

## Leverage and Risk Example

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Definitions:

Definition of Return =  $(V' - V) / V$  or  $[(\text{Net Worth at end} - \text{Net Worth at begin}) / \text{Net Worth at begin}]$

Net Worth at the beginning of the year = \$100,000

### **Case I: Buy an apartment for \$100,000.**

1) Suppose prices increase by 20%

Your net worth at the end of the year = \$120,000

The Return (in percent) on your initial net worth is:  $[(\$120,000 - \$100,000) / \$100,000] * 100 = 20\%$

2) Suppose prices decrease by 20%

Your net worth at the end of the year = \$80,000

The Return (in percent) on your initial net worth is:  $[(\$80,000 - \$100,000) / \$100,000] * 100 = -20\%$

### **Case II: Borrow \$900,000 and invest a total of \$1,000,000 in an apartment.**

This is called 10 times leverage because your total investment is 10 times your net worth.

1) Suppose apartment prices increase by 20% to \$1,200,000

Your net worth (assets minus liabilities) at the end of the year = \$1,200,000 - \$900,000 = \$300,000.

The Return (in percent) on your initial net worth is  $[(\$300,000 - \$100,000) / \$100,000] * 100 = 200\%$

2) Suppose apartment prices decline by 20% to \$800,000

Your net worth (assets minus liabilities) at the end of the year is = \$800,000 - \$900,000 = -\$100,000.

The return (in percent) on your initial net worth is  $[(-\$100,000 - \$100,000) / \$100,000] * 100 = -200\%$

### **Therefore:**

Returns vary between +200% and -200% in the levered case versus +20% and -20% in the unlevered case. This is why the standard deviation of returns is high when you sell short the risk free asset and invest more than your net worth in the risky mutual fund.

Lesson: Leverage gives high returns and can make you rich when prices rise but can make you insolvent (negative net worth) when prices decline.