DALARNA
UNIVERSITY

Lab 1 Report

Buying an apartment vs. renting it

From

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1) **If we rent the apartment; what will be the total cost be after 4 years?**

To answer this question, we must consider all the constraints:

- Initial rent of the apartment is 8500 SEK/Mo.
- For practical reasons we must pay one extra month of rent at the end of the 4-year contract.
- Every 12 month the rent will increase 2%.

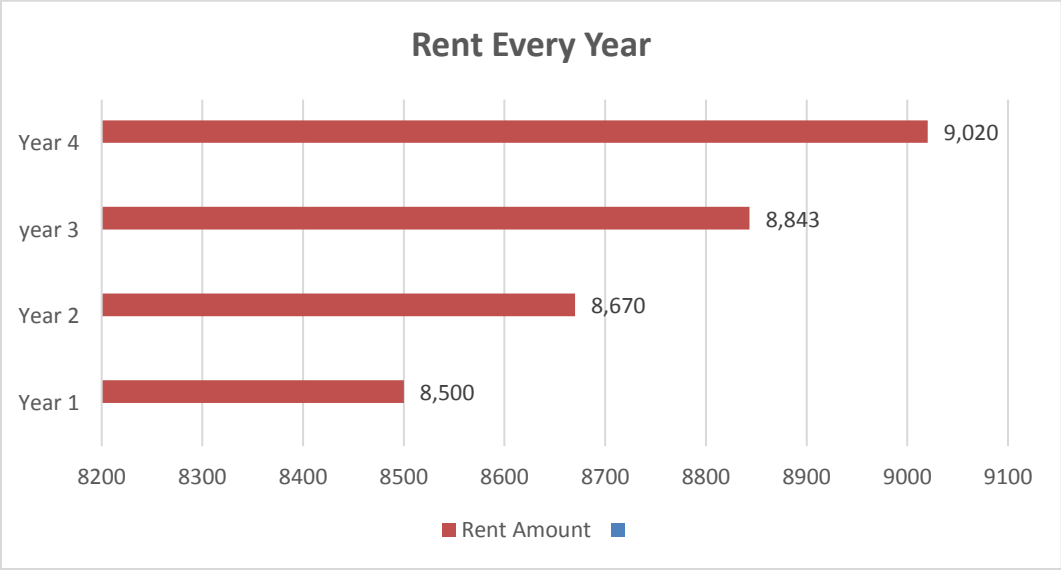
So, after considering our initial rent as 8500, with increase of 2% every month, the rent of the apartment after every year will be as follows.

- Year 1: 8500 SEK/Mo.
- Year 2: 8670 SEK/Mo.
- Year 3: 8843 SEK/Mo.
- Year 4: 9020 SEK/Mo.

So, the total rent paid each year is as follows.

- Year 1: 102,000 SEK/Year.
- Year 2: 104,040 SEK/Year.
- Year 3: 106,121 SEK/Year.
- Year 4: 108,243 SEK/Year.

The total rent paid for the house for 4-years is 402,404 SEK. But we must pay one-month extra rent for practical reasons, that one-month rent will include the increased rent of 2% after 4th year, so it will be 9,201 SEK.



Assumption: Extra one-month rent will be the updated rent of 4th year.

Hence, the total amount that will be spent if we rent a house in Gothenburg for 4 years it will be **429,605 SEK.**

2) What is the expected cost on buying the apartment?

To answer this question, we must consider all the constraints:

- When we sell our apartment, we must pay the housing agent a fixed cost of 10 000 SEK + 3% of the selling price.
- We estimate that there is a 25% probability that the value of the apartment will increase 10% in value, 25% probability that the apartment will decrease 10% in value, 50% probability that the value will remain unchanged after 4 years.
- Each month rent is 3000 SEK/mo.
- Apartment cost is 2,000,000 SEK and we make an initial down payment of 300,000 SEK.

The offer from our bank; details on the loans:

- The total amount that we can borrow is limit to 85% of the apartment's price.
- The loan amount is divided in two loans. One bottom loan, the mortgage; up to 75% of the apartment's price, and one top loan that covers from 75% up to 85% of the price. The apartment is the security of the bottom loan, the mortgage. No security is required for the top loan.
- The base rate interest on the bottom loan (0%-75% of the apartment's price) is currently 2.0%.
- The top loan (the 75%-85% of the apartment's price) has currently an interest of 4.0%. The interest is fixed at 2% higher rate than the interest rate for the bottom loan.
- Yearly we must repay exactly 2% of the original total loan (top + bottom loan) as amortization. We must pay equal part each month of the amortization. Please note, however, that if we borrow more than 4.5 times our gross annual income, we must amortize 1% in addition to the current requirement.
- Every 12 months we estimate that there is a 25% probability that the base rate will increase 0.2% fixed units, 25% probability that the base rate will

decrease 0.2% fixed units, and 50% probability that it will remain unchanged.

- All interest rates are specified in years, but we pay monthly. Meaning that the (monthly interest rate) = (yearly interest rate)/12.

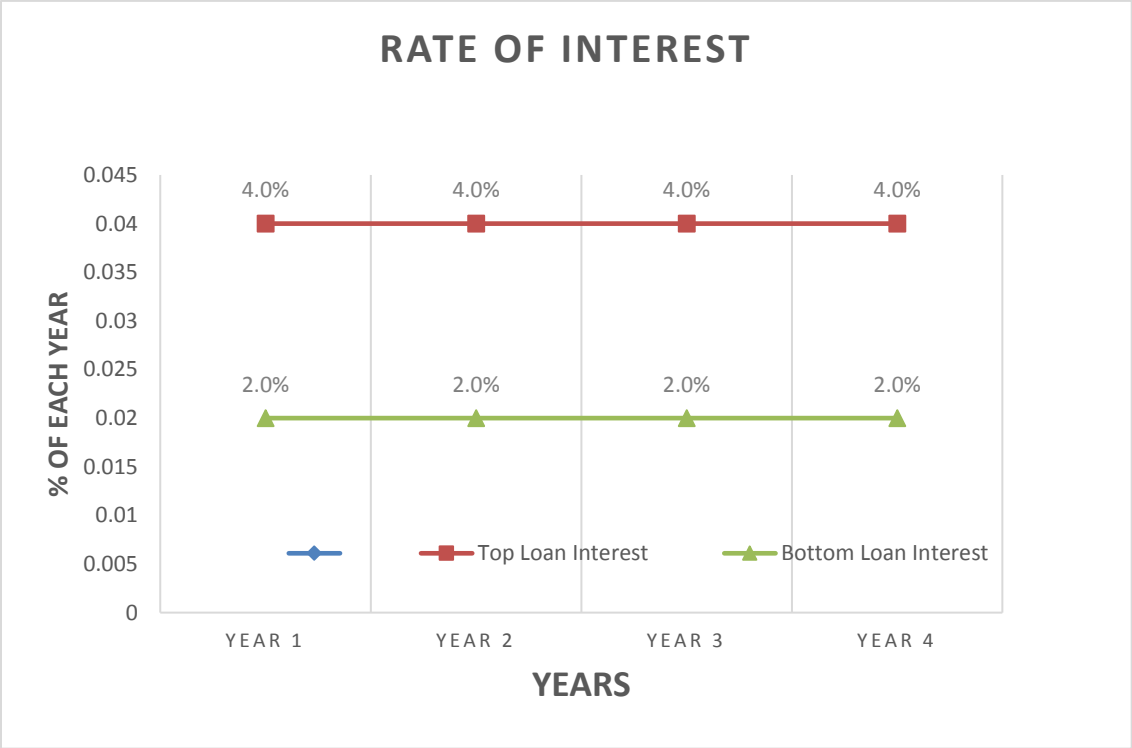
Assumptions:

- Our loan amount is 4.5 times more than our annual income and hence we pay 3% amortization each year.
- We are taking 85% loan.

a. What is the normal scenario if buying the apartment and selling it after 4 years? How probable is this scenario?

Assumptions:

- Year 1: Top loan interest = 4% and Bottom loan interest = 2%.
- Year 2: No change, Top loan interest = 4% and Bottom loan interest = 2%.
- Year 3: No change, Top loan interest = 4% and Bottom loan interest = 2%.
- Year 4: No change, Top loan interest = 4% and Bottom loan interest = 2%.
- House has neither lose nor gain in value. So, the cost of the house remains 2,000,000.



So, each year stats are as follows.

Year 1: The amounts that will be paid in 1st year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 7,065 SEK/year.
- Bottom loan interest amount: 30,000 SEK/year.
- Rent: 36,000 SEK/year.

Year 2: The amounts that will be paid in 2nd year are as follows

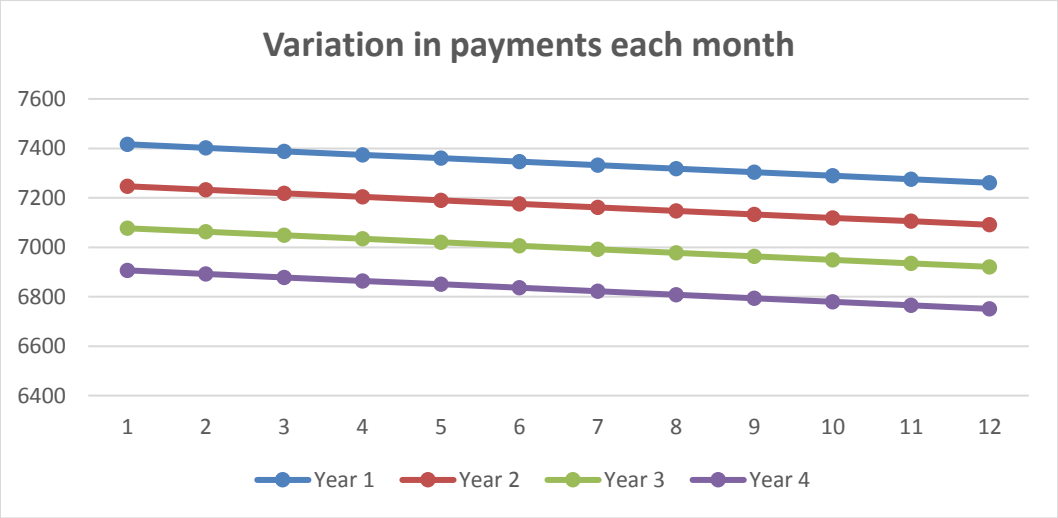
- Amortization: 51,000 SEK/year.
- Top loan interest amount: 5,025 SEK/year.
- Bottom loan interest amount: 30,000 SEK/year.
- Rent: 36,000 SEK/year.

