



Title: Rent, Sell, or Else?

A practical example of decision making and the time value of money

Course Title: Advanced Engineering Economics

Course Number: ETM 535

Instructor: Ike Eisenhauer

Term: Spring

Year: 2015

Author(s): Ross Lamberth, Justin Krueger, Lakshmi Rajagopal, Leopoldo Mariño

ETM OFFICE USE ONLY

Report No.:

Type: Student Project

Note:

i. Abstract

Understanding the theories and placing them into practice for Advanced Engineering Economics has led the team to evaluate the time value of money as a practical example of decision making in the Portland, OR., Real Estate market. Using concepts from the course material, this project seeks to formulate a case study in economic decision making based on complex and multivariable options. Rafael, the subject of the case study, is a homeowner who has been offered an opportunity to work overseas and needs to make a decision on what should be done with his current residence. The model formulated to solve the case study considers a number of variables that affect net cash flows, including commissions paid to a realtor during a sale, fees for property management, how profits from a sale may be invested, capital gains taxes that the owner should consider versus the taxes paid on the rental income, and how the mortgage and related taxes are offset by this decision. Time value of money calculations are used to evaluate the options in a comparable present worth state and a recommendation is made based on the optimal projected monetary value of the options that are considered.

ii. Table of Contents

i. Abstract

ii. Table of Contents

1. Introduction

1.1 Problem Description

1.2 House Financial Information

2. Literature Review and Research Method

2.1 Financial Concepts From the Course

2.2 Portland Market Research

2.3 Interview with Financial Advisor

3. Decision Tree

4. Financial Projections

4.1 Sell Model

4.2 Rent Model

4.3 House Sitter Option (also referred to as: Carry Costs option)

4.4 Overall Comparison

5. Analysis

5.1 Model Findings/Results

5.2 Overall Sell Projections

5.3 Overall Rental Options

5.4 Other Options Considered

6. Further Steps/Work

7. Conclusion

8. References

9. Appendices

9.1 Key Variables & Calculations - 3 and 6 Year Investment Options

9.2 Key Variables & Calculations - Income and Expenses

9.3 Key Variables & Calculations - Sell or Keep

9.4 Key Variables & Calculations - 3 Year Investment Tables

9.5 Key Variables & Calculations - 6 Year Investment Table Worst

9.6 Key Variables & Calculations - 6 Year Investment Table Likely

9.7 Key Variables & Calculations - 6 Year Investment Table Best

9.8 Key Variables & Calculations - Income & Expenses (partial example)

1. Introduction

The case study presented in this document demonstrates the use of several of the Engineering Economic concepts in a real and current application. This case is based on an actual financial decision of whether a house in SE Portland, Oregon should be sold, rented, or maintained by a house sitter during a period of 3 to 6 years. Some of the concepts demonstrated in the model include but are not limited to [1,2]:

- Electronic Spreadsheet Modeling
- Parametric Cost Estimating
- Compounding Interest
- Cash Flow Diagrams
- Relating Present, Future and Annuity Values
- Taxation
- Decision Trees
- Multi-attribute Decisions

Since the case is based on a real and current decision, real data was used to formulate the model and make assumptions. Some details, such as the name of the individual, have been changed or obfuscated for privacy. Other details have been added to the case, such as the decision on a six year evaluation period to increase the complexity and allow for additional evaluation tools to be demonstrated. The model is constructed to be flexible and portable allowing it to be reused in other similar circumstances.

1.1 Problem Description

Rafael, the homeowner, is facing a difficult challenge and needs to make a decision based on what makes the most financial sense. He works for a company in Portland, Oregon that is part of a large multinational organization based in Stuttgart, Germany. An offer has just been made to Rafael for an opportunity to work as an expatriate in the corporate headquarters for a period of 3 to 6 years, after which Rafael and his family will return to the United States at which point, he will continue to work with the home company. This is a great career opportunity for Rafael and the expatriate package has some great benefits.

The company will fly him and his family and provide an allowance to rent a house in the host country as well as educational and other benefits. One thing that the package does not include is any compensation or allotment for the house he currently owns and lives in. Rafael is accepting of the idea of selling his house; it was his intent to move his growing family to a new house in a few years anyway, but this offer requires him to make a decision of what to do sooner than later.

There is a myriad of options for Rafael to consider in making his decision. He could sell the house before moving and invest the money in a financial device like a municipal bond or a mutual fund, then let that

investment grow while he is away. Alternatively, he could keep the house for the duration of the assignment and rent it out while his family is overseas. The rental income could help offset the monthly mortgage costs and if all goes well, the house would increase in value as the local real estate market continues to appreciate. A third option would be to leave the house empty while they are out of the country, avoiding the cost of moving, the cost of a property manager, and the risk of tenants damaging the property. There is also an option to move back into the house at the end of the engagement and put off the decision to sell it and buy a new house in Portland in the following year. To make things more complicated the standard 3 year engagement could be extended by up to an additional 3 years, so Rafael must consider all his options and alternatives for a 3 year or 6 year timeframe.

Rafael has access to information he can use to make his decision. He knows approximately how much his house is worth if it were to sell this year and approximately how much he could expect to charge for rent. Based on the information that is relevant and accessible, he can estimate what a likely increase in real estate value is for the next few years and what type of costs he will need to account for should he decide to keep or to rent the house. He also knows that nothing is certain so it would be worth the time to estimate the value of each option based on a best case, worst case and most likely scenario. Rafael must carefully weigh the benefits and risks for each scenario, most importantly he must determine the potential economic gain or loss of his decision.

1.2 House Financial Information

The property evaluated is a single family dwelling, row house, in the Kenilworth neighborhood of Portland, Oregon. The house is a modest building with 2 bedrooms, 1.5 baths of approximately 1,010 square feet (ft²). It was built in 1984 and was remodeled in 2008. Some statistics about the house are shown below in **Figure 1**. In addition, it has an estimated sale value currently projected to be around \$232, 000 [3]. This and some other house financial data are shown in **Figure 2** below.

House Stats	
House Size (ft ²)	1,010
House Features	2 beds, 1.5 baths
House Location	Kenilworth neighborhood of SE Portland
House Type	Single Family row house with front garden and back porch
Year Built	1984

Figure 1: House Stats

Financial Data	
Estimated sale value	\$232,252
Estimated rental value (monthly)	\$ 1,483
Outstanding Mortgage	\$78,819
Loan Rate (nominal)	2.99%
Loan Rate (APR)	3.10%
Remaining Terms (months)	97
Mortgage Payments (monthly)	\$1,225
- Principal & Interest	\$917
- Tax	\$308
Property Tax (yearly)	\$3,289
Insurance (yearly)	\$509
Maintenance (yearly)	\$2,171

Figure 2: Financial Data

As it is denoted in **Figure 2**, the mortgage, taxes, and insurance is detailed in the breakdown. The outstanding mortgage and remaining terms have been considered in the generation of the following models and reflects the optimal decisions for Rafael to consider before taking the opportunity overseas.

2. Literature Review and Research Method

In order to properly estimate the potential value of each option the assumed values for the property had to be validated and additional information on variables that could affect the outcome had to be determined. The team began by generating a decision tree and determining the key attributes that could affect the outcome of the decision options. A decision tree (section 3) was drafted, tested and re-created in order to eliminate nonsensical options (such as leaving the house empty for 3 years, then renting it for another 3) and a number of financial models were tested with the aid of Microsoft Excel Spreadsheets in order to arrive at the key attributes and options that needed to be considered. Sources

for financial decision making, such as the class text were consulted and a financial advisor was interviewed to validate findings and identify alternative options or hidden variables.

2.1 Financial Concepts From the Course

Mortgage Rate, Types of Economic Measures

A number of concepts presented in the class text 'Engineering Economy' were directly applied to the case study, in particular information on comparison and selection among alternatives in chapter 6. For the sake of model clarity, the team chose to use present worth (PW) method for comparing alternatives. The analysis required a relevant minimum attractive rate of return (MARR), the rate of a low-risk secure investment was used. A number of current, future and amortized revenues and expenses had to be considered and accounted for in each branch of the model [2].

Having a strong understanding of making calculations based on the MARR with regard to PW is necessary in the analysis of the decision model that has been created. The outcome of these details assisted in creating a decision tree which has been created in determining the appropriate choice for Rafael. "Decision trees, also called decision flow networks and decision diagrams, are powerful means of depicting and facilitating the analysis of importation problems, especially those that involve sequential decisions and variable outcomes over time." [1] This type of analysis reflects the conceivable alternatives with the probable outcome that can be chosen.

