Estimating expected marginal future cash flows: The real challenge of the NPV

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APPENDIX

This article argues that we do students a disservice in the teaching of the process to determine the net present value (NPV) of a potential project. Typically, students are given expected future marginal cash flows of some project along with the initial cost of undertaking the opportunity. They are then given some type of information that allows them to estimate an appropriate discount rate at which the future flows are to be converted into present dollars. This article calls for the broader use of a more generalized approach that would require students to estimate future marginal cash flows themselves.

Keywords: Marginal Cash Flows, NPV, Valuation

INTRODUCTION

Inarguably, the most important topic finance teachers present is valuation. In fact, valuation is so important to any finance curriculum that the terms "finance" and "valuation" are almost synonymous (Brealey and Myers, 2003, p. 1). Derivative securities, stocks, bonds, real assets, potential projects and other investments are all subject to constant valuation. Pardon the pun, but much of the "value" that a finance graduate offers his or her employer's shareholders is the ability to accurately value something of interest to the firm. Usually, the item of interest is a type of asset or group of assets much like the list above, but even when answering the question of how to finance an asset, the corporate financier asks the question, "How much debt should I use to finance this asset so that the value of my firm is maximized?" The hedging decision is the same: "in what type of derivative instruments (and how much of them) should I invest to protect the costs of my inputs such that the value of my firm is maximized?" In short, the process of valuation is the most important concept throughout all aspects of finance.

So, how do we, as a profession, go about the business of teaching valuation? The first finance course usually begins with an introduction about how corporate finance involves three key decisions that the firm faces: 1) in what assets should the firm invest (the investment decision), 2) how should it finance those assets (the financing decision), and 3) how should the firm manage its risk (the hedging decision)? To develop the concepts that drive these decisions, the typical curriculum involves first teaching students the concepts of the time value of money - to include a discussion of risk and return. Then, the valuation of specific streams of cash flows such as annuities and perpetuities are presented, followed by various decision rules that are available to the firm to determine the economic benefits of available projects. Once students have learned the valuation calculation, a chapter on identification of marginal cash flows is presented before they tackle comprehensive capital budgeting problems. A mention is made somewhere along the way about sensitivity analysis before the final weeks of the class when capital structure and financing are discussed. If the course moves rapidly enough, dividend theory, corporate governance, ethics, or some international topics might make it into the discussion (Brealey and Myers 2003, p. xvi - xxv).

Problems abound under the scenario described above. First, hedging is rarely (if ever) discussed in an introductory corporate finance class – even though it is one of the three key corporate decisions financiers evaluate (especially at larger, financial or international firms). Derivatives are a topic usually covered in a higher level elective, so hedging is usually skipped. Second, the topics discussed at the end of the semester often get cut short (dividend theory, international finance, mergers and acquisitions, etc.). Third, for corporations that pay taxes, capital structure has an impact on the net present value (NPV). Rarely does the semester allow time to revisit the valuation calculation considering the more technical effects of leverage. Like most finance courses, due to the time constraint of a single semester, the professor must choose the topics that are most important for the student to learn. This means students still lack many crucial skills after completing an introductory finance class. These are difficult shortcomings for an educator to swallow, but they are mitigated somewhat by the fact that students will be able to continue the curriculum in either a subsequent course on financial theory or course using case studies.

Professors are all too aware of these shortcomings, and it is our anecdotal suspicion that many water cooler conversations have taken place in an effort to address them. However, the purpose of this paper is to address a more specific issue which is not as well discussed. This

issue deals directly with the NPV calculation itself. Brealey and Myers (2003, p. 91) outline the process by which a project's NPV is to be calculated: "First, forecast the cash flows generated by project X over its economic life. Second, determine the appropriate opportunity cost of capital. This should reflect both the time value of money and the risk involved in project X. Third, use this opportunity cost of capital to discount the future cash flows of project X. The sum of the discounted cash flows is called present value (PV). Fourth, calculate *net* present value (NPV) by subtracting the [initial] investment from PV. Invest in project X if its NPV is greater than zero." While students initially struggle with this important calculation, they are eventually able to apply it to a variety of projects such as expansions of existing lines of business, projects that are not similar to the firm's current industry, merger or acquisition candidates, etc., as long as an easily understood panel of data is provided for them. Finance graduates become more adept at the calculations by the time they enter the workforce – with one large caveat: in their curriculum, they are typically given too much information about the marginal future cash flows.

It is the purpose of this paper to suggest that the most difficult portion of the valuation process has been too conveniently given to students. Estimating the expected future cash flows is the most difficult portion of the valuation problem, yet this is simply provided to students (in one form or the other) in the problem.