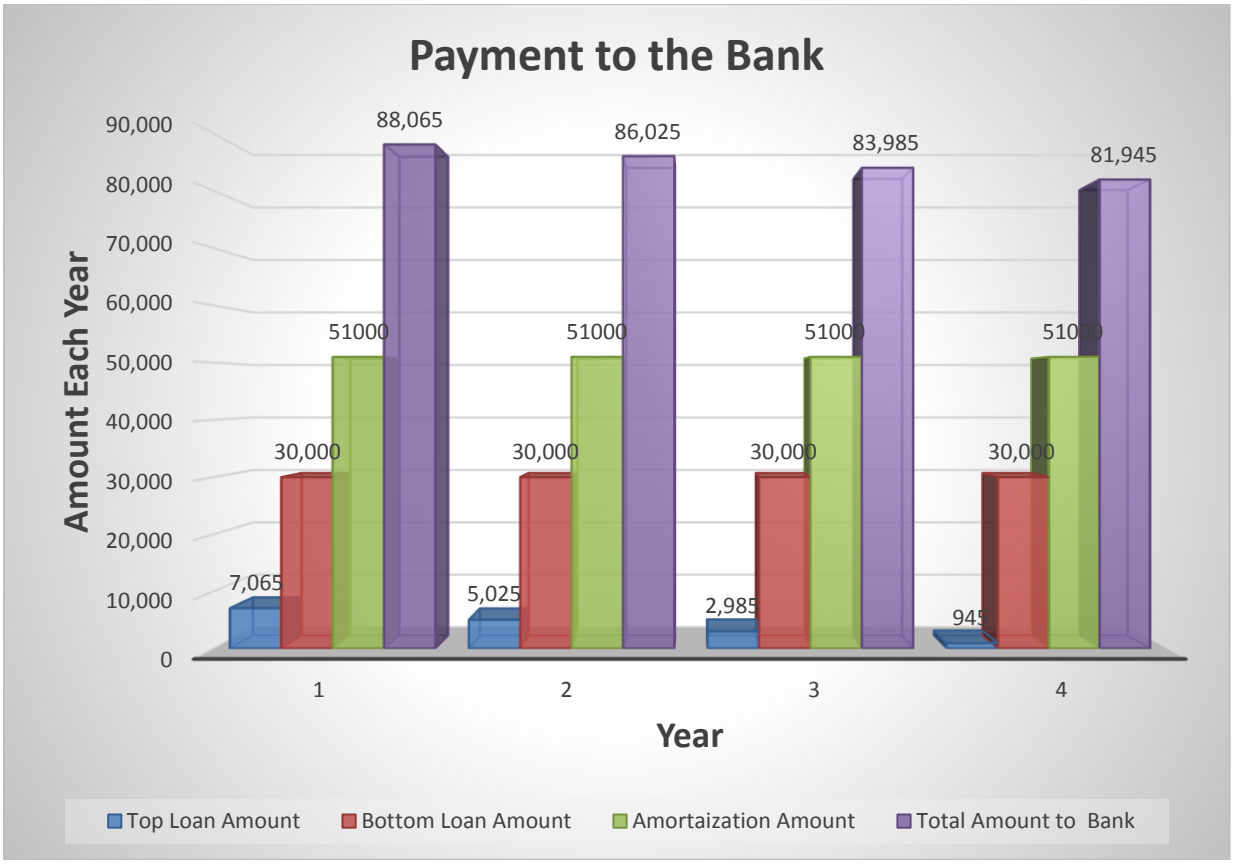
Year 3: The amounts that will be paid in 3rd year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 2,985 SEK/year.
- Bottom loan interest amount: 30,000 SEK/year.
- Rent: 36,000 SEK/year.

Year 4: The amounts that will be paid in 4th year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 945 SEK/year.
- Bottom loan interest amount: 30,000 SEK/year.
- Rent: 36,000 SEK/year.





So, total amount spent while owning the house is 484020 and with out counting amortization amount it will be 280,020 SEK because later after selling, we get back indirectly.

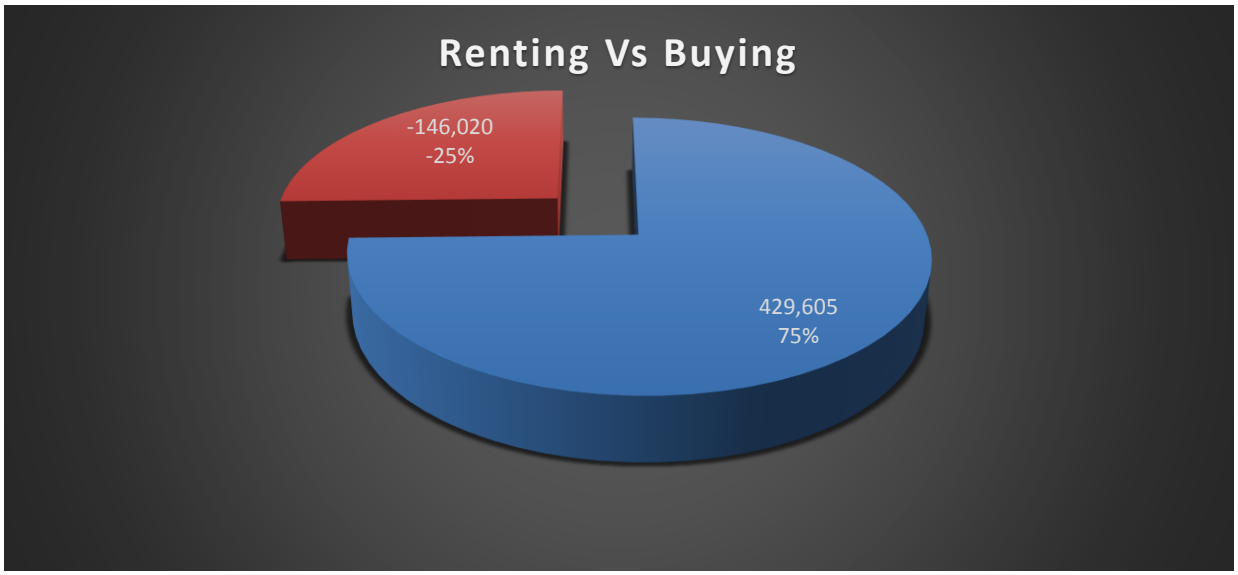
So, after selling the house for 2,000,000 SEK,

- We pay agent 70,000 SEK.
- We repay the remaining loan of 1,496,000 SEK.
- We take back our down payment of 300,000 SEK.

So, the amount left after selling the house will be 134,000 SEK. But, in this amount we must remove the amount that we paid as

- Rent: 144,000 SEK for 4-years.
- Interest amount to the bank: 136,020 SEK for 4-years.
- So, the total will be 280020 SEK for 4 years.

Hence, the total amount that we spent for 4 years will be **146,020 SEK.**



The probability of this scenario occurring is 0.66666 or 66.66%.

Let:

- Y2 = probability of no change in rate in year 2.
- Y3 = probability of no change in rate in year 3.
- Y4 = probability of no change in rate in year 4.
- H = probability of no change in the value of the house.
- C = probability of this normal case occurring.

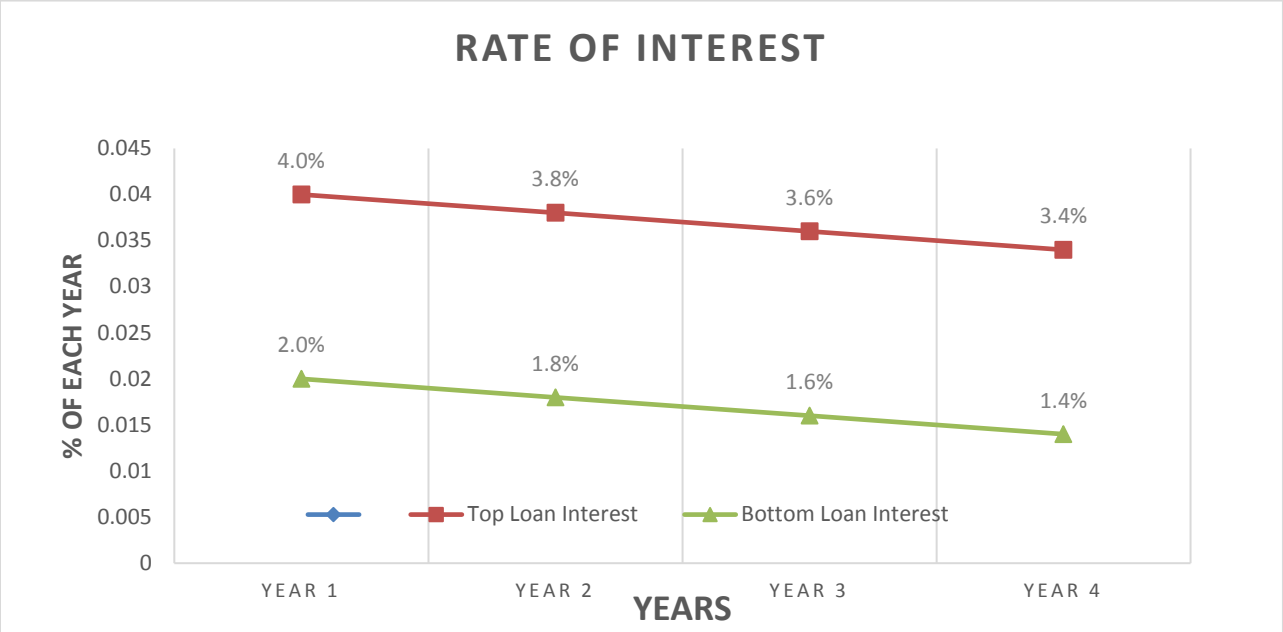
P (normal scenario) = P (C) * [P (Y2) + P (Y3) + P (Y4) + P (H)]
= 1/3 * [0.50 + 0.50 + 0.50 + 0.5]
= 0.66666

b. What is the best-case scenario if buying the apartment and selling it after 4 years? How probable is this scenario?