Optimistic-Most Likely- Pessimistic (O-ML-P) has been utilized in the creation of the models. This method is necessary due to the research and variations as they relate to the rental and sell projections that have been used from the historical and recent rates found from various sources in the industry research performed. Using these factors as an estimating technique covers a progressive sensitivity analysis approach. "One goal of progressive sensitivity analysis is to eliminate from detailed consideration those factors for which the measure of merit is quite insensitive, highlighting the conditions for other factors to be studied further in accordance with the degree of sensitivity of each. [2] Utilizing the O-ML-P method in conjunction with a sensitivity analysis with the manageable size that has been obtained has provided accurate information and the results that are advantageous for Rafael.

2.2 Portland Market Research

The team conducted a significant amount of market research as it pertains to the options affecting the decision in the use case. Due to the US Financial Crisis of 2008 and subsequent recession, a significant amount of financial data for the last few years is readily available. Over the past few years the market has shown strength and it is evident in the Portland area. Currently, the Portland housing market has been on an upswing for sellers on average of 5.5 percent from 2014 to 2015 [4].

With regard to selling, the Portland real estate market in 2014 propagated the sale of 10,000 home sales at a median price of \$305,000 which is an increase of over nine percent over the previous year. The City of Portland reflects the Real Market Value for the property being evaluated as \$206,490. Utilizing Redfin.com as a data resource for a possible sale point, the team identified \$284,000 as a possible sale price with a range starting at \$248,000 and extending to \$320,000. Another estimating source, Zillow.com, takes detailed specifications of the property into account to generate it's own 'Zestimate' of \$234,191. Using the PERT methodology of Optimistic, plus four times the Most Likely value plus pessimistic divided by six $((O + 4M + P)/6)$ produces a weighted average sales price of \$247,091. This value was used as the middle ground for the financial model with the city valuation providing a lower bound and the redfin value an upper bound [3].

The same sources also provided values for the estimated rental income for the property with Zillow estimating \$1,490 a month. A more accurate source is www.rentjungle.com which relayed that the rental market within a 10 mile radius of Portland, OR in March 2015 has raised to \$1318. A one bedroom apartment can rent for \$1,127 a month and \$1,284 for a two bedroom place on average as it relates the website research. Oregonlive.com states that Rafael could receive on average \$1.26/SQFT for rent for the home. However, based on the research performed in the article, there is little to no vacancy causing apartments to become a premium and with them a higher price point. The trend has proven to deliver owners an 11% increase over 2014 for newer rentals and approximately 5 percent for older rentals. Using the square footage of the home a rental rate of \$1271.34 which is within the range of the various resources that were researched. For the purpose of the models, \$1300.00 a month will be used as a base with the possibility for year to year increases in the more optimistic models.

Retrieved from the Red Capital Group website, in **Figure 3** below, delves deeper into the average rate of occupancy over the past five years as well as what projection are being anticipated. Based on the information in **Figure 3**, it also supports the higher rate than the average in the area and the SQFT price aforementioned because demand is at an above normal rate[6].

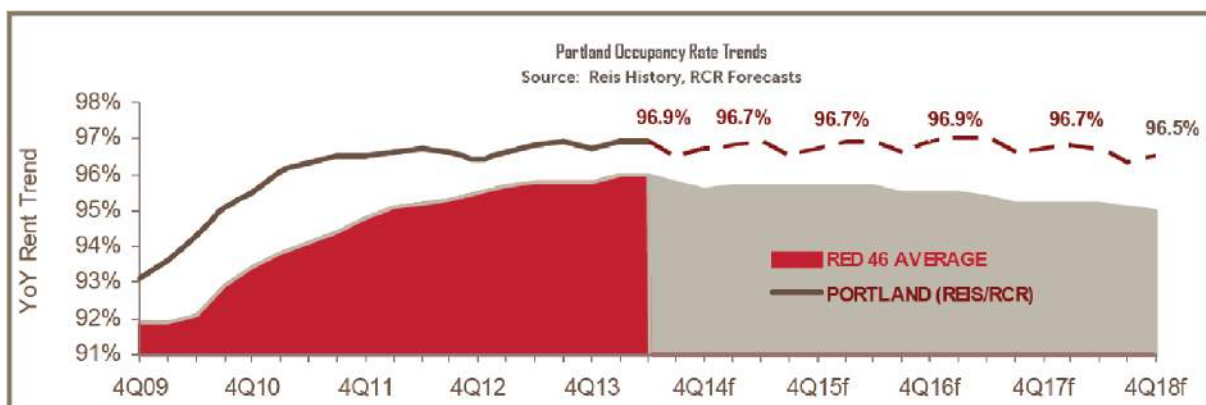


Figure 3: Portland Occupancy Rate Trends

2.3 Interview with Financial Advisor

In addition to information gathered through the course text and literature the team also consulted with a financial advisor at a Portland bank. The advisor was posed with the challenge of the use case and asked if the criteria being evaluated were correct, if there are additional factors that should be considered and what he would recommend Rafael do in order to properly evaluate his options and come to a decision. This meeting served primarily to confirm and support the assumptions the team had been making but also provided unique insights and focus on key issues.

The discussion with the advisor focused on evaluating the options as risk vs. reward decisions. The Portland Real Estate market has been, for the most part, growing at a steady rate and properties like private homes, have been growing at approximately 4% year to year appreciation. This is not certain, however, and a crash in the market could lead to a loss in value. There are additional costs that have to be considered when the house is being rented such as the maintenance and upkeep of the property plus the fees paid to a property management company, which can vary between 8% and 10% of the monthly rent. A less likely but more significant risk is that of having a bad renter in the house. At its projected worth, an unscrupulous renter can damage the property, not pay rent and lead to legal costs in order to force an eviction. In his experience he knew of one case where the eviction period lasted 9 months during which time no rent was collected and led to a house so badly damaged it costs tens of thousands of dollars to repair.

The financial advisor made a suggestion to consider selling and rolling the proceeds into a bond instead of renting. Currently municipal bonds are returning approximately 3% tax free. Treasury bonds are another safe alternative but taxes are paid on these types of bonds. Similar to mutual funds, the type of bond mechanism discussed provides a similar mentality with spreading the investments across several bonds to be safer and maintain a level of profitability.

3. Decision Tree

After evaluating the various models, the analysis was investigated further by utilizing the outcomes and incorporating a probabilities of a tree to aide Rafael in making the correct decision[2].

The real options approach is comparing the various opportunities in which to invest or whether it should be postponed. "Real options allow decision makers to invest capital now or to postpone all or part of the investment until later." [1] Creating a decision tree allows for a graphical representation that incorporates the level of risk and uncertainty in the analysis of the options.



Figure 4: Decision Tree

4. Financial Projections

Financial projections for making a determination are highlighted in section 1.2. All of the evaluations utilize the present value of the property with the various contextual factors that have been considered. The first options are concerned with the selling of the home. Selling the house immediately, at the end of year (EOY) three, and EOY six being taxed as a personal rate and as a rental. Making investments with the profit that is made will be evaluated as a PV in Cash through EOY three and six. Rental options as they were described earlier were modeled as well as having someone live in the house until Rafael returns.

Receiving enough rent to cover the current mortgage, taxes, and insurance is conceivable, however, a property management company will need to be utilized to maintain the stability necessary to have a successful rental. Even though it is likely that the rent will cover the projected overhead and overall costs, there are contextual factors that need to be considered. Renters can cause severe damage to a home and also be a challenge to evict if proper installation of a good renter does not take place. Another option that has been considered is requisitioning a house sitter to take care of the house while Rafael is on assignment.

4.1 Sell Model

The sell model is the mathematical formulation of the PV and MARR values and projections that are realistic with the current market based on the research that has been performed. Utilizing the PERT method that weighs the optimistic market value, most likely, and pessimistic projections are described below.

The scenarios as they relate to selling are based on selling the home immediately, selling the house at the EOY 3 with taxes assumed personal, selling EOY 6 with taxes assumed as personal, selling the house EOY 6 with taxes as a rental, market value of the house to live in it at EOY 3 and EOY 6. Selling the house immediately reflects a likely rate of \$133,980. The highest likely case for selling the home later is at EOY 6 taxed personally at \$216,333. Of the market value projections, if it is lived in, at the EOY 6 the likely value will be \$380,608. As readers of this report can see these results in table and chart form in **Figure 5: Sell Model Table** and **Figure 6: Sell Model Chart** below.