SUGGESTION

The problem is a challenge to overcome. Students are rarely encouraged to think beyond the superficial in problem solutions. The easiest thing to do is to serve up any element requiring critical thought and a thorough search for information because doing so reduces the student's task to a calculation that is more easily mastered. Unfortunately, the complexity and nuance of the real world is absent from such sterile exercises. On the other hand, it is also unlikely that real world experiences can be brought to bear without students immersing themselves in a business environment, where the penalty for improper handling of decision methodologies is usually termination.

The authors suggest that experiential learning can occur in a vicarious environment through the use of more involved problems and cases - at least ones that capture some of the complexity of an actual business problem and setting. In a business setting, the real challenge of the net present value analysis is rooted in searching out of the expected future cash flows. Innumerable tasks exist: making sure the estimates are incremental to the project only, that predation on the firm's existing sales are taken into account, that the cash flow estimates consider all of the tax consequences, that the sales estimates from the marketing people are valid, that the cost accounting accurately portrays the operating costs associated with the project under consideration, that the depreciation rules are appropriate and provide maximization of early cash flows, and that both current and potential tax rules are properly applied. Several mini-case examples of our suggestion follow. The examples provide only a taste of the possible information inputs. The firm's marketing analysis, distribution channel information, and volume cost savings are not present. The student's task is not only quantitatively hefty, but non-quantitative as well.

Our suggestion is that faculty provide students with problems and cases in which expected future marginal cash flows are much more difficult to determine. You'll note how much less information is provided for the students.

EXAMPLE 1 - BUILDING PURCHASE

The first example is for a real estate operator - not an industrial firm. The same principles apply in either case, and our suggestion is equally applicable. The value created by the purchase not only depends on rent and expenses but on the probabilities of lease renewals. In other words, the example emphasizes the fact that *expected* future marginal cash flows are valued. Most capital budgeting problems give cash flows with 100% probability, but it is more likely that firms will have to estimate or assume the probability of actually incurring the cash flow at a particular point in time.

You are looking to invest in a small single-tenant office building in Richmond, Virginia, that is 100% leased to one tenant. The property is being offered for $8.0 million. You want to buy the building now to provide you with income for the next 10 years at which time you plan on selling the building. A short abstract of the major terms of the existing lease is provided below:

Lease Abstract:

Rentable Square Footage: 60,000 square feet
Term: Expires 24 months from now
Annual Rental Rate per Square Foot: $25 per square foot per year
Landlord-paid Operating Expenses (Expense Stop): $10 per square foot per year

Weak market conditions dictate upfront leasing expenditures of $2.50 per square foot per year to pay broker commissions and construct suites that meet the needs of new tenants (payable at lease commencement). This cost is not expected to increase for the foreseeable future. Expenditures of $1.50 per square foot per year are sufficient for renewing tenants. Current rental rates in Richmond for properties of similar quality are anywhere from $18 to $22 per square foot per year, and building expenses are approximately $10 per square foot per year for occupied space and $5.00 per square foot for unoccupied space. It is taking landlords an average of 12 months to lease space that tenants vacate. You have reviewed the credit worthiness of the tenant and are comfortable with their financials, but they did not show their hand when you interviewed them as to whether or not they would renew their lease. Doing so would reduce their strength in negotiations for a renewal. You can expect that purchasers of office properties in 10 years will require a capitalization rate (defined as net operating income divided by the purchase price) similar to the 7.0% currently seen in the marketplace. The cost of capital appropriate for the risk of multi-tenant office properties is currently 9.0%.

Questions (with solutions for instructors):

(1) Should you purchase the property at the $8.0 million asking price?

Answer: Answers to this question will vary depending upon the assumptions each student or groups makes. A potential solution to the case is included below. For the solution in an actual Excel file, please contact either author. A solution is included in Table 1 (Appendix).

Note: A more accurate answer would actually analyze the property on a monthly basis (rent and expenses are paid each month). Since leasing downtime for vacant spaces is 12

months, the annual solution presented is acceptable. If that assumption is changed to 9 months or 15 months, then a monthly analysis should be conducted. Additionally, students could be required to estimate the appropriate the opportunity cost of capital with some additional information. The learning point emphasized here is expected future cash flow estimation.

(2) What type of change in your assumptions would cause you to change your answer to question (1)? In other words, complete a sensitivity/scenario analysis to determine how robust your purchase price is to changing market conditions.

Answer: Answers to this question will also vary depending upon question (1) responses. If spreadsheets are constructed with a series of inputs/assumptions with appropriate cell references (as presented in the above solution), then a scenario or sensitivity analysis would be very easy.

(3) What aspects of this real estate case differ from other industrial problems or cases that you've worked through in the past?

