Chapter 11: Capital Structure

A firm's basic recourse is the stream of cash flows produced by its assets. When the firm is financed entirely by common stock, all those cash flows belong to the stockholders. When it issues both debt and equity securities, it splits the cash flows into two streams, a relatively safe stream that goes to the debt holders and a riskier stream that goes to the stockholders. The firm's mix of debt and equity financing is called **capital structure**. Actually, a firm will choose the capital structure that maximizes the overall market value of the firm.

We begin this chapter by presenting the Modigliani-Miller's (MM) proposition 1 about the optimal capital structure. It states that financing decisions don't matter in perfect capital markets, thus the firm cannot change the total value of its security just by splitting its cash flows into different streams. The firm's value is determined by its real assets, not by the securities it issues. MM proposition 1 allows complete separation of investment and financing decisions. It implies that any firm can evaluate the project without worrying about where the money for capital expenditures comes from. In other words, we can assume all-equity financing. If MM proposition 1 is right, that is exactly the right approach. If the firm is uses a mix of debt and equity financing, its overall cost of capital will be exactly the same as its cost of equity with all-equity financing. However, the majority of financial managers would agree that debt policy does matter, and thus the MM proposition 1 needs some generalizations.

In the remaining of the chapter we undertake these generalizations incorporating in the model things that we left out. The first that we ignore was taxes. We also ignored that bankruptcy (or the probability of it) has a cost. We didn't take into account potential conflict of interest between the firm's security holders. We did not consider the information problems that favor debt over equity when cash must be raised from new security issues. We finally ignored the incentive effects of financial leverage on management's investment and payout decisions.

When we put all things back to the initial MM model we will conclude that indeed capital structure policy matters.

11.1. The Modigliani-Miller model

First, note that the value of the firm is equal to the sum of the value of the assets of the firm. The firm finances its projects by issuing securities (stocks and bonds). The holders of these securities have specific claims on the cash flows of these projects. Thus, the value of the firm should be equal to the sum of the value of the firm's securities.

The two basic securities issued by a company are common stocks and bonds. Thus if the firm has issued 1,000 stocks with current price \$50 then the value of the stocks is E = $1,000 \times 50 = \$50,000$. Also, if the firm has borrowed \$25,000 by issuing bonds the value of debt is D = \$25,000. The value of the firm is V = E + D = \$50,000 + \$25,000 = \$75,000. Thus 2/3 of the firm's value is due to stocks and 1/3 is due to debt. This defines the **capital structure** of the firm. We also refer to this 2/3 as the **(market) equity ratio** and the 1/3 as the **(market) debt ratio.**

A financial manager would like to know the *optimal* capital structure, i.e., the capital structure that maximizes the firm's value with respect to the firm's assets and projects. This poses the problem of finding the optimal combination of equity and debt which maximizes the firm's assets assuming that the future cash flows remains the same.

11.1.1. The model

Modigliani and Miller (1958)[1] make the following (implicitly or explicitly) assumptions for the economy:

1. Capital markets are frictionless (there are no transaction costs)
2. Individuals can borrow and lend at the risk-free rate
3. There are no costs to bankruptcy or to financial distress
4. Firms issued two types of securities: risk-free debt and equity
5. There are no taxes
6. Corporate insiders and outsiders have the same information
7. Managers always maximize shareholders' wealth
8. Operating cash flows are completely unaffected by changes in capital structure

Many of these assumptions are unrealistic but by relaxing them later we can understand how they may affect the firm's capital structure. For example, by relaxing the assumption that debt is risk-free will not change the main conclusion of the model. On the other hand, assumptions 3 and 5 are critical because they change the implications of the model. Assumptions 6 and 7 rule out asymmetric information and agency costs, respectively. Finally assumption 8 separates investment from financing decisions. When this is not the case, as we will see later, then these two decisions should be thought of as codeterminant.

Suppose there is a firm U which finances the projects only by equity capital, i.e., $V_U = E_U$. Also suppose that there is another firm, denoted as firm L, which has identical projects with firm U thus it produces the same future cash flows. Firm L finances its projects using both debt and equity thus the firm L's value is equal to $V_L = E_L + D_L$.
Consider an investor which buys 1% of firm U. His/her investment has a value equal to $0.01\times E_U = 0.01\times V_U$. This investor expects as future cash inflows $0.01\times TP$, where TP are the total profits of the firm in the future.
An alternative investment strategy is to buy 1% of firm L's value. In that case he/she should buy 1% of the firm's stocks and 1% of the firm's bonds. The total value of this position is $0.01\times E_L + 0.01\times D_L = 0.01\times V_L$. As stockholder he/she will obtain a future cash inflow equal to $0.01\times(TP - I)$, where I is the interest payments of the firm's debt. As debtholder he/she will obtain $0.01\times I$. Thus the total future cash inflows would be $0.01\times(TP - I) + 0.01\times I = 0.01\times TP$.
The two strategies generate the same future cash flows, thus in perfect capital markets they should have the same cost, which implies that:

[1] Modigliani, F., and M. H. Miller, 1958, The cost of capital, corporation finance and the theory of investment", American Economic Review 48, 261-297.

$$0.01\times V_U = 0.01\times V_L \Rightarrow V_U = V_L$$

Thus in perfect capital markets the financing decision does not matter. If V_U is the value of an **unlevered** firm (i.e. an all-equity financing firm) and V_L is the value of a **levered** firm (i.e. a firm that is partly financed by equity and debt) then:

$$\boxed{V_U = V_L}$$

This is **Modigliani-Miller proposition 1**, implying that *the value of the firm is independent of its capital structure*. The firm's value is determined by its real assets, not by the securities it issues. In other words, it is determined on the left-hand-side of the balance sheet by real assets – not by the proportion of debt and equity securities issued to buy the assets. This implies that capital structure does not matter for firm value maximization. Thus, the only thing that a financial manager should care about is to find projects with the maximum possible NPV.

11.1.2. Financial risk and expected returns

In Chapter 10 we defined the company cost of capital as "the expected return on a portfolio consisting of all the company's existing securities". That portfolio usually includes debt as well as equity. Thus the company cost of capital is estimated as a blend of the cost of debt (bonds yield) and the cost of equity (the expected return demanded by investors in the firm's stock). Since the company cost of capital is the average of the cost of debt and the cost of equity it is also called the **weighed-average cost of capital (WACC)**. Therefore,

$$\boxed{\text{WACC} = \frac{D}{V}r_D + \frac{E}{V}r_E} \qquad (1)$$

We denote D the market value of the debt, E the market value of equity and V the firm's value, where V = D + E.
For example if the value of the firm is V = \$100,000 and D = \$30,000 is the value of the debt with expected return 7.5% and E = \$70,000 is the value of the equity with expected return 15% then,

$$\text{WACC} = \frac{30,000}{100,000}7.5\% + \frac{70,000}{100,000}15\% = 12.75\% .$$

