



USING THE FINANCIAL CALCULATOR IN PRINCIPLES OF CORPORATE FINANCE

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Most “Principles” courses cover such topics as: time value of money, valuation of securities, cost of capital, capital budgeting, and so forth. The use of a financial calculator commonly expedites the coverage these topics. However, one of the problems is the necessity to teach the students how to use the calculator, especially if there are a number of different “makes and models”. In my own classes, I have been able to save one to two weeks on the time value of money topics by using the calculator instead of the time value of money tables. By using a standard calculator, such as the TI BA II Plus (cost: about \$30), instruction can be universal instead of necessarily being individualized.

The Physical Operation and Introduction of the Calculator

TI (Texas Instruments) has a special teaching model calculator to assist the instructor in the use of the TI BA (Business Analyst) II Plus in the classroom. The calculator is manufactured such that it can be used on an overhead projector. The light projects through the calculator, and onto the screen. AND the calculator actually works! Since we use dry-erase (white) boards in our classes, I project onto the board, then I can write numbers at the appropriate location (i.e., on the appropriate key). (NOTE: One problem with this method is that the glare can be distracting for some students.)

The company recommends that a piece of fishing line (monofilament, to the fishermen out there) be tied to the calculator with a loop in the other end to loop over the projector so it cannot be dropped easily. Needless to say, dropping is hard on any calculator, but this model is literally “made of glass”!

I recommend that students get their calculators early, so we can schedule a day to discuss the operation of the calculator. I announce the date well ahead of time, and continue to remind the students of the date. The things I recommend they change (from the factory defaults) are: payments per year (see Appendix for methods to change) and number of decimal places. I recommend one payment per year, since we do many problems on an annual basis, explaining that we will correct manually by using “m” (compounding “m” times per year: multiple number of years by “m”, and divide the interest rate by “m”). I also recommend that they set their number of decimal places to four, since we do many calculations in thousands (k’s). The

explanation of a banker, real estate agent, car salesman, etc. needing monthly payments, and dollars and cents, seems to justify to them the factory defaults of 12 payments per year and two decimal places. I also show them how to change the end/ beginning of period option for annuities (ordinary annuity/ annuity due), store/ recall data values, and enter/ quit different menu functions.

Time Value of Money Calculations

After a brief lecture on the compounding formula, annuities, and compounding more than once (“m” times) a year, we attack the calculator! First, I give them a table for lump sum & annuities (with a predictive caution about bonds later in the course):

keys=>	N	I/Y	PV	PMT	FV
Lump sum	?	?	?	0	?
Annuity	?	?	0*	0*	?

* ONE of the is zero, the other is NOT

For Lump sum, payment (PMT) is always zero. For the other variables (assuming you know “m”), if you know three of the four variables (marked with a “?” in the table), you can solve for the fourth. For Annuities, either present value (PV) or future value (FV) is zero (the other is non-zero). I explain that if you are “saving for retirement”, you start with (i.e., PV) nothing (PV=0), and save for the future (FV). For a loan, the amount of the loan is the present value, but at the end, the loan is paid off (therefore, FV=0).

I give some simple problems (“find the future value of a lump sum compounded annually”, same for present value, etc.). Then, after a discussion of positive and negative cash flows, I solve for “i” or “n”. (The first time I tell them to watch as I do it wrong [i.e., all cash flows as positives] and show them that you get “Error five”.) Then (if you do not do a “2nd” and “CLR TVM” [clear the time value of money]), you can replace either PV or FV with a negative (I explain the bank’s point of view vs. the consumer’s point of view) and get a logical answer. (Often I change each sign to show you get the same answer, again, depending on the point of view.) This also is a good time to introduce and illustrate the “Rule of 72”. For the solution of each sample problem, I ask for student input for the input numbers for each variable, writing them below the appropriate key projected on the board. Then I give them one problem at a time to work, which I then work with their input.

When they seem to have those mastered, we compound more than once a year. We use the standard “multiply the number of years by ‘m’; divide the interest rate(s) by ‘m’.” This is a good time to introduce effective rate and continuous compounding. I show how sensitivity analysis is easy on the calculator. For instance, you will receive a trust fund (e.g., \$100,000) from your grandfather on your 42nd birthday (assuming they are 22 at graduation). What is it worth today, if inflation is 3%? But, what if inflation is 6%, or 12% like back in 1980-81?