Answer: First, there is no impact on net cash flows due to changes in working capital. Second, due to the structure of commercial office leases, landlords are insulated from increases in operating expenses - at least until expiration of the current lease. Technically, operating expenses incurred by the landlord do increase at lease expiration, but those terms of the lease are negotiable. Third, leases are contractual revenue. A landlord does not have to worry about opening the door and hoping that customers come patronize a product. They have to underwrite the credit-worthiness of the tenant. A less credit worthy tenant would be required to put up a security deposit or letter of credit to back up their promise to pay rent over the lease term. The case could be altered to include a security deposit - in which case the time value of money of the security deposit should be taken into account. Students may also present other differences.

(4) What was the most difficult part of determining an answer to question (1)?

Answer: The most difficult part of determining an answer to question (1) is estimating the expected future cash flows! Students have to determine an appropriate renewal probability based upon the facts given. Interviews of tenants prior to purchasing give new landlords a better (or worse) feeling about their renewal probability assumptions - but not always. Students also have to determine what the market capitalization rate (cap rate) should be at the end of the holding period. In this case, the cap rate was given, but that is not a fixed rate. This determines the sales price of the building at the end of the holding period - a significant input to the NPV calculation.

The second example problem is an exercise emphasizing the importance of including opportunity costs in estimating marginal or incremental cash flows. Failure to include opportunity costs is one of the more common pitfalls of the cash flow estimation process (along with spillover effects, overhead allocation, and others).

EXAMPLE 2 - OFFICE LEASE RENEGOTIATION

As the landlord of a multi-tenant office property in downtown Phoenix, Arizona, you aren't too worried about falling market rental rates. For the past three years, your property has been leased long-term to two very creditworthy tenants. Rental rates were near all-time highs when each tenant inked their lease, and you feel pretty good about the return that your property is providing to your shareholders - especially when you look at the much reduced rental rates at which comparable landlords are signing leases.

Just as you are feeling comfortable, a 20,000 square foot tenant approaches you about restructuring their lease. They would like to take advantage of the falling rental rates to decrease their costs in the near future. In exchange, they are offering to extend their lease beyond the current termination date. Because they are offering you so much additional term, they are not only asking for a reduction in their base rent. They also request a new expense stop to reflect the current (higher) operating expenses for the property. The tenant has leased space in the property for over 16 years and has never missed a rent payment. (Aside: In a *gross lease*, base rent includes a component contributable to building operating expenses. In other words, the landlord is responsible for paying the operating expenses of the property [janitorial, utilities, security, repairs and maintenance, taxes, insurance, etc.]. Landlords, however, are only required to pay operating expenses up to an *expense stop*. If operating expenses exceed the expense stop stated in the lease, then the tenant must pay the landlord a monthly expense reimbursement in addition to their base rent.) A summary of the existing lease terms follows.

Lease Commencement:	January 1, 2006
Lease Expiration:	December 31, 2012
Base Rent:	$30 per square foot per year
Expense Stop:	$16 per square foot per year

The terms of their restructure offer:

Lease Commencement:	January 1, 2010
Lease Expiration:	December 31, 2016
Base Rent:	$24 per square foot per year
Expense Stop:	$17 per square foot per year

They do not have a termination option, so they are still contractually obligation to the existing deal if you do not accept their offer. They are not using a broker, and you are representing yourself as well. They are not asking for any improvement allowance to do any construction in the suite. Investor's current required return on office properties of similar quality in Phoenix is 7.0%. You don't know whether or not to accept the deal.

Questions (with solutions for instructors):

(1) What is the NPV of the restructured lease deal?

Answer:
Net cash flows for the period 1/1/2010 to 12/31/2010 would be an annuity due:

Rent Forgone:	($50,000.00) per month	[20,000 square feet * $30 / 12]
Expenses Not Paid:	$26,666.67 per month	[20,000 square feet * $16 / 12]
Rent Received:	$40,000.00 per month	[20,000 square feet * $24 / 12]
Expenses Paid:	($28,333.33) per month	[20,000 square feet * $17 / 12]
Net Cash Flows:	($11,666.67) per month	

$$PV = \frac{(11{,}666.67)}{\left(\frac{.07}{12}\right)}\left[1 - \frac{1}{(1+\frac{.07}{12})^{36}}\right]\left(1+\frac{.07}{12}\right)$$

$$PV = (\$380{,}046)$$

Net cash flows for the period 1/1/2011 to 12/31/2016 are also an annuity due (36 months from commencement):

Rent Received:	$40,000.00 per month	[20,000 square feet * $24 / 12]
Expenses Paid:	($28,333.33) per month	[20,000 square feet * $17 / 12]
Net Cash Flows:	$11,666.67 per month	

$$PV = \frac{\frac{11{,}666.67}{\left(\frac{.07}{12}\right)}\left[1 - \frac{1}{(1+\frac{.07}{12})^{48}}\right]\left(1+\frac{.07}{12}\right)}{\left(1+\frac{.07}{12}\right)^{36}}$$

$$PV = \$397{,}465$$

So, the NPV of the restructured deal is **$17,419**. For a spreadsheet solution to the problem, contact either author.