Assumptions:

- Year 1: Top loan interest = 4% and Bottom loan interest = 2%.
- Year 2: Decrease by 0.2%, Top loan interest = 3.8% and Bottom loan interest = 1.8%.
- Year 3: Decrease by 0.2%, Top loan interest = 3.6% and Bottom loan interest = 1.6%.
- Year 4: Decrease by 0.2%, Top loan interest = 3.4% and Bottom loan interest = 1.4%.

- House has gained value by 10%. So, the cost of the house remains 2,200,000.



So, each year stats are as follows.

Year 1: The amounts that will be paid in 1st year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 7,065 SEK/year.
- Bottom loan interest amount: 30,000 SEK/year.
- Rent: 36,000 SEK/year.

Year 2: The amounts that will be paid in 2nd year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 4,774 SEK/year.
- Bottom loan interest amount: 27,000 SEK/year.
- Rent: 36,000 SEK/year.

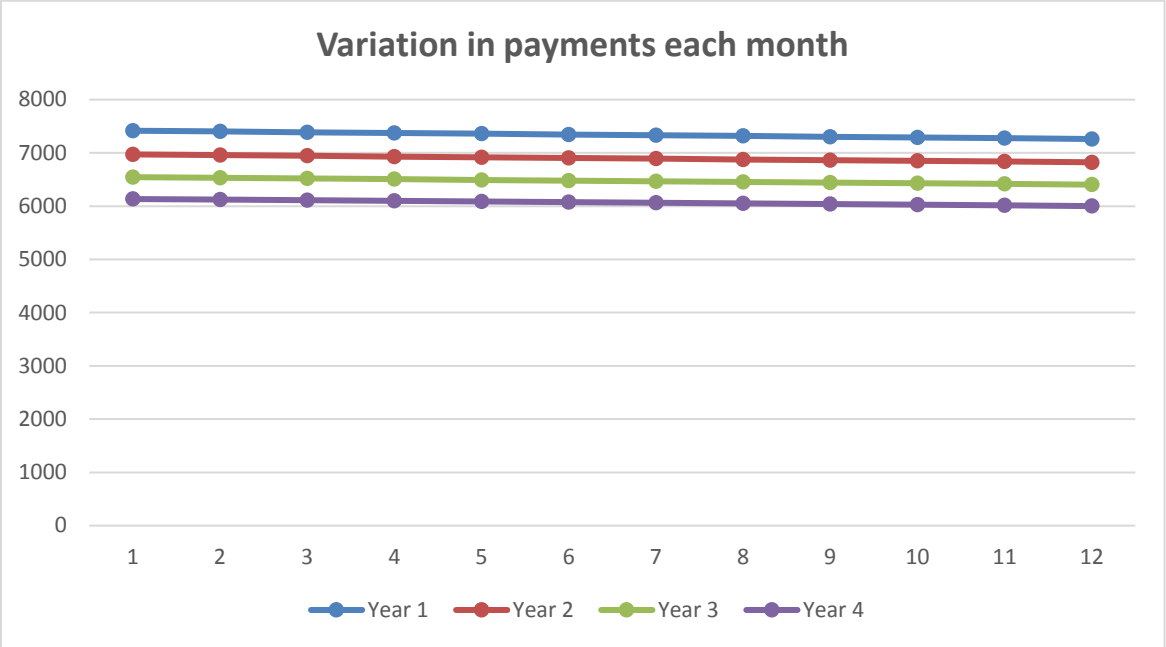
Year 3: The amounts that will be paid in 3rd year are as follows

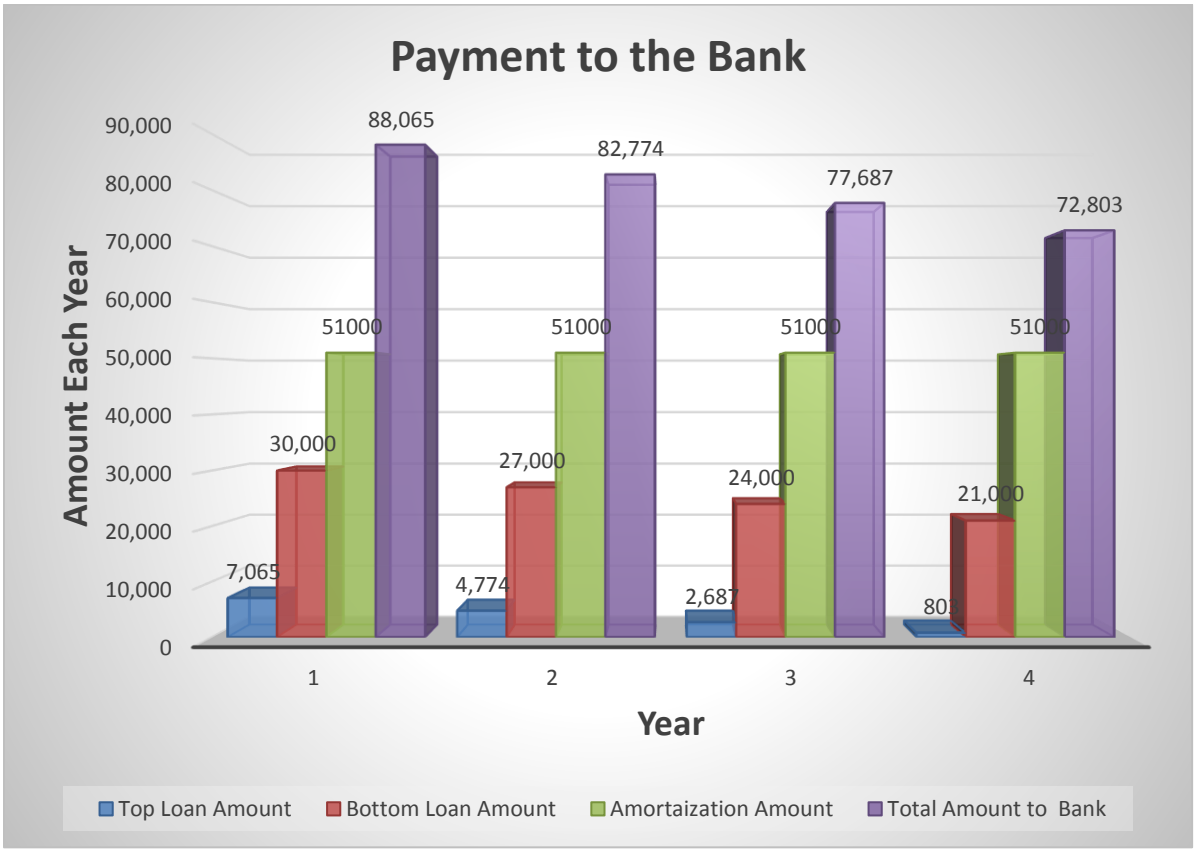
- Amortization: 51,000 SEK/year.
- Top loan interest amount: 2,687 SEK/year.
- Bottom loan interest amount: 24,000 SEK/year.
- Rent: 36,000 SEK/year.

Year 4: The amounts that will be paid in 4th year are as follows

- Amortization: 51,000 SEK/year.

- Top loan interest amount: 803 SEK/year.
- Bottom loan interest amount: 21,000 SEK/year.
- Rent: 36,000 SEK/year.





So, total amount spent while owning the house is 465,329 SEK and without counting amortization amount it will be 261,329 SEK because later after selling, we get back indirectly.

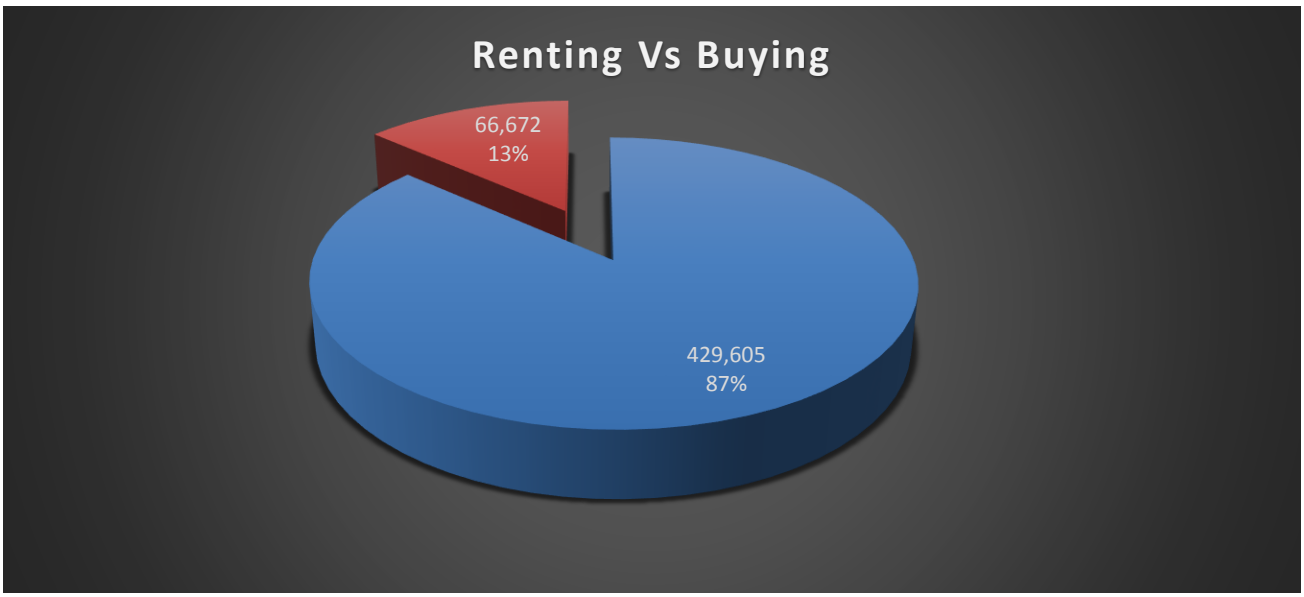
So, while selling the house, it has gained an 10% increase in its value. Hence the cost of the house will be 2,200,000 SEK,

- We pay agent 76,000 SEK.
- We repay the remaining loan of 1,496,000 SEK.
- We take back our down payment of 300,000 SEK.