For annuities I try to use practical examples, for instance for future value, (again, stereo typing for the age of a “traditional” student): when you graduate, you are 22 years old and plan to retire at 62 (giving a nice round number of 40 years). If you deposit \$100 a month and can earn a

return of 6%, what will you have when you retire? (I multiply the \$100 times 12 months times 40 years so they can see the actual amount of deposits compared to the FV of the compounded annuity. I also point out that 6% is a fairly conservative rate.) Next, I show what they could accumulate if they would save \$100 per week, deposited and compounded weekly. Then it is an easy transition (again, if you don't "clear" the TMV, to put in \$1M, and solve for PMT: "What would you have to deposit each week to be a millionaire when you retire?" For sensitivity analysis, I show what would happen to their "retirement nest egg" if they "waited to buy car furniture, car, etc. and save for the down payment on a house, etc." and started saving later (i.e., reduce the "periods" to 30 [start saving at age 32 instead of 22]). Or wait till "the kids" graduate (start saving at age 42).

For present value of an annuity, I generally use the loan example. This is a good lesson in life to let them solve for the car payment on a \$20,000 loan for 5 years at 10% (point out that they can get a quote on current rates from any bank, etc., but most financing on autos is limited in time due to depreciation with five years normally being an upper limit). Then I ask: "How many of you could afford that size of a car payment?" We then discuss alternatives to lower the payment, such as shopping for a better rate, paying a down payment and thus reducing the loan, buying a used (and therefore cheaper) car, etc. This is good practice for using "m" of 12 for compounding more than once a year.

This type of exam is fairly easy to set up in a multiple choice format. This is probably superfluous advice to most, but the "wrong" answers can be the "solutions" they find if they 'forgot to multiply/ divide by m,' solve for FV instead of PV, etc.

Acquiring and Using "That" Calculator

I contacted TI (Texas Instruments) and asked about their program. The website for more information is:

<http://education.ti.com/us/resources/financesupport/financesupport.html>

As I'm sure everyone knows, TI does this program to help them sell calculators! But they have been very cooperative and helpful from my perspective.

At a FMA (Financial Management Association) meeting I asked the TI representative at TI's booth about the use of the TI 83 calculators. (All our students are required to have the TI 83 for their math classes.) After much discussion, I was told that the TI 83 could do everything except the CF (Cash Flow) menu on the BA II Plus. However, now I believe that software can be downloaded to perform even that function. Therefore, the use of the TI 83 would save money for the students. But... TI is a little stricter on release of the TI 83 made for the overhead projector, admittedly (by them) because of the cost to them of that calculator.

As most professors who cover the TVM know, there are rounding differences from the formulae to the TVM “tables” to the calculator. The test bank for the text we use has as one of the multiple choice answers to TVM problems is: D.) “none of the above”. Of course, as can readily be seen by students: \$1,000.00 on the calculator is NOT equal to \$1,000.01 on the test! Therefore, oft times, they choose “D”. So, if all use the calculator set with four decimal places, adjust the correct answer to the calculator solution. This avoids many “protests” of answers and grading on exams.

Appendix

Changing the “Defaults”

I recommend that students change the following in their calculators:

Number of decimal places from 2 to 4.

I first point out the “2nd” key (second row of keys from the top; left end). The keystroke combination of “2nd”, then the decimal point (“.”; bottom row of keys), gives the “Format” function. The calculator prompts: “Dec= 2.00”. I recommend they type: “4”, then explain that they must hit the “Enter” key (top row) to send the information to the ‘cpu’. The calculator displays: “Dec= 4.0000”. I also mention that the display showing four decimals tells them if their defaults have been re-set.

Payment per year from 12 to 1.

By pressing “2nd” and “I/Y” (or “P/Y” as the second function), the students can set their ‘payments per year’ from monthly compounding to annual compounding. Students type in “1” and “enter” key. The calculator now displays: “P/Y= 1.0000”. Then, students can adjust manually by use of compounding ‘m’ times per year. The interest rate is divided by ‘m’ and the number of periods is multiplied by ‘m’. (I give numerical examples: for ‘semi-annual’ compounding, $m=2$. Therefore, for example, for 3 years at 10%: there are (3×2) 6 semi-annual periods. And you receive 5% $(10\%/2)$ each six months. Then ask: “What is “m” for quarterly compounding?” (Hopefully, they all answer $m=4$.) I go through that example. Without ‘doing the math’, I ask what is “m” for monthly compounding? Weekly? Daily? Then is a good time to go into continuous compounding as the limit as “m” approaches infinity.)

Other calculator explanations.

I illustrate the method for changing annuity payment receipt from the ‘end’ of the period (“ordinary annuity”) to the ‘beginning’ of the period (“annuity due”). “2nd” and “PMT” (or “BGN” for ‘beginning’ on the 2nd function) shows the current setting. By pressing “2nd” “enter” (or “set”), the ‘end’ and ‘beginning’ toggle back and forth. To quit, press “2nd” and “CPT” (top left); this keys sequence gets one out of any ‘menu’.

I also demonstrate the storage and retrieval of data. Store (“STO”) must be followed by a number (0 through 9), giving ten possible storage locations. The same is true for ‘recall’ (“RCL”).