(2) What is/are the shortfall(s) of your NPV calculation?

Answer: The biggest shortfall of this calculation is that releasing the space after the expiration of either deal is ignored. All true expected marginal future cash flows would include the cash flows associated with leases commencing later. In other words, if you don't accept the restructured deal, then there is a chance that the tenant will move on 12/31/2010, and you will incur the costs of leasing the space to a new tenant - including potential downtown in a softer leasing market. There is also

Follow-up Question: Do you think managers consider this shortfall in making actual leasing decisions? YES. Landlords do not want their tenants to move out. Finding new tenants is expensive. Renewing existing tenants is much cheaper. In fact, some landlords publicize that they are not in the real estate business. They consider themselves to be in the "tenant retention business."

(3) How would a "typical" compensation arrangement for the landlord alter the decision to accept or reject the proposal?

Answer: Compensation arrangements usually reward managers for performance in a twelve month time period. If a manager has a target earnings number for the next year, it would be difficult for him or her to accept the deal since it reduces earnings immediately for benefit in later years. An earnings based bonus would not properly align managerial and shareholder interest in this case.

EXAMPLE 3 - MONTE CARLO SIMULATION

One challenging aspect of cash flow estimation involves capturing the notion of risk. While capital budgeting adjustments such as a certainty equivalent cash flow or a risk adjusted discount rate can effectively penalize riskier projects, thus making their acceptance less likely, neither method has a particular objectivity concerning the penalty factor. After project cash flows are estimated, it is a relatively minor mechanical process to calculate a net present value. A positive decision is dependent on the NPV being greater than or equal to zero. However, if we allow for rationally perceived variation in the cash flow estimates based on distribution inputs, what results is a distribution of possible net present values. The proximity of the mean of this distribution to zero gives us some insight as to an appropriate decision, but the moments of the distribution can yield even greater insight.

For example, suppose a corporation is considering investment in a new project, with first year's sales expectations given at $500,000. After the first year, estimates are that sales will grow at a declining average of 20%, 18%, 16%, 14%, 12%, 10%, and 8% for years 2-8, and then settle in at 4% for the remaining two years. Of course, as the scenario moves further into the future, less and less confidence exists regarding the accuracy of the growth estimates, so it is also specified that an increasing standard deviation: 1%, 1.5%, 2.5%, 4%, 5.5%, 7%, 8%, 9%, 10.5%, and 12% for years 1-10. In addition, cash expenses as a percent of sales may be, on average, 50%, but further into the future, it may be specified increasing standard deviations for each year: 1%, 1.25%, 1.5%, 1.75%, 2%, 2.25%, 2.5%, 2.75%, 3%, and 3.25% for years 1-10. Noncash operating expenses are likely predetermined according to some depreciation algorithm, such as MACRS; perhaps a seven-year schedule. Tax rates, on the other hand, can also vary from year to year, so an average of 38% could be specified with a 2% standard deviation. As these parameters are specified in an excel workbook, multiple pages can be constructed representing the parameters, a sales worksheet, a cash operating cost worksheet, and a sheet to summarize net operating cash flows. This can be repeated with many trials, the spreadsheet program providing the randomly selected, normally distributed input distribution observations. For each iteration, an NPV can be calculated based on the particular set of random inputs. The distribution of this column of NPV's can then be analyzed using statistical moments and using graphical summaries to show the portion of the output distribution that is in positive range (indicating the probability that an 'accept' decision would result) and negative range (indicating a 'reject' decision). The likelihood of errors can also be perceived (the acceptance of a project that has a high likelihood of underperforming or the rejection of a project with a high likelihood of over performing). For the scenario specified above, spreadsheet output will resemble the screenshots in Figures 1-6 (Appendix).

The resulting frequency distribution of the NPV's provides a decision maker with an understanding not just of a NPV calculated purely on the basis of a single set of input variables. It provides an understanding of possible outcomes based on specified variation in those input variables. Again, the mechanical process of discounting cash flows is not the managerial challenge; rather it is the specification of reasonable input distribution tolerances and the use of those specifications that provide the output distribution useful for a capital budgeting decision.

Figure 7 (Appendix) shows a histogram of net present values resulting from one set of 500 random numbers for each input variable. The expected NPV, a simple average of the 500 NPV's, is positive. A large portion of the distribution, however, extends well into negative NPV territory, indicating a substantial likelihood of a rejection preference given the potential variation in the input variables.

