Financing decisions (2)

Class 16
Financial Management, 15.414

Today

Capital structure

- M&M theorem
- Leverage, risk, and WACC

Reading

- Brealey and Myers, Chapter 17

Financing decisions

Key goal

- Ensure that funds are available for positive NPV projects, now and in the future
- Signaling, taxes, mispricing, issue costs, and corporate control also important

Observations

- Firms follow a pecking order
- Different industries seem to have different target debt ratios
- Stock issues are bad news, but debt issues are either neutral or good news

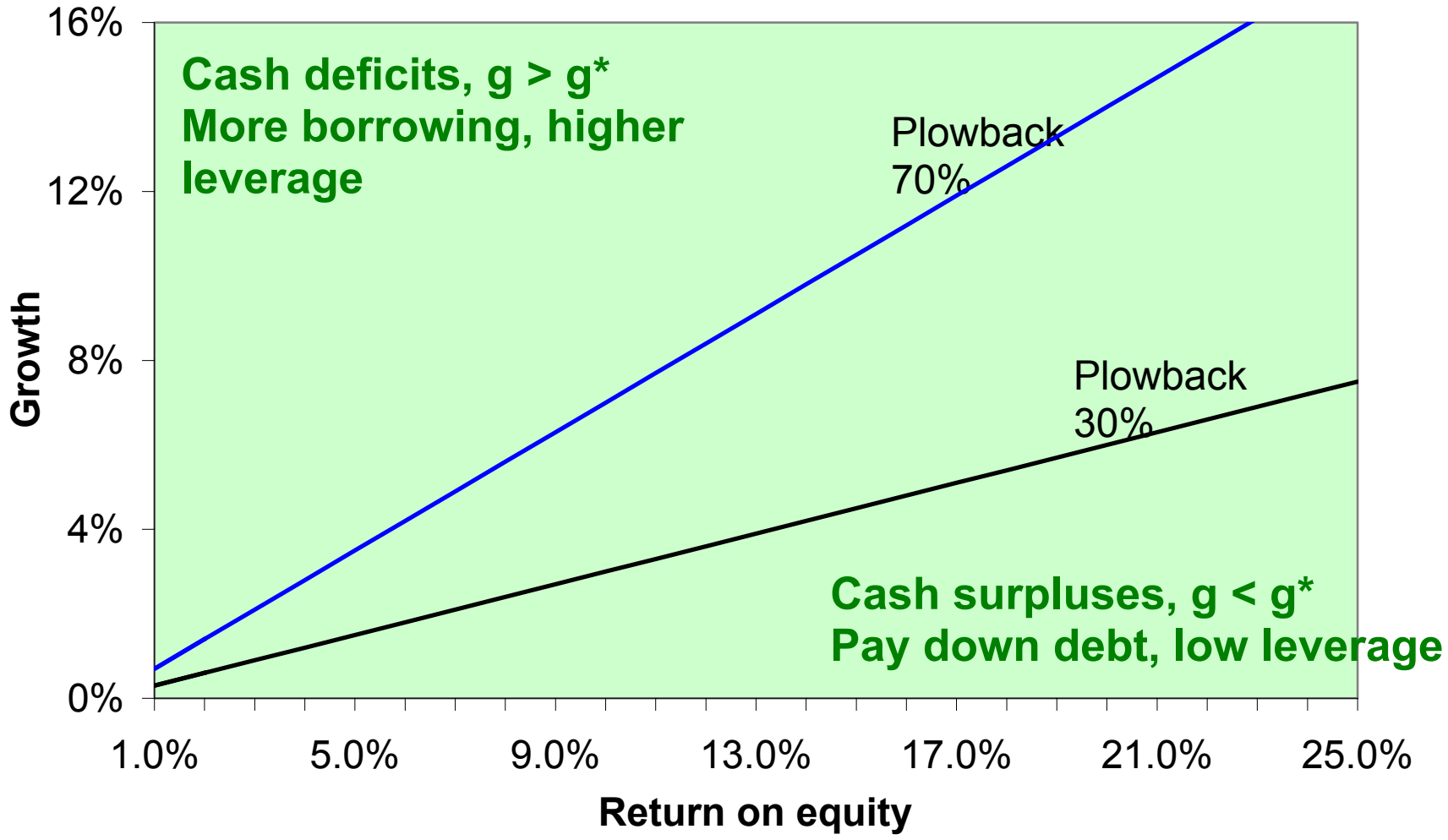
Financing decisions

Two models

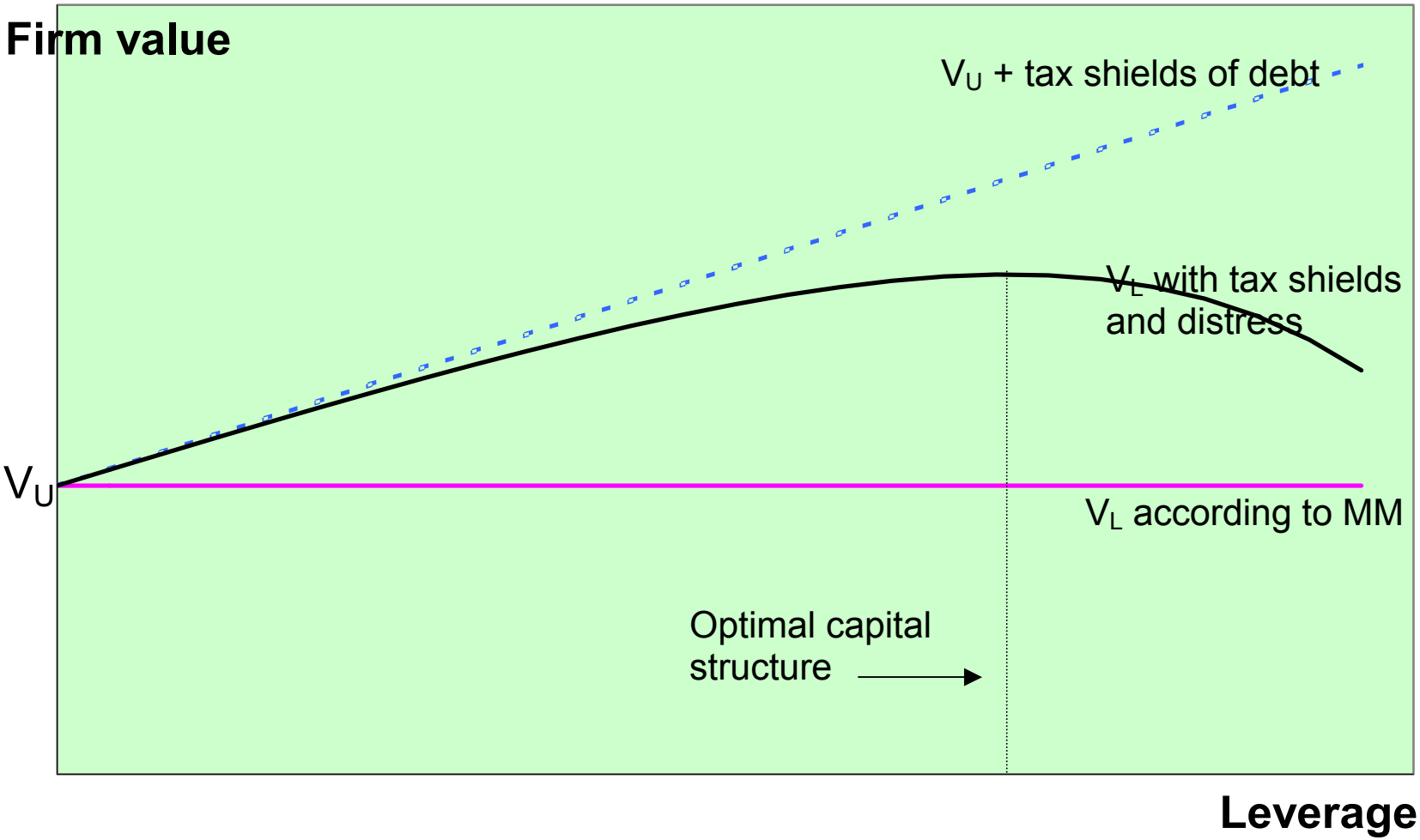
- **Pecking-order theory**
  Firms are worried primarily about selling undervalued shares. They sell equity only when they have no other choice, and there isn't a specific target debt ratio.

- **Trade-off theory**
  Firms care mostly about taxes and distress costs. The tax benefits of debt dominate at low leverage, while distress costs dominate at high leverage. This trade-off leads to an optimal capital structure.

Growth, leverage, and the pecking order



Trade-off theory



Financing decisions

Modigliani-Miller Theorem

Assume

- **Efficient markets and no asymmetric information**
- **No taxes**
- **No transaction or bankruptcy costs**
- **Investment decisions don't change**

Then

- **The value of the firm is independent of its capital structure.**
- **Financing choices are irrelevant!**

Value is created on the left-hand side of the balance sheet, not the right-hand side.

