TIØ4146 Finance for Science and Technology Students

Chapter 5 - Capital Structure

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February 16, 2024

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Dimensions of securities

Capital structure analysis

Models of optimal capital structure

Dividends

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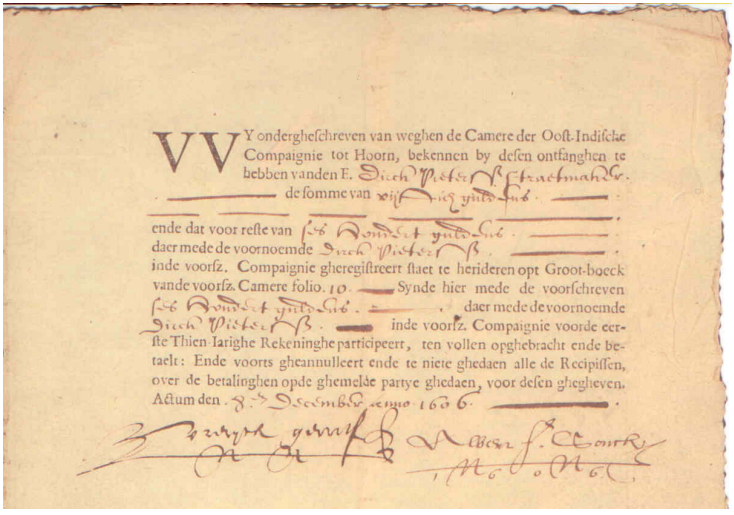


VVY ondergheſchreven van weghen de Camere der Ooſt-Indiſche Compaignie tot Hoorn, bekennen by deſen ontfanghen te hebben vanden E. Dirck Pietersz Cruchmaker. de somme van vijfhondert guldens. ende dat voor reſte van fl. Hondert guldens. daer mede de voornoemde Dirck Pietersz. inde voorſz. Compaignie gheregiſtreert ſtaet te herideren opt Groot-boeck vande voorſz. Camere folio. 10. Synde hier mede de voorſchreven fl. Hondert guldens. daer mede de voornoemde Dirck Pietersz. inde voorſz. Compaignie voorde eerſte Thien-Iarighe Rekeninghe participeert, ten vollen opghebracht ende betaelt: Ende voorts gheannulleert ende te niete ghedaen alle de Recipiſſen, over de betalinghen opde ghemelde partye ghedaen, voor deſen ghegheven. Actum den. 8. Decembris anno 1606.

The oldest printed share certificate in the world, issued by the Dutch East India Company on December 8, 1606.

There was a lively trade in these certificates on the exchange. Dividends were paid in 'pounds of pepper'.

General dimensions of securities:

- Riskiness:
  - nature of return:
    - profit dependent - low priority - no upper limit
    - predetermined - high priority - fixed maximum
  - counterparty or default risk:
    - risk of not getting your money back
- Maturity:
  - short
  - long
  - permanent
- Property rights attached:
  - yes: equity (ownership + control)
  - no: liabilities (creditor + priority)

general dimensions (cont'd):

- Deposited or promised:
  - financing function
  - guarantee function (Lloyds Names)
- Primary or secondary
  - from firm to investor
  - from investor to investor
- Spot (direct delivery) or for future delivery
- Secured or unsecured
- Underlying or derivative

Best known, often used examples:

- Common stocks (or shares):
  - permanent investments, profit dependent return, ownership
  - low priority (residual claim), no upper limit
  - usually deposited, can be stock market traded
  - unsecured, can be underlying for derivatives
- Bonds and bank loans:
  - temporary investments, predetermined return, no property rights
  - high priority, fixed maximum return
  - deposited, bonds can be stock market traded
  - can be secured, bonds can be underlying for derivatives

All ingredients can be varied in countless ways

The wide variety of shares:

- Common shares
- Shares with limited voting rights:
  - non-voting common stock
  - dual class stock:
    - Google class B shares have 10 votes
    - Google class A shares have 1 vote
    - A and B also used other way around
  - B aksjer in Norway
  - Certificates of share in The Netherlands:
    - All shares deposited in 'administration office'
    - office issues new shares without voting rights
    - (protective construction, now being phased out)

- Preferred shares:
  - priority claim on profits (fixed or floating)
  - priority voting rights for some decisions
    'golden share' giving the state veto right over merger
    (recently outlawed by EU)
  - priority claim on proceeds in case of liquidation
- Repayable shares
- Convertible shares:
  - from preferred to common
  - from certificate to common

Many different types of bonds:

- Ordinary bonds (corporate or government)
- Income bonds:
  - only pay interest if profits allow it
- Index bonds:
  - interest dependent on government bonds
  - or something else e.g. price of railway tickets!
- With or without regular interest payments (coupon)
  - ordinary coupon bond (x% paid every year or half year)
  - zero coupon (or pure discount) bonds: 1 final payment of interest + repayment

- Junk bond:
  - ordinary bonds with very high interest rate
  - and very high default risk
- Bull-bear bond, issued in 2 parts (tranches)
  - 1 part principal repayment *increases* with price other security
  - other part principal repayment *decreases* with price other security
- Profit sharing bonds
- Convertible bond:
  - bond can be converted into share
- Catastrophe bond
  - reduced payments if specific catastrophe happens

Debt can be secured with:

- Priority claims on certain assets:
  - mortgage (buildings, ships)
  - inventories
  - accounts receivable
  - also assets outside the firm (private house or jewellery)
- 'Me first' rules (seniority, i.e. priority)
- Ratio clauses (e.g. current ratio > 2)
- Action clauses (not allowed to sell assets)

Note that securing (make sure) $\neq$ securitization (turning e.g. 'internal' debt into publicly traded security)

Variety of derivatives is even larger:

The value of a derivative security is dependent on (derived from) the value of another security (called underlying security)
Underlying can be almost anything, usually stock, bond, currency, commodity, etc.

