NTNU Trondheim
Norwegian University of
Science and Technology

Faculty of Economics
Department of Industrial Economics
and Technology Management

Contact person for the exam:
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EXAM IN COURSE TIØ4146
FINANCE for SCIENCE and TECHNOLOGY STUDENTS
4 June 2019 Time: 09.00 - 13.00

Aid A: All calculators allowed
All printed and written material allowed

Problem 1 (weight 30%)

Kolaric et al. (2016)[1] examine the returns of South Korean stocks following large price shocks. They analyse monthly returns over the period 2000-2014 of stocks that are included in a main Korean stock market index (the KOSPI 50 index). A price shock is defined as a month with an absolute price change of 20% or more. Their data contain 863 shocks, 501 price increases and 362 decreases. Using the market model and event study methodology, they calculate cumulative average abnormal returns (CAARs) in several time windows before and after the event months (which is month 0) and in two sub-periods (2000-2007 and 2008-2014). Their main results are summarized in Table 1 below.

Table 1: CAARs (in %) surrounding large price changes

window	price increases		price decreases	
(months)	2000-2007	2008-2014	2000-2007	2008-2014
-3 to -1	2.04*	-3.37*	1.92	1.38
1 to 6	3.59*	-0.24	9.84*	12.47*
1 to 12	12.33*	0.98	15.42*	12.31*
1 to 24	21.39*	1.44	23.70*	15.36*

* means significantly different from 0

a) Which form of market efficiency is tested by Kolaric et al. and do any of their results in Table 1 contradict the Efficient Market Hypothesis (EMH)? If so, explain which specific result(s) and why.

Problem 2 (weight 30%)

Quick Drive AS is a young and successful company in the automotive industry. Several years of rapid growth have boosted the book value of Quick Drive to a total of €165 million today. It relies heavily on debt: two thirds of its book value consists of loans. As a young and dynamic company its interest rate is high; it currently pays 8.5% interest on its debt, 3.5% above the risk free interest rate. Quick Drive has 4.4 million shares outstanding, they trade at €22.50 per share to give a return of 16%. Quick Drive's development team is always on the lookout for profitable investment opportunities and it came across a

[1] Sascha Kolaric, Florian Kiesel and Dirk Schiereck, 2016, Return patterns of South Korean stocks following large price shocks, Applied Economics, vol. 48 no. 2, pp. 121-132

promising project to install solar panels on the roofs of private houses. The TOP project, as it is called, requires an immediate and irreversible investment of €45 million and will generate an after tax cash flow of €18 million per year for 3 three years, starting 1 year after the investment. Quick Drive can finance the investment with a loan of €30 million. The loan will be paid back in equal amounts over the next 3 years, starting 1 year after the loan is received. The bank is willing to provide the loan against an interest rate of 9% per year. The rest of the investment will be financed with internal funds. Quick Drive's development team also analysed the riskiness of installing solar panels in the private market. After an extensive analysis they conclude that the business risk of such projects is so high that investors would require a return of 11% on projects that would be financed exclusively with equity. On financial markets, the return of the market portfolio is 12%. The corporate tax rate is 30% and other taxes can be ignored.

a) Should Quick Drive take on the TOP project or not? Show calculations to support your answer and make additional assumptions if necessary.

Problem 3 (weight 30%)

After the bankruptcy of Skyways Express, SvenskAir has taken over the licence to fly passenger aircraft between Værnes airport near Trondheim and Arlanda airport near Stockholm. So far it has not been profitable to open the route, but SvenskAir has made a business plan that shows that the route Arlanda-Værnes could become a very profitable one in the near future. However, developments in the airline industry could also make it very unprofitable. In financial terms this means that the present value of the cash flows from operating the route can increase by 47.5% over each of the next two years, but they can also decrease by 32.2%. Today, the present value of these cash flows is estimated at €45 million. However, it requires an investment of €46 million to start the route, so the project has a negative NPV and should not be accepted. The decision cannot be deferred either, because the licence expires at the end of the year. A junior employee, who took the course Finance for Science and Technology students, suggested negotiating a sell-back option for the equipment with the supplier. There is a well functioning second hand market for the type of regional airliner involved. After some discussion the supplier is willing to buy back the equipment for €35 million after one year and for €30 million after two years. However, including the option will increase the purchasing price of the equipment by €1.5 million to €47.5 million.

a) Assuming a risk free interest rate of 7% per year and using a three-moment, two-period binomial model, calculate the value for SvenskAir of the option to sell back the equipment and the effect this has on the decision to open the route.