MM proposition 1 implies that a change in capital structure will not affect the value of the firm as well as the cash flows. *This means that the WACC should be independent of the capital structure of the firm.*
If we solve equation (1) for r_E we obtain:

$$\boxed{r_E = \text{WACC} + (\text{WACC} - r_D)\frac{D}{E}} \qquad (2)$$

Equation (2) is Modigliani-Miller proposition 2 which implies that *the expected rate of return of the common stock of a levered firm increases in proportion to the debt-equity ratio D/E*. Not that when D = 0, r_E = WACC. The increase of the expected rate of return of the stock with respect to the debt-equity ratio imply that a change in the capital structure do affect the risk of the stock. When the company issues new debt (this is also called **financial leverage**) the shareholder's dividends are more severely affected by a decrease on the company's operating income, thus the risk increases. Thus shareholders demand a correspondingly higher return because of this *financial risk*.
An investor bears only the systematic risk of the stock, measured by the beta β_E. Therefore, *when the debt-equity ratio increases the stock beta also increases*. We can prove that:

$$\boxed{\beta_E = \beta_{WACC} + (\beta_{WACC} - \beta_D)\frac{D}{E}} \quad (3)$$

where β_D is the debt beta and β_{WACC} the beta of the portfolio that contains all the securities issued by the firm. Since the WACC is independent of the firm's capital structure its beta is also independent. Note that when D = 0, $\beta_E = \beta_{WACC}$.
The following figure sums up the implications of Modigliani-Miller proposition for the cost of debt and equity and the WACC. The figure presents two cases. In the first case the firm's bonds are risk-free, thus r_D is independent of D/E and r_E increases linearly with D/E (see the black dashed and dot dashed lines). In the second case the firm's bonds are risky. As the firm borrows more, the risk of default increases and the firm is required to pay higher rates of interest. Proposition 2 predicts that when this occurs the rate of increase in r_E slows down. The more debt the firm has, the less sensitive r_E is to further borrowing. Essentially because holders of risky debt bear some of the firm's business risk. As the firm borrows more, more of that risk is transferred from stockholders to bondholders.

Example: Assume that an all-equity financed firm has issued 1,000 stocks at \$10 each. The value of this firm is $V = 1,000 \times 10 = \$10,000$. Assume that the company produces an annual operating income of \$1,500 in perpetuity which is paid as dividends to the stockholders. The expected earnings and dividends per share are \$1.50.
The expected rate of return of the firm's stock is:

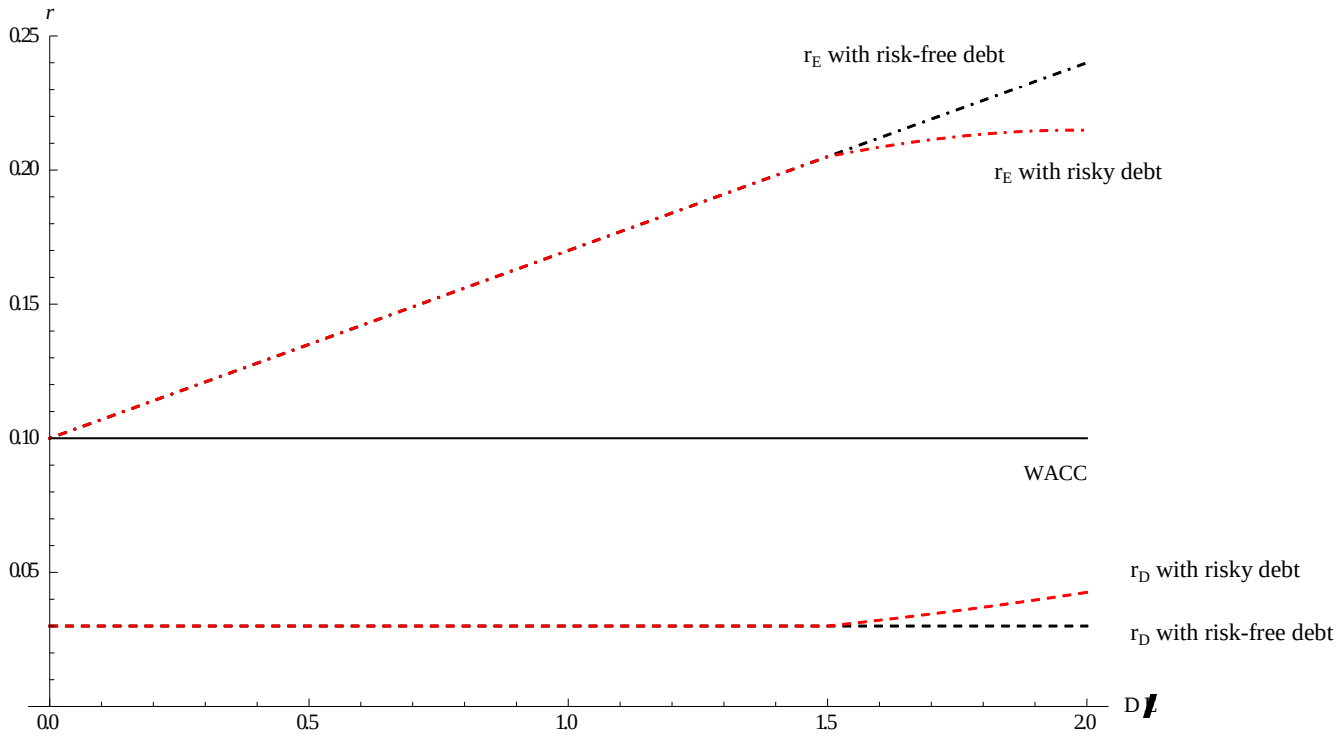
$$r_E = \frac{D_1}{P_0} = \frac{1.50}{10} = 15\%$$

This is also the WACC of the firm.
Assume that the company issues a \$5,000 debt with interest r_D = 10% and use the proceeds to repurchase 500 stocks.
The annual coupon paid by the firm to debt holders would be:

$$5,000 = \frac{C}{0.10} \Rightarrow C = \$500$$

Following MM proposition 1 the value of the firm would not change. This implies that:

$$10,000 = 5,000 + 500 \times P_0 \Rightarrow P_0 = \$10$$



Thus the stock price does not change. This means that in perfect capital markets the firm will not allow investors to do anything that they could not do already, and so it will not increase value.

The annual operating income remains at \$1,500, but with this amount the firm must also pay the interests. Therefore, the annual income distributed to stockholders is now \$1,500 - \$500 = \$1,000. The dividend paid to each stockholder is thus,

$$D_1 = \frac{1,000}{500} = \$2$$

Therefore, the expected return of the stock is:

$$r_E = \frac{D_1}{P_0} = \frac{2}{10} = 20\%$$

The WACC under the new capital structure is:

$$WACC = \frac{D}{V} r_D + \frac{E}{V} r_E = 0.5 \times 0.10 + 0.5 \times 0.20 = 15\%$$

We observe that the WACC remains unchanged with respect to the capital structure of the firm.

By taking into consideration that the WACC is the same we can calculate the expected return of the stock using MM proposition 2:

$$r_E = WACC + (WACC - r_D)\frac{D}{E} = 0.15 + (0.15 - 0.10)\frac{5,000}{5,000} = 20\%$$

We observe that the increase in leverage has increased the expected return of the stock from 15% to 20%.