Calcs	PVs to calc:	ID	Worst	Likely	Best
1	PV Sell House ASAP	(a)	\$91,245	\$133,980	\$169,151
4	PV Sell House EOY 3 (taxed as personal)	(c)	\$89,583	\$156,626	\$220,212
5	PV Sell House EOY 6 (taxed as personal)	(d)	\$119,503	\$216,333	\$320,967
6	PV Sell House EOY 6 (taxed as rental)	(e)	\$107,322	\$200,937	\$303,496

Figure 5: Sell Model Table

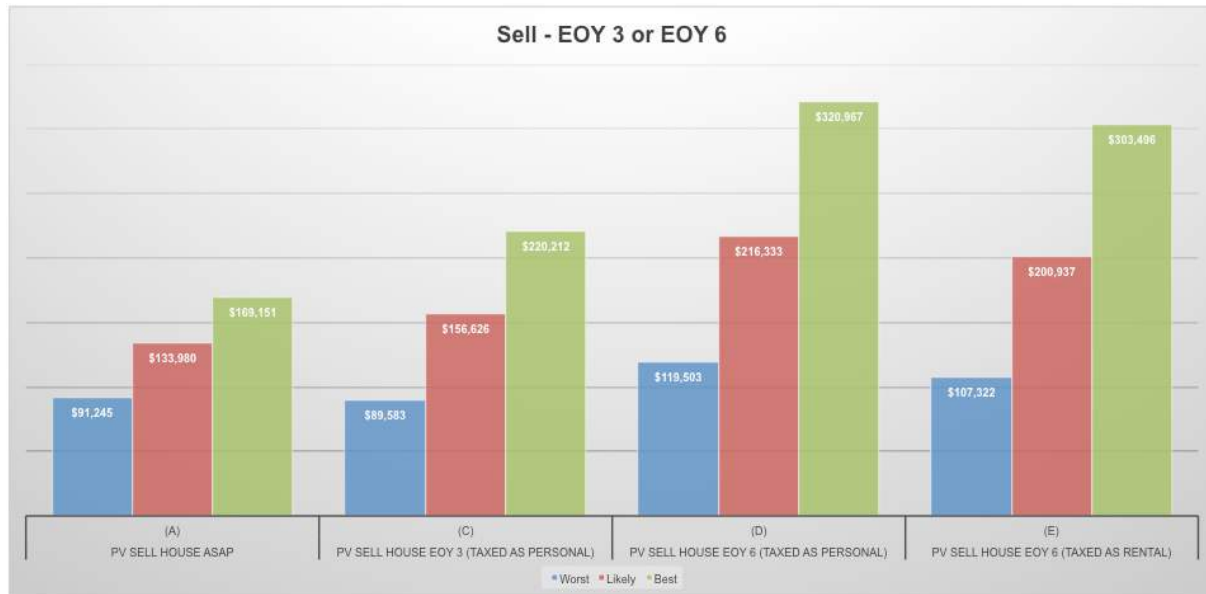


Figure 6: Sell Model Chart

4.2 Rent Model

The rental model is the mathematical formulation of the PW and MARR values and projections that are realistic with the current market. Similar to the selling model, the rent model is based on the same methodology utilizing PERT. Based on the inputs that have been utilized in the equation, the best outcome that is likely for renting the house is \$110,141 at the EOY 6.

Calcs	PVs to calc:	ID	Worst	Likely	Best
8	PV House ownership expenses through EOY 3	(f)	\$55,687	\$53,840	\$53,182
9	PV House ownership expenses through EOY 6	(g)	\$108,413	\$105,622	\$104,737
10	PV Rental income through EOY 3	(h)	\$45,125	\$52,012	\$57,192
11	PV Rental income through EOY 6	(i)	\$87,144	\$110,141	\$124,991

Figure 7: PV Calculations for Rental

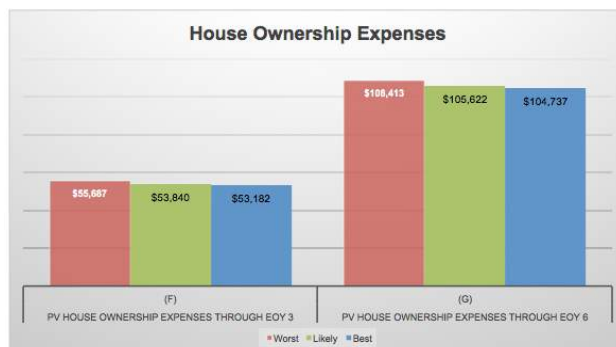


Figure 8: PV House Ownership Expenses Chart

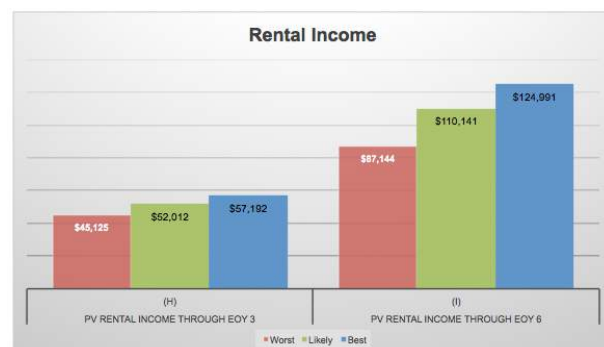


Figure 9: PV Rental Income Chart

4.3 The House Sitter Option (also referred to as: Carry Costs)

It is unlikely that Rafael will actually leave the house unrented and unsold. The house sitter (also referred to as the Carry Costs option) model is mostly used for the purpose of having a baseline to compare the other models to. By comparing the Carry Costs model to the rented model evaluators can approximate how much revenue is generated due to renting. By comparing the Carry Costs then Sell model to the Rent then Sell model they can approximate how much extra expense is incurred because of taxes on rental income [7]. These values are calculated by adding the House ownership expenses shown in **Figure 7**, but not adding the Rental income, also shown on **Figure 7**.

4.4 Overall Comparison

Calcs	PVs to calc:	ID	Worst	Likely	Best	PERT
1	PV Sell House ASAP	(a)	\$91,245	\$133,980	\$169,151	\$132,719
2	PV Cash in Investment Instruments through EOY 3	(b)	-\$29	\$5,276	\$14,379	\$5,909
3	PV Cash in Investment Instruments through EOY 6	(n)	-\$1,596	\$8,453	\$26,358	\$9,763
4	PV Sell House EOY 3 (taxed as personal)	(c)	\$89,583	\$156,626	\$220,212	\$156,050
5	PV Sell House EOY 6 (taxed as personal)	(d)	\$119,503	\$216,333	\$320,967	\$217,634
6	PV Sell House EOY 6 (taxed as rental)	(e)	\$107,322	\$200,937	\$303,496	\$202,428
8	PV House ownership expenses through EOY 3	(f)	-\$55,687	-\$53,840	-\$53,182	-\$54,038
9	PV House ownership expenses through EOY 6	(g)	-\$108,413	-\$105,622	-\$104,737	-\$105,939
10	PV Rental income through EOY 3	(h)	\$45,125	\$52,012	\$57,192	\$51,728
11	PV Rental income through EOY 6	(i)	\$87,144	\$110,141	\$124,991	\$108,783
12	PV Market Value of House to live in at EOY 3	(j)	\$186,706	\$257,813	\$328,775	\$257,789
13	PV Market Value of House to live in at EOY 6	(k)	\$168,818	\$269,001	\$380,608	\$270,905

Figure 10: Overall Comparison Summary Calculation Table

Opt	3 years abroad PV combos to compare:	ID	Worst	Likely	Best	PERT
1	Sell ASAP and Invest Cash Until EOY 3	(a) + (b)	\$91,215	\$139,256	\$183,529	\$138,628
2	carry costs 3 years then sell EOY 3 (taxed as personal)	(f) + (c)	\$33,896	\$102,785	\$167,030	\$102,011
3	carry costs 3 years then move back in (no sales costs)	(f) + (j)	\$131,019	\$203,973	\$275,593	\$203,751
4	rent for 3 years then sell EOY 3 (taxed as personal)	(f) + (c) + (h)	\$79,021	\$154,798	\$224,222	\$153,739
5	rent for 3 years then move back in (no sales costs)	(f) + (j) + (h)	\$176,144	\$255,986	\$332,785	\$255,479

Figure 11: 3 Year Options to Compare

Opt	6 years abroad PV combos to compare:	ID	Worst	Likely	Best	PERT
6	sell ASAP and invest cash until EOY 6	(a) + (n)	\$89,649	\$142,434	\$195,509	\$142,482
7	carry costs 6 years then sell EOY 6 (taxed as personal)	(g) + (d)	\$11,090	\$110,711	\$216,230	\$111,694
8	carry costs 6 years then move back in (no sales costs)	(g) + (k)	\$60,406	\$163,380	\$275,871	\$164,966
9	rent for 6 years then sell EOY 6 (taxed as rental)	(g) + (i) + (e)	\$86,053	\$205,456	\$323,750	\$205,271
10	rent for 6 years then move back in (no sales costs)	(g) + (i) + (k)	\$147,549	\$273,520	\$400,862	\$273,749

