Lecture 3 practice exercises with solutions

Question 1:

Graham (2022) surveys firms on their capital budgeting techniques in practice. Describe three key conclusions from his survey on capital budgeting techniques in practice.

Solution 1:

1. In line with theory, NPV & IRR are the most important capital budgeting techniques for large firms.
2. Simple and near-term metrics, such as payback and ROIC, have risen in importance since 2001
3. Analyses incorporating uncertainty, such as scenario analysis and real options, have also increased in importance since 2001.
4. Discount rates are conservative and sticky.

Question 2:

Why may conservative hurdle rates be problematic for long-term transition projects?

Solution 2:

Conservative hurdle rates mean applying a discount rate above the true cost of capital. Because discounting reduces the present value of distant cash flows more strongly than near-term ones, the application of conservative hurdle rates biases project selection toward short-term, quick-payback projects and against long-term investments.

Question 3:

Describe the Integrated PV investment decision rule. Discuss its strength and limitation.

Solution 3:

The Integrated PV rule combines financial value (FV), social value (SV), and environmental value (EV) into one metric:

$$\boldsymbol{IPV = FV + b \cdot SV + c \cdot EV}$$

With weights b, c > 0 and set by the firm's board.SV and EV are obtained by applying shadow prices to relevant social and environmental impacts. A project is accepted if IPV > 0.

Strength: IPV provides a single metric that integrates FV, SV, and EV, enabling comparability across projects.

Limitation: IPV calculations may face data and measurement limitations and shadow prices may be contentious.

Question 4:

A researcher estimates the following two OLS regressions of investment on Tobin's Q and Total Q for a large sample of firms and years. The numbers in parentheses below each coefficient are t-statistics, while *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels.

	Investment/Assets	*Investment/Assets*
Tobin's Q	0.09*	
	(1.79)	
Total Q		0.32***
		(2.61)
No. of Observations	15,213	15,213
R^2	0.109	0.211

Interpret each independent variable. What do you conclude about the standard Q-theory and its empirical limitations.

Solution 4:

The coefficient on Tobin's Q implies that a 1-unit increase in Q increases Investment/Assets by 0.09. The relationship is marginally statistically significant.

The coefficient on Total Q implies that a 1-unit increase in Cashflows/Assets increases Investment/Assets by 0.32. The relationship is statistically significant at the 1% level.

Tobin's Q coefficient is marginally significant and shows only a weak link to investment, explaining about 11% of the variation (see R2). Total Q is a much stronger predictor, raising explanatory power to 21%. Standard Q-theory would expect Tobin's Q alone to strongly predict investment (large, significant coefficient; R^2 near 1), but we do not observe this. The improvement with Total Q highlights the importance of accounting for intangible assets, though much variation remains unexplained.

Question 5:

Consider a company that currently has cash holdings of 500€, but no access to any further external finance (ever). Cash earns a risk-free return of 0%. The discount rate is 0%.

In year 0, the company has access to one investment project. The project has the following characteristics:

- Upfront investment of €500 in year 0.
- Payoff in year 1: With a probability of 0.8 a return of €800 and with a probability of 0.2 a return of €300.
- The project is neither divisible nor scalable.

In year 1, the company with certainty has access to the following investment project:

- Upfront investment of €400 in year 1.
- Payoff in year 2: With a probability of 1 a return of €800.
- The project is neither divisible nor scalable.

In year 2, the company terminates.

Compare the following two strategies: (A) Invest in the project in year 0. (B) Do not invest in the project in year 0 but save the money. For both strategies, the firm does whatever is optimal in year 1.

5a. Calculate the payoff for both strategies.
5b. Which strategy is optimal?
5c. Give one change in parameter that would tilt the decision toward the other strategy and explain why.
5d. What does this problem imply for the validity of Tobin's Q?

Solution 5:

5a. Calculate the payoff for both strategies.

Strategy (A): Note that only in the case of a high return (of €800), the firm will be able to invest again in year 1. Investing in year 1 is optimal if possible.

$$\boldsymbol{NPV = -500 + 0.8 \cdot 800 + 0.2 \cdot 300 + 0.8 \cdot (-400 + 800) = €520}$$

Strategy (B): The firm will not invest in year 0 and will therefore always be able to invest in year 1.

$$\boldsymbol{NPV = -400 + 800 = €400}$$

Note: We do not need to make any additional adjustments for the cash savings, as they do not earn any return and thus are 0 NPV.

5b. Which strategy is optimal?

The payoff in strategy A is higher than in strategy B. It is therefore optimal to invest in year 0 rather than saving.

5c. Give one change in parameter that would tilt the decision toward the other strategy and explain why.

If the probability of the bad state increases (and the probability of the good state decreases), the decision would start to tilt towards strategy B (precautionary savings), as the chance of reinvestment decreases.

If the payoff of the project in year 1 relative to the payoff of the project in year 0 increases, the decision would also start to tilt towards strategy B (precautionary savings).

5d. What does this problem imply for the validity of Tobin's Q?

The example shows why Q may not fully predict investment. Firms may forgo positive NPV projects to save cash if future financing constraints may occur. Here, the firm invests (Q "works"), but in other states, precautionary saving can dominate.