So, the amount left after selling the house will be 328,000 SEK. But, in this amount we must remove the amount that we paid as

- Rent: 144,000 SEK for 4-years.
- Interest amount to the bank: 117,329 SEK for 4-years.
- So, the total will be 261,329 SEK for 4 years.

Hence, the total amount that we spent for 4 years will be **0 SEK**. But we can make a profit or gain of **66,627 SEK.**



The probability of this scenario occurring is 0.04 or 0.4%.

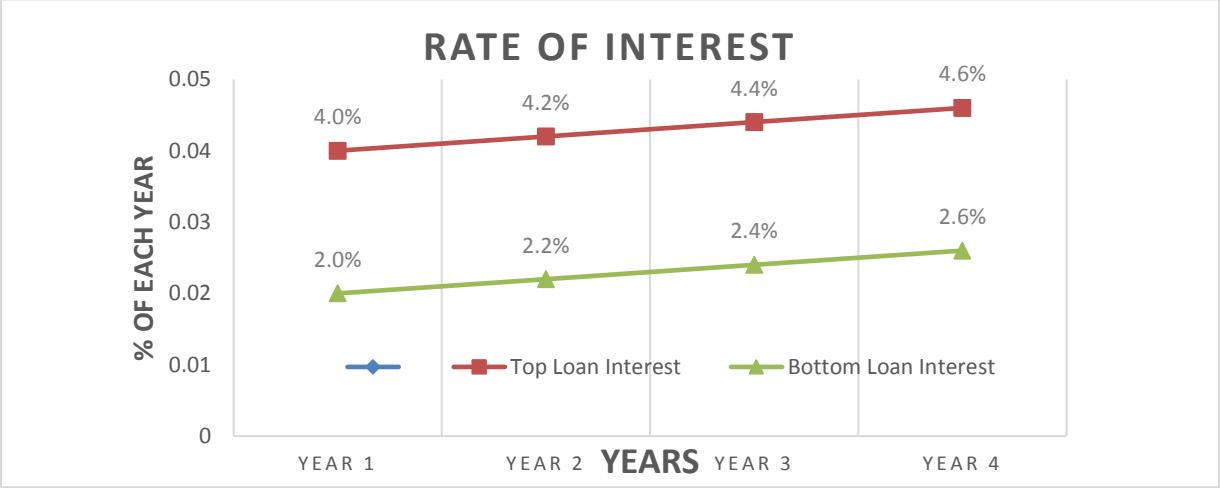
Best case probability:

$$P(\text{ best }):\ b(4, 4, 0.25) = 4C4 * (0.25)^4 * (1-0.25)^{4-4} = 0.04$$

c. What is the worst-case scenario if buying the apartment and selling it after 4 years? How probable is this scenario?

Assumptions:

- Year 1: Top loan interest = 4% and Bottom loan interest = 2%.
- Year 2: Increase by 0.2%, Top loan interest = 4.2% and Bottom loan interest = 2.2%.
- Year 3: Increase by 0.2%, Top loan interest = 4.4% and Bottom loan interest = 2.4%.
- Year 4: Increase by 0.2%, Top loan interest = 4.6% and Bottom loan interest = 2.6%.
- House has lost value by 10%. So, the cost of the house will be 1,800,000 SEK.



So, each year stats are as follows.

Year 1: The amounts that will be paid in 1st year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 7,065 SEK/year.
- Bottom loan interest amount: 30,000 SEK/year.
- Rent: 36,000 SEK/year.

Year 2: The amounts that will be paid in 2nd year are as follows

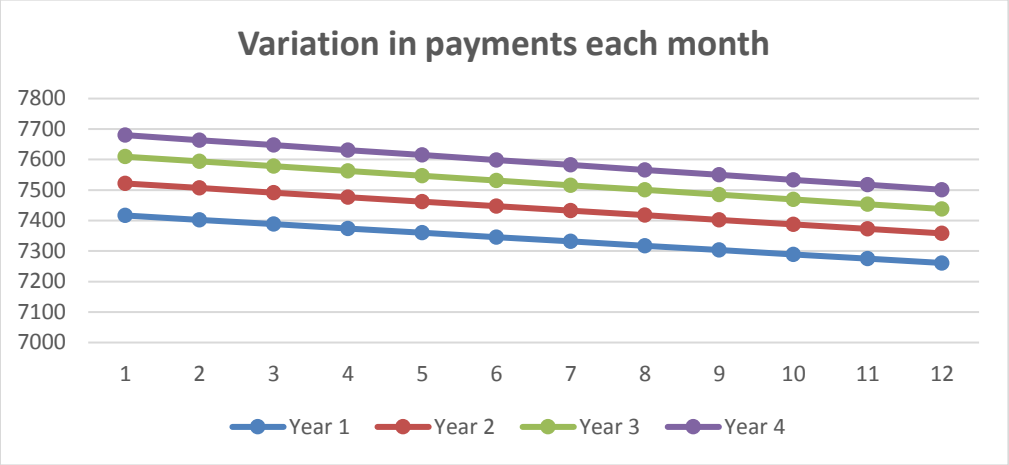
- Amortization: 51,000 SEK/year.
- Top loan interest amount: 5,276 SEK/year.
- Bottom loan interest amount: 33,000 SEK/year.
- Rent: 36,000 SEK/year.

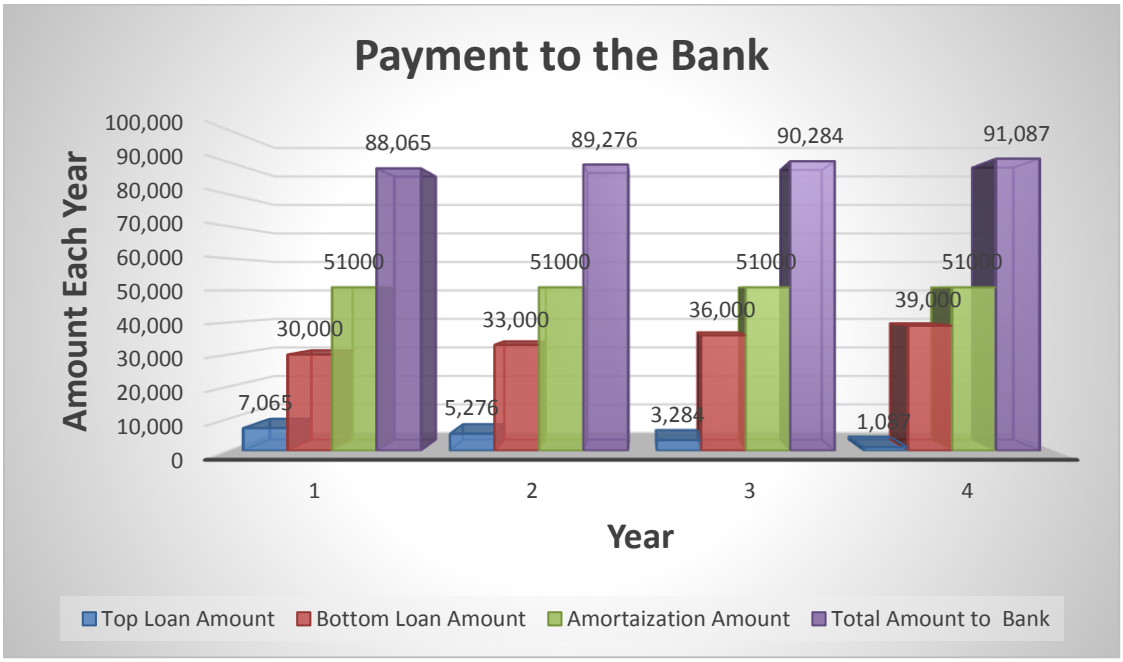
Year 3: The amounts that will be paid in 3rd year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 3,284 SEK/year.
- Bottom loan interest amount: 36,000 SEK/year.
- Rent: 36,000 SEK/year.

Year 4: The amounts that will be paid in 4th year are as follows

- Amortization: 51,000 SEK/year.
- Top loan interest amount: 1,087 SEK/year.
- Bottom loan interest amount: 39,000 SEK/year.
- Rent: 36,000 SEK/year.





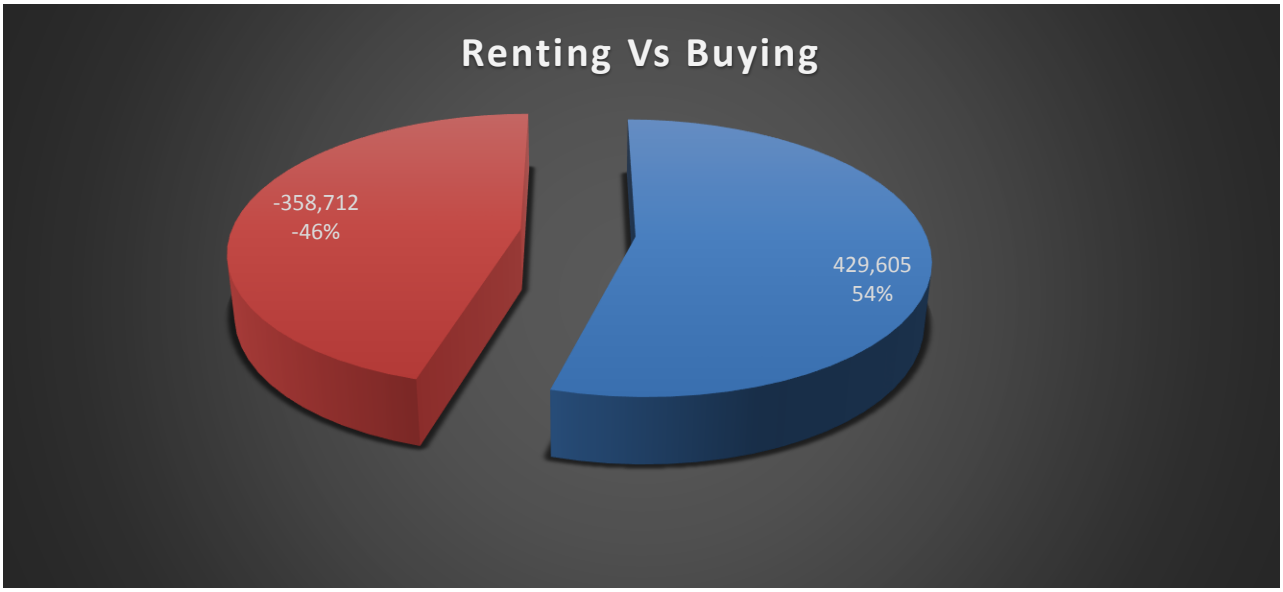
So, total amount spent while owning the house is 502,712 SEK and without counting amortization amount it will be 298,712 SEK because later after selling, we get back indirectly.
So, while selling the house, it has lost 10% value. Hence the cost of the house will be 1,800,000 SEK,

- We pay agent 64,000 SEK.
- We repay the remaining loan of 1,496,000 SEK.
- We take back our down payment of 300,000 SEK.

