

Market Efficiency

-The notion of an efficient capital market is central to the modern theory of finance

Efficient Capital Markets

-An efficient capital market is a market that efficiently processes information

- Prices reflect rational and unbiased valuations based on all available information
- It is not possible to make **abnormal** profits from trading on publicly available information

The two fundamental questions of the financial manager:

- 1) In what to invest?
- 2) How to finance the investment?

At this point we are talking about “how to finance the investment”.

What does informational efficiency tell us about the market, about the players? What assumptions can we make?

If we know the true value of something it is likely the asset will be traded at its exact value. This is because investors are rational. Opportunities to make risk free profits will immediately disappear (be acquired). If the investor does not know the exact value of an asset he/she will bid the expected value of the asset.

In the presence of uncertainty the Market will bid the expected value. The market processes information in an efficient way, the price will adjust until ...

The price of the asset will reflect all relevant information about the asset. In an efficient market there will be no opportunity to make an abnormal positive profit.

**NEW INFORMATION ABOUT AN ASSET WILL BE REFLECTED
IN THE PRICE OF THE ASSET IMMEDIATELY.**

The market processes information in an efficient way such that any opportunity to make profit immediately disappears. (rational investors)

WEAK FORM EFFICIENCY

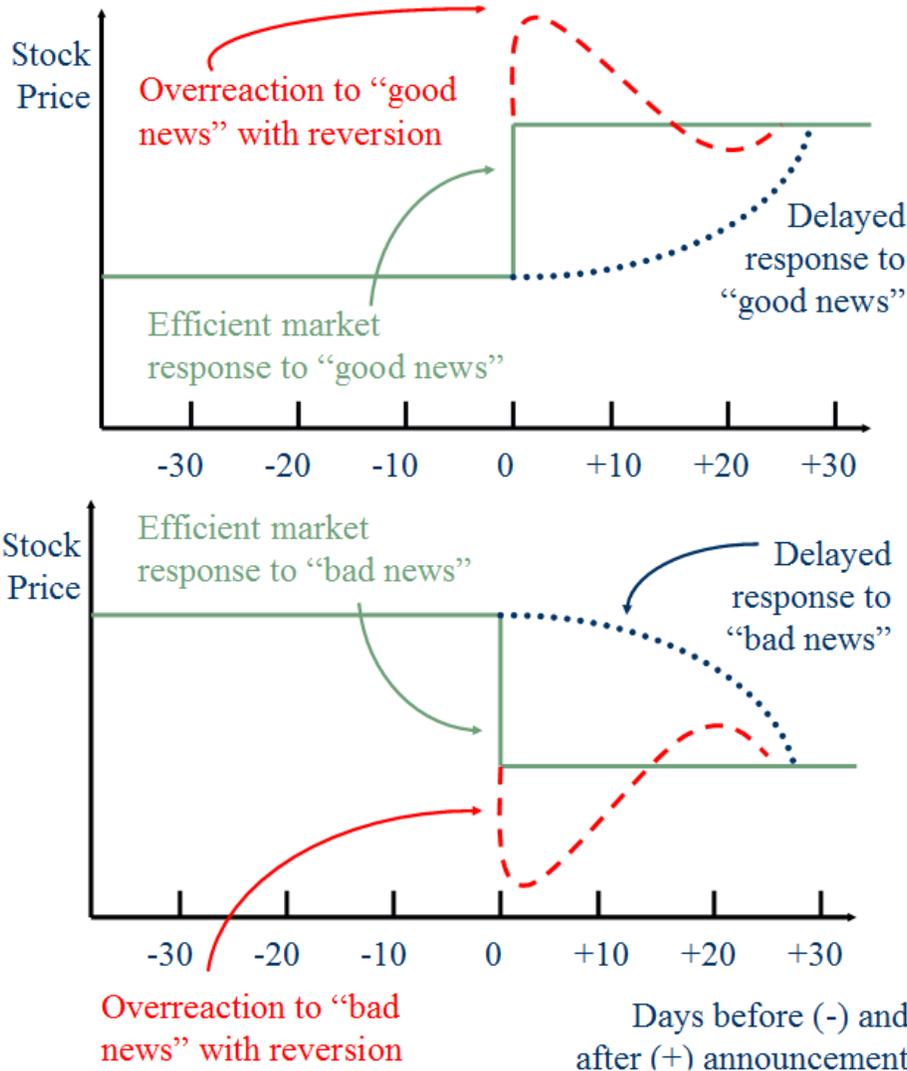
*It is not possible to make abnormal trading profits based on information in **past** stock prices or **past** stock price changes.*

We cannot make profit based on what a stock has done in the past. We cannot predict future returns based on past returns.

