Assignment 4

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Q1. A suitable MARR for this project becomes the mortgage rate the bank has set i.e **0.035**. The MARR serves as a benchmark for when a project is acceptable to undertake.

The NPV calculated for the inflated after tax cash flow **is $4071875.123** see results section in calculation procedure

Calculation procedure

	tax	0.38		
	MARR	0.035		
cost	mortgage			
12000000	900000			
year	revenue from rent	costs	btcf	i
0	0	-403000	-403000	
1	35000	-17000	18000	
2	36295	-17306	18989	
3	37637.915	-17617.508	20020.407	
4	39030.51786	-17934.62314	21095.89471	
5	40474.64702	-18257.44636	22217.20066	
6	41972.20896	-18586.0804	23386.12856	
7	43525.18069	-18920.62984	24604.55084	
8	45135.61237	-19261.20118	25874.41119	
9	46805.63003	-19607.9028	27197.72723	
10	48537.43834	-19960.84505	28576.59329	
11	50333.32356	-20320.14026	30013.1833	
12	52195.65653	-20685.90279	31509.75374	
13	54126.89582	-21058.24904	33068.64679	
14	56129.59097	-21437.29752	34692.29345	
15	58206.38583	-21823.16887	36383.21696	
16	60360.02211	-22215.98591	38144.0362	
17	62593.34293	-22615.87366	39977.46927	
18	64909.29662	-23022.95939	41886.33723	
19	67310.94059	-23437.37266	43873.56794	
20	69801.44539	-23859.24536	45942.20003	
21	72384.09887	-24288.71178	48095.38709	
22	75062.31053	-24725.90859	50336.40194	
23	77839.61602	-25170.97495	52668.64107	
24	80719.68181	-25624.0525	55095.62932	
25	23413568.78	-26085.28544	23387483.49	

Figure 1: before tax cash flows

- For the before tax cash flow section – years range from 1- 25. Revenue is mainly from rent from 1-24 years. The inclusion of the inflated selling price of the land and the house is in row 25 with roughly 23 million dollars (see pt. 5 in points to be addressed by calculations).
- Costs start with 103,000 + 300,000 in year 0. The $17000 charge begins from year 1 going down.
- Btcf is the net of these values.

init UCC	CCA	End UCC	Dispositions	i
75000	3000	72000	0	
147000	5880	141120	0	
288120	11524.8	276595.2	0	
276595.2	11063.81	265531.392	0	
265531.392	10621.26	254910.1363	0	
254910.1363	10196.41	244713.7309	0	
244713.7309	9788.549	234925.1816	0	
234925.1816	9397.007	225528.1744	0	
225528.1744	9021.127	216507.0474	0	
216507.0474	8660.282	207846.7655	0	
207846.7655	8313.871	199532.8949	0	
199532.8949	7981.316	191551.5791	0	
191551.5791	7662.063	183889.5159	0	
183889.5159	7355.581	176533.9353	0	
176533.9353	7061.357	169472.5779	0	
169472.5779	6778.903	162693.6748	0	
162693.6748	6507.747	156185.9278	0	
156185.9278	6247.437	149938.4907	0	
149938.4907	5997.54	143940.951	0	
143940.951	5757.638	138183.313	0	
138183.313	5527.333	132655.9805	0	
132655.9805	5306.239	127349.7412	0	
127349.7412	5093.99	122255.7516	0	
122255.7516	4890.23	117365.5215	0	
117365.5215	4694.621	112670.9007	0	
52670.90067	2106.836	50564.06465	60,000	

