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The Impact of Regulation on the Firm's Cost of Capital

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What is the Cost of Capital?

$$WACC = k_e(1 - L) + k_d(1 - T_c)L$$

$$k_e = R_f(1 - T) + MRP\beta_e$$

$$\beta_e = \beta_a\left[1 + \frac{L}{1 - L}\right]$$

$$k_d = R_f + DRP$$

$$WACC = R_f(1 - T) + MRP\beta_a + DRP(1 - T)L$$

Choosing the Risk Free Rate term

This should be chosen so that the present value of the future cash flows equals the initial investment.

Example Regulator resets the output price every year
Initial Investment = $100m, with a life of two years
No other costs
Complete certainty, including future interest rates

$$R_{f01} = .06, \quad R_{f02} = .07, \quad R_{f12} = .08$$

$$REV_1 = \$50m + (\$100m)k$$
$$REV_2 = \$50m + (\$50m).08 = \$54m$$

Choosing the Risk Free Rate term

Policy 1: Set *k = 0.06*

- $REV_1 = \$50m + \$100m(.06) = \$56m$
- $PV(REV_1, REV_2) = \frac{\$56m}{1.06} + \frac{\$54m}{(1.07)^2} = \$100m$

Policy 2: Set *k = 0.07*

- $REV_1 = \$50m + \$100m(.07) = \$57m$
- $PV(REV_1, REV_2) = \frac{\$57m}{1.06} + \frac{\$54m}{(1.07)^2} = \$101m$

The effect of regulation on the Asset Beta

Example

Regulator resets the output price *P* every year

Initial Investment = $1000m, with an infinite life

No other costs

Historic Cost asset valuation applies

Demand level is the only source of uncertainty

All risk free rates are 6%

Expected level of demand = 10m units per year

Risk not currently compensated

The effect of regulation on the Asset Beta

- $E(REV_1) = \$1000m(.06) = \$60m = PE(Demand) = P(10m)$
- $P = \$6$

The effect of regulation on the Asset Beta

Demand Shock

Suppose demand in the first year is only 8m units

- $REV_1 = \$6(8m) = \$48m$

P is reset so that

$$E(REV_2) = \$1000m(.06) = \$60m = PE(Demand) = P(8m)$$

- $P = \$7.50$

- cash flow shortfall resulting from the shock is only $12m (PV = $11.3m)

- Firm value suffers by 1.1%

The effect of regulation on the Asset Beta

What if the Regulator resets *P* every five years?

The above shock then generates a cash flow shortfall of $12m in each of years 1… 5

The present value of this shortfall is $51m

- Firm value suffers by 5.1%

The effect of regulation on the Asset Beta

Conclusion

- The length of the regulatory cycle is crucial to the risk faced by a firm
- For a one year cycle, risk is trivial

The effect of ODRC on risk

Example

Regulator resets the allowed revenues every year

Initial Investment = $1000m, with an infinite life

No other costs

ODRC asset valuation applies

Future ODRC is the only source of uncertainty

All risk free rates are 6%

Expected future ODRC = $1000m, i.e., no expected depreciation

Risk not currently compensated

The effect of ODRC on risk

- $REV_1 = \$1000m(.06) = \$60m$

$E(REV_2) = \$1000m(.06) = \$60m$

$E(REV_3) = \$1000m(.06) = \$60m$

.....

- $PV = \frac{\$60m}{1.06} + \frac{\$60m}{(1.06)^2} + ... = \$1000m$

The effect of ODRC on risk

ODRC Shock

Suppose ODRC in one year is $900m, and is not expected to change

$$\Rightarrow \quad REV_2 = \$900m(.06) = \$54m$$

$$E(REV_3) = \$900m(.06) = \$54m$$

$$E(REV_4) = \$900m(.06) = \$54m$$

$$\Rightarrow \quad PV = \frac{\$54m}{1.06} + \frac{\$54m}{(1.06)^2} + \ldots\ldots\ldots\ldots = \$900m$$

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The effect of ODRC on risk

Is this risk systematic?

- Risk of optimising assets out is industry specific
- Risk of changes in replacement cost of assets comprises CPI risk and industry specific risk
- CPI risk lowers asset beta, i.e., lower than expected CPI reduces the allowed revenues, and hence firm value, as above, but it is also associated with higher stock market returns