-Investors who believe that the market is not weak form efficient are called **TECHNICAL ANALYSTS**, they try to predict future prices based on information from the past.

Technical analysts make investment decisions based on **TECHNICAL INDICATORS** that are calculated from past stock prices.

Weak form efficiency says it is not possible to make profits based on historical information. Future returns are independent of the past returns.



Autocorrelations of Returns

-Weak form efficiency implies that stock return **AUTOCORRELATIONS** (**correlations over time**) are zero (cannot make abnormal profit based on past performance).

Autocorrelation is a property of one random variable with itself at some different time (lag point). Example, $\rho_{R^I_2, R^I_1}$ This represents weak form inefficiency because by definition

the investor cannot profit from past information. Weak Form Efficiency states that future returns are independent of past returns, meaning autocorrelation is 0.

Example of autocorrelation of degree 1:

Time	IBM	IBM	
May-99	R^I_1	R^I_2	We would be taking the correlation of these pairs.
Jun-99	R^I_2	R^I_3	
Jul-99	R^I_3	R^I_4	

-Suppose **autocorrelations were positive**. What could that imply about individual behavior?



This sequence shows market inefficiency. The price converged in steps to a new value (as a result of some new information about the asset). There was an under-reaction to the news and the market had to compensate. This demonstrates market inefficiency, an opportunity

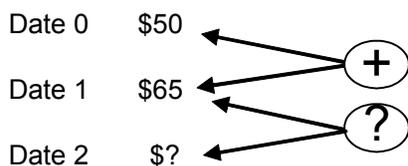
to make profit any time new information is released about the asset. In this case the effect of the new information was gradual, took two days. Opportunity for abnormal profit.

-Suppose **autocorrelations were negative**. What could that imply about individual behavior?



Also inefficient, the market over-reacts to new asset information and then has to readjust downward. Opportunity to make profit based on past performance.

Weak Form Efficient



Weak Form Efficiency says the future is unknown, random! The autocorrelation test pretty much supports the efficient market theory in the weak form. But there are more advanced test which show that sometimes we can predict the future based on past performance.

Empirical evidence on weak form market efficiency

Most available evidence indicates that **Weak Form Efficiency** is a good first approximation for developed financial markets

Empirical tests in the US indicate a **very small positive autocorrelation**. However, when **transaction costs** are accounted for, **no profit can be made**.

As the tests become more powerful, it is possible to identify violations of weak form efficiency, which we call **ANOMALIES** – for example, some **MOMENTUM STRATEGIES** and some **CONTRARIAN STRATEGIES** seem to generate abnormal returns.

MOMENTUM STRATEGY

This is a method of future prediction based on past performance. You can construct a portfolio based on momentum in stock prices and make profit. For example, look at all the stocks in the market for the past year. Rank them based on returns. Take the 10% with the highest returns and buy them. But how do you pay for them? You take the 10% with the lowest return and sell the **SHORT**. Selling in short means you are expecting the price to go down because in the future you will have to buy that stock!

We get money from the short sell of the lowest 10% and use that money to buy the stocks with the highest return. So we are 0 out of pocket. This is a zero finance portfolio.

The research showed that doing this year after year will result in an approximate return of 12%.

There is debate weather or not these theories really work when we consider transaction cost. These are considered abnormalities.

CONTRARIAN THEORY

A variation of the momentum strategy is to sell short the highest return stocks in order to buy the lowest return stocks but to hold the low return stocks for 5 years. Here we are betting that firms which did well in the last year in the long run will do worst.

These theories are saying that in the short run there is momentum in stock prices and in the long run there is a contrarian effect.

SHORT SELLING

IBM stock is currently priced at \$85. In the two scenarios below we buy now and hold for two years and short sell now and buy back in two years.

Time	0	1	2	
Buy	-85		P_{IBM}	market price
Sell Short	+85		$-P_{IBM}$	must buy in the future, hopefully at a lower price than sold for

↙ sold it short now

Short selling requires guarantees to prove we can repay. There is also a “margin” aspect. The broker is taking on a lot of risk and requires compensation.

