

Saving Money for Finance Students by Utilizing the TVM Capabilities of Graphing Calculators

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Finance

Abstract

Many Business Finance students purchase a calculator with time value of money functions, such as the TI Business Analyst, or TI BA II plus. This may be a needless expense. After a preliminary survey of Henderson State University Finance students showed that the majority already owned a graphing calculator, two national surveys were conducted to determine the likelihood that this is also the case at many other Universities and Colleges. The first survey was conducted on AACSB schools to determine what math classes are a prerequisite for Finance. The second survey was conducted of 2,256 math department chairs in the United States. The survey asked questions about the requirement that students purchase graphing calculators in College Algebra. The surveys suggest that nationwide, many Business Finance students have already been required to purchase a graphing calculator such as the TI 83 for their math classes. The TI 83 can perform time-value of money calculations. Other graphing calculators, such as the TI-82 and several others, can easily download this capability. In this paper we show the capabilities of the TI 83 and also show how to download financial programming for the TI 82 and other calculators so that they will perform the necessary financial calculations.

The rise of college tuition and textbook costs in recent years has put quite a strain on the budget of many college students. The rising costs raise the importance of the decision faced by professors of Business Finance classes whether to require students to purchase a financial calculator. Is the financial calculator essential? Certainly the capability to compute TVM (time-value of money) calculations, including annuities, is extremely important. But can the students capably compute these financial calculations without the additional purchase of a financial calculator? This paper examines this question.

The Preliminary Survey

Two sections of Business Finance Students were surveyed at Henderson State University in Fall Semester, 2001. The survey consisted of one question. This question was “Did you already own a graphing calculator prior to the beginning of this course and if so, what model?” The results are presented in detail in Exhibit 1. Those students having a Texas Instruments Graphing Calculator represented 74% of the students surveyed. Students who had a Graphing Calculator of any model represented 79%.

Since appropriate TVM calculation software exists for the TI-82, 83, 83+, 83+SE, 85, 86, 89, 92, 92+, and Voyage 200 at this time, it seems wasteful to make students who own these calculators purchase a dedicated financial calculator. If the Fall Semester 2001 was typical of the student population at Henderson, and if only the TI models described here had financial

capabilities, this means that only 26% of the Henderson State Finance students would need to buy a new calculator. The percentage would only be 21% if the non-Texas Instruments calculators also have the TVM capability.

This preliminary survey did not answer the question of whether the results for Business Finance students at Henderson State University could be generalized to a wider student population.

The Two Larger Surveys

Two different surveys were conducted. In the first, AACSB accredited schools were surveyed to determine the likelihood that a College Algebra type course would be a prerequisite for Business Finance. The second survey asked 2,256 Mathematics Chairs questions about the requirement that students purchase graphing calculators in College Algebra.

The first survey, of AACSB accredited schools, examined 60 online college catalogs chosen on a randomized basis. The results are as follows:

1. Of the schools in the sample, sixteen (26.7%) required College Algebra. *A 95% confidence interval for the population of AACSB schools would have a lower bound of 15.5% and an upper bound of 37.9%.*
2. Twenty (33.3%) of the schools in the sample required some algebra, including College Algebra and all other course titles containing the word Algebra. *A 95% confidence interval for the entire population of AACSB schools would have a lower bound of 21.4%, and an upper bound of 45.3%.*
3. A majority of the schools require at least some math as a prerequisite to Business Finance. There were 36 schools in this category, comprising 60% of the schools in the sample. *A 95% confidence interval for the entire population of AACSB schools would have a lower bound of 47.5%, and an upper bound of 72.4%.*

A group of AACSB professors who attended the Annual Meeting of the Academy of Economics and Finance expressed dismay at the results of this survey when this paper was presented in February 2003. A survey of the professors attending the presentation showed 100% of those professors came from AACSB schools that required College Algebra as a prerequisite for Business Finance. To explain the discrepancy between the results of our study and the impromptu survey at the presentation, the authors suggested that perhaps the sample of schools represented in the presentation at the conference was not random. Perhaps, we surmised, schools that are lax in their mathematical prerequisites are also less likely to send faculty to conferences. The authors assured the conference attendees that survey of AACSB schools presented in this paper was indeed a random sample.

The second survey, of math department chairs, was conducted using an email survey. Of these, we received a total of 979 responses. Some of the conclusions from the survey were:

1. The fraction of departments that either require or recommend a graphing calculator for college algebra is 61.5% +/- 3.3% (5% margin of error).
2. When a math department recommends or requires a graphing calculator, Texas Instruments are the choice of the majority, or 91.9% +/- 2.4% (5% margin of error).

3. The TI-83 was especially popular.

The Time Value of Money Capabilities of TI graphing calculators

The TI-83 and other Texas Instruments graphing calculators have financial applications which operate similar to the TI Business Analyst series. Instead of the standard Business Analyst horizontal row of buttons such as n, i/r, pv, pmt and fv, the graphing calculators have a screen with a vertical column of these same items. The student enters the numbers on the screen in much the same manner that one operates the Business Analyst series. The TI-83 has annuity functions, can handle annuity due, can calculate the remaining principal after x number of payments and can graph the declining value of a loan over time.

