

$$\text{TSEM: } P = \sum(T:1:N:1:(Ex(1+G1)^Tx(1-B1)) \div (1+K)^T) + Ex(1+G1)^Nx(1+G2)x(1-B2) \div (1+K)^N \div (K-G2) \quad (2)$$

TSEM is the name of the equation. When Eq. (2) is entered into the calculator, the

following menu is created:

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| P | N | E | G1 | B1 | MORE |
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| K | G2 | B2 | MORE |
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Any variable can be solved if the other variables are known. The model can be solved as a dividend model if $E = \text{Dividends}$ and $B1$ and $B2$ are set equal to zero.

Example: Problem One

Jim Evans, a financial analyst for the 2nd National Bank, is trying to determine the value for the Orleans Company's common stock, a rapidly growing trucking company. Jim has estimated that Orleans earnings will continue to grow for the next six years at a rate of 26%. After six years, he expects earnings to level-off to a long term rate of 6%. The current dividend-payout per share is only 10%. However, Jim expects the dividend-payout to increase to 50% in year seven and remain at that level.

- (a) If the estimated required rate of return for the stock is 16% and its current earnings per share are \$2.50, determine the price of Orleans using Jim's inputs.
- (b) If the current price of Orleans is \$21, should Jim recommend buying the stock?

In order to solve for the price (part a), enter SOLVE Eq. (2) into the calculator and then enter the inputs. The solution of \$23.79 is given below:

P	N	E	G1	B1	MORE
*23.785	6	2.50	.26	.90	
	↑	↑	↑	↑	
K	G2	B2	MORE		
.16	.06	.50			
↑	↑	↑			

*Calculated Value ↑ Inputs

Remember that the dividend-payout is equal to the following: $(1 - \text{retention rate})$. In part (b) since the calculated value is greater than the current price, the stock is undervalued and should be purchased.

Example: Problem Two

The Crawford Corporation has been experiencing an above normal dividend growth rate of 20 percent for the past 4 years. This above normal growth rate is expected to continue for another 6 years before it levels off at a more normal rate of 5 percent. Crawford's last dividend was \$.75 per share. Determine the current value of Crawford's stock if its required rate of return is 14 percent.

This problem should be solved as a dividend model problem. Therefore, set $E = D = \$.75$, $B1$ and $B2 = 0$, $N = 6$, $G1 = .20$, $G2 = .05$, and $K = .14$. The solution is $P = \$17.31$.

P	N	E	G1	B1	MORE
*17.31	6	.75	.20	0	
	↑	↑	↑	↑	

K	G2	B2	MORE
.14	.05	0	
↑	↑	↑	

*Calculated Value ↑ Inputs

When P is pressed, a value of \$17.31 is quickly determined as indicated above.

Concluding Remarks

As noted above, financial calculators are widely used in the teaching of Business Finance today. They are fairly cheap, easy to use, and can be carried in ones shirt pocket. It is hard to imagine someone taking a finance exam without a financial calculator. Will spreadsheets eventually replace calculators in the classroom.? This is a difficult question to answer. At the present time, both appear to have an important role to play in the teaching of finance.

The teaching of finance has changed a lot since the author started teaching finance in 1974. The use of financial calculators has improved the efficiency of solving problems. It has allowed calculator users to spend more time teaching finance and less time on mechanics.

References

- Bodie, Ziv, Alex Kane, and Alan J. Marcus. 2010. *Essentials of Investments*. 8th edition, McGraw-Hill/Irwin.
- Brigham, Eugene. 1985. *Financial Management: Theory and Practice*. 4th edition, The Dryden Press.
- Brigham, Eugene, and Joel Houston. 2009. *Fundamentals of Financial Management: Concise*. 6th edition, Thompson.
- Brigham, Eugene, and Joel Houston. 2009. *Instructor's Manual, Fundamentals of Financial Management: Concise*, 6th edition, Thompson.
- Hall, Pamela L.2000. *Effective Use of a Financial Calculator*, The Dryden Press.
- Hewlett-Packard. 1979. HP-38E/38C, *Owner's Handbook and Programming Guide*.

- Hewlett-Packard. 1983. HP-12C, *Owner's Handbook and Problem-Solving Guide*.
- Hewlett-Packard. 1987. HP-17B, *Business Calculator Owner's Manual*.
- Hewlett-Packard. 1989. HP-17BII, *Business Calculator Owner's Manual*.
- Hewlett-Packard. 2003. HP- 17BII+, *Business Calculator Owner's Manual*.
- Hewlett-Packard 1988. HP-10B, *Business Calculator Owner's Manual*.
- Hewlett-Packard. 2002. HP-10BII, *Business Calculator Owner's Manual*.
- Hewlett-Packard. 2003. HP-12C, *Platinum Owner's Handbook and Problem-Solving Guide*.
- Taylor, Richard W. 1983. "A Pedagogical Note on the use of a Financial Calculator in the Basic Corporation Finance Class." Paper presented at the 1983 Midsouth Academy of Economists meeting.
- Taylor, Richard W. 1984. "Portfolio Management with Hand-held Calculators." *The Journal of Portfolio Management* (Summer): 27-31.
- Taylor, Richard W. 1987. "Option Valuation for Alternative Instruments with the Black-Scholes Model: A Pedagogical Note," *Journal of Financial Education* (Fall): 73-77.
- Taylor, Richard W., and Donald Brown. 2001. "Common Stock Valuation: A Pedagogical Note." *Journal of Accounting and Finance Research* (Winter II): 41-45.
- Taylor, Richard W. 2003. "Calculating the Standard Deviation for a Discrete Probability Distribution: A Note." *The Journal of Accounting and Finance Research* (Winter): 27-30.
- Taylor, Richard W. 2005. "Discrete Probability Analysis with the BAII Plus Professional Calculator." *Journal of Financial Education* (Winter): 100-106.
- Texas Instruments. 1976. *TI Money Manager*.
- Texas Instruments. 1976. *Electronic Slide Rule Calculator (TI-30) Owner's Manual*.
- Texas Instruments. 1982. *Business Analyst (BA-35) Guidebook*.
- Texas Instruments. 1990. *BA II-PLUS Guidebook*.
- Texas Instruments. 2004. *BA II-PLUS PROFESSIONAL Guidebook*.
- White, Mark A. 2007. *Financial Analysis with a Financial Calculator*, 6th edition, Irwin/McGraw-Hill.

Weston, J. Fred, and Eugene Brigham. 1971. *Essentials of Managerial Finance*. 2nd edition, Holt, Rinehart, and Winston.

Weston, J. Fred, and Eugene Brigham 1985. *Essentials of Managerial Finance*. 7th edition, The Dryden Press.