Figure 12: 6 Year Options to Compare

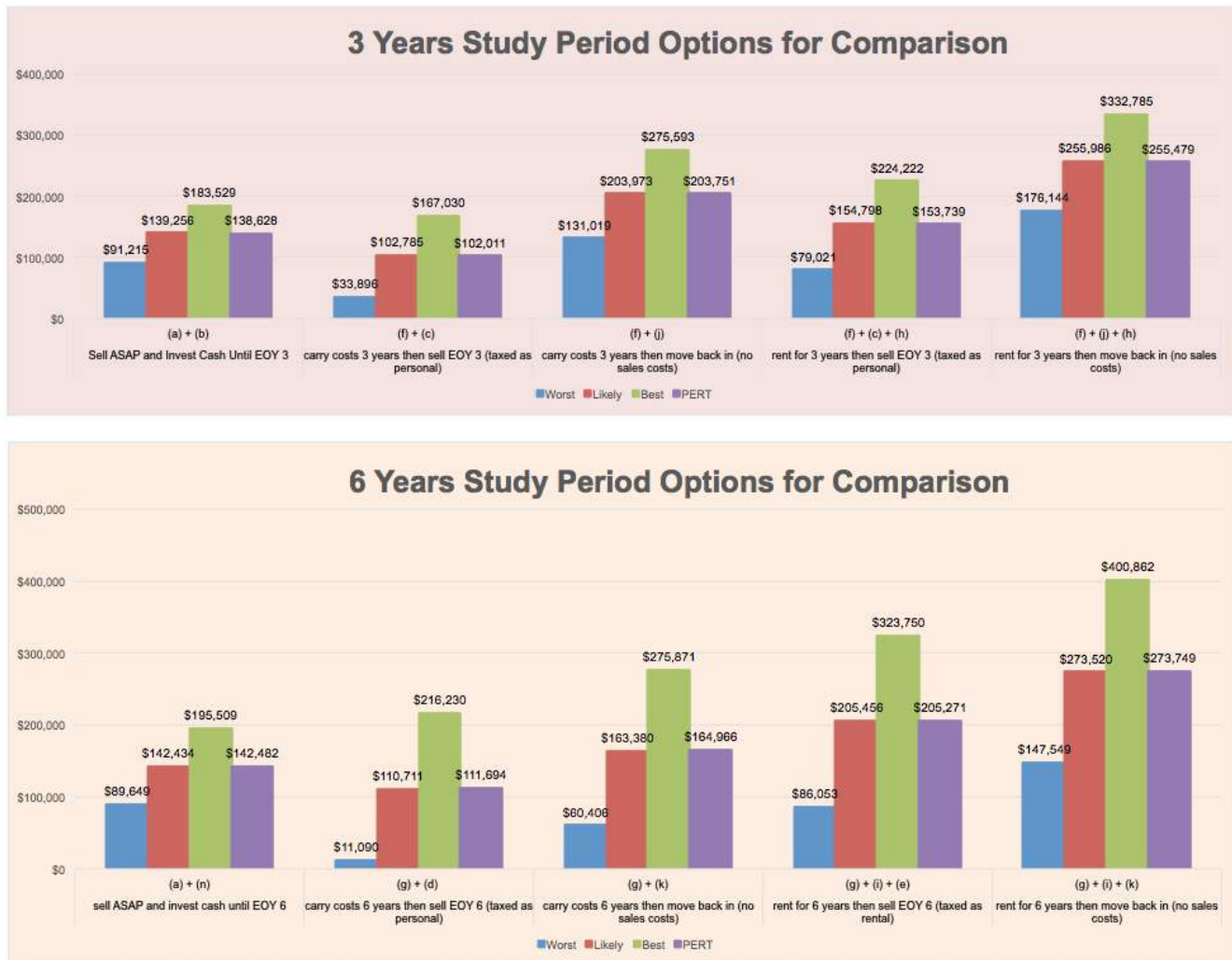


Figure 13: 3 and 6 Year Options to Compare as Charts

5. Analysis

5.1 Model Findings/Results

All of the current trends in the Portland area at this time reflect that rent and house prices are on the rise. With rental housing in such short supply, it is no surprise that renting the house, then moving back into it at a future date to avoid taxes on the income, appears to be the option that generates the greatest present value scenario. According to the model, the following is a table of the approximate values for each of the most likely options for both the 3 years abroad scenario and the 6 years abroad scenario.

5.2 Overall Sell Projections

The Portland real estate market was negatively impacted by the national real estate market downturn in 2008 just like most U.S. metropolitan areas. Unlike many areas in the county, Portland has clearly bounced back and has surpassed the level that was achieved before the infamous 2008 crash. For this reason, it is not surprising that projections suggest that selling the house now, three years from now, or six years from now will all be quite profitable and will return Rafael's original purchase price plus quite a bit of capital gains.

5.3 Overall Rental Options

The team considered four rent options in the study. Renting the house and then selling after EOY 3 or EOY 6 and renting and then moving back into at EOY 3 or 6. If the house was rented for 3 years, the rental income would not cover the house ownership expenses, but the appreciation in its market value would be above that. Having the house rented for 6 years, the value of rental income would cover the house ownership expenses. Whether the house owner would be away for 3 or 6 years, the option that created the most value would be moving back in. Selling the house would force the house owner to pay taxes on it and destroy the value that was created up to that point.

Opt	3 years abroad PV combos to compare:	ID	Worst	Likely	Best	PERT
5	rent for 3 years then move back in (no sales costs)	(f) + (j) + (h)	\$176,144	\$255,986	\$332,785	\$255,479

Opt	6 years abroad PV combos to compare:	ID	Worst	Likely	Best	PERT
9	rent for 6 years then sell EOY 6 (taxed as rental)	(g) + (i) + (e)	\$86,053	\$205,456	\$323,750	\$205,271
10	rent for 6 years then move back in (no sales costs)	(g) + (i) + (k)	\$147,549	\$273,520	\$400,862	\$273,749

Figure 14: 3 and 6 Year Results Tables for Rental Options



Figure 15: 3 Year Rental Option



Figure 16: 6 Year Rental Options to Compare

5.4 Other Options Considered

Rafael has the option to sell the house and invest the proceeds of the sale into investment instruments for the duration of his stay abroad. Under the likely scenario, Rafael will have \$133,980 to invest. Based on these projections, he would earn on an APR of 1.32%, 4%, or 7% on his investment depending on the scenario. As the graphic below shows, Rafael creates \$5,276 of value under the likely scenario EOY 3 and \$8,453 under the likely scenario EOY 6. The number below have been adjusted for inflation. Projected inflation rates used in this model were taken from the US Federal Reserve's website [7,8, 9].

Calcs	PVs to calc:	ID	Worst	Likely	Best
1	PV Sell House ASAP	(a)	\$91,245	\$133,980	\$169,151

Calcs	PVs to calc:	ID	Worst	Likely	Best
2	PV Cash in Investment Instruments through EOY 3	(b)	-\$29	\$5,276	\$14,379
3	PV Cash in Investment Instruments through EOY 6	(n)	-\$1,596	\$8,453	\$26,358

Opt	3 years abroad PV combos to compare:	ID	Worst	Likely	Best	PERT
1	Sell ASAP and Invest Cash Until EOY 3	(a) + (b)	\$91,215	\$139,256	\$183,529	\$138,628

Opt	6 years abroad PV combos to compare:	ID	Worst	Likely	Best	PERT
6	sell ASAP and invest cash until EOY 6	(a) + (n)	\$89,649	\$142,434	\$195,509	\$142,482

Figure 17: 3 and 6 Year Results Tables for Investment Options



Figure 18: 3 and 6 Year Results Charts for Investment Options

6. Further Steps/Work

Aforementioned, the models have taken considerable amounts of information and conjugated them with the principles of engineering economics. This level of input and detail has delivered a model that has proven to be accurate in assisting in the decision making process. However, to better understand making a choice outside of what has been produced, the model can be dissected a little further by incorporating a sensitivity analysis. By understanding the risk appetite of Rafael, there are limits that could be set that would identify which attributes would have a further impact on the decisions. Another area of research that could be utilized in further steps would be to make the model more user friendly and more easily manipulated so that the user could essentially create a monte carlo analysis to run several iterations of the model. Creating this tool, could also be marketed and possibly sold as phone applications or through a website to analyze market conditions for realtors, lenders, and conceivable homeowners. Taking it a step further, this type of model and tool could be used for understanding whether buying a new or used car is the correct choice, investing in land or other property, purchasing a boat or motorhome, upgrading equipment at a manufacturing plant, the applications are endless.

7. Conclusion

Arriving at the overall conclusion of the case study and model was not a particular surprise. The assumption from the team on considering the case and building the model was that the appreciation of the property plus the cash from rental income would yield a greater positive value than the alternatives of selling and investing or leaving the property empty. What was more elucidating was the realization of the sheer number of variables that must be considered and estimated to generate a model that can be relied upon with high confidence. Also of interest was the significant loss of capital to taxes in the investment model and in renting the house past the five year mark. Another interesting finding was how sensitive the decision was to certain variables, such as the assumed monthly upkeep on the house which could increase or decrease significantly depending on what assumptions were made. Overall, the exercise of generating and working with the model helped the team realize how the conceptual economic principles can be applied to a real life situation.