M&M Theorem

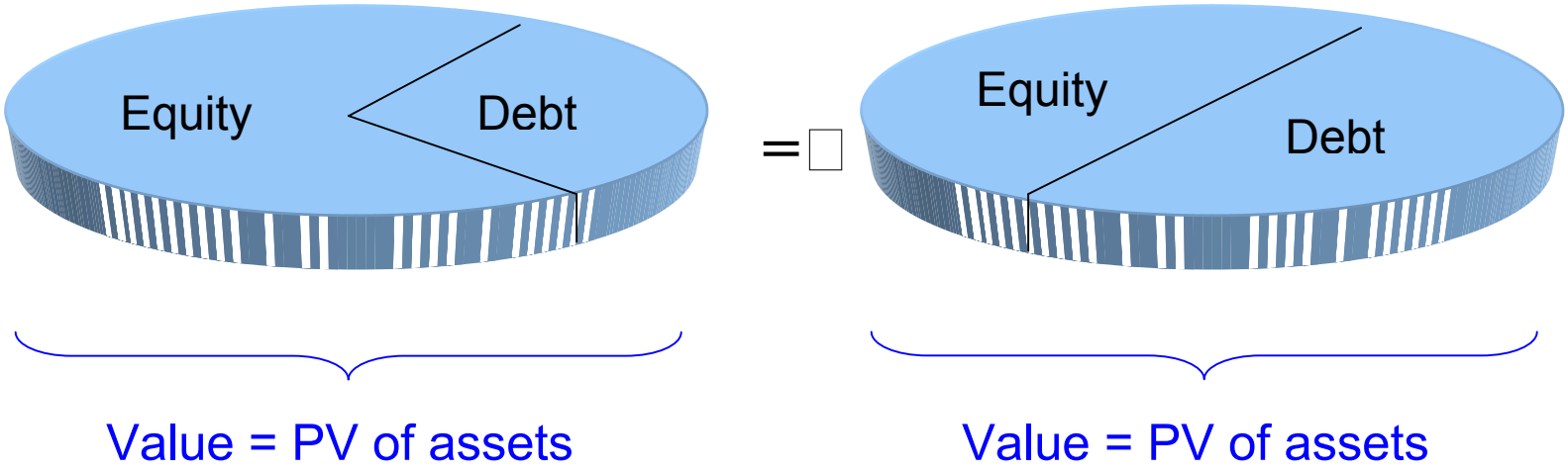
Why is MM useful?

- **It tells us what is important …**
  Does debt affect investment decisions?
  Does debt affect taxes?
  Can equity be issued at fair value?
  Are transaction costs or bankruptcy costs important?

- **And what isn't …**
  Impact of debt on ROE and risk
  Cost of debt relative to the cost of equity (r_D vs. r_E)

MM Theorem, cont.

Message 1 (pie theory)*



* Credit to Yogi Berra

Yogi Berra

Wisdom

- “Nobody goes there anymore; it's too crowded.”
- “You should always go to other people's funerals; otherwise, they won't come to yours.”
- “The future ain't what it used to be.”
- “Baseball is 90% mental -- the other half is physical.”

MM Theorem, cont.

Message 2

In general, financial transactions don't create or destroy value as long as securities are sold at fair value.

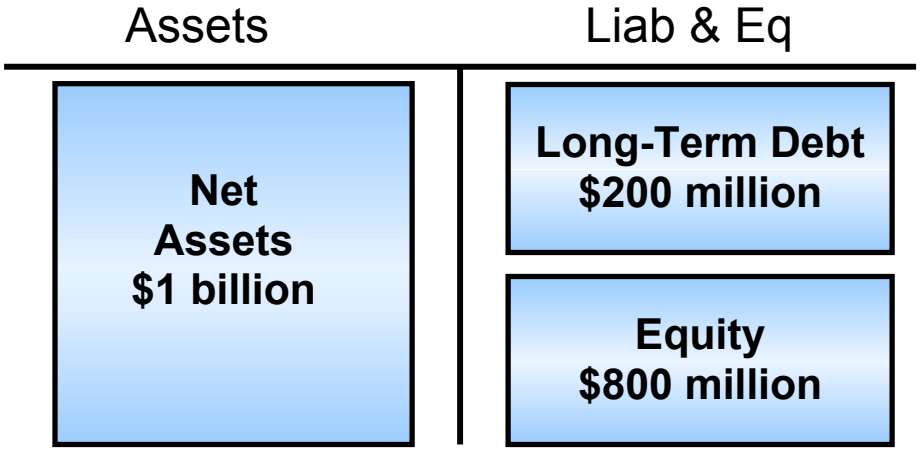
[Unless they affect taxes, investment decisions, etc.]

Example

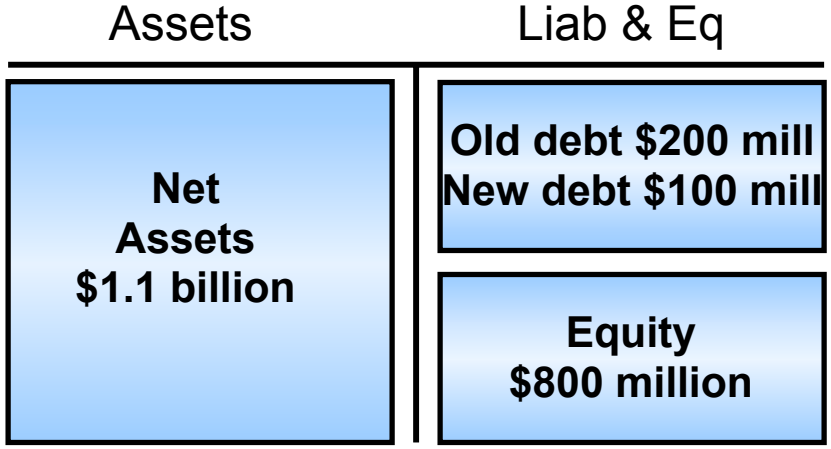
Your firm needs to raise $100 million. Does it matter whether you decide to issue debt or equity?