To better assess the implications of MM proposition 2, that is, the risk of the stock increases with respect to the debt-equity ratio let assume that the operating income drops from \$1,500 to \$500. For the all-equity financed case the return is equal to:

$$r_E = \frac{D_1}{P_0} = \frac{0.5}{10} = 5\%$$

reducing the return on the shares by 10%.
If the firm issues a debt with a fixed interest payment of \$500 a year, then the decline of \$1,000 in the operating income reduces the return on the shares by 20%. In other words, the effect on leverage is to increase the standard deviation of the return.
Assume that the debt is risk-free, thus the risk-free rate is equal to 10% and that the expected rate of return of the market portfolio is 18%. Then the unlevered beta (the beta when the firm was all-equity financed) is equal to:

$$r_E = r_f + \beta_U (r_m - r_f) \Rightarrow \beta_U = \frac{r_E - r_f}{r_m - r_f} = \frac{0.15 - 0.1}{0.18 - 0.1} = 0.625$$

This is also the β_{WACC}.
Equation (3) implies that:

$$\beta_E = \beta_{WACC} + (\beta_{WACC} - \beta_D)\frac{D}{E} = 0.625 + (0.625 - 0)\frac{5,000}{5,000} = 1.25$$

Thus with the new capital structure the beta of the firm's share is doubled. This is something to expect because the effect of leverage doubled the amplitude of the return.

11.2. The value of the firm given corporate taxes

The previous section argued that debt policy is irrelevant. This implies that actual debt ratios should vary randomly from firm to firm and industry to industry. Yet almost all airlines, utilities, banks and real estate development companies rely heavily on debt. And so do many firms in capital-intensive industries like steel, aluminum, chemicals, petroleum and mining. On the other hand, it is rare to find a pharmaceutical company or advertising agency that is not predominantly equity-financed. The explanation of these patterns lies partly in the things we left out of the last section. We mostly ignored taxes. However, we will not throw away the MM theory developed in the previous section. We are shooting for a theory combining MM's insights plus the effects of taxes, investigating how well-functioning capital markets respond to them.

The following table shows a simple income statement for firm U, which has no debt, and firm L, which has borrowed \$1,000 at 8%. The tax bill of L is \$28 less than that of U. This is the *tax shield* provided by the debt of L. In effect the government pays 35% of the interest expense of L. The total income that L can pay out to its bondholders and stockholders increases by that amount.

Income statement		
	Firm U	Firm L
EBIT	\$1,000	\$1,000
Interests	0	80
Pretax Income	1,000	920
Tax at 35%	350	322
Net income	650	598
Total income to bondholders and stockholders	0 + 650 = 650	80 + 598 = 678
Interest tax shield (Interest × 0.35)	0	28

Tax shields can be valuable assets. Suppose that the debt of L is fixed and permanent. Then L can look forward to a permanent stream of \$28 per year. The risk of these flows is likely to be less than the risk of the operating assets of L. The tax shields depend only on the corporate tax rate and on the ability of L to earn enough to cover interest payments. The corporate tax rate has been pretty stable. And the ability of L to earn its interest payments can be associated to the risk of the debt. Thus a common assumption is that the risk of the tax shields is the same as that of the interest payments generating them. This implies that the firm holds a fixed amount of debt in perpetuity. Thus we discount at 8% and the PV of the tax shield is equal to:

$$\text{PV(tax shield)} = \frac{28}{0.08} = \$350$$

Under these assumptions, the PV of the tax shield is independent of the return on the debt $r_D = 8\%$ since,

$$\text{PV(tax shield)} = \frac{\tau_c \left(r_D D\right)}{r_D} = \tau_c D$$

Now we want to calculate the value of the firm L and U, assuming that the previous cash flows are perpetuities.

The value of U, denoted as V_U, is:

$$V_U = \frac{\text{EBIT}(1-\tau_c)}{r}$$

where r is an appropriate discount rate for the all-equity financed firm U.

The value of L, denoted as V_L, is the sum of the values of stockholders and bondholders. The cash flow paid to them each year are: $(\text{EBIT} - r_D D)(1 - \tau_c)$ for the stockholders and $r_D D$ for the bondholders. Thus the total income to stockholders and bondholders is:

$$(\text{EBIT} - r_D D)(1 - \tau_c) + r_D D = \text{EBIT}(1 - \tau_c) + \tau_c\, r_D D$$

The first part of the stream is exactly the same as the cash flows for the unlevered firm U, with exactly the same risk. Therefore, we can discount it at the appropriate rate r. The second part of the stream is the tax shield which, as argued before, can be discounted at the bond rate of return r_D. Consequently, the value of the levered firm is the sum of the discounted value of the two types of cash flow that it provides:

$$V_L = \frac{EBIT(1-\tau_c)}{r} + \tau_c D$$

or

$$\boxed{V_L = V_U + PV(\text{tax shield})} \quad (4)$$

The value of the levered firm L is equal to the value of the unlevered firm U plus the PV of the tax shield provided by the debt. So, as the value of debt increases so does the value of the firm. This indicates that more debt in the capital structure will cause firm value to increase, as the firm takes into advantage the interest tax shield.

Example: The financial manager of a company has proposed that the company should sell equity and buy back debt in order to maximize value. The company currently position is $1,000 debt and $500 equity. The number of shares outstanding is 10. If 10 new shares are issued at $50 each, $500 is collected and used to retire $500 debt (which pays a coupon rate of 8% equal to the risk-free rate). The net operating income is $100 and the tax rate is 50%. Find the value of the firm and the per share price after the restructure. Discuss the above proposal.

Solution: The market value before restructuring is $1,500.
Therefore equation (4) implies that:

$$1,500 = \frac{100(1-0.5)}{r} + 0.5 \times 1,000 \Rightarrow r = 5\%$$

This is the discount rate when the firm is all-equity financed. Using this fact we can determine the value of the firm after restructuring. Again equation (4) implies:

$$V = \frac{100(1-0.5)}{0.05} + 0.5 \times 500 = \$1,250$$

The price per share is:

$$P = \frac{E}{n} = \frac{V-D}{n} = \frac{1,250-500}{20} = \$37.5$$

This proposal is not in the interest of shareholders. Both the firm's value and the price of the stock decrease.

Other things being equal the benefits of debt are much greater when the tax rates are higher. Consequently, four predictions related to taxes can be made about differences in debt ratios across companies and across time.

1. The debt ratios of firm with higher tax rates should be higher than the debt ratios of comparable firms with lower tax rates.
2. Firms that have substantial non-debt tax shields, such as depreciation, should be less likely to use debt than firms that do not have these tax shields.
3. If tax rates increase over time, we would expect debt ratios to go up over time as well, reflecting the higher tax benefits of debt.
4. We would expect debt ratios in countries where debt has a much larger tax benefit to be higher than debt ratios in countries where debt has a lower tax benefit.

