# Econ435 – Financial Markets and the Macroeconomy
# Transactions on Margin

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## Buying on Margin

Suppose that you are bullish, i.e. you think that the price of stock X will rise until next year, when the current price is \$30. You instruct your broker to buy 100 shares on margin, with an initial margin of 60%. This means that the total value of the transaction is $100 \cdot \$30 = \$3,000$, of which you pay $60\% \cdot \$3,000 = \$1,800$ and you borrow $\$1,200$. Your account with the broker looks like this:

| **Assets** | | **Liabilities and Equity** | |
|---|---|---|---|
| Value of stock | $\$3,000$ | Loan from broker | $\$1,200$ |
| | | Equity | $\$1,800$ |

Notice that the equity is valued at the market value of the shares minus the loan from the broker. Also, since you borrow *money* from the broker, the value of the loan is not affected by fluctuations in the stock price.

The maintenance margin required by the broker is 40%, or 0.4. When would the broker issue a margin call? The price has to be such that the margin in the account, i.e. the ratio of equity to the market value of the shares, is equal to the maintenance margin. Let $p$ be this price. Since you have 100 shares, the market value of shares is just $100 \cdot p$, so the value of equity in your account is $100p - \$1,200$. Thus, what we need to find is the price $p$ such that

$$\frac{100p - \$1,200}{100p} = 0.4.$$

Solving for $p$ yields:

$$100p - \$1,200 = 40p \quad \Rightarrow \quad 60p = \$1,200 \quad \Rightarrow \quad p = \$20.$$

So, as long as the stock price is higher than \$20, the margin on the account is above the maintenance margin. When the stock price gets at or below \$20, the broker will issue a margin call.

Suppose the price did drop to \$20 and the broker issued a margin call. The value of stock is now $100 \cdot \$20 = \$2,000$, which means that the value of equity in your account is $\$2,000 - \$1,200 = \$800$ (you can check that the margin is going to be exactly 40%). Your account with the broker looks like this:

| **Assets** | | **Liabilities and Equity** | |
|---|---|---|---|
| Value of stock | $\$2,000$ | Loan from broker | $\$1,200$ |
| | | Equity | $\$800$ |

The broker will issue a margin call, which gives you the following options:

(i) inject cash in the account

By doing so, you basically repay part of the loan. If you want to restore your initial margin of 60%, you need the value of equity in your account to be $60\% \cdot \$2,000 = \$1,200$, or alternatively the loan to be $\$2,000 - \$1,200 = \$800$. Thus, you need to repay \$400:

| **Assets** | | **Liabilities and Equity** | |
|---|---|---|---|
| Value of stock | $\$2,000$ | Loan from broker | $\$800$ |
| | | Equity | $\$1,200$ |

(ii) inject stock in the account

Alternatively, you can buy more shares (with your own money) so that the margin increases. Suppose again you want to restore the initial margin of 60% and you buy $x$ shares. You now have $(100 + x)$ shares which are worth $\$20 \cdot (100 + x)$, and the value of equity in your account is $(\$800 + \$20 \cdot x)$. Then, the margin is

$$\frac{\$800 + \$20 \cdot x}{\$20 \cdot (100 + x)} = 0.6 \quad \Rightarrow \quad \$800 + 20x = \$1,200 + 12x \quad \Rightarrow \quad x = 50.$$

After you made an injection of $\$20 \cdot 50 = \$1,000$, your account looks like this:

| **Assets** | | **Liabilities and Equity** | |
|---|---|---|---|
| Value of stock | $\$3,000$ | Loan from broker | $\$1,200$ |
| | | Equity | $\$1,800$ |

(iii) instruct the seller to sell some of the stock

The seller will sell some of the stock so as to restore the margin. Suppose, again, you want to bring the margin to its initial value of 60%. Then the broker would sell $x$ shares and repay part of the loan. You are left with $(100 - x)$ shares, with a market value of $\$20 \cdot (100 - x)$. The proceeds from the sale, $\$20 \cdot x$, go towards repaying the

loan, so the value of the loan is $\$1,200 - \$20 \cdot x$. However, the value of equity in your account will be unchanged: \$800. The margin is

$$\frac{\$800}{\$20 \cdot (100 - x)} = 0.6 \quad \Rightarrow \quad \$800 = \$1,200 - 12x \quad \Rightarrow \quad x = 33.$$