- Options:
  - puts and calls
  - European or American
  - plain vanilla or exotic (Asian, Bermuda, barrier, basket, chooser, etc.)
- Forwards and futures
- Swaps

Financial engineering

Constructing new securities from existing ones

- distribute risk and return in other ways
- make securities available/customized for investors

Illustrate process with mortgages and mortgage-backed securities, played a major role in financial crisis

Simplest situation:

- Bank gives mortgage loan to customer
- bank collects interest and repayments
- bank bears risk of the loan
  - prepayment risk
  - default risk

Mortgages can be bundled in special firm (legal entity) called 'special purpose vehicle', SPV

- bank sells its mortgage loans to SPV
- SPV collects interest and repayments
- SPV bears risk of the loans
- SPV issues bonds to finance its operations
- parent company SPV (usually investment bank)
  - creates secondary market for bonds
  - so that bondholders can buy and sell
  - makes bonds more attractive

Construction is example of *securitization*:

- mortgages that were privately held by banks
- become available to investors
- bank gets money to issue new mortgages
- construction pools risks of mortgages
  - safety in large numbers
  - risk not otherwise transformed

Risks are transformed by structuring bonds

- divide bonds in *tranches* (parts) with different risk and return
- called *structured products*

Example structured product:

- SPV collects €80 million mortgages, pay 8% interest
- issues €80 million bonds, in 3 tranches:
  1. €20 m. with low interest, 6%, priority over 2 and 3
  2. €40 m. with interest of 8%, priority over 3
  3. €20 m. with high interest, 10%, lowest priority
- In a year without defaults
  - mortgage pool produces $80 \times .08 = 6.4$ interest
  - first tranche gets $20 \times .06 = 1.2$ million
  - second tranche gets $40 \times .08 = 3.2$ million
  - third tranche gets rest, 2 million i.e. 10%

- In a year with 15% defaults on interest payments
  - mortgage pool produces $80 \times .85 = 68 \times .08 = 5.44$ interest
  - first tranche gets $20 \times .06 = 1.2$ million
  - second tranche gets $40 \times .08 = 3.2$ million
  - third tranche gets rest, 1.04 million i.e. 5.2%

In addition, investment bank behind SPV can use derivative securities to 'insure' risk

- e.g. buy credit default swaps
- pay regularly amount to seller
- seller takes risk of default

Constructions used on very large scale before the crisis,
value measured in hundreds of billions of dollars

What went wrong?

- constructions create large distance between mortgage issuer and investors who bear default risk
- requires additional risk management tools
- not enough were put in place
- 'old' averages and parameters used, from time when mortgages were 'as safe as a house'

In old situation, banks had risks and returns:

- they sold mortgages
- collected (and lived of) the interest
- bore the risks $\Rightarrow$ result:
- would not give mortgage to clients that could not pay

With securitized mortgages:

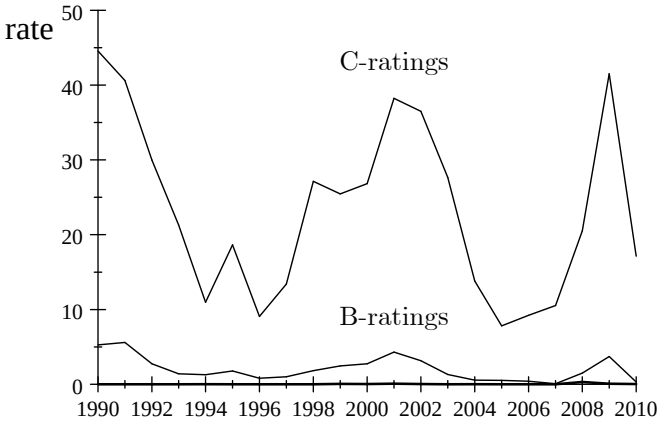
- banks get fee (commission) for selling mortgage
- risk is borne by investors who buy bonds of SPV
  (including municipalities in arctic Norway)
- gives banks incentive to lower standards
- effect was largely missed by rating agencies that assess quality of bonds

Rating agencies have a very long history

- traditionally, graded corporate bonds according to security
- grading widely recognized and used
- triple A grading gave lower interest rates

Credit ratings (selection) and one year default rates

Rating	2006	2007	2008	2009	2010
Aaa/AAA	0.00	0.00	0.00	0.00	0.00
Aa/AA	0.00	0.00	0.56	0.00	0.00
A	0.00	0.00	0.45	0.18	0.19
Baa/BBB	0.00	0.00	0.47	0.86	0.00
Ba/BB	0.20	0.00	1.16	2.41	0.00
B	1.18	0.00	2.07	7.41	0.48
Caa-C/CCC-D	6.04	5.98	14.78	34.36	12.01
Investment grade (Baa +)	0.00	0.00	0.46	0.37	0.07
Speculative grade	1.46	0.96	4.37	13.14	3.17
All rated	0.65	0.37	2.03	5.42	1.28



Default rates by rating category; A-ratings largely coincide with x-axis
(compiled from various sources on the internet)

Example of grading mistakes

Summer 2006, Goldman Sachs put together residential mortgage pool

- held $338 million of second mortgages
- to subprime, or riskier, borrowers
- Safest tranche held $165 million in loans
- Aug. 17, 2006, Moody's and S.& P. rated it triple-A
- Aug. 16, 2007, Moody's dropped rating to Baa
- Dec. 4, 2007, Moody's downgraded the tranche to "junk"rating
- the tranche stopped trading some months later

Example of grading mistakes

Is not a single incident:

- of AAA-rated sub-prime mortgage-backed securities issued in 2006, 93% (!) have now been downgraded to junk status (Paul Krugman in NYT 26-04-2010)

Two comments by Sean Dobson, CEO of Amherst Securities, who collected data on the pool:

- I guess people are shocked that such fine pool would experience 60% defaults. We're more impressed that 25% of the loans actually paid.
- For 20 years we turned down these borrowers. Then the gates were opened and a bunch of obviously stupid loans were made.