The goal of a financial manager is to maximize the value if its firm. Equation (4) implies that firm value and stockholder's wealth continue to go up as D increases. All firms should be 100% debt-financed. This is not reasonable given that no firm follows this capital structure policy. Thus something is missing from the model. The first that we have not taken into account is personal taxes that both shareholders and bondholders pay. The second is that firms that borrow incur other costs, for example bankruptcy costs or other financial distress costs.

11.3. The value of the firm given corporate and personal taxes

When we consider personal taxes also equation (4) is generalized to:

$$\boxed{V_L = V_U + \left[1 - \frac{(1-\tau_c)(1-\tau_{pS})}{(1-\tau_{pB})}\right] D} \quad (5)$$

where τ_{pS} is the personal tax rate for stockholders and τ_{pB} the personal tax rate for bondholders. Consequently, with the introduction of personal taxes, the gain from leverage (the present value of interest tax shields) is the second term of equation (5):

$$\text{PV(tax shield)} = \left[1 - \frac{(1-\tau_c)(1-\tau_{pS})}{(1-\tau_{pB})}\right] D$$

We can define the *relative tax advantage of debt over equity* as:

$$\frac{(1-\tau_{pB})}{(1-\tau_c)(1-\tau_{pS})}$$

We can easily demonstrate that if the relative tax advantage of debt over equity is larger than 1 then the increase on debt also increases the value of the firm. If the opposite is true, then the increase of debt decreases the value of the firm.

Assume, for example, that the tax rate on debt is higher than the tax rate on equity. For example, $\tau_{pB} = 60\%$, $\tau_{pS} = 28\%$ and $\tau_c = 35\%$. Then, the relative tax advantage is equal to

$$\frac{1-0.6}{(1-0.28)(1-0.35)} = 0.85$$

This is lower than 1. In that case it is not optimal to increase your debt ratio as the value of the firm would decrease. Intuitively, this happens because for \$1 of operating income bondholder receives $1 - 0.6 = 0.4$, whereas stockholder receives $(1 - 0.28)(1 - 0.35) = 0.468$. Therefore, it would be better for the firm to issue equity rather than debt.

With this expanded equation several scenarios are possible.

1. When $\tau_{pS} = \tau_{pB} = 0$, equation (5) is similar to equation (4), the earliest result.

2. When $\tau_{pS} = \tau_{pB}$, then equation (5) is again similar to (4) and we have the earliest results. In that case the relative tax advantage of debt is $1/(1 - \tau_c)$.
3. Assume finally that the three tax rates satisfy the following equation:

$$\left(1-\tau_{pB}\right)=\left(1-\tau_{c}\right)\left(1-\tau_{pS}\right)$$

In that case the relative tax advantage is exactly 1, and equation (5) yields that $V_L = V_U$, i.e., we are back to MM proposition 1, indicating the capital structure is irrelevant.

Formula (5) is an extension of MM proposition 1 allowing for corporate and personal taxes. However, before using it we need to think about the personal tax rates. In reality as personal tax rates are progressive we don't have *one* personal tax rate but different personal tax brackets. For example, equity investors of a corporation could include tax-exempt pension funds (for which $\tau_{pS} = 0$) as well as millionaires. The same holds for the personal tax rate on debt. This is zero for tax-exempt institutions but most retail investors will be taxed for their income on interest. In that case taxpaying investors may be more reluctant to hold debt and they will prepared to do so only if they are compensated by a high rate of interest. This is particularly true for investors in the top tax brackets. They will prefer to hold stocks or tax-exempt municipal bonds.
To determine the relative tax advantage of debt we need to know the *personal marginal tax rates* (i.e., the tax rates individuals would pay for an additional dollar of income) of the *marginal investor* (i.e., the representative investor who trade and set market prices).
However, we can still reach some conclusions about the practical implications of the model. Most people would agree that the corporate tax rate and the personal tax rate on interest would be close to each other and the (effective) personal tax rate of equity income is small. In that case the relative tax advantage of debt is marginally higher than 1 and the benefit of debt on firm's value is very low. To give an illustration assume that τ_{pB} = 35%, τ_{pS} = 12% and τ_c = 32%. Then the relative tax advantage is equal to 1.086 and $\text{PV}(\text{tax shield}) = 0.079 \times \text{D}$. So, for \$1 increase on debt, the value of the firm would increase by 7.9 cents. The previous discussion indicates that the combined effects of personal and corporate taxes (and especially the low personal tax on equity income) may limit the tax advantages of debt.