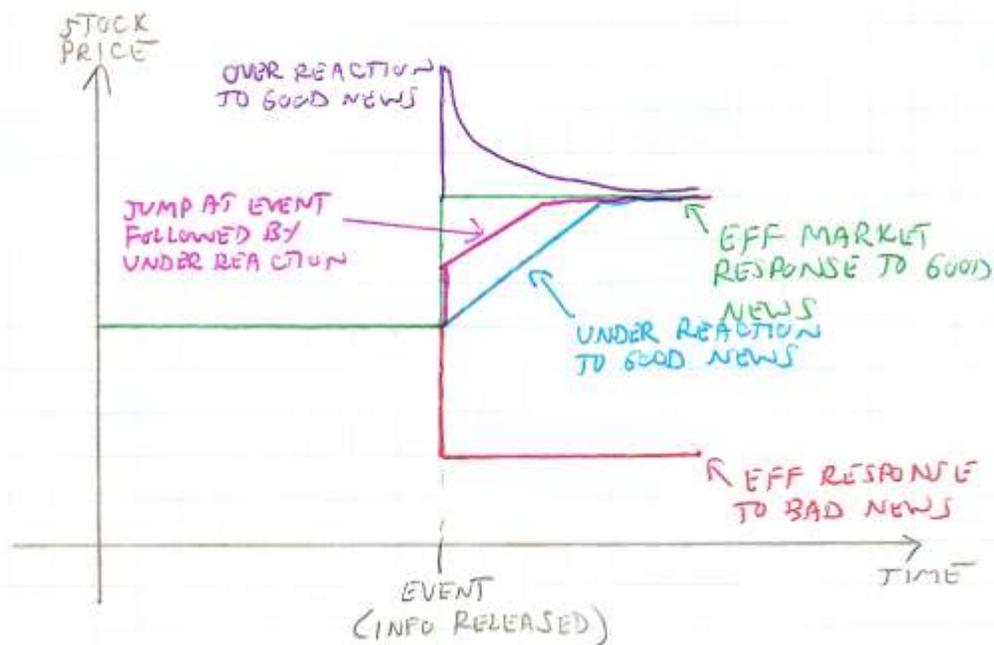
Definitions of Market Efficiency

SEMI-STRONG FORM EFFICIENCY

It is not possible to make abnormal trading profits based on any PUBLICLY available information

The methodology of testing semi-strong efficiency is called **Event Studies**.

There is a large body of literature in finance that uses a technique called an EVENT STUDY. Event studies examine how stock prices respond to new public information.



Event Studies and Market Efficiency

-The vast majority of the event study evidence indicates that security prices respond quickly and rationally to new public information

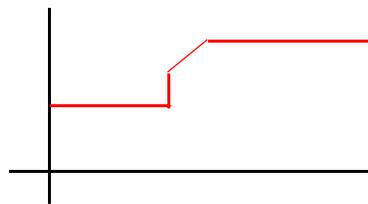
-Although it might take some time for investors to sort out the implications of new information, there is little evidence that investors systematically under-react or over-react to news.

However, there are plenty of anomalies where stock prices do not respond in the way we would expect

Examples:

- **Positive long-run abnormal returns after**

- Dividend initiations
- Share repurchase announcements



Here the stock price jumps at the event (information release) but continues to rise to some new value afterwards. This is most likely an indication that the company is buying back the stock. This signals the market that the company has excess cash and also speaks to the expected future value of the firm. Owners purchasing stock is a good sign that they believe in the stock, they know more about what is going on in the firm than the average investor.

- **Negative long-run abnormal returns after**

- Dividend omissions: indicates not enough cash, low profit, not a good sign.
- Initial Public Offerings (IPOs): typically stock price will over-react in the positive direction at IPO.

STRONG FORM EFFICIENCY

*It is not possible to make abnormal trading profits based on **any information, public or private***

-There is **plenty** of **evidence that financial markets are not strong-form efficient**. For example, **empirical evidence of insider trading shows that insiders can earn abnormal profits**

Summary of market efficiency

- **Weak** form efficiency appears to be **TRUE**
- **Strong** form efficiency appears to be **FALSE**
- There is an ongoing debate on the semi-strong form efficiency

Capital structure I: Basic Concepts

What is a capital structure?

The big question:

How should the firm finance its investments?

The methods the firm uses to finance its investments is called its capital structure.