Hence, after selling $\$20 \cdot 33 = \$660$ worth of securities, your account looks like this (again, verify that the margin is approximately 60%):

| **Assets** | | **Liabilities and Equity** | |
|---|---|---|---|
| Value of stock | $\$1,340$ | Loan from broker | \$540 |
| | | Equity | \$800 |

Let us look now at the profit and return from such a transaction. After holding the stock for a year, you decide to sell and pay back the broker. Suppose the stock paid no dividends, and the interest rate the broker charges is 5%. This means that you owe the broker $5\% \cdot \$1,200 = \$60$, whatever the result of the sale. Your rate of return is given by the ratio of net profits to your initial investment, where net profits are the proceeds from sale less the initial investment and the loan and interest owed ($\$1,200 + \$60 = \$1,260$). We will analyze the following cases:

(i) the stock price increased to \$35

In this case, the proceeds from sale are $\$35 \cdot 100 = \$3,500$. After paying your dues to your broker, you are left with $\$3,500 - \$1,260 = \$2,240$, meaning that your net profit is $\$2,240 - \$1,800 = \$440$. The rate of return on this investment is $\$440/\$1,800 = 24.44\%$.

If you were to buy the stock on your own, you could only buy $\$1,800/\$30 = 60$ shares, but you would have received the entire proceeds from their sale: $\$35 \cdot 60 = \$2,100$. In this case, your net profit would be $\$2,100 - \$1,800 = \$300$, and your rate of return would be $\$300/\$1,800 = 16.67\%$.

Hence, when the price increases, buying on margin is more profitable than investing only your money in the stock.

(ii) the stock price falls to \$25

The proceeds from sale are now $\$25 \cdot 100 = \$2,500$. After paying your dues to your broker, you are left with $\$2,500 - \$1,260 = \$1,240$, meaning that your net profit is $\$1,240 - \$1,800 = -\$560$ (a net loss). The rate of return on this investment is $-\$560/\$1,800 = -31.11\%$.

When buying the stock on your own, you again receive all the proceeds from the sale ($\$25 \cdot 60 = \$1,500$), with an initial investment of $\$1,800$. Your loss, in this case,

would be $\$1,500 - \$1,800 = -\$300$, so your rate of return would be $-\$300/\$1,800 = -16.67\%$.

Hence, when the price falls, buying on margin entails a larger loss than investing only your money in the stock.

## Short Sales

While similar to transactions on margin, short sales present some differences:

(i) the loan consists of *stocks* rather than money, so its value will fluctuate with the stock price,

(ii) there is no stock to be used as collateral by default, so the broker needs to ask for something as collateral (usually Treasury bills).

Suppose we're in a similar setup as before: the stock price is \$30, you are bearish (i.e., you think the price will falling the future), so you want to sell short. You instruct your broker to sell 100 shares, with you providing T-bills as collateral for 60% of the transaction (the initial margin). The broker sells the stock and credits your account with the cash, so that your account with the broker looks like in the table below.

| **Assets** | | **Liabilities and Equity** | |
|---|---|---|---|
| Cash | $\$3,000$ | Short position (100 shares) | $\$3,000$ |
| T-bills | $\$1,800$ | Equity | $\$1,800$ |

The margin is now calculated as the ratio of equity in the account to the market value of the stock owed. Initially, it is equal to $\$1,800/\$3,000 = 60\%$. As stock prices fluctuate, the value of the stock owed and equity fluctuate too, but their sum will always equal the sum of assets, $\$3,000 + \$1,800 = \$4,800$.

How high can the price go for the margin to fall until the maintenance margin? The maintenance margin of your broker is 40%, like before. Let $p$ be the price that makes the margin equal to 40%. The market value of the stok owed would be $100 \cdot p$ and the equity in your account is $\$4,800 - 100p$. Then $p$ has to solve:

$$\frac{\$4,800 - 100p}{100p} = 0.4.$$

Solving for $p$ gives

$$\$4,800 - 100p = 40p \quad \Rightarrow \quad 140p = \$4,800 \quad \Rightarrow \quad p = \$34.29$$

So, as long as the stock price is lower than \$34.29, the margin on the account is above the maintenance margin. When the stock price gets at or above \$34.29, the broker will issue a margin call. When that happens, you can either put up additional cash or cover your short position.