Each project brings a different variability scenario to its input variables, and it may be the case that a positive expected NPV would be accompanied by a very small likelihood of a negative occurrence, or that a negative expected NPV would be accompanied by a very small likelihood of a positive occurrence. The decision represented by the sign of the expected NPV would thus be well supported, even given the variability in the input variables. In cases where a large portion of the distribution is on either side of the origin, though, more careful consideration may be in order.

CONCLUSION

The above examples illustrate that it is not only challenging for students to consider technical and quantitative aspects of net cash flow calculation; it is challenging to present the complexity of informational inputs necessary to formulate such estimates. As mentioned previously, the examples are short, and they provide less information rather than more. Students are left to intentionally struggle with inputs and assumptions about how to estimate the expected marginal future cash flows.

This article argues that current back-of-the-chapter problems and "mini-cases" are far from sufficient to illustrate the truly challenging aspects of capital budgeting analysis in the professional management world. Perhaps for most business school graduates, the superficial knowledge of the capital budgeting decision is all that should be required. However, for those whose potential includes the possibility of becoming a professional manager, it would seem that a large foundational brick is missing in the traditional exposition of the capital budgeting process - at least the part with which students are expected to demonstrate expertise. Perhaps the reason professors do not cover anything beyond the mechanical is that instructional resources are simply not available. Cases that contain the richness of a real-world cash flow estimation problem are rather hard to find. There are, however, many professors who have real-world experiences and still others who have been business consultants. If their experience and expertise can be manifested in new and effective case resources, then the possibility would exist for a much richer exposition of the capital budgeting process.

The authors also recognize that resistance may be a factor in the application of these resources in teaching techniques. It is not only easier for students to repetitively carry out the calculations for a net present value; it is also easier for professors to only require that piece as a learning outcome. Also, some professors may not have any business experience of their own, so applying someone else's experiential teaching tools may prove confounding to them.

Finally, the authors also acknowledge that it is simply impossible for students to come out of school with a command of the intricacies associated with every single industry. Two of our examples involve real estate. Examples for pharmaceutical, manufacturing, oil and gas production, etc., would all differ substantially. The largest shortcoming in our suggestion is that one cannot prepare students for the capital budgeting decisions faced in every single line of business in our economy.

The benefit to the students, though, is not in doubt. The adoption of real world experiential learning methods creates student beneficiaries. Many professors in business schools hear of the dismal quality of business school graduates from company executives and their recruiters. Perhaps a less superficial teaching regime would alleviate those complaints to some degree. At least graduates would know that they bring very little expertise to the table for any single employer until on-the-job experience can continue the education process. What is important is for students to understand that their education is only the first step toward a lifetime of learning and personal growth.

REFERENCES

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Figure 1. Solution to Example #1

Solution to Real Estate Example													
To Accompany "Identifying Marginal Cash Flows: The Real Challenge of the NPV"													
Assumptions (Inputs)													
	Building Size	60,000	The total Rentable Square Feet of the Building										
	Renewal Probability	75%	The probability that the tenant will renew upon expiration										
	Reletting Time	1	The number of years required to lease the space if the tenant moves out										
	Market Rent	20	The market rental rate per square foot per year for the space										
	Occupied Expenses	$ 10.00	The building operating expenses on a per square foot per year basis while OCCUPIED										
	Vacant Expenses	$ 5.00	The building operating expenses on a per square foot per year basis while VACANT										
	Leasing Costs	$ 2.50	Capital Expenditure Required to Lease NEW Space on a per square foot per year basis										
	Leasing Costs	$ 1.50	Capital Expenditure Required to RENEW Space on a per square foot per year basis										
	Lease Term	5	Number of Years on a Lease Term										
	Cap Rate	7%	Capitalization Rate for Sales Price										
	OCC	9%	Opportunity Cost of Capital for Commercial Real Estate in Richmond Virginia										
Year		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Cash Flows from Capital Investment													
	Purchase Price	(8,000,000)	-	-	-	-	-	-	-	-	-	-	-
	Leasing Expenditures	-	-	-	(337,500)	(187,500)	-	-	-	(253,125)	(225,000)	(46,875)	-
	Sales Price	-	-	-	-	-	-	-	-	-	-	8,571,429	
	Total Cap Investment	(8,000,000)	-	-	(337,500)	(187,500)	-	-	-	(253,125)	(225,000)	8,524,554	-
Cash Flows from Operations (Net Operating Income)													
	Building Size		60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Revenue												
	Rent		25	25	20	20	20	20	20	20	20	20	20
	Probability		100%	100%	75%	75%	75%	75%	75%	56%	56%	56%	56%
	Rent									-	20	20	20
	Probability									19%	19%	19%	19%
	Rent				-	20	20	20	20	20	20	20	20
	Probability				25%	25%	25%	25%	25%	25%	19%	19%	19%
	Rent										-	20	20
	Probability										6%	6%	6%
	Total Expected Rent	-	25	25	15	20	20	20	20	16	19	20	20
	Total Expected Revenue	$ -	$ 1,500,000	$ 1,500,000	$ 900,000	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ 975,000	$ 1,125,000	$ 1,200,000	$ 1,200,000
	Expenses												
	Occupied Expenses		600,000	600,000	450,000	600,000	600,000	600,000	600,000	487,500	562,500	600,000	600,000
	Vacant Expenses		-	-	75,000	-	-	-	-	56,250	18,750	-	-
	Total Expected Expenses		600,000	600,000	525,000	600,000	600,000	600,000	600,000	543,750	581,250	600,000	600,000
	Total CFs from Operations	-	900,000	900,000	375,000	600,000	600,000	600,000	600,000	431,250	543,750	600,000	600,000
Total Net Expected Cash Flow		(8,000,000)	900,000	900,000	37,500	412,500	600,000	600,000	600,000	178,125	318,750	9,124,554	
NPV		(852,488)											