So, the amount left after selling the house will be 0 SEK. But we have lost 60,000 SEK. Later, we must also consider the following

- Rent: 144,000 SEK for 4-years.
- Interest amount to the bank: 154,712 SEK for 4-years.
- So, the total will be 298,712 SEK for 4 years.

Hence, the total amount that we spent for 4 years will be **358,712 SEK**



The probability of this scenario occurring is 0.04 or 0.4%.

Worst case probability:

$$P(\text{ worst }): \; b(4, 4, 0.25) = 4C4 * (0.25)^4 * (1-0.25)^{4-4} = 0.04$$

3) How is question 2 changed if you instead make a down payment of 700 000 SEK? According to the bank; it is not necessary to have a top loan in that case.

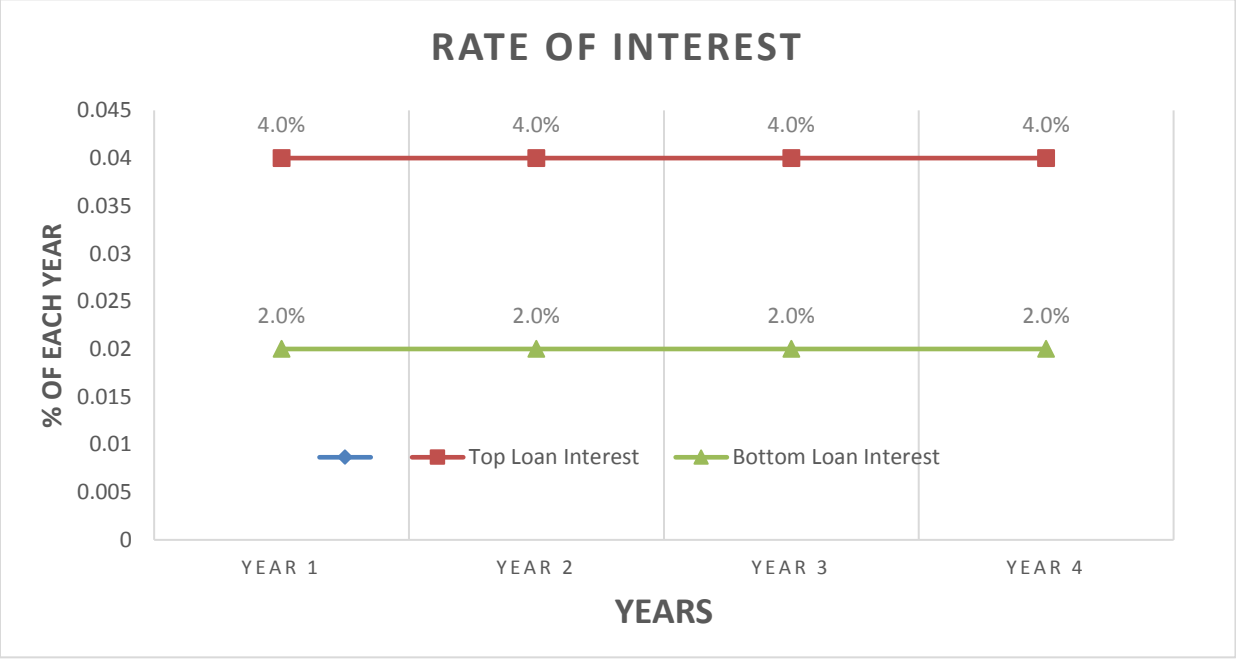
Assumptions:

- Our loan amount is 4.5 times more than our annual income and hence we pay 3% amortization each year.
- We are taking 65% loan. Hence no top loan.

Case 1: What is the normal scenario if buying the apartment and selling it after 4 years? How probable is this scenario?

Assumptions:

- Year 1: Bottom loan interest = 2%.
- Year 2: No change, Bottom loan interest = 2%.
- Year 3: No change, Bottom loan interest = 2%.
- Year 4: No change, Bottom loan interest = 2%.
- House has neither lose nor gain in value. So, the cost of the house remains 2,000,000.



So, each year stats are as follows.

Year 1: The amounts that will be paid in 1st year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 24,863 SEK/year.
- Rent: 36,000 SEK/year.

Year 2: The amounts that will be paid in 2nd year are as follows

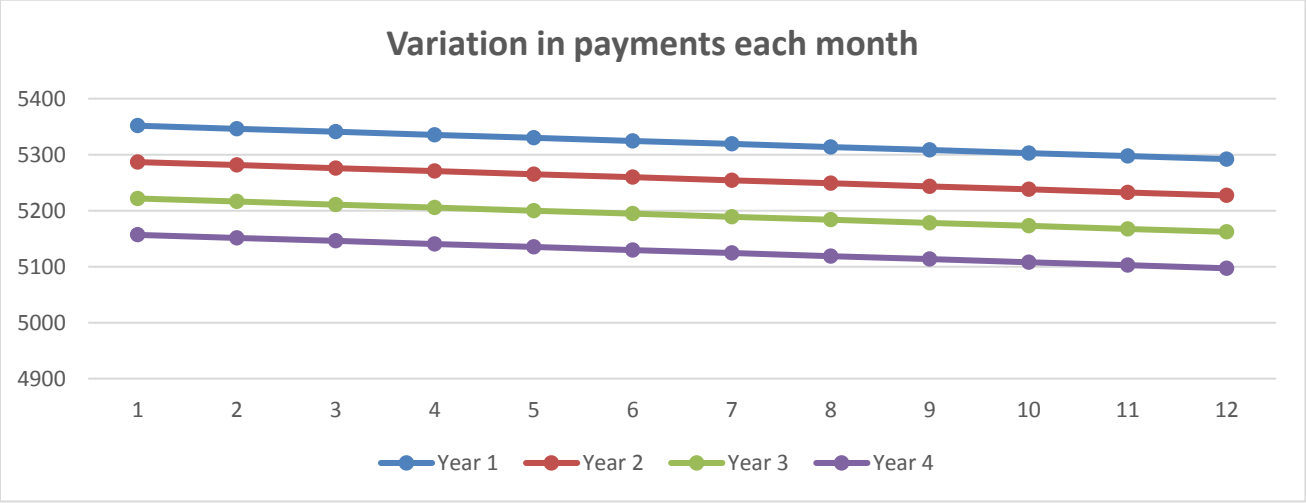
- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 24,083 SEK/year.
- Rent: 36,000 SEK/year.

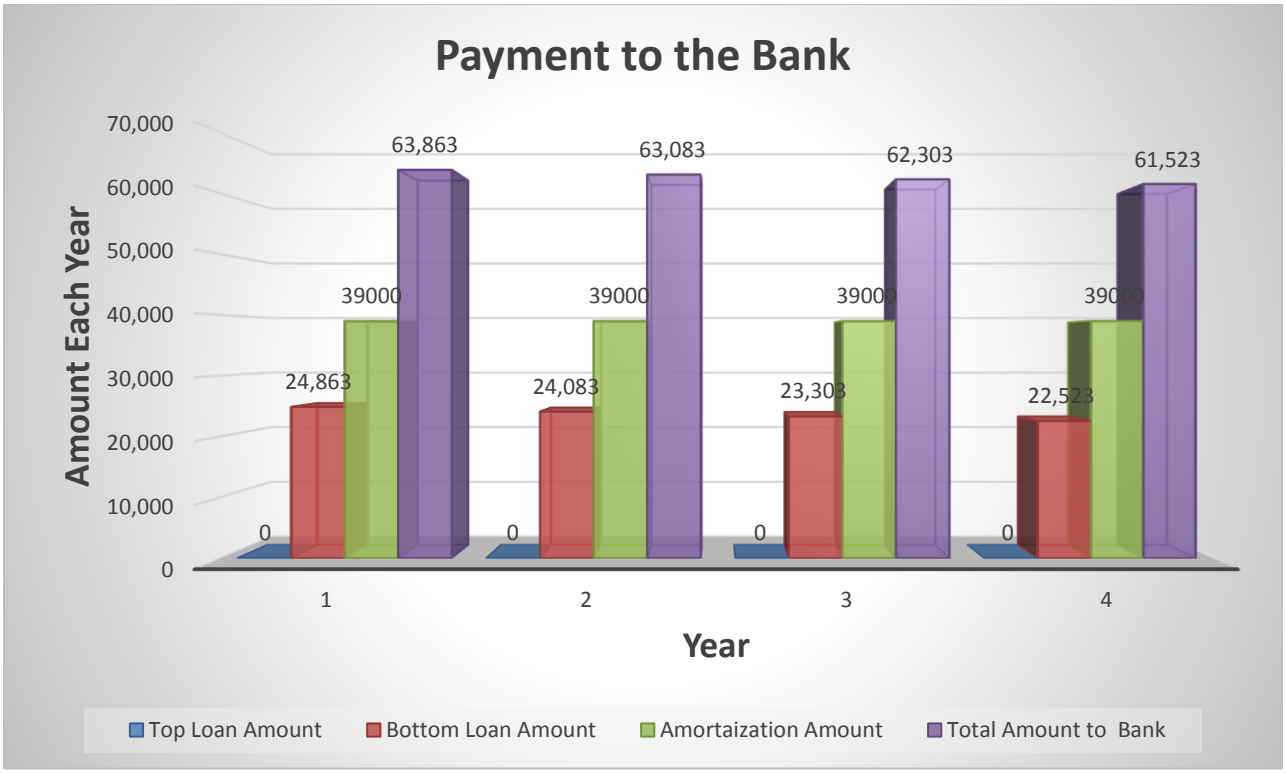
Year 3: The amounts that will be paid in 3rd year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 23,303 SEK/year.
- Rent: 36,000 SEK/year.