Example

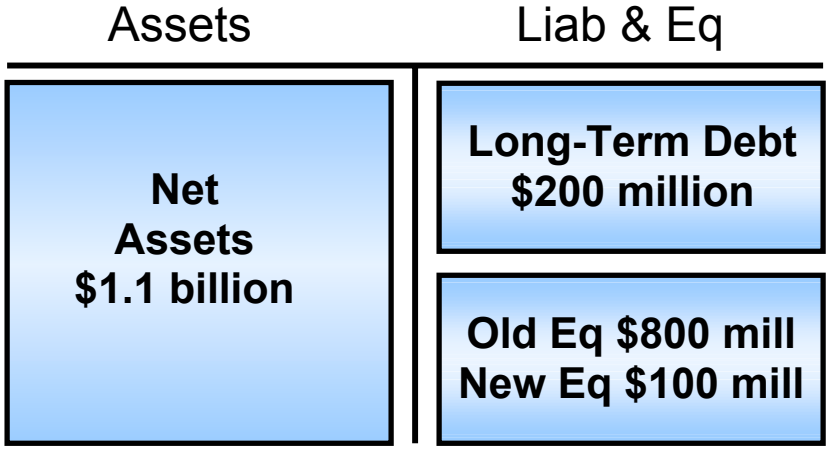
Current



Issue new debt



Issue new equity



MM Theorem, cont.

Message 3

Leverage increases ROE and the expected returns to stock-holders, but it also increases risk.

According to M&M, the two effects offset each other exactly.

$$\text{ROE} = \frac{\text{NI}}{\text{Equity}} = \underbrace{\frac{\text{NI}}{\text{Assets}}}_{\text{ROA}} \times \underbrace{\frac{\text{Assets}}{\text{Equity}}}_{\text{Financial leverage}} \frac{E + D}{E}$$

$$\text{ROE} = \text{ROA} \times \left[1 + \frac{\text{Debt}}{\text{Equity}}\right]$$

MM Theorem, cont.

Leverage and risk

Asset = Debt + Equity

If D / E = 0%, then \$1 of equity supports \$ 1 of assets
If D / E = 100%, then \$1 of equity supports \$ 2 of assets
If D / E = 900%, then \$1 of equity supports \$10 of assets

Leverage magnifies equity risk

\$1 change in A $\rightarrow$ \$1 change in E [E is residual claim]

1% change in A $\rightarrow$ 1% $\times$ (A / E) change in E

$$\text{Multiplier} = \frac{\text{Asset}}{\text{Equity}} = \left[1 + \frac{\text{Debt}}{\text{Equity}}\right]$$

[Same multiplier for ROE]

Example

Your firm is all equity financed and has $1 million of assets and 10,000 shares of stock (stock price = $100). Earnings before interest and taxes next year will be either $50,000, $125,000, or $200,000 depending on economic conditions.

The firm is thinking about a leverage recapitalization, selling $300,000 of debt and using the proceeds to repurchase stock. The interest rate is 10%.

How would this transaction affect the firm's EPS and cashflows to stockholders? Ignore taxes.

Current: A = $1 million; E = $1 million (10,000 shares); D = $0

Recap: A = $1 million; E = $700,000 (7,000 shares); D = $300,000

Example, cont.

