

EMGT6225: ECONOMIC DECISION MAKING

ECONOMIC ANALYSIS FOR A CONSTRUCTION CORPORATION

Under Professor Mohammad Dehghani

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INTRODUCTION

The objective of the project is to conduct an economic analysis of the choice made by a corporation as to what to build on a plot of land in the city of Boston, Massachusetts to maximize their earnings.

The three alternatives that the corporation has are:

- Residential Buildings
- Mall
- Hotel

Residential Buildings

The residential buildings comprise of four 20-story high buildings. Each floor comprises of 14 four-bedroom apartments. The area of the foundation of each building is 20000 square feet. The remaining area of 20000 square feet is left for garden and roads.

Initial Investment: The construction cost per apartment includes the cost of materials, labor, machines, and contractor which amounts to \$635,000. Thus, the total cost for building 4 such buildings amounts to \$711.2 million.

Monthly O&M Cost

For Repair & Maintenance: Assuming each building requires maintenance for plumbing, heating/cooling, electric appliances, etc.

For Insurance: assuming it to be about \$10,000 per month.

For Marketing: The initial cost is assumed to be \$8,000 per month. Assuming that for the first 2 years, marketing is going to be 100% of the initial cost. The marketing cost would decrease and is assumed to remain fixed after the end of year-2 since only a few apartments would be vacated each year. The marketing rate is assumed to be fixed at 70% of the initial cost from year-3 onwards. The Annual cost (per building) for marketing = $\$8,000 \times 12 = \$96,000$.

The Annual cost (per building) = Monthly Cost (per building) * 12

Table-1: Costs for various categories

	Monthly Costs (per building)	Annual Cost (per building)
Salaries & Personnel	= \$20 (/hr) * 8 hrs * 3 shifts * 30 days = \$14,400	\$172,800
Repair & Maintenance	\$2000	\$48,000
Utilities	= \$4000 (per floor) * 20 = \$80,000	\$960,000
Insurance	\$10,000	\$120,000
Management Fees	= \$35 (per hr) * 8 hrs * 10 people * 30 days = \$84,000	\$1,008,000

The Total Annual Cost for the corporation = (Summation of the Annual Costs (per building) + Annual Marketing Cost) * Number of Buildings.

Revenue

All the apartments are leased on a yearly basis. We take the occupancy rate into account to calculate the total annual revenue. The rent for each apartment is \$5600 per month. Thus the total Annual revenue amounts to:

$$\$5600 \times 14 \text{ apartments (per floor)} \times 20 \text{ floors} \times 4 \text{ buildings} \times 12 \text{ months} = \$ 75,264,000.$$

This is the total annual revenue when the occupancy rate is 100%. We assume that for the first 2 years, the occupancy rate is 50% and 70% respectively, and for the subsequent years, the occupancy rate is assumed to be 100%, i.e., all the apartments have been leased.

Thus, Total Annual Revenue = Occupancy Rate * Ideal Total Annual Revenue (100% occupancy)

Two types of cash flows are considered: Uniform & Geometric. The geometric rate is fixed at 2% annually.

Thus, the **Net Cash Flow** = Total Annual Revenue - Total AO&MC

Mall

The mall is going to be a 3-floor building, with an area of 90,000 square feet each floor. The total area is going to be 270,000 square feet. It would contain a basement parking garage, with an area of 90,000 square feet.

Initial Investment: The cost incurred for building the mall can be calculated by the area multiplied by the sum of the cost of material (\$200 / sqft) and the cost of labor (\$250 / sqft):

$$270,000 \text{ sqft} * (\$200 + \$250) / \text{sqft} = \$121,500,000$$

The cost incurred for building the parking garage can be calculated in the same way as the mall, but with cheaper cost of material (\$30 / sqft) and cost of labor (\$30 / sqft). Thus, the cost of the garage is:

$$90,000 \text{ sqft} * (\$30 + \$30) / \text{sqft} = \$5,400,000$$

Thus, the total initial investment for the Mall = \$121,500,000 + \$5,400,000 = \$126,900,000

Cash Flow

Costs: The monthly costs include various categories such as utility, salaries for the personnel, repair & maintenance, management fees, and the insurance cost. As a corporation, we are only responsible to pay for the fees generated on the public area, which means that we don't cover the utility fees, maintenance and repairing inside a specific unit store.

