

## Cash Flow Analysis: Angus and ARGUS<sup>1</sup>

**Objective:** The purpose of this assignment is to give you experience in setting up and analyzing real estate cash flow spreadsheets. Besides this, the project demonstrates your ability to integrate the lectures and readings through practical application of real estate finance principles.

**Practical Use of Project:** Once you have completed this project, you can take the report with you on job interviews. This will help you demonstrate to potential employers that you can set up a spreadsheet, validate the numbers in your spreadsheet using ARGUS, do the necessary analysis, and effectively communicate the results of this analysis. Students have used the project not only to get investment banking jobs/managerial consulting jobs in real estate but also to obtain corporate finance jobs as well.







**Strategy for Analysis:** In analyzing this case, you are expected to use the scientific method/process. This process involves defining what the problem is, discussing what possible alternatives are available to solve the problem, what are the qualitative and quantitative criteria which you will use in choosing among the alternatives, and finally, selecting the most probable "fit" -- criteria vs. alternatives.

1. Executive Summary (15 points): The executive summary is a stand alone document which provides a capsulized summary of your detailed analysis. As such it includes the problem statement, alternatives to address the problem, the criteria used to choose among the alternatives, and also the most probable solution to the problem. Your executive summary should include tables which i) summarize the salient qualitative findings with respect to the 4 properties, ii) summarize the salient quantitative findings for the 4 alternatives, and iii) summarize the results of your sensitivity analysis. Please limit your executive summary to 8 pages.
2. Detailed Analysis : In addition to your executive summary, you are required to do a detailed analysis which elaborates on the executive summary. The components of the detailed analysis are as follows:
  - Problem Statement (1 point): State what problem Angus Cartwright is faced with.
  - Alternatives to Address the Problem (4 points): Discuss the alternatives to the problem. Please do not copy verbatim from the case.

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Building Picture				
Project	Alison Green (AG)	900 Stony Walk(SW)	Ivy Terrace (IV)	Fowler (FB)
Profile	AG is a 100 unit existing garden apartment building located in Montgomery County, MD.	SW is an existing five story, 40,000 square foot office building that is also located in Montgomery County, MD.	IV is an 80 unit apartment building under construction near Arlington, VA.	FB is a two-story, 45,000 sqft office building under construction in Arlington, VA.

- Criteria Used to Choose Among the Alternatives: The criteria used to address this problem involve the use of qualitative and quantitative criteria.

### Qualitative Criteria:

Profile Each Investor (5 points): Please profile Martha DeRight and John DeRight in terms of their risk and return requirements. Are the risk and return requirements identical for Martha and John DeRight? Your profile should also include qualitative considerations such as stage in the life cycle, aversion to risk, preference for dividends vs. capital gains, etc.

Profile Each Property (10 points): Discuss the qualitative factors which have an impact on risk and return. Be sure to discuss what the impacts are on risk and return. One qualitative factor, for example, is the building moratorium which is in effect for Montgomery County, MD. The consequence of the moratorium is that it constrains supply and stabilizes/increases rent in the short run. There are at least 6-7 qualitative factors that have an impact on each property.

### Quantitative Criteria:

Discounted Cash Flow Analysis (40 points): Do the Exhibits 1-10 for each property using Excel. You should first set up your spreadsheet and replicate the numbers for Allison Green. Look at the risk and return measures. Compare and contrast the risk and return measures with respect to each property. To facilitate easier readability, you should include charts and graphs. Please use the text wrap option in inputting with your graphs into the report. Next, use ARGUS to generate the same output that you generated using Excel. Please discuss the results of your analysis.

Sensitivity Analysis (20 points): Do sensitivity analysis on all feasible alternatives using Excel. In particular, change the vacancy rate, the growth rate in rents, the

growth rate in operating expenses, change the interest rate, etc. and see what the impact is on key risk and return measures. For example, for at least one of the properties, the actual vacancy differs from that of the guaranteed occupancy for the first couple of years. As such, you need to perform an analysis of what if no more lease up will occur by the end of year 3 when the guaranteed occupancy expires. These measures should include but not be limited to the default point, added margin, cash on cash before taxes, IRR, NPV, and also a partitioning of the IRR. The main focus of sensitivity analysis is to see which variables have a major impact on risk and return i.e., what are the key drivers. To perform this sensitivity analysis you should use the Data Table function in Excel and also the Scenario function in Excel. An example of how to use the Data Table function in Excel was given in the Backdoor-Frontdoor case. An example of how to use the Scenario function in the **Tools** submenu is discussed in Appendix B below. Please discuss the results of your analysis. In **addition to** using the Scenario function, you can also use the limited sensitivity analysis features of ARGUS. However, you must use the Scenario function as a minimum.