Figure 2: CCA section

- We start in year 0 with half the initial building value as cost basis going down.
- Year 25 (last) includes an arbitrary disposition value for the building (it is assumed the building value has depreciated over time following piazza information.
- CCA rate used is 4%
- End Ucc is the net of the 1st 2 columns

interest	income to be taxed	tax	Net	ATCF	Ncfo
18606.63	-424606.63	-161351	-263256.1106	-241649	-260256
18606.63	-6486.63	-2464.92	-4021.7106	20464.92	1858.289
18606.63	-11142.43	-4234.12	-6908.3066	23223.12	4616.493
18606.63	-9650.031	-3667.01	-5983.01922	23687.42	5080.789
18606.63	-8131.990969	-3090.16	-5041.834401	24186.05	5579.421
18606.63	-6585.834798	-2502.62	-4083.217575	24719.82	6113.188
18606.63	-5009.050675	-1903.44	-3105.611418	25289.57	6682.938
18606.63	-3399.086421	-1291.65	-2107.433581	25896.2	7289.574
18606.63	-1753.345782	-666.271	-1087.074385	26540.68	7934.053
18606.63	-69.18466656	-26.2902	-42.89449327	27224.02	8617.387
18606.63	1656.09267	629.3152	1026.777455	27947.28	9340.648
18606.63	3425.237502	1301.59	2123.647252	28711.59	10104.96
18606.63	5241.060581	1991.603	3249.45756	29518.15	10911.52
18606.63	7106.436149	2700.446	4405.990413	30368.2	11761.57
18606.63	9024.306038	3429.236	5595.069743	31263.06	12656.43
18606.63	10997.68384	4179.12	6818.563984	32204.1	13597.47
18606.63	13029.65921	4951.27	8078.388707	33192.77	14586.14
18606.63	15123.40216	5746.893	9376.509337	34230.58	15623.95
18606.63	17282.1676	6567.224	10714.94391	35319.11	16712.48
18606.63	19509.29989	7413.534	12095.76593	36460.03	17853.4
18606.63	21808.23751	8287.13	13521.10726	37655.07	19048.44
18606.63	24182.51787	9189.357	14993.16108	38906.03	20299.4
18606.63	26635.78229	10121.6	16514.18502	40214.8	21608.17
18606.63	29171.78101	11085.28	18086.50423	41583.36	22976.73
18606.63	31794.37846	12081.86	19712.51464	43013.77	24407.14
18606.63	23366770.02	8879373	14487397.42	14508111	14489504

Figure 3: Tax section

- The interest column represents debt interest which is calculated as $yearly\ payment = 900{,}000 * 0.035 * \frac{(1.035)^{25}}{(1.035)^{25}-1}$.$36000 (900,000/25 = 36000) is then subtracted from this annuity amount.
- Income to be taxed follows the formula BTCF – CCA – I
- Tax is calculated as taxable income multiplied by the personal tax rate
- Net refers to the difference between taxable income and the income tax.
- ATCF is calculated as Net profit + CCA +interest
- Ncfo in this case is calculated as ATCF – I – DIVIDENDS (div = 0)

			1.05363
	For NPV	For IRR	
	-241649.4806	-241649	
	19423.25048	19079.81	
	20919.16639	20185.93	
	20251.32087	19195.97	
	19625.1262	18273.48	
	19037.26818	17412.68	
	18484.70997	16608.33	
	17964.66851	15855.68	
	17474.59285	15150.43	
	17012.14452	14488.69	
	16575.17942	13866.93	
	16161.73137	13281.96	
	15769.99706	12730.88	
	15398.32227	12211.03	
	15045.18927	11720.03	
	14709.20533	11255.7	
	14389.09221	10816.06	
	14083.67648	10399.29	
	13791.88079	10003.77	
	13512.71574	9627.973	
	13245.2726	9270.547	
	12988.71648	8930.235	
	12742.28024	8605.895	
	12505.25879	8296.478	
	12277.00397	8001.027	
	3930136.834	2516015	
after tax npv	4071875.123	IRR	13%

Figure 4: Results section

- The first column (for NPV) refers to inflated ATCF and is calculated using the formula ATCF/(1.053)^x. Where 1.053 is the nominal market interest rate. The NPV at the bottom is simply the summation of this column
- The last column is created for calculating the real IRR (see pt. 5 in points to be addressed in calculations).