Utility	$270,000 \text{sqft} * 33.33\% * \$80 + 90,000 \text{sqft} * \$1.6 = \$7,344,000$
Salaries & Personnel	$[(4 \text{ security} + 1 \text{ cleaning}) * 3 \text{fl} + 2 \text{ garage}] * \$5000 = \$85,000$
Repair & Maintenance	\$10,000
Management Fee	$3 \text{fl} * \$7000 = \$21,000$
Insurance	\$30,000

In total, the monthly cost of the mall is the sum of the cost above as $\$7,344,000 + \$85,000 + \$10,000 + \$21,000 + \$30,000 = \$7,490,000$. So the Annually Total Cost is $\$7,490,000 * 12 = \$89,880,000$

Revenue:

All the shop units as well as the whole garage are leased on a yearly basis. The revenue from the mall is purely based on the rent coming from leasing the stores and the garage. The cash flow of retail stores is not of our concern. The public area in the mall is assumed to be 33.33% of the whole building area, leaving the pure store area to be $270,000 \text{ sqft} * (1 - 33\%) = 180,000 \text{ sqft}$. Based on **Graph 1** of **APPENDIX**, it is wise to make a unit store of area 2000 square feet. According to the graph, as an example, small stores like GameStop and Fossil would fit in one unit store; Medium size retailers like Tiffany & Co. and Foot Locker fits in two unit stores; and large size retailers such as Under Armour and Victoria's Secret would need multiple unit stores. So there will be $180,000 \text{ sqft} / 2000 = 90$ unit stores for leasing. The price for the unit stores is \$50 per square feet per month. Retail stores that need multiple unit stores can lease consecutive stores at the same time. There will not be any discount on the price for leasing multiple unit stores, but they can break through the walls and get extra spaces from the wall. The construction needs to be done by the retailers and under certain safety regulations. So the total revenue from leasing the unit stores per month is $\$50 * 2000 * 90 = \$9,000,000$ and the annual revenue from the unit stores of the mall is \$108,000,000. We assume the first two years occupancy to be 50% and 70% as a warm-up period and the process of decorating. For the garage, we are leasing the whole garage out, and similar to the mall, the revenue is purely from the rental price of the garage. The monthly garage rent is simply \$100,000. So the annually revenue from the garage is $\$100,000 * 12 = \$1,200,000$.

The total annual revenue of the mall is the lease from the unit stores and the garage: $\$108,000,000 + \$1,200,000 = \$109,200,000$.

So the **Annual Cash Flow** for the Mall Project is $\$109,200,000 - \$89,880,000 = \$19,320,000$.

Hotel

The hotel is a 20-story building, 200 rooms in total with a pool on the roof, two restaurants, and 4 meeting halls. The building occupies about 70% of the land, which is 70,000 square feet. The rest of the area is assigned for parking and garden. The construction cost per floor includes the cost of materials, labor, machines, and contractor which amounts to \$5,730,000. Thus, the total cost for building the hotel amounts to \$114.6 million.

Cash flow

Revenue:

Season	Price (per room per night)	Total Revenue (per 6 months)
Offseason	\$250	= $\$250 * 200 \text{ rooms} * 30 \text{ days} * 6 \text{ months} = \9 million
Peak Season	\$550	= $\$550 * 200 \text{ rooms} * 30 \text{ days} * 6 \text{ months} = \19.8 million

We are categorizing the revenue by the season since a hotel would have more revenue during the peak season and less revenue during the off-season. The months for off-season are assumed to be February, March, April, May, October & November. The months for peak season are assumed to be January, June, July, August, September & December.

Cost:

For the salaries and wages of the managers and staff of the hotel, it's expected to reach \$83,500.00 per month:

- 3 Managers working 8-hour shifts for a \$68,800.00/ month in total.
- 120 staff including desk clerks, restaurants chefs, waiters, pool lifeguards, gym trainers, doors guards. Totaling their wages to \$185,850.00/month
- The operating and maintenance costs vary by the season. It costs on an average of \$50,000.00/ month during the off-season and goes up to about \$100,000.00 during the peak season since all rooms are fully booked and more energy and electricity is required to operate the hotel.
- The marketing budget is \$100,000.00 /month is devoted to the marketing department.
- insurance coverage is estimated to cost about \$50,000.00/ month which equals \$600,000.00/year.

PLANNING HORIZON

The planning horizon is assumed to be 30 years since the initial investment is very high for the project that the corporation is taking. Since the discounted payback period would be around 20 years, for the corporation to make profits, the planning horizon should be greater than 20 years.

REGRESSION MODEL

The two types of regression model we have used are Linear & Exponential Regression.

