FIN 325 Corporate Finance

L6 (Theory): Tax Benefits of Debt under APV Method

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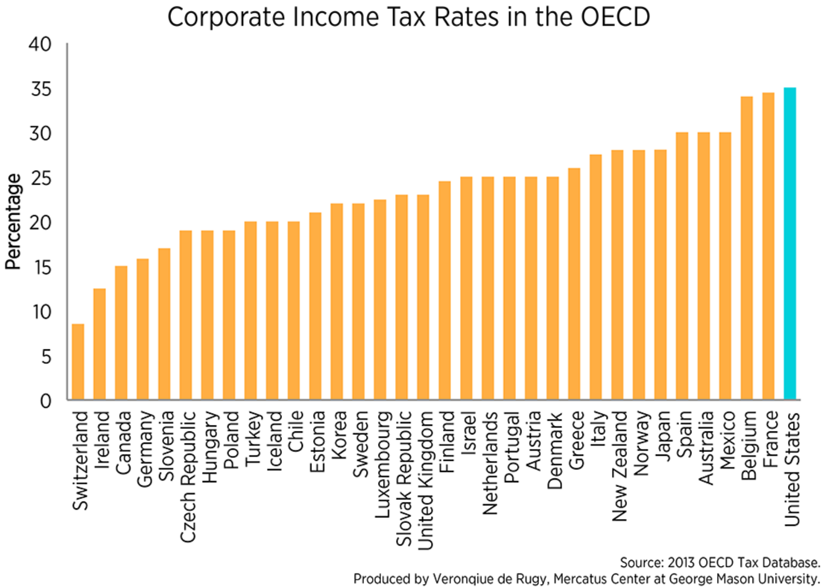
Motivation

- In L6 we saw that firm value was independent of capital structure under certain conditions.
- The traditional assumption to relax first is that there are **no taxes**.
- Perhaps the most obvious violation of the MM assumptions!

Corporate tax rates across the OECD



Tax deductibility of interest (1)

- Interest payments are tax deductible in the United States.
- Paid out of **before** tax earnings.
- Holding all else equal, a higher level of interest payments reduces the firm's taxable income.
- Debt financing has an **additional benefit** over equity financing along this channel.

Tax deductibility of interest (2)

- Consider two firms — Firm Unlevered and Firm Levered.
- Firm Unlevered is 100% equity while Firm Levered borrowed $1,000 worth of debt at 8% interest.
- Assume that capital expenditures, depreciation and the change in net working capital are zero.

	Firm Unlevered	**Firm Levered**
EBIT	500	500
Interest	0	80
Pretax income	500	420
Tax (35%)	175	147
Net income to shareholders	325	273
Total income to D and E	$325 + 0 = 325$	$273 + 80 = 353$
Tax shield from debt	0	28

- Total cash flow from Firm Levered is 28 higher — known as the **debt tax shield (DTS)**.

Tax deductibility of interest (3)

- Firm Unlevered is 100% equity while Firm Levered borrowed $D worth of debt at r_D% interest.

	Firm Unlevered	**Firm Levered**
EBIT	C	C
Interest	0	$r_D D$
Pretax income	C	$C - r_D D$
Tax (35%)	$\tau^C C$	$\tau^C (C - r_D D)$
Net income to shareholders	$(1 - \tau^C) C$	$(1 - \tau^C)(C - r_D D)$
Total income to D and E	$(1 - \tau^C) C$	$(1 - \tau^C) C + \tau^C r_D D$
Tax shield from debt	0	$\tau^C r_D D$

- Value from having debt of D at interest rate of r_D is $\tau^C r_D D$.

Valuation of tax shields

- If a firm takes-out some debt worth D at an interest rate of r_D for T periods

$$PV(DTS) = \sum_{t=1}^{T} \frac{\tau^C r_D D}{(1 + r^*)^t}. \quad (1)$$

- If the debt is assumed to be held in perpetuity, then

$$PV(DTS) = \frac{\tau^C r_D D}{r^*}. \quad (2)$$

- What discount rate should we use for r^* in (1) and (2)?

Discount rate for tax shields

- What discount rate should we use for r^* in the tax shields formula?
- The rate should reflect the riskiness of the tax shield payments.

  (1) r_D: reflects the risk of the debt that generates the tax shields.

  (2) r_A: reflects the risk of the corporate profits, which we need to generate tax shields.

  (3) r_E: gives a conservative estimate of the risk.