Q2. The real rate of return calculated is **approximately 13%.**

Points to be addressed by calculations

1. Although the whole purchase is 1.2 million, land does not figure into the depreciation calculations. Further, even though we have a personal expense of 300,000 as an initial cost the building value is only $150,000 which becomes the cost basis for depreciation. The factors of importance is the 4% depreciation rate.
2. The initial personal expense of $300,000, the combined expense from land transfer tax and renovation $103,000 are included in year 0. The 1st annual expense of $17000 is included in year 1 costs. As to dispositions, the house and land is sold in year 25 with an inflated selling price of roughly $23 million. For CCA calculations an arbitrary real dollar amount of $60,000 was chosen for the building disposition. It has been assumed that the building depreciates in value over time.

3. Since inflation rates seem to be for the past 5 years it is impossible to say that this will continue for the life of the project. Generally, an averaged value which takes into account possible fluctuations could be used for a similar analysis.
4. The ½ year rule of the CCA has been accounted for in the first two segments of the depreciation calculation
5. On selling, the cumulative inflated value must account for the increase in selling price due to housing specific inflation and a subsequent decrease in selling price due to general inflation rates. The general market interest rate is calculated as

$$(1+i) = (1+i') * (1+f)$$

Where we are I' = 0.035 and f =0.018. The LHS becomes 1.0536.
In a similar manner the interest rate (housing specific rate) becomes 1.19 = (1.0350*(1.15))
Given the arbitrary building price of $60,000 and that the land has not depreciated. The selling price in terms of year 0 is $1.11 million. After inflation selling price becomes

$$price = \ 1.11E6 * \left(\frac{1.19}{1.053}\right)^{25} = \$23620426$$

There can be much variability in this if the inflation rates were to fluctuate. But CCA recovery remains based on the selling price of the building in terms of year 0.

6. The inflation rate to use for the real rate of return is simply 1.018. This is applied to the inflated after-tax cash flow in the formula:

$$R = A/(1+f)^N$$

Where f = 0.018

Points to discuss

1. This is not likely to continue but again an averaged value for inflation could capture a more robust rental increase or perhaps a sensitivity analysis can shed more light on the topic; it is fair to impose it consistently – having the ability to raise/decrease rent when tenants move out can have a major effect on the analysis.
2. This is not very realistic and does not account for variation in interest rates, a simulation with a range of realistic interest rates which vary every 2-3 years could account for the change.
3. Our analysis is quite sensitive to both the MARR (as in interest on the mortgage) and the generic inflation rate. A sensitivity analysis with a max/min change in each value could give a better picture of the risk in the investment.

Appendix

	tax	0.38		CCA %	0.04	inflation rate			0.018										
	MARR	0.035		allowable increase	0.037	housing spec rate			0.15					cost basis	300000				
cost	mortgage																		1.05363
12000000	900000																		