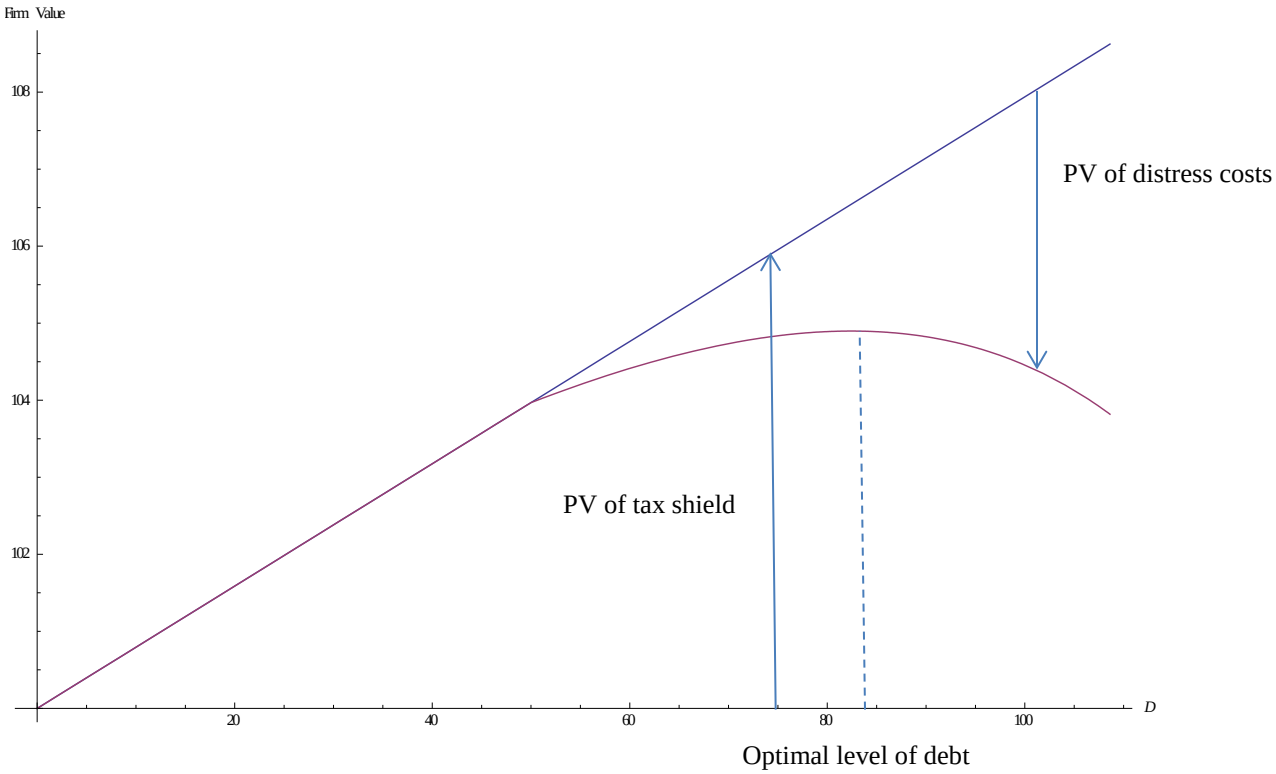
11.4. The costs of financial distress

Even if the benefit of an increasing debt ratio may be small when we consider both corporate and personal taxes we can still conclude that equation (5) indicates that the optimal financing policy is to be 100% debt-financed. Again, no financial manager would agree with that. The reason is very simple. As debt ratio increases (all others being equal), the probability that the firm will be financially distressed also increase. Financial distress occurs when promises to creditors are broken or honored with difficulty. Sometimes financial distress leads to bankruptcy. Sometimes it only means to be threatened by this event.

As we will see, financial distress is costly. When investors worry about the possibility that a firm will fall into financial distress the firm's market value starts to decrease. Given that, we can extend model (5) to:

$$\boxed{V_L = V_U + PV(\text{tax shield}) - PV(\text{costs of financial distress})} \quad (6)$$

The PV of the financial distress costs depend on the probability of distress and the magnitude of the costs encountered if distress actually occur.
Formula (6) indicates that there is a trade-off between the PV of interest tax shields and the PV of financial distress costs. This trade-off can determine an optimal capital structure. The following figure shows the implications of this formula. At moderate debt levels the probability of financial distress is trivial, and so the PV of interest tax shields dominates that of financial distress costs. But at some point the probability of financial distress increases rapidly with additional borrowing and the PV of the costs of distress start to have a significant negative impact on the firm's value. The theoretical optimal capital structure is reached when the PV of interest tax shields is just offset by increases in the PV of the costs of financial distress. This is called the **trade-off theory of capital structure**.
Costs of financial distress cover several specific items. Next we are going to discuss them in details and try to understand what causes them.



11.4.1. Direct costs of bankruptcy

Bankruptcy is a legal mechanism allowing creditors to take over when a firm defaults. This occurs when stockholders exercise their right to default. When a firm gets into trouble, limited liability allows stockholders simply to walk away from it, leaving all its troubles to creditors. The former creditors become the new stockholders, and the old stockholders are left with nothing. **Direct bankruptcy costs** are the costs of using this mechanism including court, legal and administrative fees. The costs are paid out of the remaining assets of the bankrupt firm. Consequently, a firm which issues risky debt has given lawyers and the court system a claim on the firm if it defaults. The market value of the firm is reduced by the present value of this claim.

The cost of bankruptcy comes out of stockholders' pockets. Creditors expecting that default will occur and that they will pay these costs demand compensation in advance in the form of higher payoffs when the firm does not default. This is done by demanding higher promised yields on the firm's bonds. This decreases the expected payoffs of stockholders and reduces the present market value of their shares.

The PV of the direct costs of bankruptcy depends on (a) the probability of default and (b) their actual level. The higher the probability of default, the higher this PV would be.[2] Several studies have further examined the actual direct costs of bankruptcy. For example Warner (1977) estimated these costs to be, on average 5.3% and 1.4% of the value of the assets at the time of bankruptcy and five years before this event, respectively. Weiss (1990) indicated that average costs were about 3% of the total book assets and 20% of the market value of equity in the year prior to bankruptcy.[3] Based on these studies, we could conclude that the direct costs of bankruptcy, especially for large firms, are likely to be fairly small.

11.4.2. Indirect costs of bankruptcy

If the only costs of financial distress were direct costs of bankruptcy, the low debt ratios maintained by many firms would be puzzling. There are, however, much greater costs associated with debt and the increasing default risk that arises prior to bankruptcy. In fact, financial distress can occur even if the threatened firm does not go bankrupt. We can categorize these costs as the **indirect costs of bankruptcy**. These indirect costs can be separated into three categories.

The first category of indirect costs includes those related to the loss in revenues that may occur due to the customer's perception that this firm is in trouble. For example, in 1980 when the car buyers believed that Chrysler was close to bankruptcy, they chose to buy cars from other companies because they were concerned about the resale value of the car and the availability of service and replacement parts. Similarly, in the late 1980s, when Continental Airlines found itself in financial trouble, frequent travelers switched to other

[2] In Chapter 5 we have seen how to estimate this probability using credit scoring systems.

[3] Warner, J. B., 1977, Bankruptcy costs: Some evidence, Journal of Finance 26, 337-348. Weiss, L. A., 1990, Bankruptcy resolution: Direct costs and violation of priority claims, Journal of Financial Economics 27, 285-314.

airlines because they were unsure whether they would be able to use their flier miles in the troubled airline.
The second indirect cost is the stricter terms suppliers demand to protect themselves against the possibility of default, leading in an increase in working capital and a decrease in cash flows.
The third indirect cost is the difficulty that the firm may experience to raise new capitals for its projects. Both debt and equity investors are reluctant to take the risk of investing in these firms, leading to capital rationing constraints and the rejection of good projects.
Shapiro (1989) and Titman (1984) argue that the indirect costs of bankruptcy are higher for the following groups of firms:[4]

- Firms that sell durable products with long lives that require replacement parts and services (for example, cars and computers)
- Firms that provide goods or services for which quality is an important attribute that is difficult to determine in advance (for example, airlines for which financial trouble may scare away customers who worry that the planes are not in a good condition)
- Firms producing products whose value to customers depends on the services and complementary products supplied by other independent firms (for example, a personal computer manufacturer that uses services from other software companies)
- Firms that sell products requiring continuous service and support from the manufacturer (for example, a manufacturer of copying machine).

11.4.3. Implications of financial distress costs

With the PV of financial distress to depend on the probability of bankruptcy and the sum of the direct and indirect bankruptcy cost, interesting and testable implications emerge for capital structure decisions.
First, firms operating in businesses with volatile earnings and cash flows should use debt less than otherwise similar firms with stable cash flows. For example, utility companies which operate in a regulated and monopolistic environment have stable earnings and cash flows, allowing them to have high debt ratios. On the other hand, toy manufacturers can have large shifts in income from one year to another based on the commercial success of a product. These firms should use debt far less to finance their projects.
Second, if firms can structure their debt in such a way that the cash flows on the debt increase and decrease with their operating cash flows, they can afford to borrow more. For example, companies whose cash flows increase as interest rates go up and decrease as interest rates go down may be able to use more debt if the debt has a floating rate feature.
Third, if an external entity, such as the government or an agency of a government, provides protection against bankruptcy (through bailout programs for troubled firms) firms will tend to borrow more.

[4] Shapiro, A., 1989, Modern Corporate Finance, New York: Macmillan. Titman, S., 1984, The effect of capital structure on a firm's liquidation decision, Journal of Financial Economics 13, 1371-1375.