Residential Buildings

Exponential Regression:

Rent: $Y = a * (b)^X$,

where $X = t - 1$

Y = rent for next year

a = rent for year-1

b = Increase rate

Wages: $Y = a * (b)^X$,

where $X = t - 1$

Y = rent for next year

a = wages for year-1

b = Increase rate

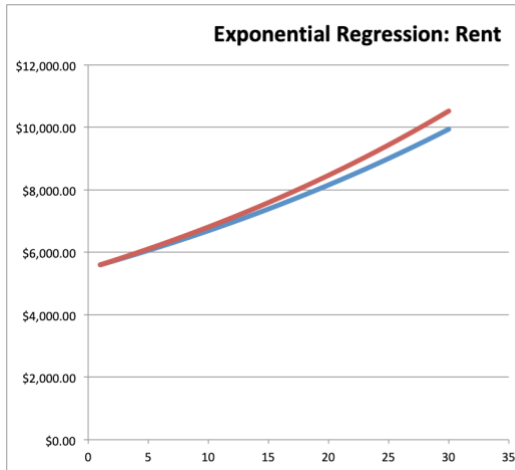


Figure-1: Exponential Regression for Rent



Figure-2: Exponential Regression for Wages

Linear regression:

Rent: $Y = a + b \cdot X$,
where $X = t - 1$

Y = rent for next year

a = rent for year-1

b = Increase per year = \$100

Wages: $Y = a + b \cdot X$,
where $X = t - 1$

Y = wages for next year

a = wages for year-1

b = Increase per year = \$300

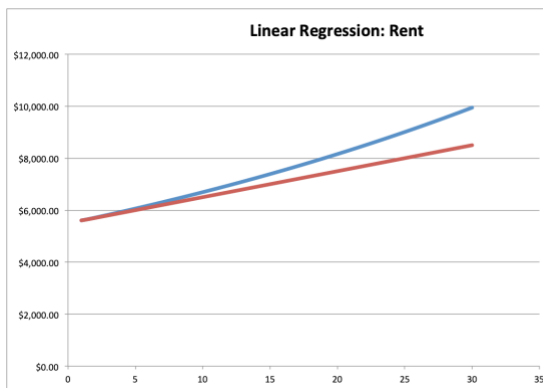


Figure-3: Linear Regression for Rent



Figure-4: Linear Regression for Wages

WACC

In order to obtain the capital of our initial investment, we used the following different resources are loan, Common Stock, Preferred Stock & Retained Earnings. We are assuming that the tax rate is 40%.

Loan: The interest rate is assumed to be 5% compounded annually from the bank. So, the effective rate is 5.00%, and thus, the cost of capital = $5\% \cdot (1 - 40\%) = 3.00\%$.

Common Stock: The dividend per share (CSD) is \$5, the current trading price per share (PCs) is \$100, & the growth rate is assumed to be 4%. Thus, the cost of capital = $\$5 / \$100 + 4\% = 9.00\%$.

Preferred Stock: the dividend per share (PSD) is \$7, the current trading price per share (PPs) is \$100, & the Cps is \$1. Thus, the cost of capital = $\$7 / (\$100 - \$1) = 7.0707\%$

Retained Earnings: The cost of capital = cost of capital of Common Stock = 9.00%.

Table 2: Source of Initial Investment

	Percentage	Cost of Capital
Loan	30.00%	3.0000%
Common Stock	40.00%	9.0000%
Preferred Stock	20.00%	7.0707%
Retained Earnings	10.00%	9.0000%

From **Table 2**, $WACC = 30\% * 3\% + 40\% * 9\% + 20\% * 7.0707\% + 10\% * 9\% = 6.81414\%$. Our profit margin is set to be 2%, so our Before Tax MARR is $6.81414\% + 2\% = 8.81414\%$. We have assumed the income tax rate to be 40%. Thus, the **After Tax MARR** turns out to be $= 5.28848\%$.

PAYBACK METHOD

We are considering Plan-3 & Plan-4 for paying back the loan. The Lender's rate is 5% compounded annually and the ATMARR is 5.28848%, which is equal to TVOM for us.