Equity

-Stocks

-**Warrants**: another security, the firm gives you the option to buy a stock at a specified price. If you exercise the warrant you dilute the stocks value. Not the same as an option. We can trade an option on the firms stock. An option is outside the firm. A warrant is an option which the firm issues. This means that if you hold the warrant and you decide to exercise the warrant, you are going to dilute the value of the other stock holders. (We will discuss options in a later class. Warrants are not options. It sounds like a warrant is an issue of NEW stock). Example, if you have a warrant worth \$100 it means that you can convert it to stock worth &\$100.

DEBT

-Bank loans

-**Corporate bonds**: bond holders become the creditors.

A **CAPITAL STRUCTURE** describes the **mix of the firm's financing sources** (i.e., equity and debt)

Say the firm has many projects to finance. It has two choices on how to do so, Equity or Debt. The firm will usually use a mix of equity and debt, this mix is called the firm's capital structure.

If we know one proportion of the capital structure we can calculate the other.

The ratio is also called the **LEVERAGE** of the firm, the proportion financed by debt.

Measures of Leverage

$$\text{BOOK LEVERAGE} = \frac{\text{Book value of debt}}{\text{Book value of debt} + \text{Book value of equity}}$$

The book ratio is the ratio of the book value of the debt divided by the book value of the total assets (which is the book value of the debt divided by the book value of the equity). We extract this ratio from the balance sheet.

Example:

Balance Sheet	
Assets	D & E
10 Mil	D = 3 Mil
	E = 7 Mil

$$\text{book leverage} = 3/(3+7) = .3$$

$$\text{MARKET LEVERAGE} = \frac{\text{Book value of debt}}{\text{Book value of debt} + \text{Market value of equity}}$$

Here we replace the book value of the equity with the market value of the equity. The market value is the real value of the equity, it's not based on historical value or "cost based value" (?). It is a more realistic value so we prefer to use it. So we would like to know what is the ratio of the assets that are financed by debt when taking into account the real market value assets.

Now we want to try to answer why we do not take the market value of the debt. We take the market value of the equity but why not also take the market value of the debt to make the equation entirely market based leverage?

What is the market value of the debt? The book value of the debt is some face or historical value. The market value of the debt is the current market value. Will it be close to the face value? Probably it will be very close to the face value. So we know the market value of the equity is not surprising larger than the book value.

This is the first reason, it is a good measure of the book value. Another reason is that the market value of the debt is not readily available. It is very hard to get the market value of the debt. There would in most cases be many bonds, many stock issues, we would have to take representative averages and such. Not easy. This is a good approximation.

Capital structure represents the proportion of the firms assets which are represented by debt and the proportion which are financed by equity. Since these proportions are related one to the other it is enough to know one and solve for the other.

Usually the one specific proportion that we look at is the debt proportion. The debt to asset ratio. When speaking of the capital structure of a firm we will usually say “the debt to asset ratio is” some percentage. This ratio is also called the leverage of the firm.

The **LEVERAGE** represents the proportion of the firm which is financed by **debt**.

Empirical Evidence

The 7 big industrial countries.

Country	Average Book Leverage
US	0.27
Japan	0.27
Germany	0.05
France	0.26
Italy	0.18
UK	0.15
Canada	0.30

(Difference with Germany because loans are expensive due to regulation)

With the exception of Germany the average book leverage is about 20 to 25% (say between 15 and 30%). Most of the assets are financed by equity and about 25% financed by debt (with the exception of Germany).

So how should the firm choose its capital structure? Why will its capital structure make a difference? This is a non-intuitive question. Why will the capital structure effect the value of the firm? All we are considering is the way we finance the projects. Both debt and equity cost money. Why does the way we finance the investment effect the value of the investment? We will see the answer ahead. But we must be clear of the question. The firm has many projects (assets), now the firm wants to finance the assets. It can issue stocks and it can issue bonds. So the question is, What is the optimal financing structure? What is the optimal proportion?

First we must realize that the value of the assets of the firm is the sum of the value of the equity and the value of the debt.

The Pie Theory

-The value of a firm is defined to be the sum of the value of the firm's equity and the firm's debt. The goal is to increase the value of the firm as much as possible.