Time-Value-Money Solver on the TI-83, 86, 89, 92+, and Voyage

The 83 already comes loaded with appropriate TVM capability, and the 86, 89, 92+ and Voyage 200 can be loaded with a program or application that work in a very similar manner. Since the TI-83 was the most popular calculator of the students surveyed, we will use it in the examples that follow. Later in this paper, the 82 and 85 calculators will be discussed. This section presents a short tutorial on the TVM functions of the 83, 83+ and 83+Silver.

On the TI-83, touch the Finance button, or for a TI-83+, touch the APPS button and then select Finance by using the arrow keys and the enter key to see the menu as shown in Exhibit 2. Select the time-value-money solver menu to see the variables shown in Exhibit 3. These variables are defined as follows:

- N is the total number of compounding periods.
- I% is the annual percentage rate in percent.
- PV is the present value.
- PMT is the payment
- FV is the future value.
- P/Y is the number of payments per year.
- C/Y is the number of compounding periods per year.

The last line of screen allows the student to set whether a payment is made at the end or beginning of each compounding period.

The time-value-money solver will solve for any one of the first five variables as long as the other variables are supplied. For example, if a student wants to know the monthly payments for a \$100,000 30-year loan at 7% annual interest, then he or she moves the cursor next to the payment variable as shown in Exhibit 4. Then the SOLVE command is invoked (ALPHA ENTER keys) and a payment of \$665.30 is found. See Exhibit 5.

Other Finance Commands

Scrolling down the Finance menu shows the following commands:

- npv(finds the net present value for a cash flow.
- irr(finds the internal rate of return for a cash flow.
- bal(finds the balance for an amortization schedule.
- Σ Prn(and Σ Int(find the sum of the principal and interest, respectively, during a specified period for an amortization period.

>Nom(and >Eff(find the nominal rate, given the effective rate and the number of compound periods or find the effective rate, given the nominal rate and number of compound periods.

See Exhibit 6 for a screen view of these commands. The calculator comes with a manual that discusses these commands in detail.

The 83 and 83+ not only has the features of the financial calculators, it also does more than the financial calculators. It has the ability to graph results, an example of which follows in the next section.

A graphing example with the TI-83

Using the above example of a \$100,000 loan, we will show how to graph the outstanding balance. Under the MODE key, use the arrow keys and enter to set the number of decimal places to 2 and select parametric (Par) for the graphing mode. See Exhibit 7. We could graph the balance using the using function mode (Func), but parametric (Par) allows us to trace and see the balance for each month or year.

1. Press the “Y=” key.
2. Return to the Finance/Calc menu. The bal(command, which is item 9 under the Finance/CALC menu is put into Y1 by pressing enter. T is the payment number. See Exhibit 8 for a picture of the parametric function list.
3. Set the WINDOW variables to run from the 0th to the 360th payment and plot the balance every 12 months. (Setting the Tstep to 1 would allow you to see the balance for each month, but it would take a long time to graph.) See Exhibit 9 for a list of all the WINDOW variables values. Tracing will show the month and the corresponding balance. In the example shown in Exhibit 10, tracing to T=180, shows that the outstanding balance is \$74,019.59. This illustrates that only about one quarter of the loan is paid off after half the payments are made.

Creating Tables with the TI-83:

The TI-83 also makes tables easily. For example, you could put the payment allocated to the principal in an X variable and the interest allocation in a Y variable. The first graphing pair was deselected by moving the cursor over an = and pressing ENTER. See Exhibit 11 showing the first parametric function pair deselected and the change to the 2nd function pair. Set the TBLSET menu as shown in Exhibit 12 and then select TABLE. The Table in Exhibit 13 shows that about equal amounts are applied to the principal and interest during the 242nd payment.

Finance Features on Other TI Graphing Calculators

The finance features for the TI-83, TI-83+, and TI-83+ Silver Edition graphing calculators are built in. The other TI calculators can be re-programmed quite easily by going to the following locations on the web:

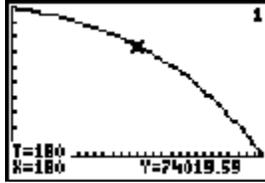
- For the TI-82, a BASIC program called TVMSLVR can be downloaded from <http://www.hsu.edu/faculty/lloyd/ti/82/82.html#82misc>.

- For the TI-85, a group of two finance equation variables called TVMSLVR can be downloaded from <http://www.hsu.edu/faculty/lloyd/ti/85/85.html#85misc>.
- For the TI-86, there is an assembly program very similar to the TI-83 Finance feature at <http://education.ti.com/us/product/tech/86/down/download.html>; the documentation in Adobe PDF format is also found at this web site.
- For the TI-92, a BASIC program called TVMSLVR can be downloaded from <http://www.hsu.edu/faculty/lloyd/ti/92/92.html#92misc>.
- For the TI-89, 92+ and Voyage 200, there is a flash application very similar to the TI-83 Finance feature at <http://education.ti.com/us/product/apps/89/finance.html>.