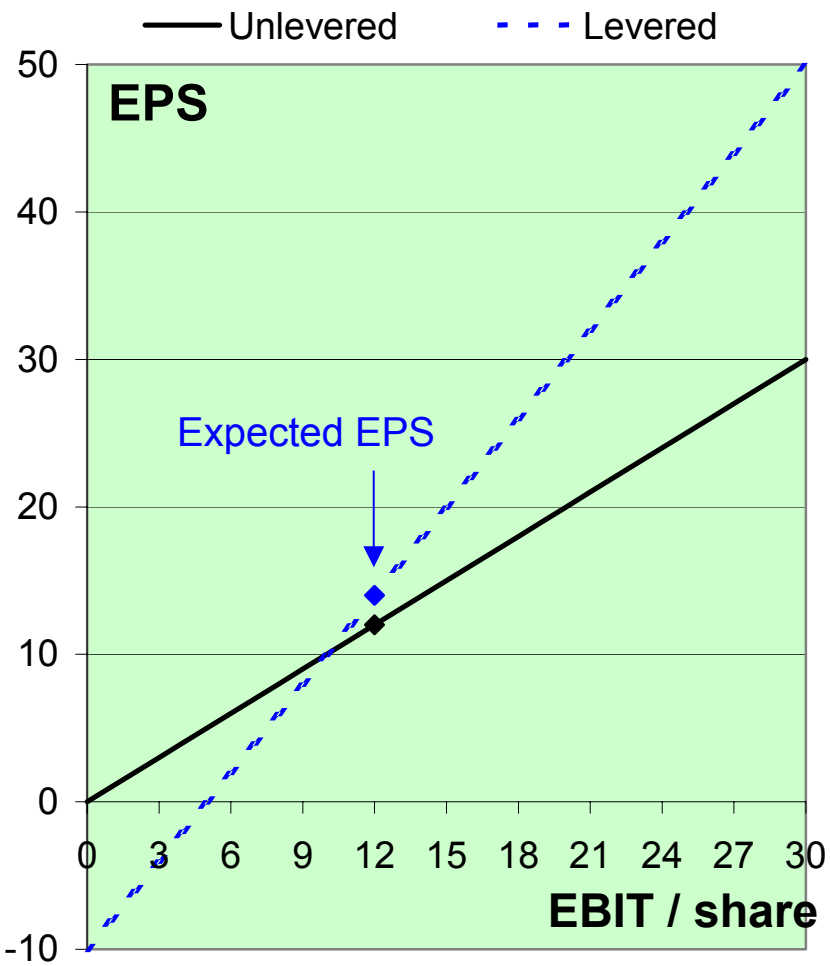
All equity

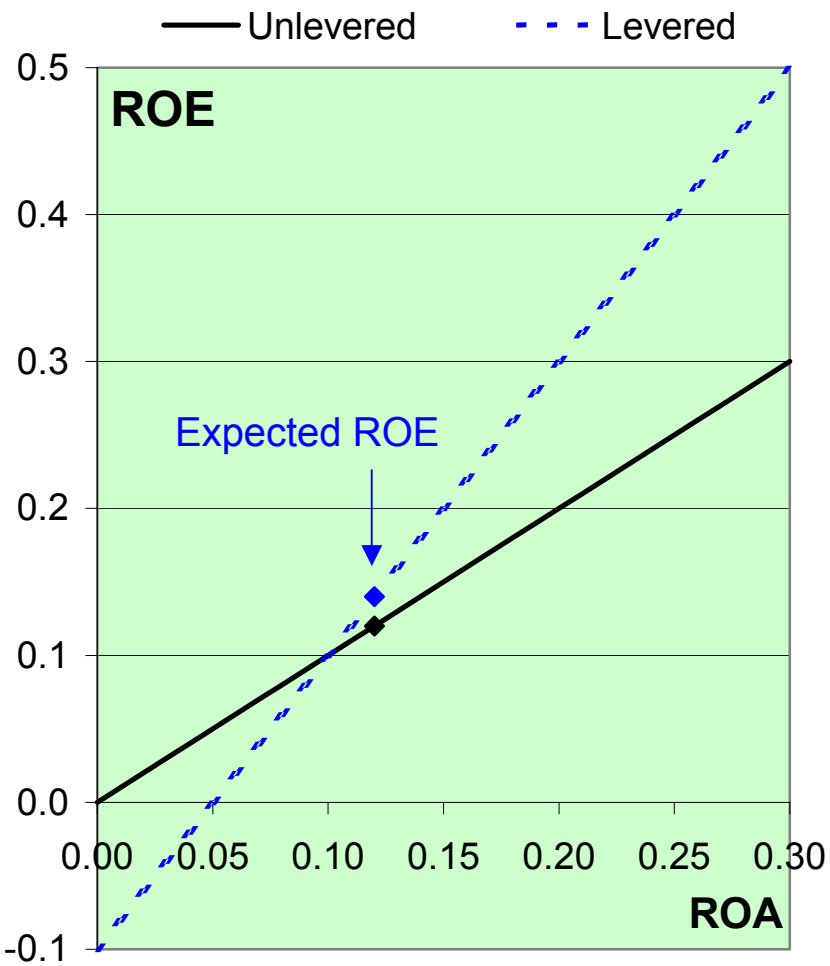
	Bad	Expected	Good
# of shares	10,000	10,000	10,000
Debt	$0	$0	$0
EBIT	$50,000	$125,000	$200,000
Interest	0	0	0
Net income	$50,000	$125,000	$200,000
EPS	$5	$12.5	$20

Recapitalization

	Bad	Expected	Good
# of shares	7,000	7,000	7,000
Debt (r=10%)	$300,000	$300,000	$300,000
EBIT	$50,000	$125,000	$200,000
Interest	30,000	30,000	30,000
Net income	$20,000	$95,000	$170,000
EPS	$2.86	$13.57	$24.29

Leverage, EPS, and ROE





Leverage increase risk and expected payoff

MM Theorem, cont.