- Most Probable Solution (5 points): Discuss which property(ies) is suitable for James and Martha DeRight by fitting their respective investor profiles to the profile of each property. Do not recommend that they should form a portfolio and each take shares in this portfolio. The goal of this case is to choose a project(s) for each of them given their respective criteria and profile relative to the profile of the building.

This is an individual project. No late projects will be accepted. Please do not email me your project. You will receive 3 scores: one for analysis, one for quantitative ability, and the third for grammar. Please format your report so that it resembles a Wall Street report from a major Investment Bank. I will discuss how this format looks like in class.

## Appendix A: Calculating IRR and NPV with Excel

Among the performance measures that you will need to calculate in the Angus Cartwright case are the internal rate of return (IRR) and the net present value (NPV). This is easy to do in Excel using the IRR and NPV functions. Suppose that we have the following set of cash flows for our property.

	A	B	C	D	E	F	G	H	I
1	Rate	12%							
2	Time	Cash Flow							
3	0	-3600		Performance Measures					
4	1	343		Internal Rate of Return (IRR)	14.9%	=IRR(B2:B12)			
5	2	358		Net Present Value (NPV)	\$735	=NPV(B1,B4:B13)+B3			
6	3	374							
7	4	390							
8	5	407							
9	6	424							
10	7	441							
11	8	459							
12	9	478							
13	10	6914							

The current period (time 0) is when the investor invests his money which is entered as a **negative** number since it is a cash outflow. Starting in the next period (time 1) the investor will receive a cash inflow, a **positive** number, which will continue until year 10 when the property is sold.

**IRR:** The syntax for the IRR in Excel is IRR(values,guess) where values is an array or a reference to cells that contain numbers for which you want to calculate the internal rate of return. Values must contain at least one positive value and one negative value to calculate the internal rate of return. IRR uses the order of values to interpret the order of cash flows. Guess is a number that you guess is close to the result of IRR. In our example above, we don't use a guess.

**NPV:** The syntax for the NPV in Excel is NPV(rate,value1,value2, ...) where Rate is the discount rate, value1, value2, ... are 1 to 29 arguments representing the cash inflows. Recall that the value starts from time period 1 if cash flows are presumed to occur at the end of each period. If your first cash flow occurs at the **beginning** of the first period (e.g., cash outflow), the first value must be added to the NPV result, not included in the values arguments. Intuition: NPV = Present Value of Benefits - Present Value of Costs = NPV(B1,B4:B13) + B3 where NPV(B1,B4:B13) is the Present Value of Benefits and B3 is equal to - Present Value of Costs.

## Appendix B: Sensitivity Analysis Using Scenarios

A scenario is a set of assumptions that you wish to test. The use of the Scenario option in Excel allows you to create and save different sets of assumptions and then to view how these scenarios change your results.

Example: Suppose that we wish to see how our monthly payment as well as the total amount of interest owed over 30 years (360 months) will change given a change in the interest rate, the term of the loan, and the loan amount. *Note:* If we had used the **Data Table** command to do this sensitivity analysis, we could only do a two by two analysis e.g., look at only two variables at a time. More specifically, the borrower is considering the following alternatives:

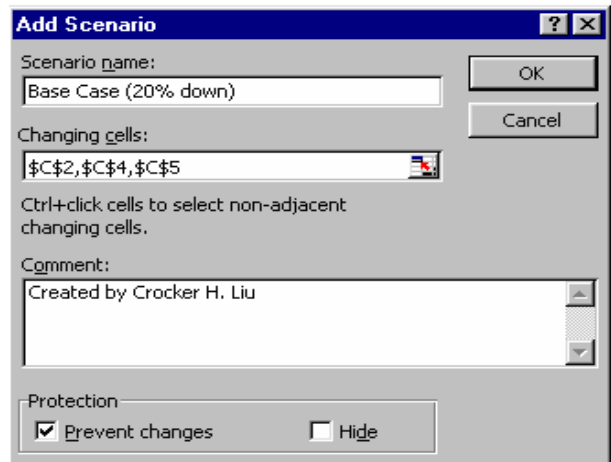
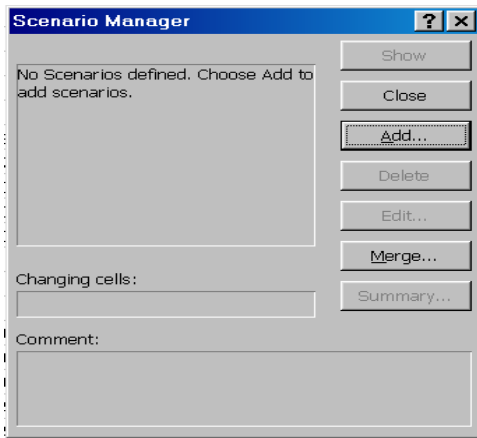
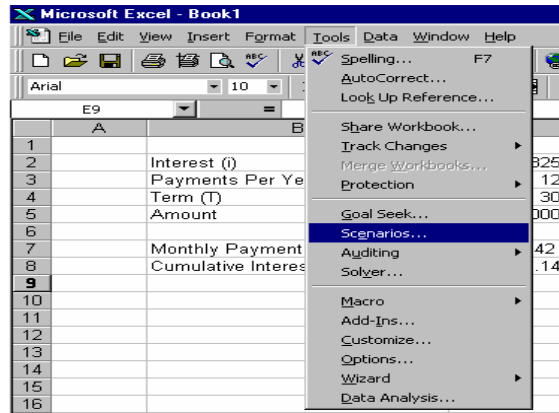
Scenario	Interest Rate	Term	Loan Amount
Base case (20% down)	8%	30	\$240,000
Minimal down (5%)	8.25%	30	\$285,000
Low down (10%)	8.25%	30	\$270,000
Fast pay, 5% down	8.25%	15	\$285,000
Fast pay, 10% down	8.25%	15	\$270,000
Fast pay, 20% down	8%	15	\$240,000