Year 4: The amounts that will be paid in 4th year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 22,523 SEK/year.
- Rent: 36,000 SEK/year.





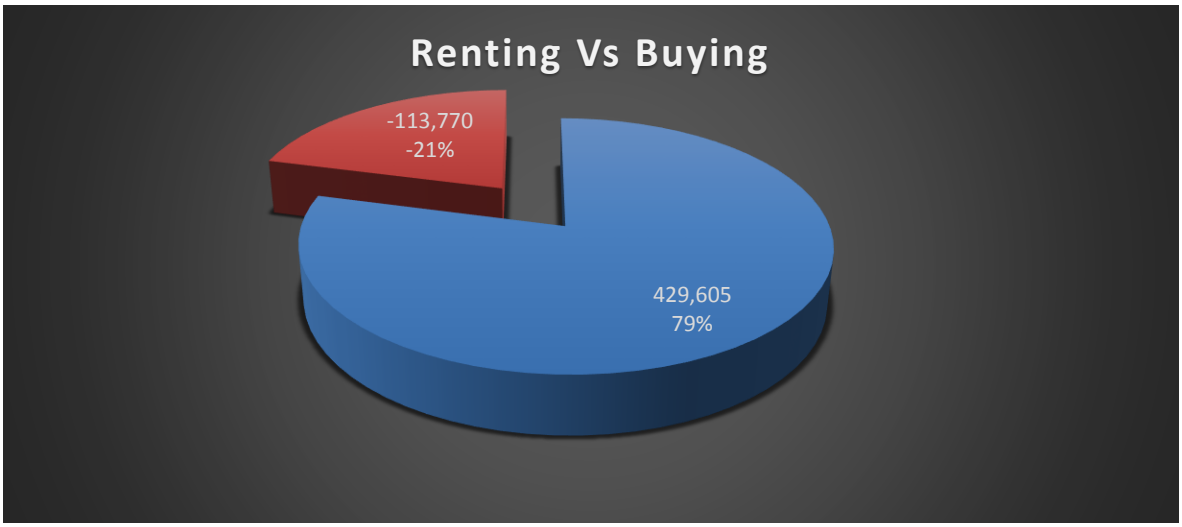
So, total amount spent while owning the house is 394,772 SEK and without counting amortization amount it will be 238,772 SEK because later after selling, we get back indirectly.
So, after selling the house for 2,000,000 SEK,

- We pay agent 70,000 SEK.
- We repay the remaining loan of 1,105,000 SEK.
- We take back our down payment of 700,000 SEK.

So, the amount left after selling the house will be 125,000 SEK. But, in this amount we must remove the amount that we paid as

- Rent: 144,000 SEK for 4-years.
- Interest amount to the bank: 94,770 SEK for 4-years.
- So, the total will be 238,770 SEK for 4 years.

Hence, the total amount that we spent for 4 years will be **113,770 SEK.**



The probability of this scenario occurring is 0.66666 or 66.66%.

Let:

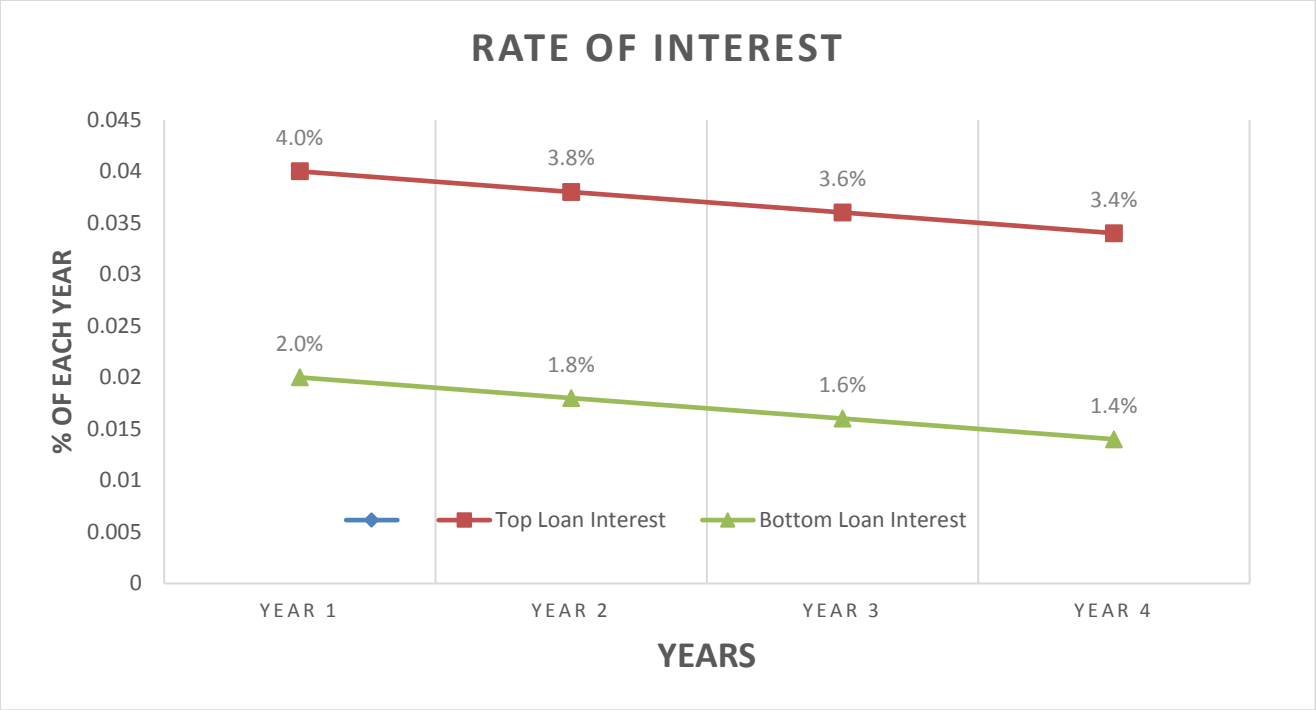
- Y2 = probability of no change in rate in year 2.
- Y3 = probability of no change in rate in year 3.
- Y4 = probability of no change in rate in year 4.
- H = probability of no change in the value of the house.
- C = probability of this normal case occurring.

P (normal scenario) = P (C) * [P (Y2) + P (Y3) + P (Y4) + P (H)]
= 1/3 * [0.50 + 0.50 + 0.50 + 0.5]
= 0.66666

Case 2: What is the best-case scenario if buying the apartment and selling it after 4 years? How probable is this scenario?

Assumptions:

- Year 1: Top loan interest = 4% and Bottom loan interest = 2%.
- Year 2: Decrease by 0.2%, Top loan interest = 3.8% and Bottom loan interest = 1.8%.
- Year 3: Decrease by 0.2%, Top loan interest = 3.6% and Bottom loan interest = 1.6%.
- Year 4: Decrease by 0.2%, Top loan interest = 3.4% and Bottom loan interest = 1.4%.
- House has gained value by 10%. So, the cost of the house remains 2,200,000.



So, each year stats are as follows.

Year 1: The amounts that will be paid in 1st year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 24,863 SEK/year.
- Rent: 36,000 SEK/year.

Year 2: The amounts that will be paid in 2nd year are as follows

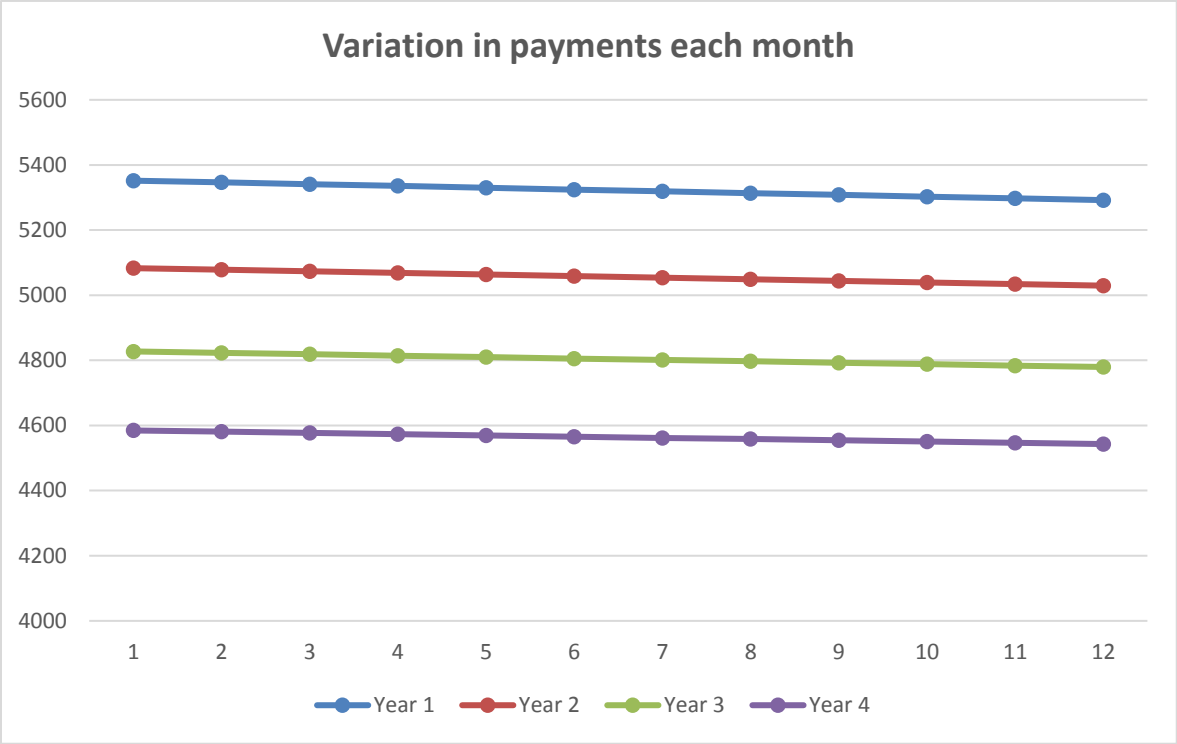
- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 22,674 SEK/year.
- Rent: 36,000 SEK/year.