year	revenue from rent	costs	btcf	init UCC	CCA	End UCC	Dispositions	interest	income to be taxed	tax	Net	ATCF	Ncfo		For NPV	For IRR
0	0	-403000	-403000	75000	3000	72000	0	18606.63	-424606.63	-161351	-263256.1106	-241649	-260256		-241649.4806	-241649
1	35000	-17000	18000	147000	5880	141120	0	18606.63	-6486.63	-2464.92	-4021.7106	20464.92	1858.289		19423.25048	19079.81
2	36295	-17306	18989	288120	11524.8	276595.2	0	18606.63	-11142.43	-4234.12	-6908.3066	23223.12	4616.493		20919.16639	20185.93
3	37637.915	-17617.508	20020.407	276595.2	11063.81	265531.392	0	18606.63	-9650.031	-3667.01	-5983.01922	23687.42	5080.789		20251.32087	19195.97
4	39030.51786	-17934.62314	21095.89471	265531.392	10621.26	254910.1363	0	18606.63	-8131.990969	-3090.16	-5041.834401	24186.05	5579.421		19625.1262	18273.48
5	40474.64702	-18257.44636	22217.20066	254910.1363	10196.41	244713.7309	0	18606.63	-6585.834798	-2502.62	-4083.217575	24719.82	6113.188		19037.26818	17412.68
6	41972.20896	-18586.0804	23386.12856	244713.7309	9788.549	234925.1816	0	18606.63	-5009.050675	-1903.44	-3105.611418	25289.57	6682.938		18484.70997	16608.33
7	43525.18069	-18920.62984	24604.55084	234925.1816	9397.007	225528.1744	0	18606.63	-3399.086421	-1291.65	-2107.433581	25896.2	7289.574		17964.66851	15855.68
8	45135.61237	-19261.20118	25874.41119	225528.1744	9021.127	216507.0474	0	18606.63	-1753.345782	-666.271	-1087.074385	26540.68	7934.053		17474.59285	15150.43
9	46805.63003	-19607.9028	27197.72723	216507.0474	8660.282	207846.7655	0	18606.63	-69.18466656	-26.2902	-42.89449327	27224.02	8617.387		17012.14452	14488.69
10	48537.43834	-19960.84505	28576.59329	207846.7655	8313.871	199532.8949	0	18606.63	1656.09267	629.3152	1026.777455	27947.28	9340.648		16575.17942	13866.93
11	50333.32356	-20320.14026	30013.1833	199532.8949	7981.316	191551.5791	0	18606.63	3425.237502	1301.59	2123.647252	28711.59	10104.96		16161.73137	13281.96
12	52195.65653	-20685.90279	31509.75374	191551.5791	7662.063	183889.5159	0	18606.63	5241.060581	1991.603	3249.45756	29518.15	10911.52		15769.99706	12730.88
13	54126.89582	-21058.24904	33068.64679	183889.5159	7355.581	176533.9353	0	18606.63	7106.436149	2700.446	4405.990413	30368.2	11761.57		15398.32227	12211.03
14	56129.59097	-21437.29752	34692.29345	176533.9353	7061.357	169472.5779	0	18606.63	9024.306038	3429.236	5595.069743	31263.06	12656.43		15045.18927	11720.03
15	58206.38583	-21823.16887	36383.21696	169472.5779	6778.903	162693.6748	0	18606.63	10997.68384	4179.12	6818.563984	32204.1	13597.47		14709.20533	11255.7
16	60360.02211	-22215.98591	38144.0362	162693.6748	6507.747	156185.9278	0	18606.63	13029.65921	4951.27	8078.388707	33192.77	14586.14		14389.09221	10816.06
17	62593.34293	-22615.87366	39977.46927	156185.9278	6247.437	149938.4907	0	18606.63	15123.40216	5746.893	9376.509337	34230.58	15623.95		14083.67648	10399.29
18	64909.29662	-23022.95939	41886.33723	149938.4907	5997.54	143940.951	0	18606.63	17282.1676	6567.224	10714.94391	35319.11	16712.48		13791.88079	10003.77
19	67310.94059	-23437.37266	43873.56794	143940.951	5757.638	138183.313	0	18606.63	19509.29989	7413.534	12095.76593	36460.03	17853.4		13512.71574	9627.973
20	69801.44539	-23859.24536	45942.20003	138183.313	5527.333	132655.9805	0	18606.63	21808.23751	8287.13	13521.10726	37655.07	19048.44		13245.2726	9270.547
21	72384.09887	-24288.71178	48095.38709	132655.9805	5306.239	127349.7412	0	18606.63	24182.51787	9189.357	14993.16108	38906.03	20299.4		12988.71648	8930.235
22	75062.31053	-24725.90859	50336.40194	127349.7412	5093.99	122255.7516	0	18606.63	26635.78229	10121.6	16514.18502	40214.8	21608.17		12742.28024	8605.895
23	77839.61602	-25170.97495	52668.64107	122255.7516	4890.23	117365.5215	0	18606.63	29171.78101	11085.28	18086.50423	41583.36	22976.73		12505.25879	8296.478
24	80719.68181	-25624.0525	55095.62932	117365.5215	4694.621	112670.9007	0	18606.63	31794.37846	12081.86	19712.51464	43013.77	24407.14		12277.00397	8001.027
25	23413568.78	-26085.28544	23387483.49	52670.90067	2106.836	50564.06465	60,000	18606.63	23366770.02	8879373	14487397.42	14508111	14489504		3930136.834	2516015
														after tax npv	4071875.123	IRR	13%		