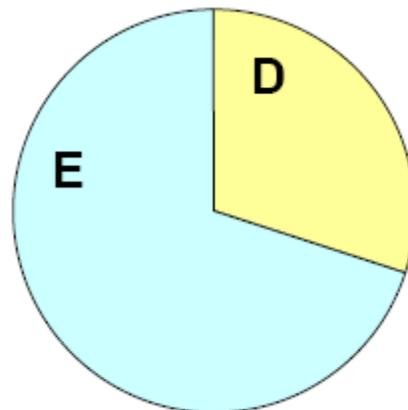
Value = Equity + Debt

$$V = E + D$$

How should the firm select the capital structure? With many projects to finance what is the best proportion?

Goal is to increase the size of the firm as much as possible.

Shareholders (equity) want to increase the size of the entire pie. Related to efficiency, maximize the value of the firm not only the size of the equity.



Important questions:

1. Why should the stockholders care about maximizing firm value? Perhaps they should be interested in strategies that maximize the equity value
2. What is the ratio of debt-to-assets that maximizes the equity value?

As it turns out, **CHANGES IN CAPITAL STRUCTURE BENEFIT THE STOCKHOLDERS IF AND ONLY IF THE VALUE OF THE FIRM INCREASES**

-If the goal of the management of the firm is to make the firm as valuable as possible, then the firm should pick the debt-to-assets ratio that makes the pie as big as possible

We will see that maximizing the equity will **MAXIMIZE THE VALUE OF THE ENTIRE FIRM (PIE)**. So for now we assume that the share holder want to increase the size of the entire pie.

Modigliani-Miller (1958) Theory

Assumptions

- No transaction costs
- Competitive markets --both individuals and firms are price takers (no monopolies, no single market movers)
- Equal access to relevant information
- Firms and investors can borrow/lend at the same rate

If

- There are no taxes
- There are no bankruptcy costs
- The firm's investment policy is fixed (capital structure will not change according to which projects are taken).

Then

- The value of the firm is independent of its capital structure. The capital structure has no effect on the value of the firm. The capital structure is irrelevant.

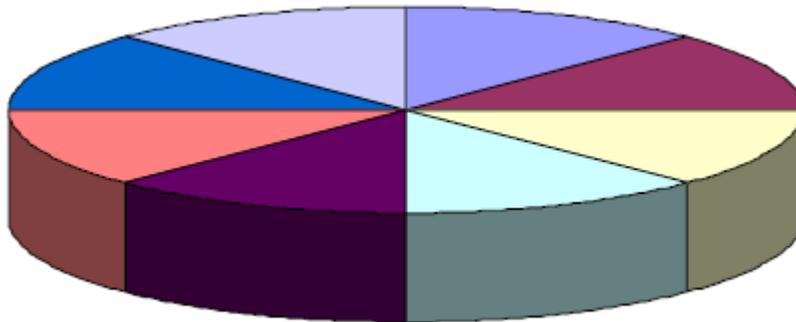
**IF WE FIND THAT CAPITAL STRUCTURE IS IMPORTANT
THEN AT LEAST ONE OF THE 3 CONDITIONS IS NOT
VALID (RELEVANT).**

We will see that the capital structure becomes relevant when we consider taxes, bankruptcy, and investment policy. If at least one is important then all 3 are important.

NOW WE WILL PROVE THE MM1 THEOREM...

Simple Proof of the Theorem

-The size of the pie does not depend on how it is sliced!



More Elaborate Proof of the Theorem

An **ARBITRAGE OPPORTUNITY** is an opportunity to generate a riskless positive cash flow with no cost!

Arbitrage opportunities cannot exist for long in the market; they quickly get traded away.

We will show that if MM1 does not hold, there is an arbitrage opportunity. That is, IF two firms are identical except for their capital structure and their total market value is not the same, THEN there is an opportunity for arbitrage.

You construct a portfolio at zero cost and sell it in the future for a positive amount. This would be an arbitrage and quickly priced out of the market.

Postulate a logical argument:

If MM1 does NOT hold then there is an arbitrage opportunity.

We know arbitrage opportunities cannot exist, thus MM1 must hold.

MM1 says capital structure is not relevant. If MM1 is not true then capital structure is relevant.