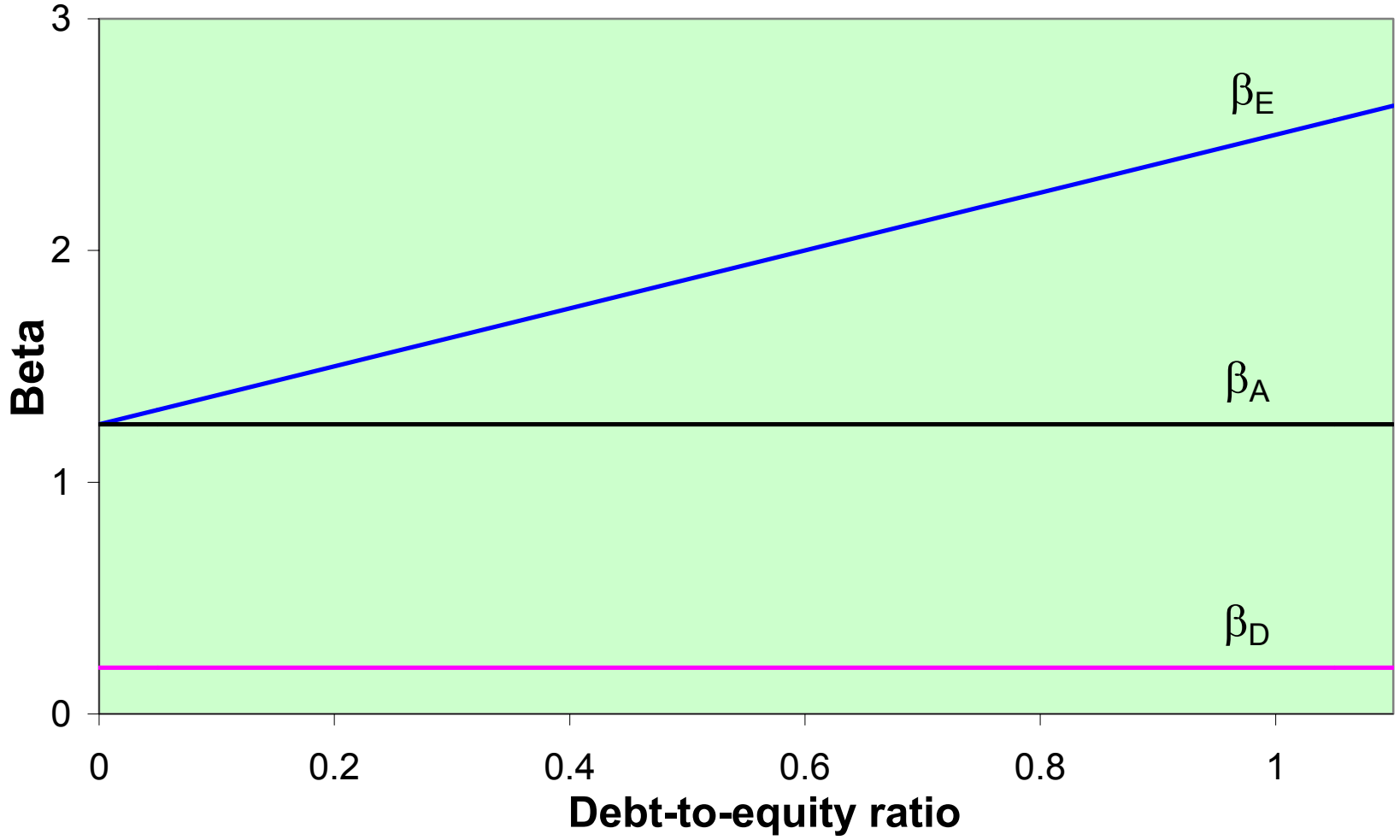
Leverage and risk

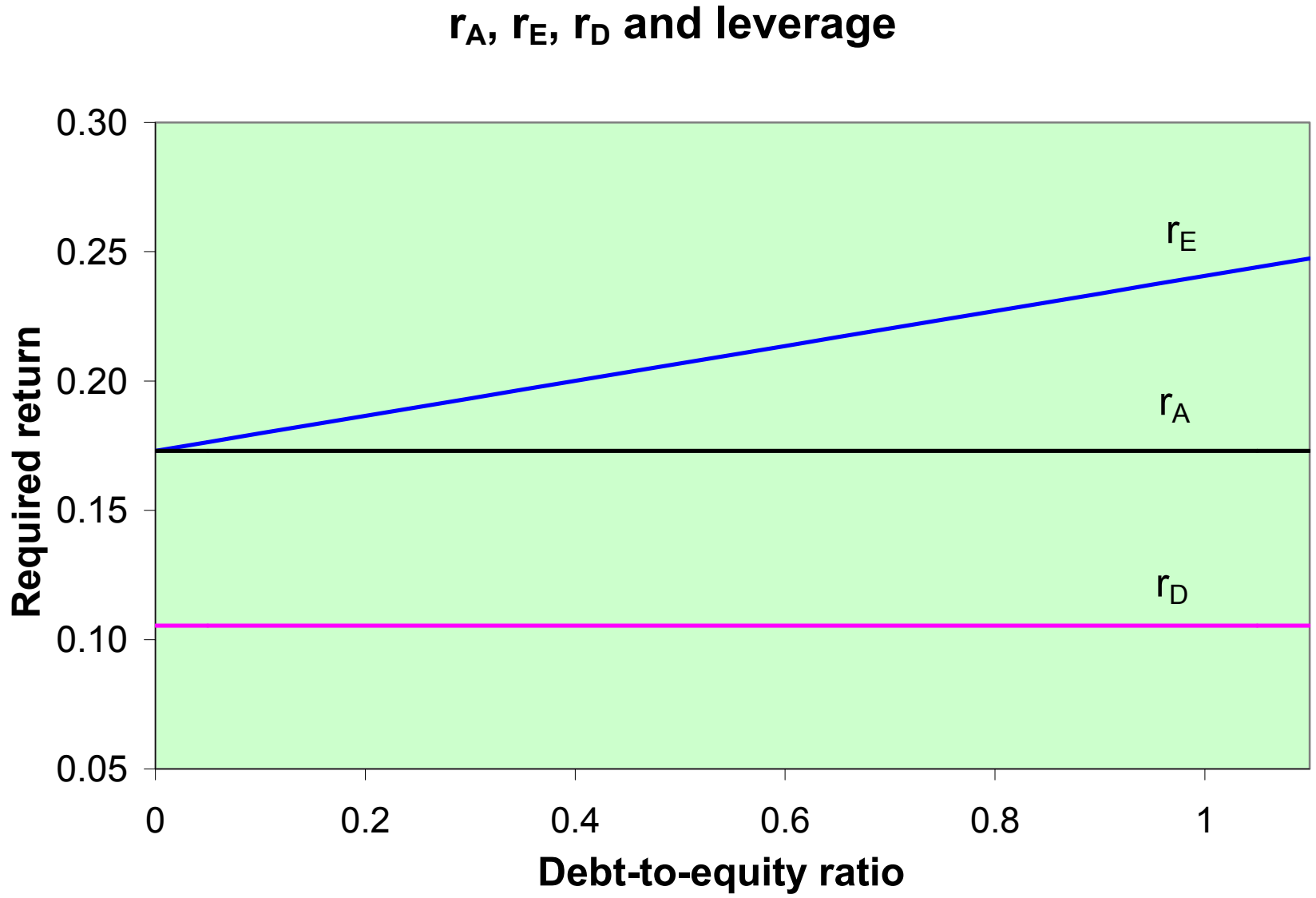
Asset = Debt + Equity

Returns: $r_A = \frac{D}{A} r_D + \frac{E}{A} r_E \quad \rightarrow \quad r_E = r_A + \frac{D}{E}(r_A - r_D)$

Betas: $\beta_A = \frac{D}{A} \beta_D + \frac{E}{A} \beta_E \quad \rightarrow \quad \beta_E = \beta_A + \frac{D}{E}(\beta_A - \beta_D)$

The required return and beta of equity goes up when leverage increases.


βA, βE, βD and leverage
3
2
1
0
Beta
βE
βA
βD
0
0.2
0.4
0.6
0.8
1
Debt-to-equity ratio


r_A, r_E, r_D and leverage
Required return
0.30
0.25
0.20
0.15
0.10
0.05
0
0.2
0.4
0.6
0.8
1
Debt-to-equity ratio
r_E
r_A
r_D

M&M Theorem, cont.

Message 4

Leverage shifts the firm towards 'low cost' debt financing, but it also raises the cost of equity.