Fourth, direct costs are higher if a firm's assets are not easily divisible and marketable. Consequently, firms with assets that can be easily divided and sold should borrow more than firms with assets that are less liquid. Thus, a real estate holding company can borrow more than a firm, such as Coca-Cola, which derives a great deal of its value from its brand name. With indirect costs, firms that sell durable products with long lives that require replacement parts and services should borrow less than firms that manufacture products without these characteristics.

11.5. Agency costs

When investors lend money to a firm, equity investors continue to control the firm and make investment and financing decisions. In fact, equity investors are acting as agents for the lenders. However, equity investors and lenders will not always agree on the best course of action for a firm, mainly because they have different cash flow claims on the firm. These costs arising from the conflict of interest between stockholders and bondholders are broadly categorized as **agency costs of debt**.
Agency costs are related to the fact that stockholders are tempted to forsake the usual objective of firm value maximization (an assumption of MM model) and to pursue narrower self-interest instead at the expense of their creditors. As firm increases its debt, it exposes itself to greater agency costs. In fact, we can generalize model (6) as follows:

$$\boxed{V_L = V_U + PV(\text{tax shield}) - PV(\text{costs of financial distress}) - PV(\text{agency costs of debt})} \quad (7)$$

The implications of formula (7) are similar to those of formula (6). There is a trade-off between the tax benefits of debt and its disadvantages which are now manifested as costs of financial distress and agency costs.
The conflict of interest appears in all three aspects of corporate finance: (a) investment decisions, (b) financing decisions, and (c) payout policy (determine how much to pay out as dividends).

11.5.1. Investment analysis and agency costs

In our earlier discussion about investment analysis, we argued that any project with positive NPV is a good project that increases firm value and should be accepted. It would seem logical for both stockholders and bondholders to be in favor of investing in such projects, but this is not always so. Although stockholders may benefit, bondholders may be hurt if the firm accepts some of these projects.
Bondholders lend money to the firm with the expectation that the projects accepted would have a certain risk level, and they set the interest rate of the bonds accordingly. If the firm chooses projects that are riskier than expected, however, bondholders will lose because the value of their bonds will decrease to reflect the higher risk. In that case the bondholder's loss is the stockholder's gain. Although the project may have a positive NPV, the stockholders not only gain the entire PV but also transfer wealth from bondholders. This shift of wealth can be more extreme when stockholders select projects

with negative NPV, but the value of equity actually increases because the wealth transferred from bondholders exceeds the negative NPV. The following example illustrates this extreme case.

Example: The next table reports a simplified balance sheet of a firm in book and market values, respectively.

Book values			
Net working capital	20	Bonds outstanding	50
Fixed assets	80	Common stocks	50
Total assets	100	Total value	100
Market values			
Net working capital	20	Bonds outstanding	25
Fixed assets	10	Common stocks	5
Total assets	30	Total value	30

The balance sheet in market values indicates that the firm is close to bankruptcy. The face value of bonds ($50) exceeds the firm's market value ($30). If the debt matures today, the firm's owners would default, leaving the firm bankrupt. But suppose that the bonds mature in one year, and there is enough cash to limp along for one year. This one-year grace period explains why the firm's share still has value. Its owners are betting on a stroke of luck that will rescue the firm, allowing it to pay off the debt with something left over. The owners win only if the firm value increases from $30 to more than $50. But the owners still control investment and operating strategy. And they will use that to make a bet in order to rescue their firm.

Suppose that the firm has $10 of cash. It can invest this cash to a project that will generate $120 with 10% probability and $0 with 90% probability. This is a very risky project and probably a lousy one. But the owners of the firm could accept since they have nothing to lose anyway. The firm is in the edge of bankruptcy, and they betting with the bondholder's money. If the project is profitable stockholders will get most of the gains.

The expected payoff of the project is $120\times 0.1+0\times 0.9=12$. If the discount rate is 50% then the $\text{NPV}=-10+12/(1+0.5)=-2$. This NPV is negative indicating that the project should not be undertaken, as it will decrease the firm value. But this is undertaken anyway by the owners of the firm. Next table reports the new balance sheet in market values.

Market values			
Net working capital	10	Bonds outstanding	20
Fixed assets	18	Common stocks	8
Total assets	28	Total value	28

Firm value drops by $2 (following the -2 negative NPV of the new project). But the owners are $3 ahead because bond's value has fallen by $5. The $10 cash that used to stand behind the bond has been replaced by a risky asset worth only $8. Thus a game has been played at the expense of the firm's bondholders.

The previous discussion illustrates the following general point: Stockholders of levered firms gain when business risk increases. Financial managers who act strictly in their stockholder's interests (and against the interests of creditors) will favor risky projects over safe ones. They may even take risky projects with negative NPV.
Bondholders often attempt to protect themselves against the risk shifting that occurs in investment decisions by adding covenants to lending agreements that constrain the firm from increasing the riskiness of its investments. These constraints may range from mild limits on investments in new businesses to tighter limits, giving bondholders veto power over investment decisions.

We have seen how stockholders, acting in their immediate, narrow self-interest, may take projects that reduce the overall market value of their firm. In some cases, however, they may refuse to accept projects that increase the firm market value. These cases are related to a possible need from their part to contribute new equity capital in the firm. This is illustrated in the following example.

Example: Consider the previous firm. Instead of the very risky project, a safe asset costing $10 with a PV of $15 and a NPV of $5 comes up. Assume that the firm does not have the cash to finance it. It can do so by issuing $10 of new stock and go ahead with the investment. The project is undertaken, and the new balance sheet in market values is shown below.

Market values

Net working capital	20	Bonds outstanding	33
Fixed assets	25	Common stocks	12
Total assets	45	Total value	45

The market value of the firm increases by $15 ($10 of new capital and $5 the NPV). Notice that the firm's bond is no longer worth $25, but $33. The bondholder receives a capital gain of $8 because the firm's assets include a new, safe asset worth $15. The stockholder loses what the bondholder gains. Equity value goes up not by $15 but by 15 – 8 = 7. So, the owners put in $10 of new capital but gains only $7 in market value. Going ahead with the project is in the firm's interest but not the owners'.

This example illustrates a general point: If we hold business risk constant, any increase in firm value is shared among bondholders and stockholders. The value of any investment opportunity to the firm's stockholders is reduced because project benefits must be shared with bondholders. Thus, it may not be in the stockholders' self-interest to contribute fresh equity capital even if it that means forgoing positive NPV investment opportunities. This problem, theoretically, affects all levered firms, but it most serious when firms have high debt ratios. The greater the probability of default, the more bondholders have to gain from investments that increase firm value.

11.5.2. Financing decisions and agency costs

The conflict of interest between bondholders and stockholders also arises when new projects have to be financed. The equity investor in a firm may favor new debt, using the assets of the firm as security and giving the new lenders prior claims over existing lenders. Such actions will reduce the interest rate of the new debt. The existing lenders in a firm obviously do not want to give new lenders priority over their claims because it makes existing debt riskier and, consequently less valuable.
Bondholders can protect themselves against these actions taken by stockholders by inserting a put clause in the bonds, allowing them to sell the bonds back to the firm at face value if these actions are taken. They can also do so by limiting additional borrowing. For example, many companies are prevented by existing bond indentures from issuing any additional long-term debt unless their ratio of earnings-to-interest exceeds 2.