Rather than use our previous worksheet, we will construct a new worksheet to demonstrate the use of the PMT function in conjunction with the CUMIPMT function in Excel. Following are the inputs to the new worksheet:

Cell(s)	Type in the following	Comments
B2	Interest (i)	
B3	Payments per Yr (n)	
B4	Term (T)	
B5	Amount (PV)	
B7	Monthly Payment (PMT)	
B8	Cumulative Interest (CUMIPMT)	
C2	.08	Interest
C3	12	Payments are monthly
C4	30	Number of years in loan
C5	240000	Loan Amount
C7	=PMT(C2/C3,C4*C3,-C5)	Formula for monthly payment
C8	=-1*CUMIPMT(C2/C3,C4*C3,C5,1,C4*C3,0)	Formula for cumulative interest. We wish to find the total amount of interest paid over the loan term

To test how these scenarios change the payments to the borrower, select the **Tools** submenu in the TITLE bar and then choose the **Scenarios ...** option.

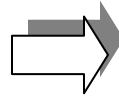
The **Scenario Manager** box now appears. In the left window, you should see the words “No Scenarios defined. Choose Add to add scenarios.” Click on the **Add...** button.



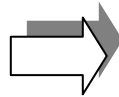
We shall construct the Scenario titled “Base Case (20% down)” as follows:

Box	What to Type	Comments
Scenario name:	Base Case (20% down)	
Changing cells:	\$C\$2,\$C\$4,\$C\$5	Use the mouse to select these cells. To select non-adjacent cells hold down the Ctrl key and click on the appropriate cells. These cells contain the “set of assumptions” that we wish to change to form a scenario.

After clicking the **OK** button after you have finished, the following box appears. Since the values given for the interest rate (\$C\$2), the term (\$C\$4), and the loan amount (\$C\$5) are equal to our Base case (20% down), click on the **OK** button. You have now



constructed the first scenario. Next, click the **Add...** button to add the next scenario. Repeating the logic process, the next scenario is the Minimal down (5%) scenario. The values

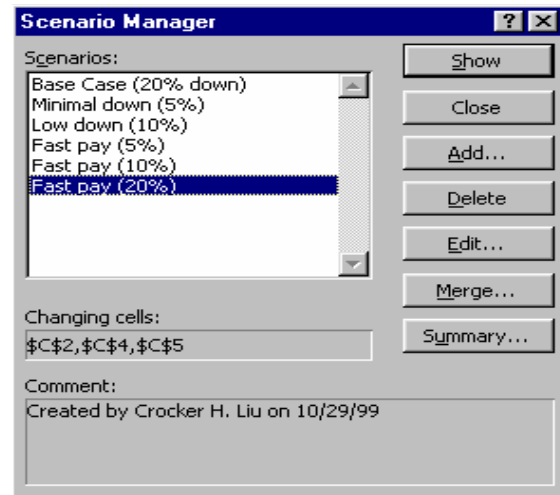


for this scenario are .0825, 30, and 285000 respectively. Click on the **OK** button.

We now have 2 scenarios. Using the same logic process, we add our other scenarios which are as follows:

Scenario	Interest Rate	Term	Loan Amount
Base case (20% down)	8%	30	\$240,000
Minimal down (5%)	8.25%	30	\$285,000
Low down (10%)	8.25%	30	\$270,000
Fast pay, 5% down	8.25%	15	\$285,000
Fast pay, 10% down	8.25%	15	\$270,000
Fast pay, 20% down	8%	15	\$240,000

This results in the following 6 scenarios. If you wish to delete a scenario, click on that scenario and then click on the **Delete** button. Similarly if you wish to modify a scenario, click on that scenario and then click on the **Edit...** button.