8. References

1. Kenneth Baker (2011), Optimization Modeling with Spreadsheets, 2nd Edition, John Wiley & Sons, Inc.
2. William G. Sullivan, Elin M. Wicks and C. Patrick Koeling (January 2, 2014). "Engineering Economy", 16th Edition. Pearsons Prentice Hall.
3. Zillow, (July 2014). "House Data". [Online].
Available: http://www.zillow.com/homes/3735-SE-43rd-AVE-Portland,-OR-97206_rb/
4. RentJungle,
(May 2015). "Rent trend data in Portland, Oregon". [Online]. Available:
<https://www.rentjungle.com/average-rent-in-portland-or-rent-trends/>
5. Portlandmonthlymag, (April 2, 2015). "Portland Neighborhoods By the Numbers: Where to Buy in 2015". [Online], Available:
<http://www.portlandmonthlymag.com/real-estate/articles/neighborhoods-by-the-numbers-where-to-buy-in-2015-april-2015>
6. Red Capital Group (September 2014), "Market Overview & Multifamily Housing Update," [Online] Available: http://redcapitalgroup.com/wp-content/uploads/2014/09/RCH-OR-001_Portland_-2Q14.pdf
7. budgeting, (2015). "How Much Should You Spend for Housing Maintenance Repairs?" [Online]. Available: http://budgeting.about.com/od/budget_home/a/How-Much-Should-You-Budget-For-Home-Maintenance-And-Repairs.htm
8. statista, (2015). "Projected annual inflation rate in United States from 2008 to 2020". [Online]. Available:
<http://www.statista.com/statistics/244983/projected-inflation-rate-in-the-united-states/>
9. bankrate, (2015). "Federal Discount Rate" [Online].
Available:] <http://www.bankrate.com/rates/interest-rates/federal-discount-rate.aspx>
10. treasury.gov, (2015), "Daily Treasury Yield Curve Rates" [Online]. Available: <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2015>

9. Appendices

9.1 Key Variables & Calculations - 3 and 6 Year Investment Options

3 Year Investment	PV - Worst	PV - Likely	PV - Best
Investment Amount	-\$91,245	-\$133,980	-\$169,151
Investment APR	1.32%	4.00%	7.00%
Investment Monthly Rate	0.11%	0.33%	0.58%
3 Year Annuity at Investment Rate	\$2,586	\$3,956	\$5,223
Projected Inflation Rate 2015	0.10%	0.10%	0.10%
Projected Inflation Rate 2016	1.49%	1.49%	1.49%
Projected Inflation Rate 2017	2.37%	2.37%	2.37%
Monthly Inflation Rate 2015	0.01%	0.01%	0.01%
Monthly Inflation Rate 2016	0.12%	0.12%	0.12%
Monthly Inflation Rate 2017	0.20%	0.20%	0.20%
PV Investment for 3 Years	-\$29	\$5,276	\$14,379

6 Year Investment	PV - Worst	PV - Likely	PV - Best
Investment Amount	-\$91,245	-\$133,980	-\$169,151
Investment APR	1.32%	4.00%	7.00%
Investment Monthly Rate	0.11%	0.33%	0.58%
6 Year Annuity at Investment Rate	\$1,319	\$2,096	\$2,884
Projected Inflation Rate 2015*	0.10%	0.10%	0.10%
Projected Inflation Rate 2016*	1.49%	1.49%	1.49%
Projected Inflation Rate 2017*	2.37%	2.37%	2.37%
Projected Inflation Rate 2018*	2.54%	2.54%	2.54%
Projected Inflation Rate 2019*	2.33%	2.33%	2.33%
Projected Inflation Rate 2020*	2.31%	2.31%	2.31%
Monthly Inflation Rate 2015	0.01%	0.01%	0.01%
Monthly Inflation Rate 2016	0.12%	0.12%	0.12%
Monthly Inflation Rate 2017	0.20%	0.20%	0.20%
Monthly Inflation Rate 2018	0.21%	0.21%	0.21%
Monthly Inflation Rate 2019	0.19%	0.19%	0.19%
Monthly Inflation Rate 2020	0.19%	0.19%	0.19%
PV Investment for 6 Years	-\$1,596	\$8,453	\$26,358

9.2 Key Variables & Calculations - Income and Expenses

Worst	
Monthly Principal & Interest	\$917
Assessed value (2014)	\$137,110
Assessment increase/Year	3.00%
Property tax rate/\$ Assesment Value	\$0.024
Insurance (Yearly)	\$509
Maintenance (yearly)	\$3,000
Yearly Rent Increase	\$0
Monthly Rent (1st year)	\$1,300
Monthly Rent (2nd year)	\$1,300
Monthly Rent (3rd year)	\$1,300
Monthly Rent (4th year)	\$1,300
Monthly Rent (5th year)	\$1,300
Monthly Rent (6th year)	\$1,300
Monthly Management Fee rate	8.0%
PV Interest rate	2.38%
Likely	
Monthly Principal & Interest	\$917
Assessed value (2014)	\$137,110
Assessment increase/year	3.00%
Property Tax rate/\$ Assesment Value	\$0.024
Insurance (Yearly)	\$509
Maintenance (yearly)	\$2,171
Yearly Rent Increase	\$100
Monthly Rent (1st year)	\$1,400
Monthly Rent (2nd year)	\$1,500
Monthly Rent (3rd year)	\$1,600
Monthly Rent (4th year)	\$1,700
Monthly Rent (5th year)	\$1,800
Monthly Rent (6th year)	\$1,900
Monthly Management Fee Rate	8.0%
PV Interest Rate	2.38%
Best	
Monthly Principal & Interest	\$917
Assessed value (2014)	\$137,110
Assessment increase/Year	3.00%
Property tax rate/\$ Assesment Value	\$0.024
Insurance (Yearly)	\$509
Maintenance (Yearly)	\$1,800
Yearly Rent Increase	\$150
Monthly Rent (1st year)	\$1,500
Monthly Rent (2nd year)	\$1,650
Monthly Rent (3rd year)	\$1,800
Monthly Rent (4th year)	\$1,950
Monthly Rent (5th year)	\$2,100
Monthly Rent (6th year)	\$2,250
Monthly Management Fee rate	8.0%
PV Interest rate	2.38%

9.3 Key Variables & Calculations - Sell or Keep

Sell ASAP as Home	Worst	Likely	Best
Market Value (June 2015)	\$206,490	\$247,091	\$284,000
Closing fees and expenses	\$10,000	\$2,000	\$500
Sales Commission/fees	5.0%	3.5%	2.0%
Outstanding Mortgage (June 2015)	\$78,819	\$78,819	\$78,819
Cash after Expenses	\$107,347	\$157,624	\$199,001
Tax Rate	15%	15%	15%
Taxes on Sale of House (June 2015)	\$16,102	\$23,644	\$29,850
Cash after Taxes	\$91,245	\$133,980	\$169,151
PV Cash after All Expenses	\$91,245	\$133,980	\$169,151

Sell EOY 3 as Home	Worst	Likely	Best
Market Value (June 2015)	\$206,490	\$247,091	\$284,000
Market Value Increase (yearly)	-1.0%	3.8%	7.5%
Market Value EOY 3	\$200,357	\$276,663	\$352,812
Interest rate for PV calc	2.38%	2.38%	2.38%
PV of MV EOY 3	\$186,706	\$257,813	\$328,775
Closing fees and expenses	\$10,000	\$2,000	\$500
Sales Commission/fees	5.0%	3.5%	2.0%
Outstanding Mortgage EOY 3	\$67,242	\$67,242	\$67,242
Cash after Expenses	\$113,097	\$197,738	\$278,014
Tax Rate	15.0%	15.0%	15.0%
Taxes on Sale of House EOY 3	\$16,965	\$29,661	\$41,702
Cash after Taxes	\$96,133	\$168,077	\$236,312
Interest rate for PV calc	2.38%	2.38%	2.38%
PV Cash after All Expenses	\$89,583	\$156,626	\$220,212

Sell EOY 6 as Home	Worst	Likely	Best
Market Value (June 2015)	\$206,490	\$247,091	\$284,000
Market Value Increase (yearly)	-1.0%	3.8%	7.5%
Market Value EOY 6	\$194,406	\$309,774	\$438,298
Interest rate for PV calc	2.4%	2.4%	2.4%
PV of MV EOY 6	\$168,818	\$269,001	\$380,608
Closing fees and expenses	\$10,000	\$2,000	\$500
Sales Commission/fees	5.0%	3.5%	2.0%
Outstanding Mortgage EOY 6	\$23,815	\$23,815	\$23,815
Cash after Expenses	\$150,871	\$273,117	\$405,217
Tax Rate	15.0%	15.0%	15.0%
Taxes on Sale of House EOY 6	\$22,631	\$40,968	\$60,783
Cash after Taxes	\$128,240	\$232,149	\$344,434
Interest rate for PV calc	2.38%	2.38%	2.38%
PV Cash after All Expenses	\$119,503	\$216,333	\$320,967