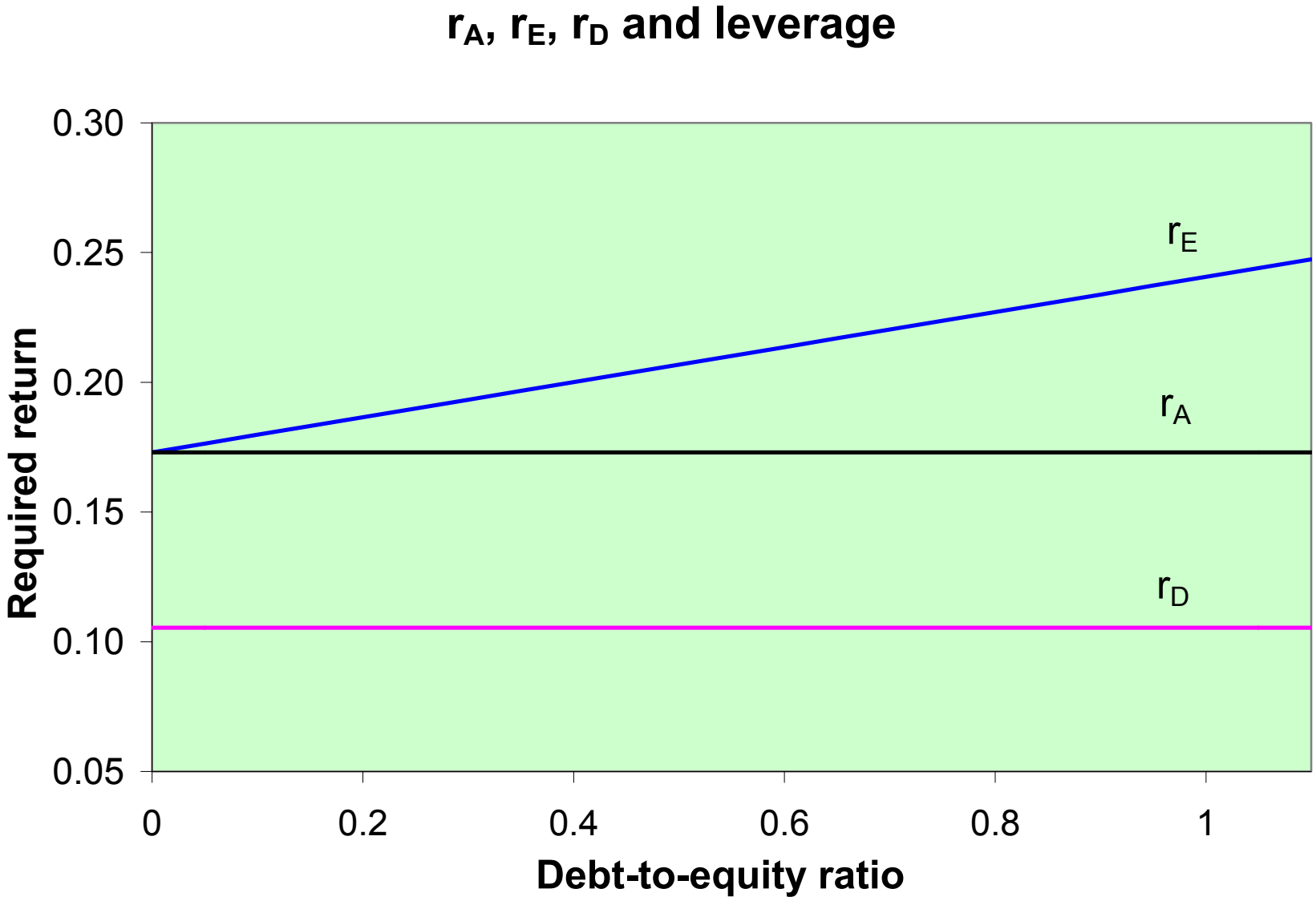
According to M&M, the two effects offset each other exactly.

Ignoring tax effects, changing capital structure doesn't affect the WACC.

Without taxes:

$$WACC = r_A = \frac{D}{A} r_D + \frac{E}{A} r_E$$

Combined effect is a wash
WACC is determined only by asset risk


r_A, r_E, r_D and leverage
Required return
0.30
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0.05
0
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0.4
0.6
0.8
1
Debt-to-equity ratio
r_E
r_A
r_D

Example

Your firm is all equity financed and has $1 million of assets and 10,000 shares of stock (stock price = $100). Earnings before interest and taxes next year will be either $50,000, $125,000, or $200,000. **These earnings are expected to continue indefinitely. The payout ratio is 100%.**

The firm is thinking about a leverage recapitalization, selling $300,000 of debt and using the proceeds to repurchase stock. The interest rate is 10%.

How would this transaction affect the firm's EPS and stock price? Ignore taxes.

Example, cont.

All equity

	Bad	Expected	Good
# of shares	10,000	10,000	10,000
Debt	$0	$0	$0
EBIT	$50,000	$125,000	$200,000
Interest	0	0	0
Net income	$50,000	$125,000	$200,000
EPS	$5	$12.5	$20

Expected EPS = $12.5

Stock price = EPS / r_E $\rightarrow$ r_E = EPS / price = 12.5%

$r_A = r_E$

Example, cont.

Recapitalization

	Bad	Expected	Good
# of shares	7,000	7,000	7,000
Debt (r=10%)	$300,000	$300,000	$300,000
EBIT	$50,000	$125,000	$200,000
Interest	30,000	30,000	30,000
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Expected EPS = $13.57

$r_E = r_A + D/E\ (r_A - r_D) = 0.125 + (0.3 / 0.7)\ (0.125 - 0.10) = 0.1357$

Stock price = EPS / r_E = $100