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Capital Structure

Modigliani-Miller: The cost of capital, corporation finance and the theory of investment *Am. Ec. Review, 1958*

- Introduced the famous capital structure irrelevance theorem
- Beginnings of modern finance (along with Markowitz' portfolio theory):
  - replaced old describing, anecdotal approach
  - with formal analyses in neoclassical paradigm
- Revolutionary at the time, often ridiculed, now generally accepted as correct fundamental analysis
- both were awarded Nobel prize later

- The prevailing view at the time was that firms had a “right” amount of debt, and dividend policy was critical to their value.
- This notion had not been subjected to rigorous theoretical analysis.
- The point of both of Miller and Modigliani’s most important works was to say, “Here’s where it doesn’t matter, so you can look for where it does.”
- The irrelevance theorems were thus the basis of the hunt for what parts of finance were relevant in firm valuation.

From https://www.chicagobooth.edu/review/why-merton-miller-remains-misunderstood

Definition
Capital structure is the combination of capital categories a firm uses to finance its operations

Study of capital structure is important:

- Connection with the cost of capital, hence: capital budgeting
- Tells us which projects can carry much debt, i.e. are easy to finance
- Major factor in the evaluation of firms
- Nice example of the neoclassical (or marginalist) paradigm in finance

We start analysis with perfect capital markets:

- no taxes, no transaction costs, limits on short selling, etc.
- everybody can borrow and lend unlimited amounts at the same rate

Methodology: compare 2 firms:

- with identical assets, giving same profits
- only differ in capital structure

We analyse 2 things:

- value of the firm
- risk and return equity

Balance sheet notation:

Unlevered firm U

Assets	A_u	Equity	E_u
total	V_u	total	V_u

Levered firm L

Assets	A_l	Debt	D
		Equity	E_l
total	V_l	total	V_l

Both firms generate same *profits*

Compare 2 investment strategies:

1. Buy a fraction α of firm U's equity
2. Buy a fraction α of firm L's debt and equity

1. Buy a fraction α of firm U's equity:
   - 1.1 invest $\alpha E_u = \alpha V_u$
   - 1.2 return is $\alpha(\textit{profits})$
2. Buy a fraction α of firm L's debt and equity:
   - 2.1 invest $\alpha D + \alpha E_l = \alpha V_l$
   - 2.2 return from debt is: $\alpha r_d D$, r_d is interest rate on debt
     return from equity is: $\alpha(\textit{profits} - r_d D)$
     total: $\alpha r_d D + \alpha(\textit{profits} - r_d D) = \alpha(\textit{profits})$

Both strategies give same return, value now has to be the same:

$$\alpha V_u = \alpha V_l \qquad \text{so} \qquad V_u = V_l$$

this is *Modigliani-Miller Proposition 1 - irrelevance theorem*

Modigliani-Miller Proposition 1:

The value of the levered firm is equal to the value of the unlevered firm

Proposition is based on arbitrage arguments:

- in perfect capital markets investors can undo or redo all capital structure decisions free of charge
- hence, any price difference will be arbitraged away

Redo company borrowing with 'home made' leverage:

1. Buy a fraction α of firm L's equity
2. Buy a fraction α of firm U's equity and borrow αD yourself

1. Buy a fraction α of firm L's equity:
   - 1.1 invest $\alpha E_l = \alpha(V_l - D)$
   - 1.2 return is $\alpha(\textit{profits} - r_d D)$
2. Buy a fraction α of firm U's equity and borrow αD yourself:
   - 2.1 invest $\alpha E_u - \alpha D = \alpha(V_u - D)$
   - 2.2 return from debt is: $-\alpha r_d D$
     return from equity is: $\alpha(\textit{profits})$
     total: $\alpha(\textit{profits} - r_d D)$

Again: both strategies give same return, value now has to be the same:

$$\alpha(V_u - D) = \alpha(V_l - D) \text{ so } V_u = V_l$$

In the same way, investors can undo a firm's leverage decision:

- undo corporate borrowing by private lending

Compare following to strategies:

1. Buy a fraction α of firm U's equity
2. Buy a fraction α of firm L's equity and put αD in the bank yourself

1. Buy a fraction α of firm U's equity:
   - 1.1 invest $\alpha E_u = \alpha V_u$
   - 1.2 return is $\alpha(\textit{profits})$
2. Buy a fraction α of firm L's equity and put αD in the bank yourself:
   - 2.1 invest $\alpha E_l + \alpha D$; since $E_l = V_l - D$ this is αV_l
   - 2.2 return from debt is: $+\alpha r_d D$
     return from equity is: $\alpha(\textit{profits} - r_d D)$
     total: $\alpha(\textit{profits})$

Again: both strategies give same return, value now has to be the same:

$$\alpha V_u = \alpha V_l \text{ so } V_u = V_l$$

Conclusion

- In a perfect capital market, levered firms cannot sell at a premium or a discount
  - would create arbitrage possibilities for home made levering/unlevering
- Hence, managers cannot change the value of the firm by changing capital structure
- Capital structure is irrelevant

Risk, return and leverage

- We now look at how return and risk of equity changes with leverage
- Use traditional example of 'trading on the equity'

Introduce 3 scenarios for return on assets, r_a, the return generated by the firm's assets:

scenario	bust	normal	boom
r_a	5%	15%	25%

Again, we look at 2 firms:

- unlevered firm U
- levered firm L, with 50% debt and equity:

Unlevered firm U			
Assets	100	Equity	100
total	100	total	100

Levered firm L			
Assets	100	Debt	50
		Equity	50
total	100	total	100

- Interest rate on debt, r_d, is 10%
- r_a and r_d determine $r_{e,l}$ and $r_{e,u}$ through
  - division rules: debt higher priority than equity
  - balance sheet identity: Assets $\equiv$ Equity + Debt

Writing the balance sheet identity in terms of returns, for the unlevered firm:

- $r_a = r_{e,u}$

and for the levered firm:

- $r_a = (D/V)r_d + (E/V)r_{e,l}$
- $(D/V)r_d + (E/V)r_{e,l} = WACC$

  Weighted Average Cost of Capital

Weighted Average Cost of Capital

- weights are fractions of capital categories in the total investment
- shows how the return generated by the assets is divided over capital categories