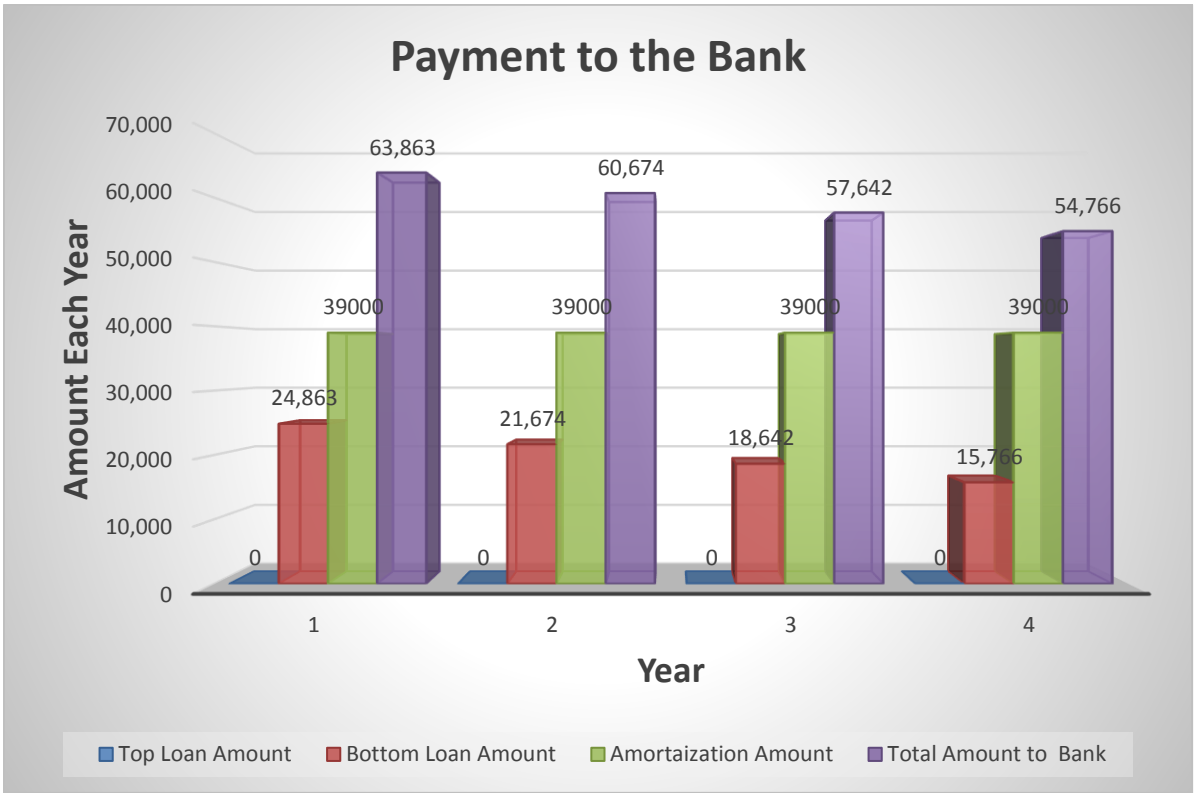
Year 3: The amounts that will be paid in 3rd year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 18,642 SEK/year.
- Rent: 36,000 SEK/year.

Year 4: The amounts that will be paid in 4th year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 15,766 SEK/year.
- Rent: 36,000 SEK/year.


Variation in payments each month
5600
5400
5200
5000
4800
4600
4400
4200
4000
1
2
3
4
5
6
7
8
9
10
11
12
Year 1
Year 2
Year 3
Year 4


Payment to the Bank
Amount Each Year
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
63,863
60,674
57,642
54,766
39000
39000
39000
39000
24,863
21,674
18,642
15,766
0
0
0
0
1
2
3
4
Year
Top Loan Amount
Bottom Loan Amount
Amortaization Amount
Total Amount to Bank

So, total amount spent while owning the house is 380,945 SEK and without counting amortization amount it will be 225,945 SEK because later after selling, we get back indirectly.

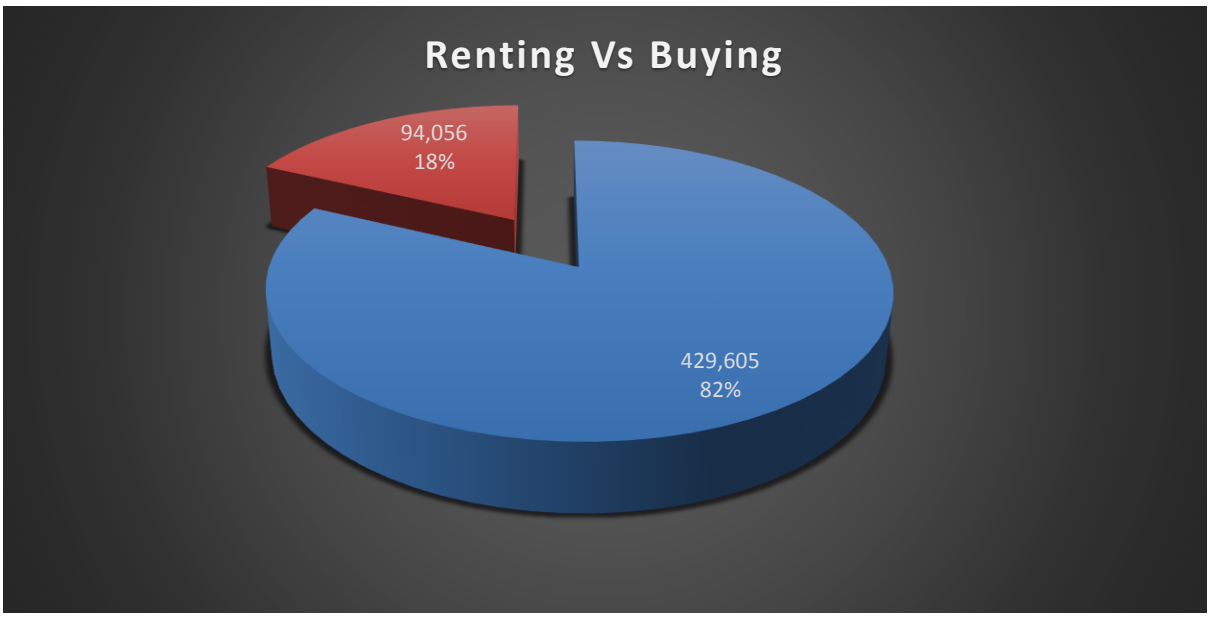
So, while selling the house, it has gained an 10% increase in its value. Hence the cost of the house will be 2,200,000 SEK,

- We pay agent 76,000 SEK.
- We repay the remaining loan of 1,105,000 SEK.
- We take back our down payment of 700,000 SEK.

So, the amount left after selling the house will be 319,000 SEK. But, in this amount we must remove the amount that we paid as

- Rent: 144,000 SEK for 4-years.
- Interest amount to the bank: 80,945 SEK for 4-years.
- So, the total will be 224,945 SEK for 4 years.

Hence, the total amount that we spent for 4 years will be **0 SEK**. But we can make a profit or gain of **94,056 SEK.**



The probability of this scenario occurring is 0.04 or 0.4%.

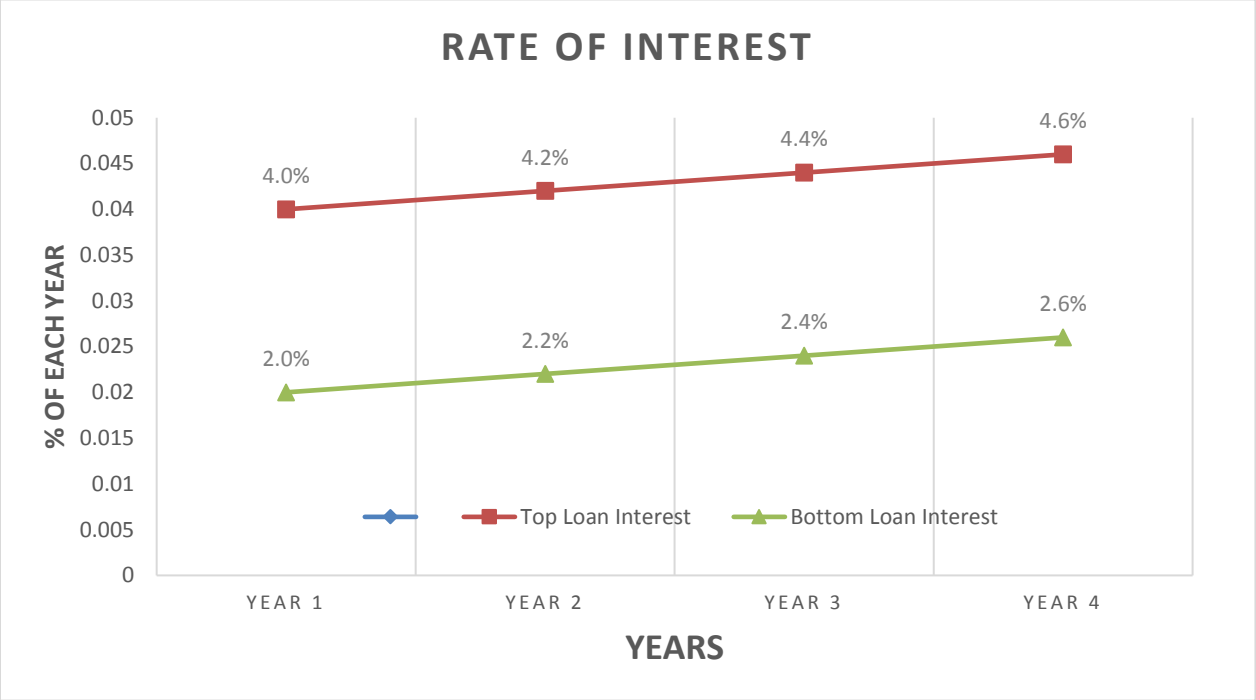
Best case probability:

$$P(\text{ best }): \; b(4, 4, 0.25) = 4C4 * (0.25)^4 * (1-0.25)^{4-4} = 0.04$$

Case 3: What is the worst-case scenario if buying the apartment and selling it after 4 years? How probable is this scenario?