Figure 2. Input Summary Sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		**PARAMETERS**											
2			**YEAR**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3		**Sales**	**Mean**		0.2	0.18	0.16	0.14	0.12	0.1	0.08	0.04	0.04
4			**Std**		0.01	0.015	0.025	0.04	0.055	0.07	0.08	0.09	0.105
5													
6		**CashExp**	**Mean**	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
7			**Std**	0.01	0.0125	0.015	0.0175	0.02	0.0225	0.025	0.0275	0.03	0.0325
8													
9		**TaxRate**	**Mean**	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
10			**Std**	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11													
12		**Depreciation %**		0.143	0.245	0.175	0.125	0.089	0.089	0.089	0.045	0	0
13		**MACRS 7-year**											
14													
15		**Year 1**		**Asset Cost**		**Discount**							
16		**Sales Est**		**(PVO)**		**Rate**							
17		$500,000.00		$1,330,000.00		0.2							
18													

Figure 3. Sales Worksheet

	YEAR	1	2	3	4	5	6	7	8	9	10
Iteration	1	$500,000.00	$594,340.12	$685,254.72	$804,658.62	$920,849.30	$1,014,537.35	$1,027,176.48	$1,091,806.66	$1,069,558.84	$1,129,053.63
	2	$500,000.00	$603,496.36	$717,334.31	$821,006.76	$907,420.98	$1,045,377.13	$1,211,034.77	$1,252,720.64	$1,362,699.76	$1,370,077.90
	3	$500,000.00	$606,769.78	$703,848.81	$841,159.27	$969,431.78	$1,153,338.99	$1,275,752.17	$1,402,569.33	$1,282,925.59	$1,415,062.93
	4	$500,000.00	$602,806.39	$716,753.98	$858,839.09	$951,813.19	$941,190.52	$1,067,040.13	$1,246,767.52	$1,339,255.37	$1,466,931.20
	5	$500,000.00	$600,784.77	$716,114.21	$838,568.94	$1,014,574.98	$1,215,048.00	$1,450,136.43	$1,523,884.76	$1,281,350.19	$1,343,906.53
	6	$500,000.00	$600,206.99	$710,423.12	$810,503.65	$911,120.26	$965,128.13	$971,864.70	$1,012,102.44	$940,936.05	$998,053.22
	7	$500,000.00	$603,218.72	$697,643.60	$794,515.65	$928,922.71	$960,779.52	$1,043,740.05	$1,240,599.21	$1,455,072.75	$1,507,989.74
	8	$500,000.00	$605,996.74	$712,499.68	$834,806.88	$959,123.41	$1,018,190.84	$1,054,478.52	$1,284,294.98	$1,230,468.83	$1,072,605.16
	9	$500,000.00	$600,246.60	$700,633.00	$801,360.31	$942,930.95	$1,133,305.98	$1,248,370.81	$1,261,189.32	$1,222,698.81	$1,388,670.06
	10	$500,000.00	$602,320.75	$704,562.54	$812,599.33	$937,064.03	$1,023,800.15	$976,277.41	$994,913.25	$1,012,080.13	$1,150,171.47
	11	$500,000.00	$596,100.53	$705,985.61	$839,581.67	$1,002,643.80	$1,155,437.62	$1,241,602.05	$1,284,517.92	$1,450,634.13	$1,580,107.09
	12	$500,000.00	$601,206.00	$706,979.43	$821,321.19	$929,124.44	$1,152,081.15	$1,393,334.49	$1,671,653.46	$1,790,726.11	$2,176,582.45