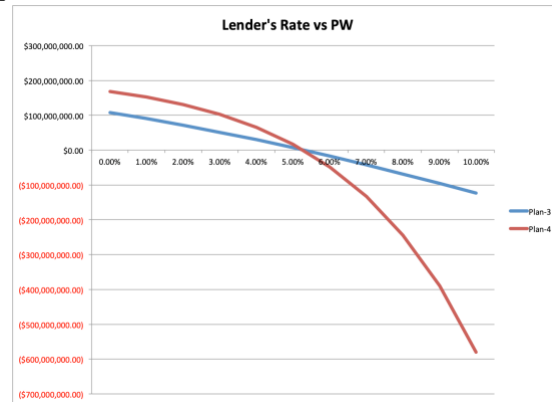


Figure-5: Lender's Rate vs PW

As we can see from the graph, (i) if the lender's rate $<$ TVOM, use plan-4 for borrowing.

(ii) if the lender's rate $>$ TVOM, use plan-3 for borrowing.

Since the lender's rate (5%) is less than the TVOM (5.29%), thus it is better for us to use Plan-4 for paying back the loan.

DEPRECIATION

The two depreciation methods used in the project are Straight Line Depreciation (SLN) & MACRS-GDS.

The residential building is considered to be a 27.5-year residential rental property using mid-month convention and the mall & hotel are considered to be 39-year nonresidential property using mid-month convention.

We are assuming that the salvage value is a constant value and is equal to 30% of the initial investment.

ECONOMIC PERFORMANCE

We use Present worth (PW) & Internal Rate of Revenue (IRR) as evaluation methods for after-tax analysis.

Residential Buildings

Table 3: After-Tax Present Worth for Residential Buildings

	SLN		MACRS	
	Plan-3	Plan-4	Plan-3	Plan-4
Uniform	\$43,832,485.57	\$66,840,102.43	\$74,745,204.21	\$97,752,821.07
Geometric	\$199,985,696.03	\$222,993,312.89	\$230,898,414.67	\$253,906,031.53

Mall

Table 4: After-Tax Present Worth for Mall

	SLN		MACRS	
	Plan-3	Plan-4	Plan-3	Plan-4
Uniform	\$32,693,923.38	\$36,799,191.34	\$33,649,088.73	\$53,923,981.43
Geometric	\$242,715,360.07	\$284,890,628.04	\$281,740,525.42	\$302,015,418.13

Hotel

Table 5: After-Tax Present Worth for Hotel

	SLN		MACRS	
	Plan-3	Plan-4	Plan-3	Plan-4
Uniform	\$61,409,790.65	\$65,117,148.48	\$62,272,374.96	\$65,979,732.79
Geometric	\$98,112,342.04	\$101,819,699.87	\$98,974,926.35	\$102,682,284.18

We observe the following:

1. Since lender's rate < MARR, thus we prefer to use Plan-4. Thus, the Present Worth calculated for Plan-4 is greater than the one for Plan-3.
2. The Present Worth for Geometric CF is greater than the Uniform CF. This is expected since the revenues are greater in geometric CF.

SENSITIVITY ANALYSIS

The sensitivity analysis is done for only Residential Buildings. The 4 inputs taken into consideration are the initial investment, the marketing rate, the geometric increase rate & the rent (per apartment per month) in year-1.

Table 6: Distribution fitting for the different inputs

	Distribution	Parameter-1	Parameter-2	Parameter-3
Initial Investment	Normal	\$683,510,526.32	\$55,530,421.04	
Marketing Rate	Triangular	44.00%	70.00%	85.00%
Geometric Increase Rate	Triangular	2.00%	8.00%	10.00%
Rent	Normal	\$5,761.90	\$677.11	

Risk Analysis

The outputs for the risk analysis are PW, IRR & bonus. The simulation is run for 5000 iterations.