More Elaborate Proof of the Theorem

Proof by Example:

- 2 Firms (U and L)
- Each Exist for 1 year
- Have identical cash flows (X) and liquidate at end of the year
- Have different capital structure: firm **U has no debt**, while firm **L has debt equal to D**

	UNLEVERAGED		LEVERAGED	
	Firm U		Firm L	
	CF	Value	CF	Value
Debt	0	0	$(1 + R_D)D$	D
Equity	X	V_U	$X - (1 + R_D)D$	E_L
Total	X	V_U	X	$V_L = D + E_L$

The two firms generate identical cash flows, X, hence must have the same total (market) value (in this proof the 3 conditions hold).

Values of the firms are V_U (value unleveraged firm) and V_L (value leveraged firm).

MM1 implies $V_U = V_L$ (most). If it does not then there is an arbitrage opportunity.

More Elaborate Proof of the Theorem

-Suppose they don't. Assume:

$$V_U = \$100 \text{ million} > V_L = \$90 \text{ million}$$

$$D = \$30 \text{ million} ; E_L = \$60 \text{ million}$$

-How can you earn arbitrage profits?

-At time 0 (selling short at time 0):

- Sell 20% of shares of U → yields \$20 million
- Simultaneously, buy 20% of L's securities (equity and debt) → costs \$18 million

-Profit at time 0:

$$\$20 \text{ million} - \$18 \text{ million} = \$2 \text{ million}$$

Basically this is saying we buy 20% of each firm and since one firm is valued greater than the other we make a \$2 million arbitrage.

$$\text{Value of Debt} = (1 + R_D)D$$

X is the value of the firm liquidated and distributed to the shareholders.

-At time 1:

- You pay dividends: $0.2 * X$
- You receive dividends: $0.2 * [X - (1 + R_D)D]$
- You receive interest payments: $0.2 * (1 + R_D)D$

-Profit at time 1:

$$- 0.2 * X + 0.2 * [X - (1 + R_D)D] + 0.2 * (1 + R_D)D = 0$$

-Thus, this strategy yields a positive cash at time 0 and zero cash at time 1 i.e., an arbitrage!

-Since arbitrage opportunities cannot exist, the total market value of firms U and L must be the same, regardless of their capital structure

Time	0	1
selling 20% of U equity	+ 20	-.2X
buying 20% of L debt	- 6 (D)	.2[(1+R _D)D]
buying 20% of L equity	- 12 (E)	.2[X-(1+R _D)D]
	+ 2	0

At time 0 we have made \$2 million and buy back at time 1 for no cost. This is a valid arbitrage strategy but arbitrage cannot exist. But we only have the arbitrage opportunity because the values of the firms are different. This is a money machine, all investors will pursue this portfolio until it is priced out of the market. Price of firm L will increase and price of firm U will decrease until the arbitrage opportunity disappears. (END OF PROOF)

MM World with Taxes

If leverage affects the value of the firm, it must be via:

- Taxes
- bankruptcy costs
- or change in the firm's investment policy

Interest payments to bondholders are tax deductible, while payments to equity holders are not

Hence, issuing debt has a tax-advantage

Tax can make capital structure relevant because payments to bondholders are tax deductible and equity holders payments are not.

All Equity, Unlevered

Has Debt, Levered

Example

-Consider the following income statement:

	Firm U	Firm L
EBIT	\$1,000	\$1,000
Interest payment at 8%	\$0	\$80
Pre-tax income	\$1,000	\$920
Taxes at 34%	\$340	\$312.8
Net stockholders income	\$660	\$607.2
Total net income	\$660	\$687.2

Coupon Payment, Tax Free

Value = Equity + Debt

We are asking: Where can we use the tax exempt status of bonds to save money?

Firm U has only stock holders so no debt means no coupon payments so 0% interest. Firm U has only stockholders.

Firm L: Total income to bond and stock holders is $607.20 + 80 = \$687.20$ due to bond payment. But the firm paid less tax which is also due to the bond payment. The interest payment is tax deductible.

Note ... $687.20 - 660 = 27.2 = 80 * .34 = \text{Interest Payment} * \text{Tax Rate}$

We are getting back 34% from the IRS on the interest! This is called the

TAX SHIELD.