Figure 4. Expenses Worksheet

	YEAR	1	2	3	4	5	6	7	8	9	10
Iteration	1	$244,256.10	$297,255.59	$348,591.34	$391,066.29	$452,472.59	$506,544.40	$496,952.30	$560,104.03	$497,714.88	$593,047.45
	2	$264,390.92	$305,461.83	$369,887.86	$397,574.37	$441,240.03	$529,534.97	$596,865.33	$623,174.19	$716,800.16	$705,944.62
	3	$260,319.05	$301,463.56	$343,348.20	$417,477.83	$458,011.70	$605,325.65	$605,980.90	$766,751.78	$627,404.59	$692,271.87
	4	$241,437.45	$298,712.77	$347,782.20	$435,574.58	$492,742.07	$453,316.48	$521,448.56	$549,251.41	$682,770.46	$803,761.77
	5	$252,129.93	$288,661.97	$353,266.16	$418,933.23	$471,741.06	$627,462.91	$710,510.45	$754,847.61	$661,721.66	$562,878.54
	6	$245,097.76	$297,960.32	$380,508.20	$442,355.58	$481,333.72	$433,765.66	$489,710.23	$580,986.75	$499,541.25	$521,598.54
	7	$248,654.52	$308,726.89	$343,330.70	$404,635.37	$459,332.22	$513,943.24	$491,164.68	$640,213.48	$784,724.56	$744,505.48
	8	$253,607.32	$306,903.32	$363,393.88	$409,625.34	$477,823.74	$523,878.82	$535,559.68	$628,203.10	$616,956.42	$477,675.27
	9	$252,982.18	$299,718.60	$360,256.11	$404,950.59	$492,541.19	$552,758.99	$643,336.14	$620,952.49	$565,419.72	$658,310.29
	10	$252,027.75	$297,368.31	$367,266.09	$399,345.79	$460,442.92	$523,713.65	$500,324.20	$577,545.18	$482,670.06	$591,575.47
	11	$249,077.21	$293,770.69	$345,556.77	$430,688.97	$512,535.32	$509,485.95	$633,261.38	$624,368.87	$713,399.15	$876,834.65
	12	$246,279.50	$309,569.78	$346,758.33	$412,678.30	$456,473.89	$586,358.96	$680,687.20	$854,864.52	$872,393.08	$1,122,794.80

Figure 5. Net Cashflow Worksheet

	YEAR	1	2	3	4	5	6	7	8	9	10
Iteration	1	$230,976.84	$309,067.25	$296,850.01	$319,292.20	$329,683.33	$364,742.75	$367,174.94	$351,211.89	$347,862.90	$322,672.88
	2	$216,385.21	$309,098.31	$302,383.06	$321,859.66	$325,500.14	$374,410.51	$431,525.98	$421,035.99	$429,295.33	$412,368.99
	3	$221,511.41	$313,160.19	$306,930.25	$332,319.87	$366,920.99	$388,376.71	$453,202.55	$412,612.63	$423,136.16	$442,954.16
	4	$231,989.32	$311,757.10	$316,952.04	$322,381.37	$330,950.70	$342,333.85	$377,726.38	$500,561.51	$390,270.49	$418,645.61
	5	$223,369.96	$317,363.26	$310,440.63	$323,454.28	$391,149.62	$417,714.85	$516,767.27	$481,268.06	$398,854.24	$502,656.54
	6	$231,573.75	$311,247.58	$298,126.77	$287,282.85	$316,463.78	$368,889.46	$345,823.99	$289,643.21	$280,218.43	$300,803.04
	7	$229,502.02	$305,908.60	$308,016.04	$308,942.39	$325,628.78	$324,047.46	$374,428.34	$392,710.58	$436,030.02	$501,037.01
	8	$224,628.94	$309,510.59	$304,337.08	$321,288.01	$342,752.13	$348,040.35	$354,982.00	$434,022.73	$356,695.35	$385,613.16
	9	$224,807.27	$309,992.04	$299,884.63	$311,264.55	$329,236.85	$419,677.38	$428,676.02	$412,348.82	$390,742.11	$450,736.69
	10	$227,324.69	$312,973.58	$300,322.78	$313,827.54	$352,758.76	$339,857.02	$341,232.47	$278,495.99	$329,231.06	$351,307.16
	11	$227,708.05	$311,803.69	$311,669.34	$312,712.97	$351,994.87	$447,709.59	$434,323.10	$413,875.18	$465,274.81	$449,703.52
	12	$230,660.34	$304,804.86	$313,064.42	$317,261.99	$332,877.05	$405,578.69	$506,280.61	$519,809.47	$596,891.69	$665,013.57