11.5.3. Payout policy and agency costs

Dividend payments and equity repurchases also divide stockholders and bondholders. Consider a firm that has built up a large cash reserve but has very few good projects available. Stockholders may benefit if the cash is paid out as a dividend or used to repurchase stock. The bondholders, on the other hand, will prefer that the firm retain cash, since it can be used to make payments on the debt, reducing default risk. If increases in dividends are indeed bad news for bondholders, bond prices should react negatively to the announcement of such increases. Empirical evidences support this hypothesis.
Bondholders can protect themselves against such losses by including covenant in their debt agreement that restricts dividends to certain percentage of earnings or limit dividend increases to a specific amount. Hybrid securities can also be used to reduce agency costs. **Convertible bonds** give bondholders some protection against wealth transfer by stockholders, for instance, because they can convert their bonds into stocks.

11.5.4. Agency costs and capital structure

As we have explained in the beginning of this section, agency costs have a negative impact on the value of the firm. Moreover, they increase along with the firm's debt ratio. In fact, these agency costs can affect the firm value in two ways:

1. If bondholders believe there is significant chance that stockholder actions might make them worse off, they can build this expectation into bond prices by demanding much higher rates on debt.
2. If bondholders can protect themselves against such actions by writing restrictive covenants, two costs follow:
    a. The direct costs of monitoring the covenants, which increases as these become more detailed and restrictive.

b. The indirect costs of lost investments, since the firm is not able to take some projects, use certain type of financing, or change its payout policy. This cost also increase as the covenants become more restrictive.

Since agency costs can be substantial, two implications relating to optimal capital structure follow. First, agency costs arising from risk shifting is likely to be greatest in firms whose investments cannot be easily observed and monitored. For example, a lender to a firm that invests in real estate is less exposed to agency cost than is a lender to a firm that invests in intangible assets or people expertise. Consequently, it is not surprising that manufacturing companies and railroads, which invest in real assets, have much higher debt ratios than service companies. Second, the agency cost associated with monitoring actions is likely to be largest for firms whose projects are long-term, follow unpredictable paths and may take years to generate profits. Pharmaceutical companies, which often take on research projects that may take years to yield commercial products, have historically maintained low debt ratios, even though their cash flows would support more debt.

11.6. Loss of flexibility

The bond covenants that bondholders use to protect themselves against stockholders actions reduce the flexibility of firms to make investment, financing and payout policy decisions. Thus, the increase of debt can also cause a loss of flexibility from the part of the firm. When managers take a decision to increase the firm's debt they also consider the effects such decisions will have on the capacity of the firm to take new projects or meet unexpected future cash requirements. Practically, this translates into firms maintaining excess debt capacity or larger cash balances than are needed in each current state. Although it is difficult to measure exactly the value of the flexibility we can assume that it should be related to the following variables:

- Availability of projects: Firms with substantial investment opportunities should value flexibility more highly than stable firms without the same opportunities.
- Excess returns on projects: Firms with higher excess returns on their future projects should value flexibility more highly than firms with lower returns.
- Uncertainty about project needs and cash flows: The greater the uncertainty about future investment needs, the greater the value of preserving flexibility.

So, firms, such as Microsoft and Intel, which earn large excess returns on their projects and face more uncertainty about future investment needs, will hold large cash balance and will have a low debt ratio (maintaining excess debt capacity) as the value of preserving financing flexibility is significant for them.

11.7. Summarizing the trade-off theory

We can now summarize the trade-off theory of capital structure. Debt has a tax advantage over equity. It can also make managers more disciplined in their choice of investments.

This might be particularly important for firms with greater separation between management and ownership. On the other hand, it increases the expected cost of bankruptcy, exacerbates the conflict between stockholders and bondholders, and reduces the flexibility to raise additional financing later. The following table briefly summarizes the benefits and the costs of debt.
Overall, if the marginal benefits of borrowing exceed the marginal costs, the firm should borrow money. Otherwise, it should use equity.

The trade-off of debt vs equity

Advantage of debt	Disadvantage of debt
Tax benefit	Bankruptcy cost
Added discipline to managers	Agency cost
	Loss of future financing flexibility

Based on the previous discussion we can explain the different capital structures across industries and sectors. High-tech growth companies, whose earnings are volatile and their assets are mostly intangible, normally use little debt. This comes from the fact that these firms are more exposed to the costs of financial distress, agency costs and the loss of flexibility. On the other hand, utility firms, railroads and airlines have stable earnings and tangible assets, thus the costs of borrowing are lower for them. This can explain the high debt ratios that we observe for these firms.
However, these are some things the trade-off theory cannot explain. First, it cannot explain why the most profitable companies commonly borrow the least. Under the trade-off theory high profits should allow for a higher debt ratio, as the taxable income is high and the tax benefits of debt would be significant. In general, it is difficult to detect the PV of interest tax shields in the firm market values. Second, there are large and persistent differences between debt ratios of firms in the same industry, even after controlling for attributes that the trade-off theory says should be important. Finally, debt ratios today are not higher than they were in the early 1900s, when income taxes were low.

11.8. The pecking order of financing choices

One of the assumptions of perfect capital markets is that corporate insiders and outsiders have the same information. Consider now that this assumption is violated, implying that managers know more about their companies' prospects, risk and values than outside investors. This is known as **information asymmetry**.
Asymmetric information affects the choice between internal and external financing and between new issues of debt and equity. This leads to a **pecking order (financial hierarchy)**, in which investment is financed first with retained earnings; then by new issues of debt, and finally with new issues of equity. New equity issues are a last resort when the company runs out of debt capacity, that is, when the threat of costs exceeds the advantage of debt.
Information asymmetry implies that managers would prefer to use internal financing first because it allows them to consider projects on their merits, rather than depending on

whether markets are pricing their securities correctly. It follows that firms will tend to retain earnings over and above their current investment requirements to finance future projects.
Information asymmetry implies that a new issue of securities (stocks or bonds) is a signal to the market. In other words, when a firm makes a new issue it conveys information to investors. The information that it conveys is that these securities are overvalued (otherwise why the firm would issue these securities). This signal is likely to be more negative for stocks, where the asymmetry of information is greater, and smaller for bonds, where the asymmetry is smaller. This would explain the rankings in the pecking order of these two securities.
We can summarize the pecking order theory of corporate financing as follows:

1. Firms prefer internal financing.
2. To this end, they need to retain earnings for future investment opportunities. To do so, they set accordingly a payout ratio trying to avoid sudden changes in dividends.
3. A payout policy with low dividend variation from the one hand, and the unpredictable fluctuations in profitability and investment opportunities mean that retain earnings may be below or above capital expenditures. If it is more, the firm pays off debt or invests in marketable securities. If it is less, the firm uses its more liquid current assets (cash and marketable securities).
4. If external financing is required, firms first issue debt, then possibly hybrid securities (like for example convertible bonds), and finally equity as a last resort.