- When we set $r^* = r_D$ then the formula for (2) simplifies

$$PV(DTS) = \tau^C D$$

Adjusted present value method (APV) (1)

- A method for evaluating firms and projects.
- Say that a project is to be financed using debt **and** equity.
- APV method looks at a **counterfactual** where the project is 100% equity-financed then adds-in the tax benefits of debt.
- Explicitly separates the project's cash flows that are associated with **real** operations and **financing**.

Adjusted present value method (APV) (2)

- Refer back to slide (6) with Firm Unlevered and Firm Levered.
- Let's assume that their cash flows are perpetual.
  - I.e. each firm has project cash flows of C each period while Firm Levered has debt of D maintained in perpetuity.
- Denote the value of Firm Unlevered and Firm Levered by V_U and V_L respectively.

$$V_U = PV[(1 - \tau^C)C]$$
$$V_L = PV[(1 - \tau^C)C + \tau^C r_D D],$$

which can be combined to get

$$V_L = V_U + PV(DTS), \tag{3}$$

which is known as the **APV formula**.

- We'll make some more adjustments to equation (3) in future lectures.

Some notes on APV

- When calculating the APV of a new project, always use the **incremental** debt.
- τ^C is the **marginal** tax rate; not the average.
  - Need to look at the tax that you'll be charged on **marginal** debt.
- When we have positive taxes, we can create value by purely changing firm's capital structure, (see example later).

Personal taxes (1)

- Investors in the firm need to pay additional taxes, (e.g. capital gains and dividends).
- The cash flow to individual investors **net of all taxes** is what's important.

	C-Corporation		Individual		
Time Period	Ordinary Income (τ_c)	Capital Gains ($\tau_{c,cg}$)	Ordinary Income (τ_p)	Dividends ($\tau_{p,div}$)	Capital Gains ($\tau_{p,cg}$)
Pre-1981	46.0%	28.0%	70.0%	70.0%	28.0%
1982-1986	46.0%	20.0%	50.0%	50.0%	20.0%
1987	40.0%	28.0%	39.0%	39.0%	28.0%
1988-1990	34.0%	34.0%	28.0%	28.0%	28.0%
1991-1992	34.0%	34.0%	31.0%	31.0%	28.0%
1993-1996	35.0%	35.0%	39.6%	39.6%	28.0%
1997-2000	35.0%	35.0%	39.6%	39.6%	20.0%
2001-2002	35.0%	35.0%	38.6%	38.6%	20.0%
2003-	35.0%	35.0%	35.0%	15.0%	15.0%

Source: Scholes et al. (2005), Taxes and Business Strategy (3rd ed), Table 1.1, p. 12

Personal taxes (2)

- Denote τ^i the personal tax rate paid on **interest/ordinary income**.
- Denote τ^e the personal tax rate on **dividends**.

	Flow to debtholders	**Flow to equityholders**
Amount to distribute	1	1
Corporate taxes	0	τ^C
Income after corporate tax	1	$1-\tau^C$
Personal taxes	τ^i	$(1-\tau^C)(1-\tau^e)$
Investor flow after tax	$(1-\tau^i)$	$(1-\tau^C)(1-\tau^e)$

- See that there is no corporate tax liability for interest paid to debtholders.
- Tax benefit to debt if $(1-\tau^i) > (1-\tau^C)(1-\tau^e)$.
  - Has been the case historically.

Personal taxes (3)

- When debt is held in **perpetuity** then

$$PV(DTS) = D\tau^*$$
$$\tau^* = \frac{(1-\tau^i) - (1-\tau^C)(1-\tau^e)}{1-\tau^i},$$

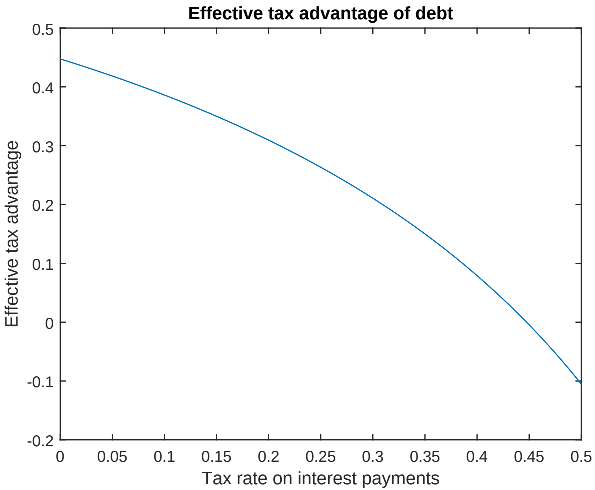
  which is expressed as a **percentage**. Derivation from Miller (1977).