Sell EOY 6 as Rental Property	Worst	Likely	Best
Market Value (June 2015)	\$206,490	\$247,091	\$284,000
Market Value Increase (yearly)	-1.0%	3.8%	7.5%
Market Value EOY 6	\$194,406	\$309,774	\$438,298
Interest rate for PV calc	2.4%	2.4%	2.4%
PV of MV EOY 6	\$168,818	\$269,001	\$380,608
Closing fees and expenses	\$10,000	\$2,000	\$500
Sales Commission/fees	5.0%	3.5%	2.0%
Outstanding Mortgage EOY 6	\$23,815	\$23,815	\$23,815
Cash after Expenses	\$150,871	\$273,117	\$405,217
Tax Rate	15.0%	15.0%	15.0%
Taxes on Sale of House EOY 6	\$22,631	\$40,968	\$60,783
Taxes on Rental Income EOY 6	\$13,072	\$16,521	\$18,749
Cash after Taxes	\$115,169	\$215,628	\$325,686
Interest rate for PV calc	2.38%	2.38%	2.38%
PV Cash after All Expenses	\$107,322	\$200,937	\$303,496

9.4 Key Variables & Calculations - 3 Year Investment Tables

3 Year Worst					3 Year Likely					3 Year Best				
Month	Annuity at Inflation	Annuity in Investment	Diff	PV Diff	Month	Annuity at Inflation	Annuity in Investment	Diff	PV Diff	Month	Annuity at Inflation	Annuity in Investment	Diff	PV Diff
1	\$2,538	\$2,586	\$48	\$47.91	1	\$3,727	\$3,956	\$228	\$227.77	1	\$4,706	\$5,223	\$517	\$515.99
2	\$2,538	\$2,586	\$48	\$47.81	2	\$3,727	\$3,956	\$228	\$227.32	2	\$4,706	\$5,223	\$517	\$514.97
3	\$2,538	\$2,586	\$48	\$47.72	3	\$3,727	\$3,956	\$228	\$226.87	3	\$4,706	\$5,223	\$517	\$513.95
4	\$2,538	\$2,586	\$48	\$47.62	4	\$3,727	\$3,956	\$228	\$226.42	4	\$4,706	\$5,223	\$517	\$512.94
5	\$2,538	\$2,586	\$48	\$47.53	5	\$3,727	\$3,956	\$228	\$225.98	5	\$4,706	\$5,223	\$517	\$511.93
6	\$2,538	\$2,586	\$48	\$47.44	6	\$3,727	\$3,956	\$228	\$225.53	6	\$4,706	\$5,223	\$517	\$510.92
7	\$2,538	\$2,586	\$48	\$47.34	7	\$3,727	\$3,956	\$228	\$225.09	7	\$4,706	\$5,223	\$517	\$509.91
8	\$2,538	\$2,586	\$48	\$47.25	8	\$3,727	\$3,956	\$228	\$224.64	8	\$4,706	\$5,223	\$517	\$508.91
9	\$2,538	\$2,586	\$48	\$47.16	9	\$3,727	\$3,956	\$228	\$224.20	9	\$4,706	\$5,223	\$517	\$507.91
10	\$2,538	\$2,586	\$48	\$47.06	10	\$3,727	\$3,956	\$228	\$223.76	10	\$4,706	\$5,223	\$517	\$506.90
11	\$2,538	\$2,586	\$48	\$46.97	11	\$3,727	\$3,956	\$228	\$223.32	11	\$4,706	\$5,223	\$517	\$505.91
12	\$2,538	\$2,586	\$48	\$46.88	12	\$3,727	\$3,956	\$228	\$222.88	12	\$4,706	\$5,223	\$517	\$504.91
13	\$2,593	\$2,586	-\$7	-\$6.56	13	\$3,808	\$3,956	\$148	\$144.10	13	\$4,807	\$5,223	\$416	\$405.02
14	\$2,593	\$2,586	-\$7	-\$6.55	14	\$3,808	\$3,956	\$148	\$143.82	14	\$4,807	\$5,223	\$416	\$404.22
15	\$2,593	\$2,586	-\$7	-\$6.54	15	\$3,808	\$3,956	\$148	\$143.54	15	\$4,807	\$5,223	\$416	\$403.42
16	\$2,593	\$2,586	-\$7	-\$6.52	16	\$3,808	\$3,956	\$148	\$143.25	16	\$4,807	\$5,223	\$416	\$402.63
17	\$2,593	\$2,586	-\$7	-\$6.51	17	\$3,808	\$3,956	\$148	\$142.97	17	\$4,807	\$5,223	\$416	\$401.83
18	\$2,593	\$2,586	-\$7	-\$6.50	18	\$3,808	\$3,956	\$148	\$142.69	18	\$4,807	\$5,223	\$416	\$401.04
19	\$2,593	\$2,586	-\$7	-\$6.49	19	\$3,808	\$3,956	\$148	\$142.41	19	\$4,807	\$5,223	\$416	\$400.25
20	\$2,593	\$2,586	-\$7	-\$6.47	20	\$3,808	\$3,956	\$148	\$142.13	20	\$4,807	\$5,223	\$416	\$399.46
21	\$2,593	\$2,586	-\$7	-\$6.46	21	\$3,808	\$3,956	\$148	\$141.85	21	\$4,807	\$5,223	\$416	\$398.67
22	\$2,593	\$2,586	-\$7	-\$6.45	22	\$3,808	\$3,956	\$148	\$141.57	22	\$4,807	\$5,223	\$416	\$397.89
23	\$2,593	\$2,586	-\$7	-\$6.43	23	\$3,808	\$3,956	\$148	\$141.29	23	\$4,807	\$5,223	\$416	\$397.10
24	\$2,593	\$2,586	-\$7	-\$6.42	24	\$3,808	\$3,956	\$148	\$141.01	24	\$4,807	\$5,223	\$416	\$396.32
25	\$2,628	\$2,586	-\$42	-\$39.75	25	\$3,859	\$3,956	\$96	\$91.77	25	\$4,872	\$5,223	\$351	\$333.73
26	\$2,628	\$2,586	-\$42	-\$39.67	26	\$3,859	\$3,956	\$96	\$91.59	26	\$4,872	\$5,223	\$351	\$333.07
27	\$2,628	\$2,586	-\$42	-\$39.60	27	\$3,859	\$3,956	\$96	\$91.41	27	\$4,872	\$5,223	\$351	\$332.41
28	\$2,628	\$2,586	-\$42	-\$39.52	28	\$3,859	\$3,956	\$96	\$91.23	28	\$4,872	\$5,223	\$351	\$331.76
29	\$2,628	\$2,586	-\$42	-\$39.44	29	\$3,859	\$3,956	\$96	\$91.05	29	\$4,872	\$5,223	\$351	\$331.10
30	\$2,628	\$2,586	-\$42	-\$39.36	30	\$3,859	\$3,956	\$96	\$90.87	30	\$4,872	\$5,223	\$351	\$330.45
31	\$2,628	\$2,586	-\$42	-\$39.29	31	\$3,859	\$3,956	\$96	\$90.69	31	\$4,872	\$5,223	\$351	\$329.80
32	\$2,628	\$2,586	-\$42	-\$39.21	32	\$3,859	\$3,956	\$96	\$90.51	32	\$4,872	\$5,223	\$351	\$329.15
33	\$2,628	\$2,586	-\$42	-\$39.13	33	\$3,859	\$3,956	\$96	\$90.33	33	\$4,872	\$5,223	\$351	\$328.50
34	\$2,628	\$2,586	-\$42	-\$39.05	34	\$3,859	\$3,956	\$96	\$90.16	34	\$4,872	\$5,223	\$351	\$327.85
35	\$2,628	\$2,586	-\$42	-\$38.98	35	\$3,859	\$3,956	\$96	\$89.98	35	\$4,872	\$5,223	\$351	\$327.21
36	\$2,628	\$2,586	-\$42	-\$38.90	36	\$3,859	\$3,956	\$96	\$89.80	36	\$4,872	\$5,223	\$351	\$326.56
Sum of PV =				-\$29	Sum of PV =				\$5,276	Sum of PV =				\$14,379