"The WACC represents the minimum return that a company must earn on an existing asset base to satisfy its creditors, owners, and other providers of capital, or they will invest elsewhere." Fernandes, Nuno. 2014, Finance for Executives: A Practical Guide for Managers, p. 32.

	bust	normal	boom
$r_a = r_{e,u}$	5%	15%	25%
r_d	10%	10%	10%
profits	5	15	25
interest (firm L)	5	5	5
eq. income (firm L)	0	10	20
$r_{e,l}$	0%	20%	40%

- Payoff pattern E_l can be replicated with E_u and borrowing (home made leverage)
- Conversely, E_l payoff pattern can be 'unlevered' by putting money in the bank
- We see that leverage makes equity riskier:
  $r_{e,u} = 5\%, 15\%, 25\%$ $\quad$ $r_{e,l} = 0\%, 20\%, 40\%$

Can also be shown with the formula for WACC:

$$r_a = \frac{D}{V} r_d + \frac{E}{V} r_e$$

multiply by V/E:

$$\frac{V}{E} r_a = \frac{D}{E} r_d + r_e$$

since V=D+E:

$$\frac{E+D}{E} r_a = \frac{D}{E} r_d + r_e$$

$$\frac{E}{E} r_a + \frac{D}{E} r_a = \frac{D}{E} r_d + r_e$$

$$r_e = r_a + \frac{D}{E}(r_a - r_d)$$

This is Modigliani-Miller Proposition 2

Modigliani-Miller proposition 2:

> *The return on equity is equal to the return on assets r_a plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between r_a and r_d.*

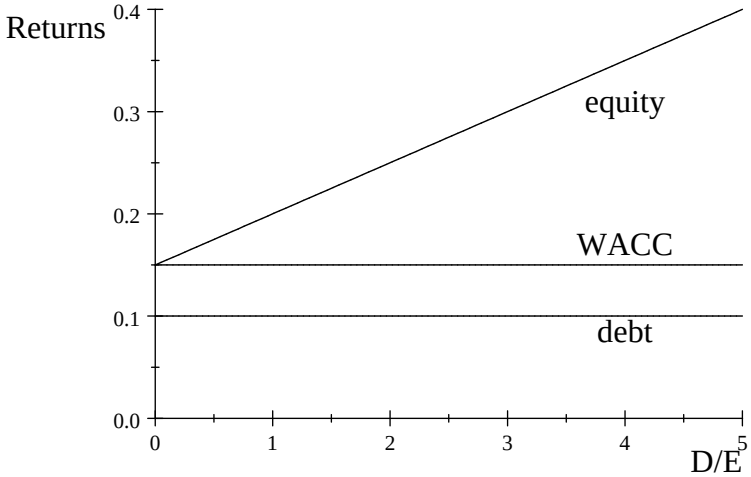
Result:

- the cost of equity increases with leverage
- such that the weighted average cost of capital is constant

As the proportion of cheap debt increases:

- the required rate on equity increases
- so that the WACC is constant

Graphical representation:



Returns and D/E ratios

Market imperfections

can make capital structure relevant:

- Taxes
  Interest payments are deductible from taxable income, dividends are not
- Limited liability / default risk
  - debt and interest may not be paid in full
- Costs of financial distress
  If a firm gets into financial trouble,
  - costly measures are necessary: selling non-strategic assets, expensive refinancing
  - income may decrease (even collapse, in case of durables that need service)

- Agency costs (discussed later)
  Capital structure can be used to 'discipline' managers or to transfer wealth from one category investors to another
- Information asymmetry
  Managers know much more about a company than outside investors, financial structure can be used to signal information

We look at:

- taxes (after tax WACC)
- default risk

first alone, then combined with costs of financial distress in trade-off theory

After tax Cost of Capital (after tax WACC)

- With taxes there is a third party, tax collector, that claims part of corporate value
- reduces value of the firm
- If interest is tax deductible while dividends are not, the tax collector's part decreases with debt.
- Result: sum of levered equity + debt $>$ unlevered equity
- Rework example (normal scenario) to show effect:

	unlevered	levered
profits (EBIT)	15	15
interest (10% of 50)	-	5
EBT	15	10
taxes (20%)	3	2
after tax profits	12	8
total income investors	12	8+5=13

- Note that total income for investors is higher in the levered firm
- if we assume that all cash flows are perpetuities, we can calculate the values of capital categories

Value of unlevered firm's assets and equity is: $12/0.15 = 80$
Value of levered firm includes tax advantage

- need to know how risky it is to find discount rate
- assumed here: debt is predetermined
  - not rebalanced to fixed % of firm value
  - does not go up and down with firm value
- Result: tax advantage of debt is just as risky as debt itself
  - $\Rightarrow$ can be discounted with r_d

Value tax advantage is 1/.1=10
exactly difference between levered and unlevered firm

Gives following values and returns:

	unlevered	levered
r_a	0.15	0.15
Value assets (12/0.15)	80	80
Value tax shield (1/0.1)	-	10
Value of the firm V (V_u, V_l)	80	90
value debt D (5/0.1)	-	50
value equity (E_u, E_l)	80	90-50=40
r_e (r_{eu}, r_{el})	0.15	8/40=0.2

- with taxes $V_u < V_l$: tax is a value flow out of the firm

Can be formulated in more general terms:

- call firms cash flow (EBIT) x
- corporate tax rate τ,

then value of *unlevered* firm, V_u, is:

$$V_u = \frac{(1-\tau)x}{r_a}$$

The cash flow to investors in the *levered* firm consists of 2 parts:

1. to shareholders: $(1-\tau)(x - r_d D)$
2. to debtholders: $r_d D$

We sum the 2 cash flows and work out terms:

$$(1-\tau)(x-r_dD)+r_dD=(1-\tau)x-r_dD+\tau r_dD+r_dD=$$
$$(1-\tau)x+\tau r_dD$$

Now we have the cash flow to *unlevered* equity plus the tax advantage of debt

- first part should be discounted with r_a
- second part with r_d as we just saw. So:

$$V_l=\frac{(1-\tau)x}{r_a}+\frac{\tau r_dD}{r_d}$$
$$V_l=V_u+\tau D$$

This is Modigliani-Miller proposition 1 with taxes

Modigliani-Miller proposition 1 with taxes:

> *Value of the levered firm is the value of the unlevered firm plus the tax advantage of debt (PV tax shield under assumptions we made)*

We can also derive Proposition 2 with taxes, look at balance sheet:

Assets	A_l	Debt	D
Tax shields	τD	Equity	E_l
total	V	total	V

Writing the balance sheet identity in terms of returns, the weighted average cost of capital becomes:

$$r_a \frac{V_a}{V} + r_d \frac{\tau D}{V} = r_d \frac{D}{V} + r_e \frac{E}{V}$$

$$r_a \frac{V_a}{V} = r_d \frac{D}{V} - r_d \frac{\tau D}{V} + r_e \frac{E}{V}$$

$$r_a \frac{V_a}{V} = r_d (1 - \tau) \frac{D}{V} + r_e \frac{E}{V} = \textit{after tax WACC}$$

Formula can be re-written to give expressions for r_a and r_e :

$$r_a = r_d (1 - \tau) \frac{D}{V - \tau D} + r_e \frac{E}{V - \tau D}$$

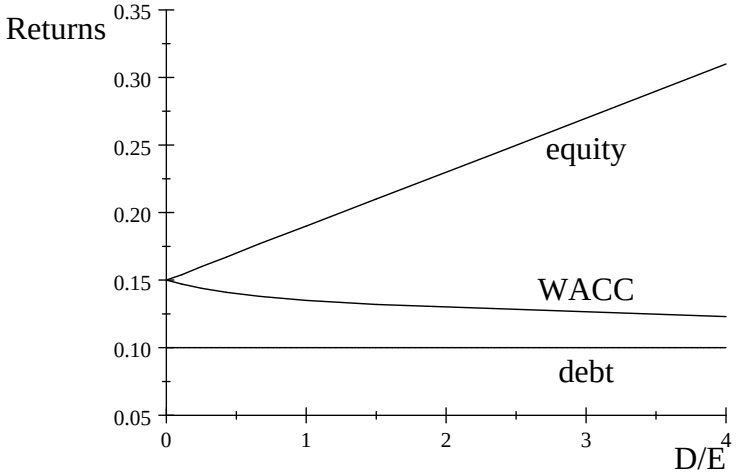
Rewriting for r_e we get *Modigliani-Miller Proposition 2 with taxes*:

$$r_e = r_a + (1 - \tau)(r_a - r_d) \frac{D}{E}$$

With taxes as only market imperfection:

- value of levered firm will increase with the debt-equity ratio
- WACC will decrease with the debt-equity ratio

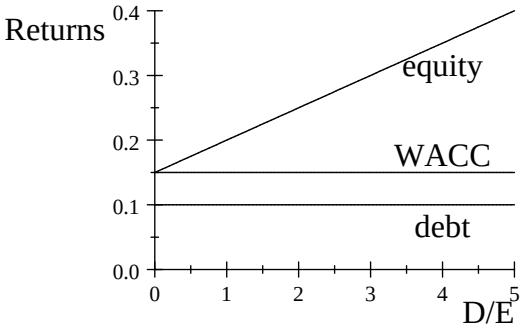
The 'optimal' solution is then 100% debt financing.
Graph depicts the decreasing WACC for the example we used.



Modigliani-Miller proposition 2 with taxes

Effect of default risk

- In MM analyses debt is free of default risk
- means r_d independent of D/E ratio:



MM analysis with risk free debt

Debt can only be risk free if:

- equity holders have unlimited liability
- and enough money to always pay debt,
  regardless how low cash flow is

Relaxing either assumption introduces *risk of default*

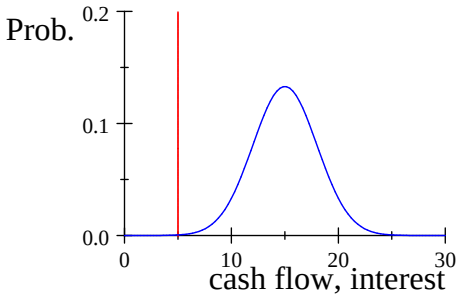
With limited liability:

- debt and interest can only be (re-)paid from firm's uncertain cash flow
- default risk is probability that

$$\text{cash flow} < \text{debt obligations}$$

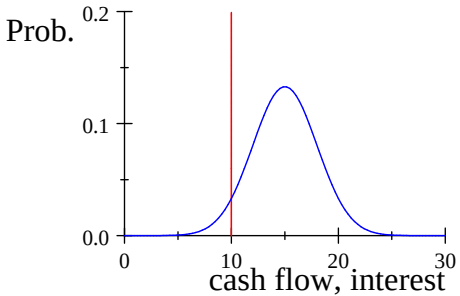
Default occurs if firm cannot pay its (interest) bills

If cash flow $\backsim N(\mu = 15, \sigma = 3)$ and interest is 5:



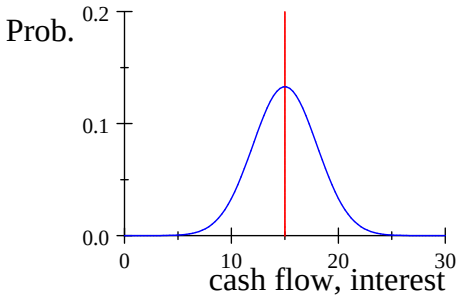
Prob (cash flow $<$ interest) = 0.5%

If cash flow $\backsim N(\mu = 15, \sigma = 3)$ and interest is 10:



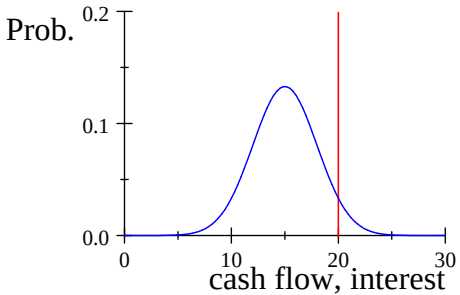
Prob (cash flow $<$ interest) = 4.8%

If cash flow $\backsim N(\mu = 15, \sigma = 3)$ and interest is 15:



Prob (cash flow $<$ interest) = 50%

If cash flow $\backsim N(\mu = 15, \sigma = 3)$ and interest is 20:



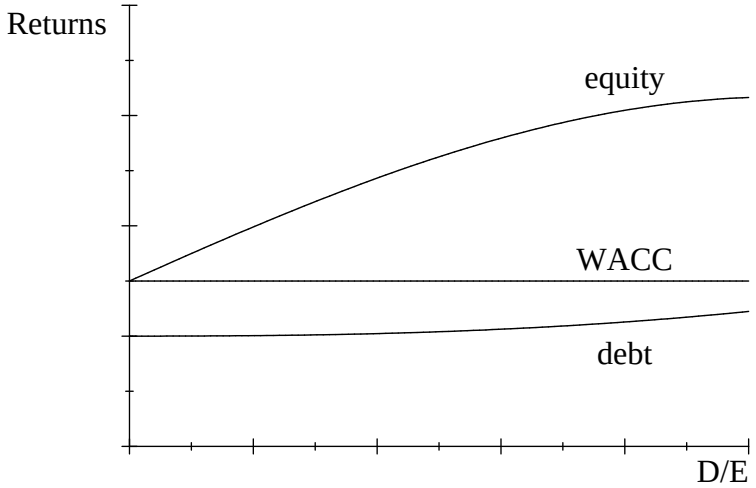
Prob (cash flow $<$ interest) = 95%

Default risk increases with D/E ratio:

- The larger debt, the larger the probability that cash flow is too small to (re-)pay debt and interest

Result:

- as debt increases, debtholders bear more of the business risk
- r_d goes up
- r_e goes down
- extreme: 100% debt $\Rightarrow$ debt has become equity



Returns and D/E ratios, limited liability, no taxes

The introduction of default risk alone does not change MM conclusions

- cash flow and debt payments become uncertain
- probability terms are introduced
- values become expected values
- but WACC still decreases with leverage
- value of firm still increases with leverage

For an optimal capital structure at $<$100% debt

- extra cost of debt financing is necessary
- such as *costs of financial distress*

gives, combined with taxes and default risk,
trade-off theory of optimal capital structure

Dimensions of securities

Capital structure analysis

Models of optimal capital structure

Dividends

Capital structure with taxes, default risk and costs of financial distress

In MM tax case:

- Taxes lower cost of capital
- firm value increases with debt
- optimal capital structure is 100% debt

Correct analysis given assumptions

However, debt brings not only tax advantage, also increased probability of *default* and *financial distress*

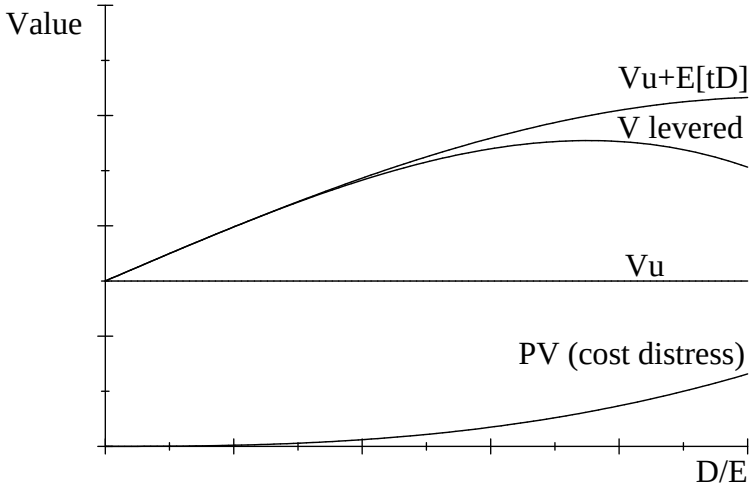
If firm cannot pay its bills

- costly emergency measures are necessary
- or even costly bankruptcy procedures
- collectively called *cost of financial distress:*
  - customers run away (durables!)
  - suppliers don't deliver or require cash payment
  - key personal leaves the company
  - investors require costly refinancing
  - expensive advisors have to be hired

- Incurring these costs becomes more likely as debt increases
- costs themselves may also increase with size of debt
- *expected distress costs* increase with leverage

Combined with tax advantage, this leads to
the *trade-off theory of capital structure*:

- debt will be increased as long as marginal expected tax advantage outweighs marginal expect costs of financial distress
- optimal capital structure reached when both are equal



Optimal capital structure

In the graph, the expected tax advantage decreases with leverage, even though the interest rate increases, as we have seen.
Reason is increasing probability of loss

- With increasing leverage, it becomes increasingly likely that the debt obligations are larger than the cash flow.
- If that is so, there is no profit, hence no tax, hence no tax advantage
- So with increasing leverage it becomes increasingly likely that the tax advantage will not be realised.

Importance of taxes and distress costs:

Relevance of trade-off theory was questioned from empirical point of view

- Importance of taxes questioned
- Initial estimates of direct bankruptcy costs very low, 2%-4%; makes expected bankruptcy costs negligible
- Later estimates much higher, 20% - 35%
- estimates of costs of financial (not economic) distress are 10%-20% of firm value
- Very nice illustration of distress costs appeared from Texaco's filing for bankruptcy after conflict with Pennzoil

After Texaco's filing for bankruptcy:

- Texaco's value fell $4.1 *billion* over entire conflict
  - this is stock market's estimate of costs of financial distress
- Pennzoil's value rose only $682 *million*
- total costs over 32% of pre-conflict value
- resolution of the conflict (avoiding bankruptcy) gave a $2.3 billion increase in value, 65% of losses recovered
- Texaco's legal fees, after tax, were $165 million, Pennzoil's fees in same order of magnitude
- rest are indirect bankruptcy costs

Indirect bankruptcy costs documented for Texaco as:

- difficulty in obtaining credit
- distraction of management attention
- suppliers demanded cash payment before performance or secured forms of payment
- suppliers halted or cancelled shipments of crude oil
- banks refused or limited Texaco's use of exchange rate future contracts (to hedge foreign currency risk)

Bankruptcy costs are related to:

- Nature and 'specificity' of assets:
  - general purpose (non-specific) assets lose little value in bankruptcy
    - (buildings, trucks, aeroplanes, securities!)
    - high default rate in shops, restaurants, etc.
  - specialized (specific) assets have limited or no value to other firms
    - expertise, results advertising campaign, growth opportunities
  - durables that need maintenance and service lose much of their value - and stop selling - with even the threat of bankruptcy
  - perishables and fashion sensitive goods decrease in value rapidly

Bankruptcy costs are also related to:

- Transparency of the firm:
  - complex legal constructions may obscure ownership relations
  - safe assets owned by holding comp., risky operations in working comp
- Size:
  - there are economies of scale even in going bankrupt

Pecking order theory

Models other market imperfections than trade-off theory:

- Asymmetric information:
  - managers know more about firms' prospects than outside investors
  - impossible or costly to reveal this information
- Conflicts of interest:
  - managers serve the interests of existing shareholders
  - use information to issue type of security that benefits existing shareholders:
    - debt when good news is coming up (equity underpriced)
    - equity when bad news is coming up (equity overpriced)

- This behaviour recognised and anticipated in market:
  - stock exchanged for debt (more stock) $\rightarrow$ stock price falls
  - debt exchanged for stock (less stock) $\rightarrow$ stock price rises
  - stock issued $\rightarrow$ stock price falls
  - stock repurchased $\rightarrow$ stock price rises
  - large debt issues do not lead to significantly lower stock prices
- Result: if new equity is issued, new stockholders require a discount
- Equivalent to old Groucho Marx joke:
  "I don't want to belong to any club that will accept me as a member."

Managers who need funds in this situation face the dilemma of:

- either issuing equity at a price they know is too low
- forgo positive NPV investment opportunities

Debt is in principle troubled with same problems, but to a much lesser extent:

- debt has a higher priority claim
- can be secured
- can have shorter maturities

Situation can be avoided by building up 'financial slack'

- cash or marketable securities
- or reserve borrowing power

Leads to a pecking order in financing alternatives:

1. internal equity
2. (external) debt (first short then long term)
3. external equity

Other implications of the pecking order theory:

- Firms adapt their long term payout ratios (dividends) to their investments and level out fluctuations in both through financial slack
- Means that there is no optimal or target debt ratio (as in the trade-off theory), depends on financing needs
- Debt ratios will depend negatively on cumulative profitability
- Financial slack is valuable

Does not mean that equity will never be issued

When firm reaches its debt capacity:

- borrowing possibilities exhausted
- expected bankruptcy costs become prohibitive

Then equity issue is no longer 'bad news'

Also the case for firms with e.g. intangible assets (R&D based firms)

Empirical evidence

Trade-off and pecking order theory share 2 predictions:

- leverage decreases with earnings volatility
- leverage decreases with growth potential

They predict opposite effects of profitability:

- trade-off: leverage increases with profitability
- pecking order: leverage decreases with profitability

Empirical tests

- regress leverage (book or market values)
- on proxy-variables representing determinants
  - depreciation (inverse tax advantage)
  - stock price volatility
  - profitability
  - fixed-to-total assets (tangibility, default costs)
  - market-to-book value (growth opportunities)
  - size (default risk and costs)

Test results Rajan and Zingales

	USA	Jap.	Ger.	France	Italy	UK
tangibility	+	+	+	+*	+	+
market/book	-	-	-	-	-	-
logsale	+	+	-	-*	+*	+*
profitability	-	-	+*	-*	-*	-
N	2207	313	176	126	98	544
R^2	.19		.14	.28	.12	.19

dependent variable: book debt/(bookdebt+market equity)
tangibility is fixed assets/total assets
* = not significantly $\neq 0$

Fama and French (2002) report similar results
Leverage is related:

- negatively to growth opportunities (market/book)
- positively to size
- negatively to profitability

Also find evidence of (slow) mean reversion

- consistent with target debt ratio from trade-off theory

Trade-off theory generally supported
except for profitability, strong point of pecking order theory

So, what projects are easy to finance?

Project that produce:

- stable (not volatile) cash flows
- soon, not far in future

and projects that use:

- general purpose (not specific) assets
- for which there is a good second hand market

These characteristics can be 'build into' a project

- start simple, using existing technology, build up market, cash flow
- introduce specialized technology gradually

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Dividends

part two of the exercise in market perfection

Dividends are paid is various forms:

- in cash as
  - ordinary (regular) dividend
  - or special (incidental) after e.g. sale of division
- as stock repurchases
- in stock (stock dividend)

Paying stock dividend is comparable to an 'event' we studied in market efficiency.
Do you know which?

- Stock splits are stock dividends on a large scale
  - e.g. 2 for 1, or 5 for 1
- dividends are a few percent

What does this say about the value of (stock)dividends?

- does not produce value
- divides value over more shares

- Dividends are announced before they are paid
- After announcement, stocks are traded:
  - 'cum dividend' until a preset date
  - 'ex dividend' after that
    - (time series of stock prices and indices should be corrected for that)
- Dividend payments are/can be limited by law and contractual obligations
- Dividends used to be paid against a 'coupon' (literally: piece cut off) attached to share.
  - 'Coupon cutter' still used as derogatory term for investors.

Value of dividends

Common opinion before Modigliani & Miller: dividends increase shareholder wealth, even under idealized assumptions
Conclusion from Modigliani & Miller (shocking at the time):

> *Both dividends and capital structure are irrelevant in a perfect capital market*

- Value is not affected by how you divide it:
  - dividends $\Leftrightarrow$ capital gains
  - debt $\Leftrightarrow$ equity

Now generally accepted as a correct analysis, not an accurate description of the actual situation.