Assumptions:

- Year 1: Top loan interest = 4% and Bottom loan interest = 2%.
- Year 2: Increase by 0.2%, Top loan interest = 4.2% and Bottom loan interest = 2.2%.
- Year 3: Increase by 0.2%, Top loan interest = 4.4% and Bottom loan interest = 2.4%.
- Year 4: Increase by 0.2%, Top loan interest = 4.6% and Bottom loan interest = 2.6%.
- House has lost value by 10%. So, the cost of the house will be 1,800,000 SEK.



So, each year stats are as follows.

Year 1: The amounts that will be paid in 1st year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 24,863 SEK/year.
- Rent: 36,000 SEK/year.

Year 2: The amounts that will be paid in 2nd year are as follows

- Amortization: 39,000 SEK/year.

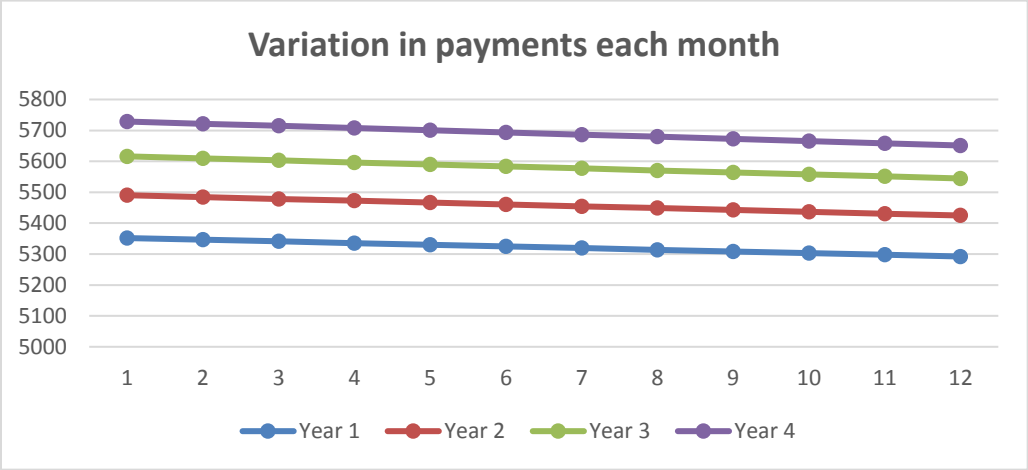
- Bottom loan interest amount: 26,491 SEK/year.
- Rent: 36,000 SEK/year.

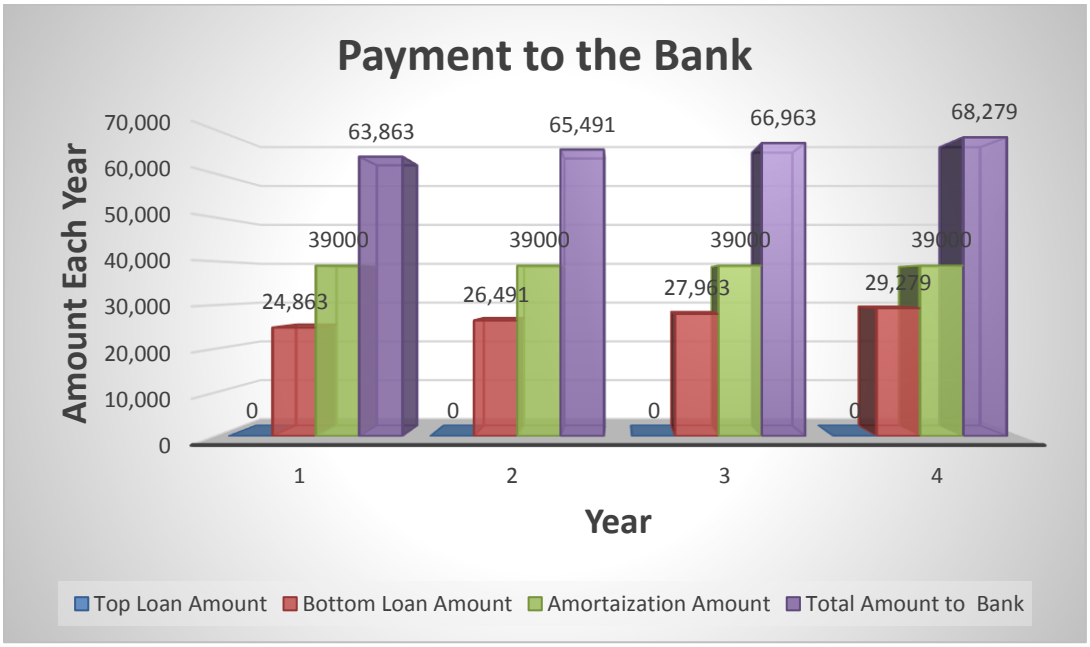
Year 3: The amounts that will be paid in 3rd year are as follows

- Amortization: 51,000 SEK/year.
- Bottom loan interest amount: 27,963 SEK/year.
- Rent: 36,000 SEK/year.

Year 4: The amounts that will be paid in 4th year are as follows

- Amortization: 39,000 SEK/year.
- Bottom loan interest amount: 29,279 SEK/year.
- Rent: 36,000 SEK/year.





So, total amount spent while owning the house is 408,596 SEK and without counting amortization amount it will be 252,596 SEK because later after selling, we get back indirectly.

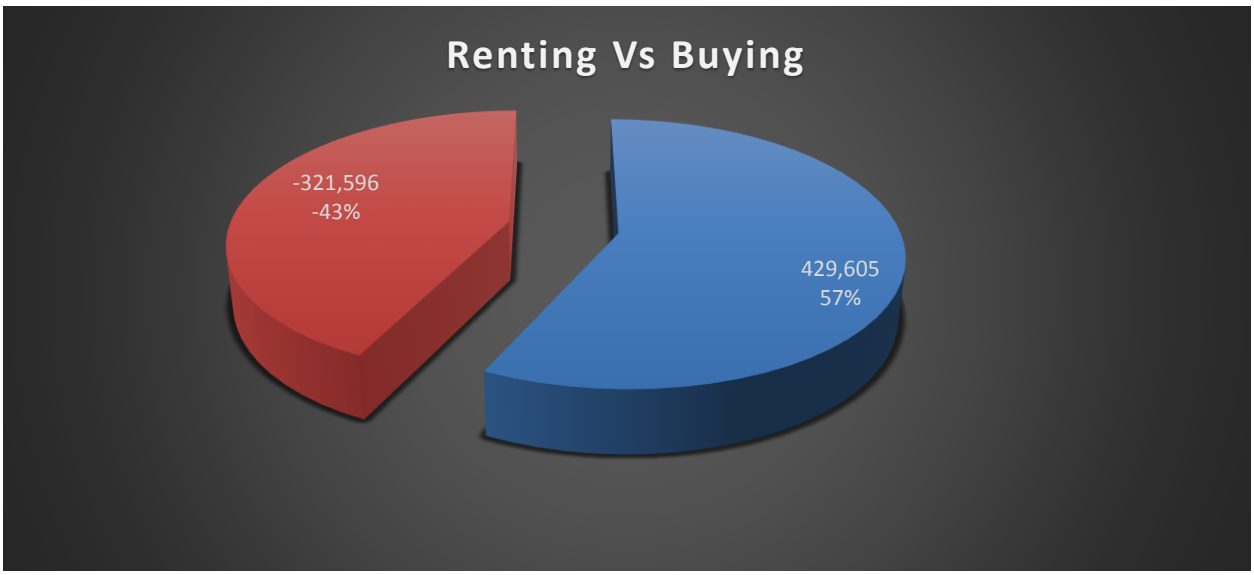
So, while selling the house, it has lost 10% value. Hence the cost of the house will be 1,800,000 SEK,

- We pay agent 64,000 SEK.
- We repay the remaining loan of 1,105,000 SEK.
- We take back our down payment of 700,000 SEK.

So, the amount left after selling the house will be 0 SEK. But we have lost 69,000 SEK. Later, we must also consider the following

- Rent: 144,000 SEK for 4-years.
- Interest amount to the bank: 108,596 SEK for 4-years.
- So, the total will be 252,596 SEK for 4 years.

Hence, the total amount that we spent for 4 years will be **321,596 SEK.**



The probability of this scenario occurring is 0.04 or 0.4%.

Worst case probability:

$$P(\text{ worst }): \; b(4, 4, 0.25) = 4C4 * (0.25)^4 * (1-0.25)^{4-4} = 0.04$$

4) What will be your conclusions and what are your motivations of those conclusions?

Buying is the best option.

As from the result, we can say that it is better to buy an apartment rather than renting it in every kind of situation.

Since, if we rent an apartment, we always end up spending **429,605 SEK**. It's also fixed that we will spend that much for sure by renting

But if we buy a house there will be a possibility to gain a profit or spend amount, but it will never cross the amount that we will be spending by renting the house.

Hence, Buying will always be a best choice over renting the house for 4-years.

If we buy a house with 300,000 SEK down payment and taking 85% loan, then

- Normal case: we spend **146,020 SEK, No Gain.**
- Best case: we spend **0 SEK**, with gain of **66,627 SEK.**
- Worst case: we spend **358,712 SEK, No Gain.**

If we buy a house with 700,000 SEK down payment and taking 65% loan with no top loan, then

- Normal case: we spend **113,770 SEK., No Gain.**
- Best case: we spend **0 SEK**, with gain of **94,056 SEK.**
- Worst case: we spend **321,596 SEK**, **No Gain.**

Hence, even with the worst case we will not spend more than the renting amount.

This confirms that Buying is best option than renting the house in Gothenburg for a span of 4-years.

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