In this theory, there is no well-defined optimal capital structure, because there are two kinds of equity, internal and external, one at the top of the pecking order and one at the bottom. Each firm's observed debt ratio reflects its cumulative requirements for external financing.
The pecking order theory explains why most profitable firms generally borrow less – not because they have low optimal debt ratios but because they don't need outside money. Less profitable firms issue debt because they do not have internal funds sufficient for their investments and because debt is preferable to equity. The theory also explains the inverse intra-industry relationship between profitability and financial leverage. As each firm invests to keep up with the growth of the industry, the rates of investment will be similar within an industry. Given that payout policy does not change frequently, the least profitable firms will have less internal funds and will end up borrowing more.

11.9. Trade-off vs pecking order theory

Empirical evidences indicate that the debt ratios of individual firms seem to depend on four main factors:[5]

1. Size: Large firms tend to have higher debt ratios.

[5] Rajan, R. G., and L. Zingales, 1995, Why do we know about capital structure? Some evidence from international data, Journal of Finance 50, 1421-1460.

2. Tangible assets: Firms with high ratios of fixed assets to total assets have higher debt ratios.
3. Profitability: More profitable firms have lower debt ratios.
4. Market-to-book ratio: Firms with higher market-to-book value ratios have lower debt ratios.

These evidences convey good news for both theories. From the one hand, large companies with plenty of tangible assets have high debt ratios according to the trade-off theory. Moreover, the market-to-book ratio can be interpreted as a measure of growth opportunities, so growth firms borrow less in accordance with this theory. On the other hand, profitable firms borrow less as they can rely on internal financing according to the pecking order theory. Market-to-book ratio is interpreted as just another measure of profitability.

Other studies tried to examine in which particular cases the one theory explains better observed capital structures than the other.[6] It seems that the pecking order works better for large, mature firms that have access to public bond markets. Smaller, younger, growth firms are more likely to rely on equity issues when external financing is required according to the trade-off theory.

EXERCISES-11

1. Firm XYZ has issued debt with a market value of $100 million and has outstanding 15 million shares with a market price of $10 a share. It now announces that it intends to issue a further $60 million of debt and to use the proceeds to buy back common stock. Bondholders, seeing the extra risk, mark the value of the existing debt down to $70 million.

   a. How is the market price of the stock affected by the announcement?
   b. How many shares can the company buy back with the $60 million of new debt that it issues?
   c. What is the market value of the firm after the change in the capital structure?
   d. Who (if anyone) gains or loses?

2. A firm has a debt ratio of 50%. The cost of debt is 12%, the beta of the common stock is 1.5, the risk-free rate is equal to 10% and the market risk premium is equal to 8%. Calculate the cost of equity, the beta of the firm's bonds, the WACC and the beta of the WACC. Assume now that the firm issues equity and repurchases debt so that the debt ratio is now 30%. The reduced borrowing causes the cost of debt to fall at 11%. Compute the other variables.

[6] Shyam-Sunder, L., and M. C. Myers, 1999, Testing static trade-off against pecking-order theories of capital structure, Journal of Financial Economics 51, 219-244.
Frank, M., and V. Goyal, 2003, Testing the pecking order theory of capital structure, Journal of Financial Economics 67, 217-248.

3. The following table presents the balance sheet of a corporation. Suppose that the firm moves to a 40% book debt ratio by issuing debt and using the proceeds to repurchase shares. Consider only corporate taxes with a tax rate of 35%. Now reconstruct the balance sheet to reflect the new capital structure. How much additional value is added to the firm?

Book values			
Net working capital	$10,752	$7,144	Long-term debt
		$21,460	Other long-term liabilities
Long-term assets	$86,900	$69,048	Equity
Total assets	$97,652	$97,652	Total value
Market values			
Net working capital	$10,752	$7,144	Long-term debt
PV interest tax shield	$2,500	$21,460	Other long-term liabilities
Long-term assets	$283,373	$268,021	Equity
Total assets	$296,625	$296,625	Total value

4. Suppose that, in an effort to reduce the public deficit, the Parliament votes a law that increases the top personal tax rate on interest and dividends to 35% but retains a 15% tax rate on realized capital gains. The corporate tax rate is also set to 35%. Compute the total corporate plus personal taxes paid on debt versus equity income, the relative tax advantage of debt over equity and the marginal effect on firm's value for $1 increase in debt if (a) all capital gains are realized immediately, (b) capital gains are deferred forever. Assume that capital gains are half of equity income.

5. Assume that personal investors pay a 40% tax rate on interest income and only 20% tax rate on equity income. If the corporate tax rate is 30%, estimate whether debt has a tax benefit over equity. If the firm with no debt and $100 million in market value borrows $50 million and buy back the same value of stocks, calculate the value of the firm with the new capital structure.

6. DotCom corporation is a unlevered firm. It has expected earnings before interest and taxes of $2 million per year in perpetuity. The tax rate is 40%. The stock has a beta of 1, the risk-free rate is 9% and the market risk premium is 6%. The financial manager considers the issue of debt in order to repurchase a number of stocks. The cost of debt is 12%. The firm's analysts have estimated that the present value of any bankruptcy costs is $8 million and the probability of default will increase with leverage according to the following table.

Value of debt (in millions)	Probability of default (in %)
2.5	0
5	8
7.5	20.5
8	30
9	45
10	52.5
12.5	70

a. Calculate the value of the unlevered firm DotCom.
b. What is the optimal capital structure when interest tax shields and bankruptcy costs are considered?
c. Calculate the value of the firm at this optimal capital structure.

7. The following table reports the book and market values balance sheet of a corporation:

Book values			
Net working capital	20	Bonds outstanding	50
Fixed assets	80	Common stocks	50
Total assets	100	Total value	100
Market values			
Net working capital	20	Bonds outstanding	25
Fixed assets	10	Common stocks	5
Total assets	30	Total value	30

The bonds mature in one year. Who gains and who loses from the following actions?

a. The firm uses $5 of cash to pay a cash dividend.
b. The firm stops operation, sell its fixed assets and converts net working capital into cash. Unfortunately the fixed assets are sold for $6 in the market. The $26 cash is invested in Treasury bills.
c. The firm encounters a project with NPV = 0, requiring an investment of $10. The firm borrows to finance the project. The new debt has the same seniority as the old one.
d. Suppose that the new project has NPV = $2 and is financed by an issue of preferred stock.
e. The lenders agree to extend the maturity of their loan from one year to two in order to give to a firm a chance to recover.

8. XYZ Pharma is a pharmaceutical company that traditionally has not used debt to finance its projects. Over the last 10 years, it has also reported high returns on its projects and growth, and made substantial research and development expenses

over the time period. The health care business overall is growing much slower now, and the projects that the firm is considering have lower expected returns.

a. How would you justify the firm's past policy of not using debt?
b. Do you think the policy should be changed now? Why or why not?