- When τ^i is high, the tax advantage of debt is smaller.

- When $\tau^e = \tau^i$ then $PV(DTS) = \tau^C D$ as before.

Personal taxes (4)

- How does τ^* vary with τ^i?
- Fix $\tau^C = 0.35$ and $\tau^e = 0.15$ and vary τ^i from 0 to 0.5 (below).



What about negative earnings before tax (EBT)?

- EBT defined as EBIT less interest expenses.
- If this measure is negative, then things get complicated...
- Need to take account of carryforwards and carrybacks for the operating losses.
  - Do we deduct the losses against previous or future losses?
- We won't worry about this case in the course.

Example 1: leveraged recapitalisation

- Firm Pure has 1b shares outstanding, which are trading at \$640 per share.
- The firm is currently 100% equity.
- Assume that $\tau^C = 0.35$ and $r_D = 0.03$ while all personal tax rates are zero.
- Say that the firm issues \$100b in perpetual debt and uses the proceeds to **repurchase shares**.
  - **(a)** What happens to the share price? What is the value of the debt tax shield?
  - **(b)** What is the firm's value after the recap?
  - **(c)** How many shares are repurchased and at what price?
  - **(d)** Who gains and loses from the recap?
  - **(e)** What happens to the price at announcement?

Example 1 solution (1)

- The firm was originally 100% equity so $V_U = \$640 \times 1b = \$640b$.

- With the new debt, we can use APV to get

$$\begin{aligned} V_L &= V_U + PV(DTS) \\ &= \$640b + \$100(0.35)b \\ &= \$675b \end{aligned}$$

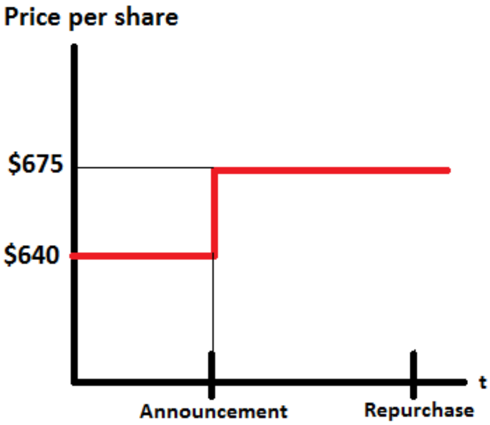
where I just assumed that the debt was perpetual and r_D was the appropriate discount rate.

- Use the two equations and two unknowns approach to find the new share price and the number of shares repurchased.

$$\begin{aligned} S \times P_{new} &= \$100b \\ P_{new} &= \frac{\$675b - \$100b}{1b - S} \end{aligned}$$

which can be solved to get $P_{new} = \$675$ and $S = \frac{100}{675}b$.

Example 1 solution (2)



- Price response at time of announcement due to forward-looking investors.
- Assumes that the announcement comes as a surprise to the investors!

Example 1 [part 2]

- Now assume that there are personal tax rates of $\tau^e = 0.15$ and $\tau^i = 0.35$. Repeat the previous exercise!

- Give an intuition for the different price that the shares rise to on announcement relative to part 1.

Example 1 [part 2] solution (1)

- The effective tax benefit of debt is given by

$$\begin{aligned}\tau^* &= 1 - \frac{(1-\tau^C)(1-\tau^e)}{1-\tau^i} \\ &= 0.15\end{aligned}$$

- Then the present value of the DTS is $PV(DTS) = \$15b$.

- $V_L = \$640b + \$15b = \$655b$.

$$\begin{aligned}SP_{new} &= \$100b \\ P_{new} &= \frac{655-100}{1-S}\end{aligned}$$

which can be solved for $S = \frac{100}{655}$ and $P_{new} = \$655$.

- The price rise is now **smaller** given that there is less of a tax benefit of debt due to $\tau^i > 0$.

Takeaways

- Introduce taxes into our capital structure model: debt has an advantage over equity.
- APV method says that $V_L = V_U + PV(DTS)$.
- But then the firm should logically **max-out** on debt relative to equity! Take out 99.9999...% debt!
- Why don't firms do this in reality?....Hold your breath until a couple of lectures time!