These files can be transferred to your calculator from a computer via a serial or USB cable used with either the TI Connect or TI Graph Link software. A description of these cables and free downloads for this software can be found at <http://education.ti.com/us/product/accessory/connectivity/features/cables.html>. If the finance professor is willing to facilitate the students in performing this download, the students would not have to purchase a cable themselves. (The TI-83+ and TI-83+SE come with the USB cable.) Several incentives have been provided by Texas Instruments to help educators obtain calculators and other accessories and these are at <http://education.ti.com/us/global/vppgraph.html>.

References	Exhibit 1		
TI-83 Plus Graphing Calculator Guidebook, ©1999 Texas Instruments Incorporated.	Preliminary Survey Results		
	<u>Graphing Calculator</u>	#	%
	TI 81	2	6%
	TI 82	8	24%
	TI 83	10	29%
	TI 85	2	6%
	Unknown graphing TI	3	9%
	None	7	21%
	Casio cfx9850gb	1	3%
	Casio fx7400g	1	3%
	TOTAL	34	100%
	With TI graphing calc	25	74%
	With graphing calc	27	79%
	Without graphing calc	7	21%

Exhibit 2	Exhibit 3	Exhibit 4	Exhibit 5
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<pre> 2nd VARS 2nd Tvm Solver... 2: tvm_Pmt 3: tvm_I% 4: tvm_PV 5: tvm_N 6: tvm_FV 7: tvm_PV </pre>	<pre> N=360 I%=7 PV=100000 PMT=-1400 FV=0 P/Y=12 C/Y=12 PMT: [PMT] BEGIN </pre>	<pre> N=360 I%=7 PV=100000 PMT=-1400 FV=0 P/Y=12 C/Y=12 PMT: [PMT] BEGIN </pre>	<pre> N=360 I%=7 PV=100000 PMT=-665.30249... FV=0 P/Y=12 C/Y=12 PMT: [PMT] BEGIN </pre>																								
<p>Exhibit 6</p>	<p>Exhibit 7</p>	<p>Exhibit 8</p>	<p>Exhibit 9</p>																								
<pre> 2nd VARS 7: tvm_PV 8: irr() 9: bal() 0: ΣPrn() 0: ΣInt() B: Nom() EFFC </pre>	<pre> Normal Sci Eng Float 0123456789 Radian DEG Func Par Pol Seq Connected Dot Sequential Simul Real a+bt re^at Full Horiz G-T </pre>	<pre> Plot1 Plot2 Plot3 X1T= Y1T=bal(T) X2T= Y2T= X3T= Y3T= X4T= </pre>	<pre> WINDOW Tmin=0 Tmax=360 Tstep=12 Xmin=0 Xmax=360 Xscl=12 Ymin=-10000 Ymax=10000 Yscl=10000 </pre>																								
<p>Exhibit 10</p>	<p>Exhibit 11</p>	<p>Exhibit 12</p>	<p>Exhibit 13</p>																								
	<pre> Plot1 Plot2 Plot3 X1T=T Y1T=bal(T) X2T=ΣPrn(T, I) Y2T=ΣInt(T, I) X3T= Y3T= X4T= </pre>	<pre> TABLE SETUP TblStart=239 ΔTbl=1 Indent: [Auto] Ask Depend: [Auto] Ask </pre>	<table border="1"> <thead> <tr> <th>T</th> <th>X_{2T}</th> <th>Y_{2T}</th> </tr> </thead> <tbody> <tr><td>239.00</td><td>327.21</td><td>338.09</td></tr> <tr><td>240.00</td><td>328.12</td><td>338.18</td></tr> <tr><td>241.00</td><td>329.04</td><td>338.26</td></tr> <tr><td>242.00</td><td>329.97</td><td>338.33</td></tr> <tr><td>243.00</td><td>330.92</td><td>338.39</td></tr> <tr><td>244.00</td><td>331.87</td><td>338.43</td></tr> <tr><td>245.00</td><td>332.83</td><td>338.47</td></tr> </tbody> </table> <p>T=242</p>	T	X _{2T}	Y _{2T}	239.00	327.21	338.09	240.00	328.12	338.18	241.00	329.04	338.26	242.00	329.97	338.33	243.00	330.92	338.39	244.00	331.87	338.43	245.00	332.83	338.47
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Biographies:

Dr. Glenna Sumner is a member of the school of business. She received her Ph.D. in Economics from the University of Oklahoma in 1993.

Michael Lloyd received his B.S in Chemical Engineering in 1984 and his Ph.D. in Mathematics from Kansas State University in Manhattan. He has presented papers at meetings of the Academy of Economics and Finance, the American Mathematical Society, the Arkansas Conference on Teaching, the Mathematical Association of America, and the Southwest Arkansas Council of Teachers. He has been at Henderson State University since August 1993.

Ying Chen received her BBA from Henderson State University in 2001. She Received her MBA from Henderson State University in 2002.