TAX SHIELD = INTEREST PAYMENT * TAX RATE

MM World with Taxes

T_C = Tax Rate

D = Face Value

R_D = Coupon Rate

Coupon Payment = Coupon Rate * Face Value

General form of tax shield 

-The tax bill of firm L is $\$T_C R_D D$ less than that of firm U

-If the debt (level) is perpetual, the value of this tax shield is:

$$PV(\text{tax shield}) = \frac{T_C \times R_D \times D}{R_D} = T_C \times D$$

-We thus have:

$$V_L = V_U + T_C D$$

or,

$$V(\text{levered firm}) = V(\text{unlevered firm}) + PV(\text{tax shields})$$

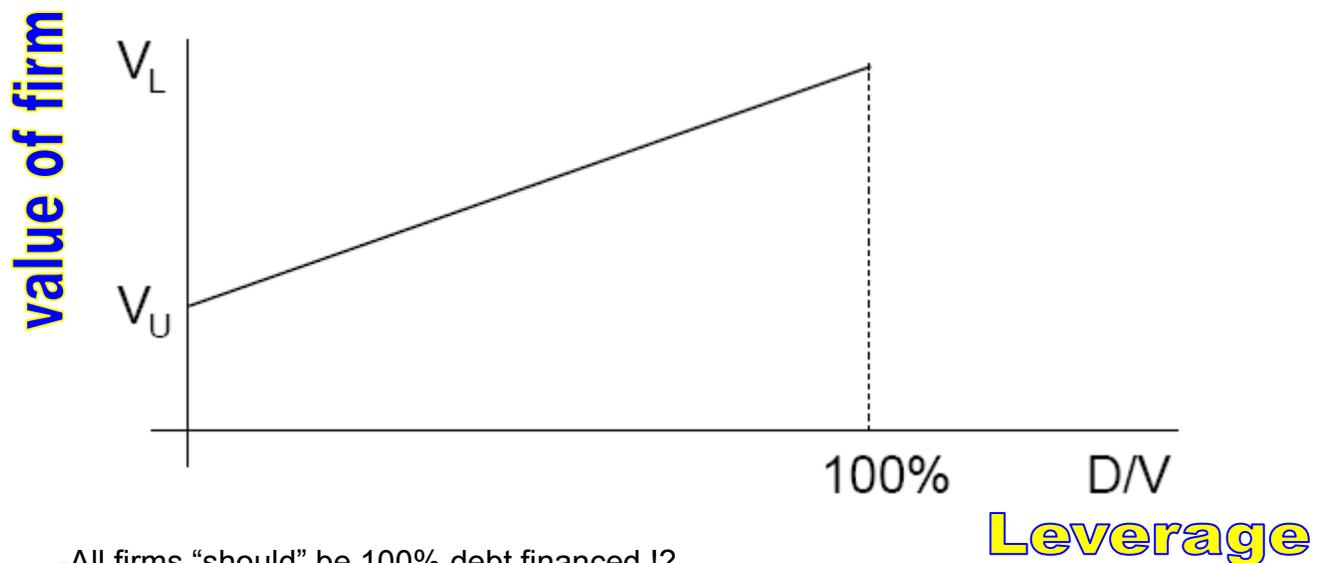
What is the difference between the value of the leveraged firm and the unleveraged firm?
The tax shield is an annual yield, so we must look out from next year to forever when making this calculation. The income of the levered firm will be higher than that of the unlevered firm.

We are using $PV = \frac{C}{R}$ but substituting R_D for C (?).

Higher debt implies higher firm value.

MM World with Taxes

-But, what does this imply..?



-All firms "should" be 100% debt financed !?

If only taxes then 100% debt would be good. But this would not be practical. Implies there are other factors at play, disadvantages. The disadvantages would be the MM1 factors, but which are relevant?

-The fact that we don't see firms financed with 100% debt (no equity) tells us that our theory is missing something

-We need to account for other factors associated with debt financing

- Bankruptcy costs
- Change in the firm's investment policy

(Taxes have been factored in, that is what we are considering!)

MM World with Taxes and Bankruptcy Costs

Firm cannot pay what it owes to bondholders and creditors so it files for bankruptcy.

US BANKRUPTCY CODE

• Chapter 7

- Liquidation
- Proceeds are distributed to the firm's claimants according to their priority

All assets of the firm are sold, proceeds go to the claimants according to their priority (bond holders are first, equity holders second). The firm ceases operations immediately.

• Chapter 11

- Reorganization plan
- Debt holders and equity holders get new claims instead of the old ones

There are negotiations, most likely new owners. New owners will have plan to recover firm, or at least keep it going through the proceedings. Bondholders get a new contract, probably less money.