9.5 Key Variables & Calculations - 6 Year Investment Table Worst

6 Year Worst				
Month	Annuity at Inflation	Annuity in Investment	Diff	PV Diff
1	\$1,271	\$1,319	\$48	\$47.68
2	\$1,271	\$1,319	\$48	\$47.68
3	\$1,271	\$1,319	\$48	\$47.67
4	\$1,271	\$1,319	\$48	\$47.67
5	\$1,271	\$1,319	\$48	\$47.67
6	\$1,271	\$1,319	\$48	\$47.66
7	\$1,271	\$1,319	\$48	\$47.66
8	\$1,271	\$1,319	\$48	\$47.65
9	\$1,271	\$1,319	\$48	\$47.65
10	\$1,271	\$1,319	\$48	\$47.65
11	\$1,271	\$1,319	\$48	\$47.64
12	\$1,271	\$1,319	\$48	\$47.64
13	\$1,326	\$1,319	-\$7	-\$6.73
14	\$1,326	\$1,319	-\$7	-\$6.73
15	\$1,326	\$1,319	-\$7	-\$6.73
16	\$1,326	\$1,319	-\$7	-\$6.73
17	\$1,326	\$1,319	-\$7	-\$6.72
18	\$1,326	\$1,319	-\$7	-\$6.72
19	\$1,326	\$1,319	-\$7	-\$6.72
20	\$1,326	\$1,319	-\$7	-\$6.72
21	\$1,326	\$1,319	-\$7	-\$6.72
22	\$1,326	\$1,319	-\$7	-\$6.72
23	\$1,326	\$1,319	-\$7	-\$6.72
24	\$1,326	\$1,319	-\$7	-\$6.72
25	\$1,361	\$1,319	-\$42	-\$41.86
26	\$1,361	\$1,319	-\$42	-\$41.85
27	\$1,361	\$1,319	-\$42	-\$41.85
28	\$1,361	\$1,319	-\$42	-\$41.85
29	\$1,361	\$1,319	-\$42	-\$41.84
30	\$1,361	\$1,319	-\$42	-\$41.84
31	\$1,361	\$1,319	-\$42	-\$41.84
32	\$1,361	\$1,319	-\$42	-\$41.83
33	\$1,361	\$1,319	-\$42	-\$41.83
34	\$1,361	\$1,319	-\$42	-\$41.83
35	\$1,361	\$1,319	-\$42	-\$41.82
36	\$1,361	\$1,319	-\$42	-\$41.82
37	\$1,368	\$1,319	-\$49	-\$48.66

38	\$1,368	\$1,319	-\$49	-\$48.66
39	\$1,368	\$1,319	-\$49	-\$48.66
40	\$1,368	\$1,319	-\$49	-\$48.65
41	\$1,368	\$1,319	-\$49	-\$48.65
42	\$1,368	\$1,319	-\$49	-\$48.64
43	\$1,368	\$1,319	-\$49	-\$48.64
44	\$1,368	\$1,319	-\$49	-\$48.64
45	\$1,368	\$1,319	-\$49	-\$48.63
46	\$1,368	\$1,319	-\$49	-\$48.63
47	\$1,368	\$1,319	-\$49	-\$48.62
48	\$1,368	\$1,319	-\$49	-\$48.62
49	\$1,359	\$1,319	-\$40	-\$40.17
50	\$1,359	\$1,319	-\$40	-\$40.16
51	\$1,359	\$1,319	-\$40	-\$40.16
52	\$1,359	\$1,319	-\$40	-\$40.16
53	\$1,359	\$1,319	-\$40	-\$40.15
54	\$1,359	\$1,319	-\$40	-\$40.15
55	\$1,359	\$1,319	-\$40	-\$40.15
56	\$1,359	\$1,319	-\$40	-\$40.14
57	\$1,359	\$1,319	-\$40	-\$40.14
58	\$1,359	\$1,319	-\$40	-\$40.14
59	\$1,359	\$1,319	-\$40	-\$40.13
60	\$1,359	\$1,319	-\$40	-\$40.13
61	\$1,358	\$1,319	-\$40	-\$39.32
62	\$1,358	\$1,319	-\$40	-\$39.32
63	\$1,358	\$1,319	-\$40	-\$39.32
64	\$1,358	\$1,319	-\$40	-\$39.31
65	\$1,358	\$1,319	-\$40	-\$39.31
66	\$1,358	\$1,319	-\$40	-\$39.31
67	\$1,358	\$1,319	-\$40	-\$39.30
68	\$1,358	\$1,319	-\$40	-\$39.30
69	\$1,358	\$1,319	-\$40	-\$39.30
70	\$1,358	\$1,319	-\$40	-\$39.30
71	\$1,358	\$1,319	-\$40	-\$39.29
72	\$1,358	\$1,319	-\$40	-\$39.29
Sum of PV =				-\$1,596

9.6 Key Variables & Calculations - 6 Year Investment Table Likely

6 Year Likely				
Month	Annuity at Inflation	Annuity in Investment	Diff	PV Diff
1	\$1,867	\$2,096	\$230	\$229.19
2	\$1,867	\$2,096	\$230	\$228.74
3	\$1,867	\$2,096	\$230	\$228.29
4	\$1,867	\$2,096	\$230	\$227.84
5	\$1,867	\$2,096	\$230	\$227.39
6	\$1,867	\$2,096	\$230	\$226.94
7	\$1,867	\$2,096	\$230	\$226.49
8	\$1,867	\$2,096	\$230	\$226.05
9	\$1,867	\$2,096	\$230	\$225.60
10	\$1,867	\$2,096	\$230	\$225.16
11	\$1,867	\$2,096	\$230	\$224.71
12	\$1,867	\$2,096	\$230	\$224.27
13	\$1,946	\$2,096	\$150	\$145.94
14	\$1,946	\$2,096	\$150	\$145.66
15	\$1,946	\$2,096	\$150	\$145.37
16	\$1,946	\$2,096	\$150	\$145.08
17	\$1,946	\$2,096	\$150	\$144.80
18	\$1,946	\$2,096	\$150	\$144.51
19	\$1,946	\$2,096	\$150	\$144.23
20	\$1,946	\$2,096	\$150	\$143.94
21	\$1,946	\$2,096	\$150	\$143.66
22	\$1,946	\$2,096	\$150	\$143.38
23	\$1,946	\$2,096	\$150	\$143.09
24	\$1,946	\$2,096	\$150	\$142.81
25	\$1,998	\$2,096	\$98	\$93.32
26	\$1,998	\$2,096	\$98	\$93.13
27	\$1,998	\$2,096	\$98	\$92.95
28	\$1,998	\$2,096	\$98	\$92.77
29	\$1,998	\$2,096	\$98	\$92.58
30	\$1,998	\$2,096	\$98	\$92.40
31	\$1,998	\$2,096	\$98	\$92.22
32	\$1,998	\$2,096	\$98	\$92.04
33	\$1,998	\$2,096	\$98	\$91.86
34	\$1,998	\$2,096	\$98	\$91.67
35	\$1,998	\$2,096	\$98	\$91.49
36	\$1,998	\$2,096	\$98	\$91.31
37	\$2,008	\$2,096	\$88	\$81.76

38	\$2,008	\$2,096	\$88	\$81.60
39	\$2,008	\$2,096	\$88	\$81.43
40	\$2,008	\$2,096	\$88	\$81.27
41	\$2,008	\$2,096	\$88	\$81.11
42	\$2,008	\$2,096	\$88	\$80.95
43	\$2,008	\$2,096	\$88	\$80.79
44	\$2,008	\$2,096	\$88	\$80.63
45	\$2,008	\$2,096	\$88	\$80.48
46	\$2,008	\$2,096	\$88	\$80.32
47	\$2,008	\$2,096	\$88	\$80.16
48	\$2,008	\$2,096	\$88	\$80.00
49	\$1,996	\$2,096	\$100	\$91.15
50	\$1,996	\$2,096	\$100	\$90.97
51	\$1,996	\$2,096	\$100	\$90.79
52	\$1,996	\$2,096	\$100	\$90.61
53	\$1,996	\$2,096	\$100	\$90.43
54	\$1,996	\$2,096	\$100	\$90.26
55	\$1,996	\$2,096	\$100	\$90.08
56	\$1,996	\$2,096	\$100	\$89.90
57	\$1,996	\$2,096	\$100	\$89.72
58	\$1,996	\$2,096	\$100	\$89.55
59	\$1,996	\$2,096	\$100	\$89.37
60	\$1,996	\$2,096	\$100	\$89.19
61	\$1,995	\$2,096	\$102	\$90.07
62	\$1,995	\$2,096	\$102	\$89.89
63	\$1,995	\$2,096	\$102	\$89.71
64	\$1,995	\$2,096	\$102	\$89.54
65	\$1,995	\$2,096	\$102	\$89.36
66	\$1,995	\$2,096	\$102	\$89.18
67	\$1,995	\$2,096	\$102	\$89.01
68	\$1,995	\$2,096	\$102	\$88.83
69	\$1,995	\$2,096	\$102	\$88.66
70	\$1,995	\$2,096	\$102	\$88.48
71	\$1,995	\$2,096	\$102	\$88.31
72	\$1,995	\$2,096	\$102	\$88.13
Sum of PV =				\$8,453