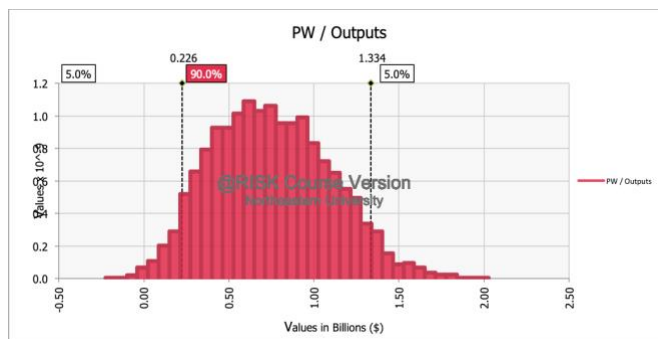


Figure-5: Present worth/output

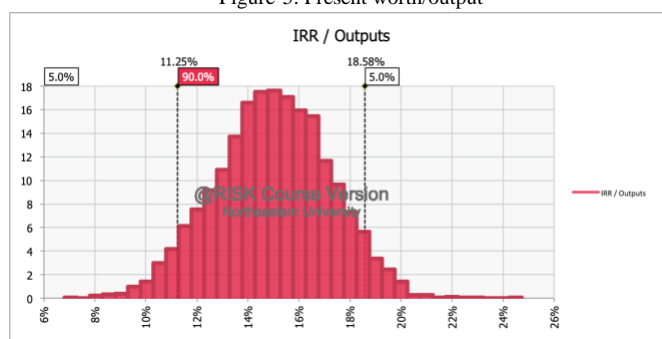


Figure-6: Internal Rate of Revenue/output

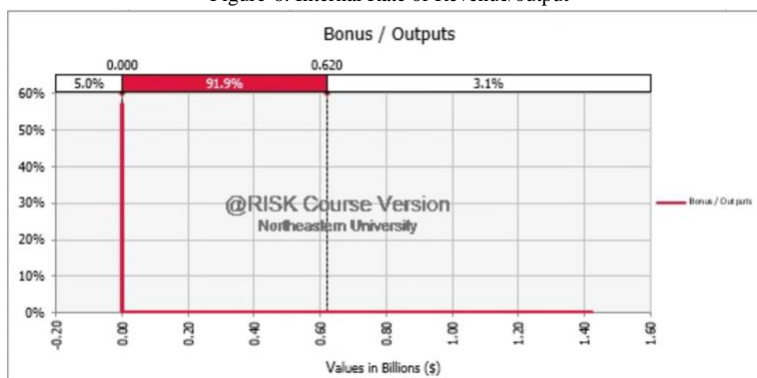


Figure-7: Bonus/output

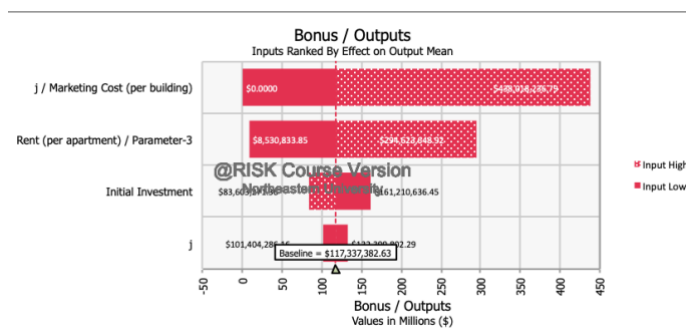


Figure-8: Factors affecting Bonus (or Profit)

ANALYTIC HIERARCHY PROCESS (AHP) ANALYSIS

For the AHP Analysis, we have taken four factors into consideration to compare the three alternatives.

Table 7: Legend of the different alternatives & factors

Legend	Alternatives
A	Residential Buildings
B	Mall
C	Hotel

Legend	Factor
1	Present Worth
2	Maintenance Fees
3	Customer Satisfaction
4	Waste Disposal

In AHP Analysis: for each row, Priority Vector = Average of the individual cells in the row divided by the sum of each column.

Weighted Factor Comparison

In Weighted Factor Comparison: Rate (i) = the priority vector of each alternative wrt the factor (i)

Score (i) = Weight (i) * Rate (i)

Total Score = summation of all score (i)

Weighted Factor Comparison							
Factor	Weight	A		B		C	
		Rate	Score	Rate	Score	Rate	Score
1	0.5582	0.2316	0.1293	0.6965	0.3888	0.0719	0.0401
2	0.1100	0.2431	0.0267	0.1181	0.0130	0.6389	0.0703
3	0.2885	0.1973	0.0569	0.0648	0.0187	0.7379	0.2129
4	0.0433	0.0819	0.0035	0.5750	0.0249	0.3431	0.0148
	100.000%		0.2165		0.4454		0.3381
RANK			3		1		2
Best Alternative				=	Alternative-B: Mall		

Figure-7: Weighted Factor Comparison Table

Table 8: Total score for the alternatives

Alternative	Total Score
Residential Buildings	0.2165
Mall	0.4454
Hotel	0.3381

As we can see, the highest total score is for Mall. Thus, it is the most beneficial for the corporation to build a Mall as it serves our interest the most.

CONCLUSION

After conducting the AHP Analysis & the Weighted Factor Comparison, we have reached the conclusion that it is the most beneficial for the corporation to construct a Mall, followed by a Hotel, & then Residential Building. Mall has the highest present worth in all of the cases considered. Since profit is a major requirement for any corporation, constructing a Mall would result in larger profits.

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APPENDIX



Graph 1: Average Store Area of Retailing Stores