MM World with Taxes and Bankruptcy Costs

BANKRUPTCY COSTS

- **Direct:**

- Lawyers', accountants', and other professionals' fees

- Court fees

- Managerial time spent on bankruptcy administration

- **Indirect:**

- Loss of reputation (risk of losing clients, employees, suppliers, etc.)

- Loss of potential business deals, partners

MM World with Taxes and Bankruptcy Costs

The probability of entering bankruptcy, and thus incurring these costs, is an increasing function of the firm's debt-to-assets ratio

Increasing leverage increases the PV of debt tax shields, but also increases the probability of bankruptcy and, thus, the PV of expected bankruptcy costs

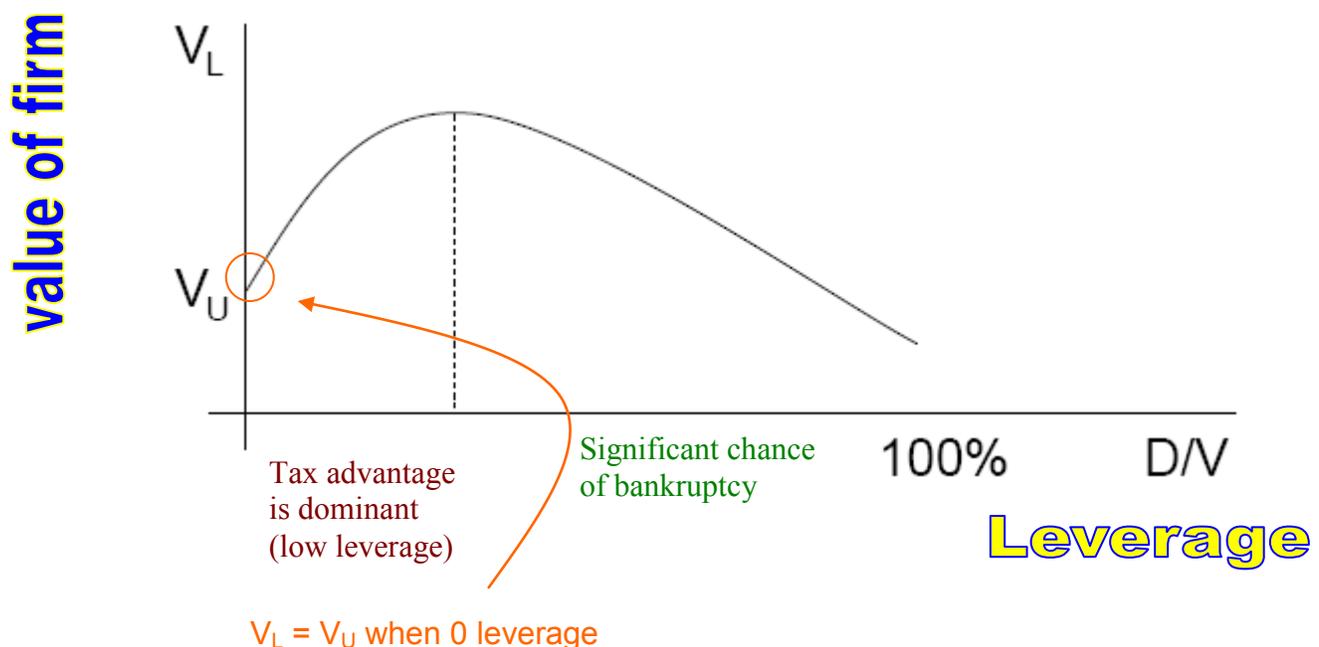
Hence,

$$\text{Value of levered firm} = \text{Value of unlevered firm} + \text{PV of tax shields} - \text{PV of bankruptcy costs}$$

High debt increases probability of bankruptcy. Very high coupon payments, may not be able to meet them. This lowers the value of the firm.

When the expected bankruptcy costs (and likelihood) increase the value of the firm decreases.

Optimal capital structure trades off the gains from increased tax shields against the increased expected costs of bankruptcy



How Big are Direct Bankruptcy Costs?

-Empirical evidence shows that direct bankruptcy costs account for 1.5% to 5% of total firm value. This range is too small to explain the firm's choice of capital structure.

-Bankruptcy costs may be too small to generate observed financing choices by corporations

-We need to account for another factor associated with debt financing

- **Change in the firm's investment policy**

This is the only MM1 factor left to explain the relevance. The factor that the level of debt explains which projects are taken.

Practice questions

15.2

15.6

15.9