9.7 Key Variables & Calculations - 6 Year Investment Table Best

6 Year Best				
Month	Annuity at Inflation	Annuity in Investment	Diff	PV Diff
1	\$2,356	\$2,884	\$527	\$526.34
2	\$2,356	\$2,884	\$527	\$525.31
3	\$2,356	\$2,884	\$527	\$524.27
4	\$2,356	\$2,884	\$527	\$523.24
5	\$2,356	\$2,884	\$527	\$522.21
6	\$2,356	\$2,884	\$527	\$521.18
7	\$2,356	\$2,884	\$527	\$520.15
8	\$2,356	\$2,884	\$527	\$519.12
9	\$2,356	\$2,884	\$527	\$518.10
10	\$2,356	\$2,884	\$527	\$517.08
11	\$2,356	\$2,884	\$527	\$516.06
12	\$2,356	\$2,884	\$527	\$515.04
13	\$2,457	\$2,884	\$427	\$415.70
14	\$2,457	\$2,884	\$427	\$414.88
15	\$2,457	\$2,884	\$427	\$414.06
16	\$2,457	\$2,884	\$427	\$413.25
17	\$2,457	\$2,884	\$427	\$412.43
18	\$2,457	\$2,884	\$427	\$411.62
19	\$2,457	\$2,884	\$427	\$410.81
20	\$2,457	\$2,884	\$427	\$410.00
21	\$2,457	\$2,884	\$427	\$409.19
22	\$2,457	\$2,884	\$427	\$408.38
23	\$2,457	\$2,884	\$427	\$407.58
24	\$2,457	\$2,884	\$427	\$406.77
25	\$2,523	\$2,884	\$361	\$343.84
26	\$2,523	\$2,884	\$361	\$343.16
27	\$2,523	\$2,884	\$361	\$342.49
28	\$2,523	\$2,884	\$361	\$341.81
29	\$2,523	\$2,884	\$361	\$341.14
30	\$2,523	\$2,884	\$361	\$340.47
31	\$2,523	\$2,884	\$361	\$339.80
32	\$2,523	\$2,884	\$361	\$339.13
33	\$2,523	\$2,884	\$361	\$338.46
34	\$2,523	\$2,884	\$361	\$337.79
35	\$2,523	\$2,884	\$361	\$337.12
36	\$2,523	\$2,884	\$361	\$336.46
37	\$2,535	\$2,884	\$348	\$323.96

38	\$2,535	\$2,884	\$348	\$323.32
39	\$2,535	\$2,884	\$348	\$322.68
40	\$2,535	\$2,884	\$348	\$322.05
41	\$2,535	\$2,884	\$348	\$321.41
42	\$2,535	\$2,884	\$348	\$320.78
43	\$2,535	\$2,884	\$348	\$320.15
44	\$2,535	\$2,884	\$348	\$319.51
45	\$2,535	\$2,884	\$348	\$318.88
46	\$2,535	\$2,884	\$348	\$318.26
47	\$2,535	\$2,884	\$348	\$317.63
48	\$2,535	\$2,884	\$348	\$317.00
49	\$2,520	\$2,884	\$364	\$330.65
50	\$2,520	\$2,884	\$364	\$330.00
51	\$2,520	\$2,884	\$364	\$329.35
52	\$2,520	\$2,884	\$364	\$328.70
53	\$2,520	\$2,884	\$364	\$328.05
54	\$2,520	\$2,884	\$364	\$327.41
55	\$2,520	\$2,884	\$364	\$326.76
56	\$2,520	\$2,884	\$364	\$326.12
57	\$2,520	\$2,884	\$364	\$325.48
58	\$2,520	\$2,884	\$364	\$324.83
59	\$2,520	\$2,884	\$364	\$324.19
60	\$2,520	\$2,884	\$364	\$323.56
61	\$2,518	\$2,884	\$366	\$324.24
62	\$2,518	\$2,884	\$366	\$323.60
63	\$2,518	\$2,884	\$366	\$322.97
64	\$2,518	\$2,884	\$366	\$322.33
65	\$2,518	\$2,884	\$366	\$321.69
66	\$2,518	\$2,884	\$366	\$321.06
67	\$2,518	\$2,884	\$366	\$320.43
68	\$2,518	\$2,884	\$366	\$319.79
69	\$2,518	\$2,884	\$366	\$319.16
70	\$2,518	\$2,884	\$366	\$318.54
71	\$2,518	\$2,884	\$366	\$317.91
72	\$2,518	\$2,884	\$366	\$317.28
Sum of PV =				\$26,358

9.8 Key Variables & Calculations - Income & Expenses (partial example)

Worst											
PV Net Income	Month	PV Rental Income	Rental Income	PV Total Expenses	Total Expenses	Mgmt Fees	Monthly Principal & Interest	Assessed Value	Monthly Property Tax	Monthly Insurance	Monthly Maint
-\$295.28	1	\$1,297	\$1,300	\$1,593	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$294.69	2	\$1,295	\$1,300	\$1,590	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$294.11	3	\$1,292	\$1,300	\$1,586	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$293.53	4	\$1,290	\$1,300	\$1,583	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$292.95	5	\$1,287	\$1,300	\$1,580	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$292.37	6	\$1,285	\$1,300	\$1,577	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$291.79	7	\$1,282	\$1,300	\$1,574	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$291.21	8	\$1,280	\$1,300	\$1,571	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$290.63	9	\$1,277	\$1,300	\$1,568	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$290.06	10	\$1,274	\$1,300	\$1,565	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$289.48	11	\$1,272	\$1,300	\$1,561	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$288.91	12	\$1,269	\$1,300	\$1,558	\$1,596	\$104	\$917	\$141,223	\$282	\$42	\$250
-\$296.60	13	\$1,267	\$1,300	\$1,564	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$296.01	14	\$1,264	\$1,300	\$1,560	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$295.42	15	\$1,262	\$1,300	\$1,557	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$294.84	16	\$1,259	\$1,300	\$1,554	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$294.26	17	\$1,257	\$1,300	\$1,551	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$293.67	18	\$1,254	\$1,300	\$1,548	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$293.09	19	\$1,252	\$1,300	\$1,545	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$292.51	20	\$1,249	\$1,300	\$1,542	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$291.93	21	\$1,247	\$1,300	\$1,539	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$291.36	22	\$1,245	\$1,300	\$1,536	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$290.78	23	\$1,242	\$1,300	\$1,533	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$290.20	24	\$1,240	\$1,300	\$1,530	\$1,604	\$104	\$917	\$145,460	\$291	\$42	\$250
-\$297.93	25	\$1,237	\$1,300	\$1,535	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$297.34	26	\$1,235	\$1,300	\$1,532	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$296.76	27	\$1,232	\$1,300	\$1,529	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$296.17	28	\$1,230	\$1,300	\$1,526	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$295.58	29	\$1,227	\$1,300	\$1,523	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$295.00	30	\$1,225	\$1,300	\$1,520	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$294.41	31	\$1,223	\$1,300	\$1,517	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$293.83	32	\$1,220	\$1,300	\$1,514	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$293.25	33	\$1,218	\$1,300	\$1,511	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$292.67	34	\$1,215	\$1,300	\$1,508	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$292.09	35	\$1,213	\$1,300	\$1,505	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$291.51	36	\$1,211	\$1,300	\$1,502	\$1,613	\$104	\$917	\$149,824	\$300	\$42	\$250
-\$299.29	37	\$1,208	\$1,300	\$1,507	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$298.70	38	\$1,206	\$1,300	\$1,504	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$298.10	39	\$1,203	\$1,300	\$1,501	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$297.51	40	\$1,201	\$1,300	\$1,498	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$296.93	41	\$1,199	\$1,300	\$1,495	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$296.34	42	\$1,196	\$1,300	\$1,493	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$295.75	43	\$1,194	\$1,300	\$1,490	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$295.17	44	\$1,191	\$1,300	\$1,487	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$294.58	45	\$1,189	\$1,300	\$1,484	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$294.00	46	\$1,187	\$1,300	\$1,481	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$293.42	47	\$1,184	\$1,300	\$1,478	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$292.84	48	\$1,182	\$1,300	\$1,475	\$1,622	\$104	\$917	\$154,319	\$309	\$42	\$250
-\$300.66	49	\$1,180	\$1,300	\$1,480	\$1,631	\$104	\$917	\$158,948	\$318	\$42	\$250
-\$300.06	50	\$1,177	\$1,300	\$1,477	\$1,631	\$104	\$917	\$158,948	\$318	\$42	\$250
-\$299.47	51	\$1,175	\$1,300	\$1,475	\$1,631	\$104	\$917	\$158,948	\$318	\$42	\$250