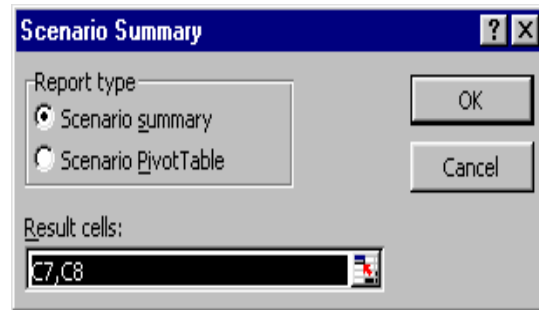
To view the results of a given scenario, simply click on that scenario in the **Scenarios:** window and then click on the **Show** button to the right of the window. The new results are now shown directly in the spreadsheet.

The Fast pay, 5% down scenario is shown below. Notice how the cells C2, C4, and C5 contain the assumptions corresponding to the Fast pay scenario. Also observe that the Payment and Cumulative interest cells have changed.

	A	B	C	D	E	F	G	H
1								
2		Interest (i)	0.0825					
3		Payments Per Year (n)	12					
4		Term (T)	15					
5		Amount	285000					
6								
7		Monthly Payment (PMT)	\$2,764.90					
8		Cumulative Interest (CUMIPMT)	\$212,682.00					
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								

To view how each scenario changes the total monthly payment, click on the **Summary ...** button. In the **Scenario Summary** box which appears, there are two Report type options.

**Report type 1: Scenario summary.** This reporting option lists the assumptions of each scenario as well as the results associated with that scenario. In the Result cells box, enter the cells containing the equations whose results are the focal point of the different scenarios. Separate multiple references with commas. In our example, the result cells are C7 and C8 which report the total payment each month and the cumulative interest payments over the term of our loan respectively. More specifically, we wish to see how the total payment as well as the cumulative interest paid over the time of the loan change with a change in loan terms. After inputting these cells into the **Result cells:** box, click on the **OK** button.

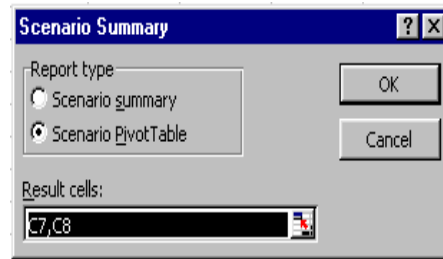


Scenario Summary							
	Current Values	Base Case (20% down)	Minimal down (5%)	Low down (10%)	Fast pay (5%)	Fast pay (10%)	Fast pay (20%)
<b>Changing Cells:</b>							
\$C\$2	0.0825	0.08	0.0825	0.0825	0.0825	0.0825	0.08
\$C\$4	15	30	30	30	15	15	15
\$C\$5	285000	240000	285000	270000	285000	270000	240000
<b>Result Cells:</b>							
\$C\$7	\$2,764.90	\$1,761.03	\$2,141.11	\$2,028.42	\$2,764.90	\$2,619.38	\$2,293.57
\$C\$8	\$212,682.00	\$393,972.59	\$485,799.54	\$460,231.14	\$212,682.00	\$201,488.21	\$172,841.70

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

**Interpretation of Table:** As the preceding table shows, the Base Case with a 20% downpayment results in the lowest monthly payments. However, if the borrower is concerned with minimizing the total amount of interest paid, then the 15 year loan with a 20% down (Fast pay, 20%) option is the best. It is also evident from the table that there is a high price (in terms of the cumulative interest paid) for putting down a minimal amount (5%) to purchase this house.

**Report type 2: Scenario Pivot Table.** This reporting option provides the same output information that is present in the Scenario Summary table. However, these Pivot tables can be further manipulated to easily see trends and connections.



	A	B	C	D	E	F	G
1	\$C\$2,\$C\$4:\$C\$5 by	(All)					
2							
3		Result Cells					
4	\$C\$2,\$C\$4:\$C\$5	\$C\$7	\$C\$8				
5	Base Case (20% down)	1761.034977	393972.5918				
6	Fast pay (10%)	2619.378966	201488.2139				
7	Fast pay (20%)	2293.565002	172841.7004				
8	Fast pay (5%)	2764.90002	212682.0035				
9	Low down (10%)	2028.419831	460231.1391				
10	Minimal down (5%)	2141.109822	485799.5358				

In contrast to other objects in Excel which are *hot-linked* to the original data e.g. automatically updated as soon as you make any changes to that data, PivotTables are *warm-linked* to the data (not changed unless you update the table manually).