Irrelevance based on arbitrage argumentation:

- In a perfect capital market, investors can undo or redo management's dividend and capital structure decisions free of charge
- so any price effects of dividends and capital structure would give arbitrage opportunities.
- Therefore, these decisions do not create value for the company, hence they are irrelevant.

Much of the confusion before M&M was due to an improper analysis, that mixed

- dividend
- investment
- and capital structure decisions

Balance sheet of a company before dividends are paid:

Before dividends:			
Cash	1000	Debt	5000
Other assets	9000	Equity (100 shares)	5000
total	10000	total	10000

If the firm uses its cash to pay a (cash) dividend the balance sheet becomes:

After dividends:			
Cash	0	Debt	5000
Other assets	9000	Equity (100 shares)	4000
total	9000	total	9000

So, in addition to the dividend payment, we have:

- Change in investment policy:
  - assets reduced with 1000 or 10%
- Change in financial policy:
  - debt/equity ratio goes from 1 to 1.25.

This makes it impossible to separate dividend, investment and financial policy.

What is the only way to single out the effect of dividends?

- If investment and financial policy are to be kept constant, dividends can only be financed by issuing shares.

If dividends are financed this way, the example becomes:

- after 1000 dividends are paid, equity is 4000, 100 shares at 40
- requires issue of 1000/40=25 new shares, new balance sheet becomes:

After dividends and refinancing:

Cash	1000	Debt	5000
Other assets	9000	Equity (125 shares)	5000
total	10000	total	10000

Result of these transactions:

- the old shares drop 10 in value
- loss is exactly offset by the cash dividend of 10 per share
- for every 'old' share of 50 investors now hold a share of 40 and 10 in cash.

If capital markets are perfect:

- Shareholders can obtain same effect without dividends by selling 20% of their shares
- Conversely, shareholders can undo the dividend decision by using the 1000 to buy the new shares:
  - they then hold 125 shares of 40 instead of 100 shares of 50.

In perfect capital markets all 'undo' and 'redo' decisions are free of charge:

- Investors can convert shares to cash and cash to shares independent of dividend policy
- No need to pay higher prices for dividend paying stocks
- Dividend policy has no effect on the value of the firm

Conclusion:
dividend policy is irrelevant

(in perfect capital markets)

Market imperfections can make dividend policy relevant (as was the case with capital structure):

- Taxes
  - different tax rates on dividend and capital gains
- Transaction costs:
  - paying dividends can be cheaper than selling shares
  - creates clientele effects (e.g. pensioners who need cash)
  - but not necessarily value if there is a large supply of dividend paying and non dividend paying stocks
  - changing policy forces investors to make costly adjustments in their portfolios $\rightarrow$ decreases value

- Information asymmetry/signalling:
  - may be ambiguous:
    - no dividends: need every penny $\Leftrightarrow$ have no penny
    - dividends: good results $\Leftrightarrow$ no investment opportunities
  - dividend *increase* generally considered a good signal (and hard to mimic in long run), *decrease* a bad signal
- Agency cost
  internal financing slips control of market.
- Is risk also a factor?
  dividend money is safe and capital gains money is risky

NO! true for all money, not just dividend money
(bird in the hand fallacy)

Stock repurchases are alternative form of paying dividends

- Increasingly popular: stock repurchases larger than cash dividends (1990's, USA)

Has to be analysed a bit differently:

- simultaneously issuing and retiring stock is nonsense
- have to assume disinvestment
- Means in example (same example as before):
  - cash is reduced with 1000
  - equity is reduced with 1000

Before dividends:

Cash	1000	Debt	5000
Other assets	9000	Equity (100 shares)	5000
total	10000	total	10000

Cash of 1000 used to pay dividends (changing investment and capital structure)

After dividends:

Cash	0	Debt	5000
Other assets	9000	Equity (100 shares)	4000
total	9000	total	9000

Collectively, the shareholders hold

- 100 shares at 40 = 4000
- plus 1000 in cash from dividends
- = 5000 as before.

What happens if we use the 1000 for stock repurchase?

- Cash is reduced with 1000
- to buy 20 shares at 50

After stock repurchase

Cash	0	Debt	5000
Other assets	9000	Equity (80 shares)	4000
total	9000	total	9000

Collectively, the shareholders now hold

- 80 shares at 50 = 4000
- plus 1000 in cash from repurchase
- = 5000 as before.

Only difference is that stock price remains the same.

Why would that be important?
We know stock splits have no effect in efficient markets, so the reverse has no effect either.

Value of some securities depends on stock price, not total value of equity. Prime example are the options that go into managements' stock option plans....

> *Firms announce repurchases when executives have large numbers of options outstanding and when employees have large numbers of options currently exercisable.*

Kathleen M. Kahle, When a buyback isn't a buyback: open market repurchases and employee options, Journal of Financial Economics,Volume 63, Issue 2, February 2002, Pages 235-261

The Economist

Buy now, while stocks last

America seems to be running out of shares … companies are now buying back as much as 2% of their outstanding equity every year. The answer might lie in …share options

Anything that uses shares as a denominator-such as earnings-per-share, or return on equity-will automatically rise, even if underlying profits are unchanged.

..stock options have created a huge incentive for firms' managers to borrow in order to buy back equity-which is not at all the same as looking after shareholders' long-term interests.

The Economist, 1999

Empirical analyses of dividends are troubled by spurious correlations, mainly because dividends are kept stable (are 'sticky')

- both very good and very bad prospects may reduce dividend rate (need every penny $\Leftrightarrow$ have no penny):
  - curved relation between dividend rate and performance
  - linear approximation may be in- or decreasing, depending on the locus on the curve
- earnings volatility and value:
  - if earnings vary strongly, (stable) dividend rate is low
  - if earnings vary strongly, their value is low
  - spurious conclusions: low dividend rate gives low value

- incidental earnings and price-earnings ratio
  - earnings double because of one time event
  - dividends kept stable $\rightarrow$ dividend rate drops
  - stock price goes up, but does not double (market sees one time event)
  - price-earnings ratio drops
  - spurious conclusion: lower dividend rate gives lower price-earnings ratio
  - reversed effect in case of an incidental drop in earnings (disaster, strike)