Figure 6. Present Value of Net Cashflows Sheet

	YEAR	1	2	3	4	5	6	7	8	9	10	PVNCF's
Iteration	1	$192,480.70	$214,630.04	$171,788.20	$153,979.65	$132,492.34	$122,151.61	$102,471.79	$81,680.66	$67,418.16	$52,113.47	$1,291,206.61
	2	$180,321.01	$214,651.61	$174,990.20	$155,217.82	$130,811.21	$125,389.32	$120,430.98	$97,919.51	$83,200.31	$66,599.89	$1,349,531.86
	3	$184,592.84	$217,472.35	$177,621.67	$160,262.28	$147,457.32	$130,066.58	$126,480.51	$95,960.51	$82,006.62	$71,539.57	$1,393,460.26
	4	$193,324.43	$216,497.99	$183,421.32	$155,469.41	$133,001.67	$114,646.91	$105,416.50	$116,414.61	$75,637.04	$67,613.60	$1,361,443.47
	5	$186,141.63	$220,391.15	$179,653.14	$155,986.83	$157,194.26	$139,891.86	$144,220.26	$111,927.57	$77,300.62	$81,181.84	$1,453,889.16
	6	$192,978.13	$216,144.15	$172,527.07	$138,543.04	$127,179.70	$123,540.33	$96,513.13	$67,361.75	$54,308.21	$48,581.37	$1,237,676.88
	7	$191,251.68	$212,436.53	$178,250.02	$148,988.42	$130,862.90	$108,522.84	$104,496.08	$91,331.93	$84,505.54	$80,920.27	$1,331,566.22
	8	$187,190.78	$214,937.91	$176,120.99	$154,942.13	$137,744.40	$116,558.01	$99,068.96	$100,939.82	$69,129.95	$62,278.68	$1,318,911.63
	9	$187,339.39	$215,272.25	$173,544.35	$150,108.29	$132,312.90	$140,549.10	$119,635.61	$95,899.16	$75,728.44	$72,796.49	$1,363,185.99
	10	$189,437.24	$217,342.76	$173,797.90	$151,344.30	$141,765.83	$113,817.43	$95,231.72	$64,769.27	$63,807.19	$56,738.07	$1,268,051.71
	11	$189,756.71	$216,530.34	$180,364.20	$150,806.80	$141,458.84	$149,937.04	$121,211.61	$96,254.14	$90,173.38	$72,629.63	$1,409,122.67
	12	$192,216.95	$211,670.04	$181,171.54	$153,000.57	$133,775.82	$135,827.48	$141,293.63	$120,891.07	$115,681.61	$107,403.40	$1,492,932.12

Figure 7. NPV, Histogram, and Frequency Distribution

		PVNCF's	NPV's	NPVfixed	BINS	Bin	Frequency
Iteration	1	$1,291,206.61	-$38,793.39	$3,458.26		-$125,000.00	1
	2	$1,349,531.86	$19,531.86	-$16,286.84	-$125,000.00	-$100,000.00	2
	3	$1,393,460.26	$63,460.26	$23,146.46	-$100,000.00	-$75,000.00	11
	4	$1,361,443.47	$31,443.47	$57,968.86	-$75,000.00	-$50,000.00	34
	5	$1,453,889.16	$123,889.16	-$42,166.42	-$50,000.00	-$25,000.00	51
	6	$1,237,676.88	-$92,323.12	-$24,034.86	-$25,000.00	$0.00	101
	7	$1,331,566.22	$1,566.22	$8,678.73	$0.00	$25,000.00	98
	8	$1,318,911.63	-$11,088.37	$23,084.30	$25,000.00	$50,000.00	78
	9	$1,363,185.99	$33,185.99	-$68,893.49	$50,000.00	$75,000.00	62
	10	$1,268,051.71	-$61,948.29	$20,500.38	$75,000.00	$100,000.00	30
	11	$1,409,122.67	$79,122.67	$31,592.22	$100,000.00	$125,000.00	22
	12	$1,492,932.12	$162,932.12	$70,287.86	$125,000.00	$150,000.00	8
	13	$1,373,325.67	$43,325.67	$7,905.49	$150,000.00	$175,000.00	2
	14	$1,286,200.63	-$43,799.37	-$25,503.07	$175,000.00	More	0
	15	$1,258,774.80	-$71,225.20	-$29,350.49			
	16	$1,337,858.90	$7,858.90	-$78,951.28			
	17	$1,373,203.45	$43,203.45	-$12,389.82		MIN	-$135,349.83
	18	$1,320,073.52	-$9,926.48	-$26,604.64		MAX	$171,851.87

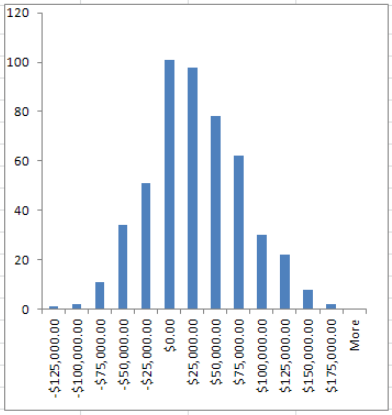

Figure 8. Distribution of potential NPV results