Problem 4 (weight 10%)

The recent finance literature devotes quite some attention to the phenomenon of zero-leverage firms, i.e. firms that do not use long and short term debt. For example, Bessler et al.[2] collect a sample of more than 30 000 industrial firms in 20 developed countries and report that the percentage of zero-leverage firms in their sample rose from almost 8.5% in 1988 to more than 25% by the end of their sample period in 2011.

a) What do the capital structure theories we discussed (the trade-off and pecking order theory) predict about zero-leverage firms?

[2] W. Bessler, W. Drobetz, R. Haller and I. Meier, The international zero-leverage phenomenon, Journal of Corporate Finance, 2013, vol. 23, p. 196 - 221.

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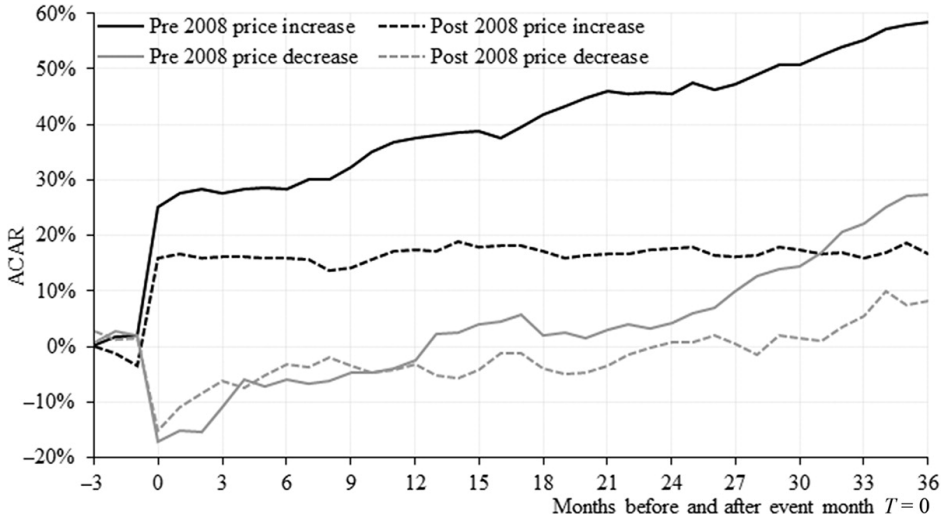
Problem 1 (weight 30%)

Kolaric et al. look for patterns in past price histories, so they analyse weak form market efficiency. The pre-event CAARs (month -3 to -1) do not test market efficiency, so their significance (which is the case for price increases) does not reject the EMH. Significant post-event CAARs (i.e. in the windows 1-6, 1-12, 1-24) do contradict market efficiency and this is the case for price increases in the period 2000-2007 and price decreases in both periods. Notice that all significant post-event CAARs are positive, so there is underreaction to positive price shocks in the period 2000-2007 and overreaction to negative price shocks followed by a correction in both periods. The authors provide the following graph to illustrate their results.



Problem 2 (weight 30%)

The project is in another line of business, so the background data on Quick Drive AS are irrelevant. The loan for the project is paid back over the project's life of 3 years. This means that the project's capital structure will change over time, as will the cost of equity and the WACC. So it is very impractical to use the WACC and, hence, APV the preferred method. We calculate the APV by starting with the base case PV, i.e. the present value of the after tax cash flows discounted at the OCC. The OCC is given as 11%, So the base case present value is:

$$\frac{18}{1.11} + \frac{18}{1.11^2} + \frac{18}{1.11^3} = 43.987$$

The only side-effect mentioned in the text is that of taxes. The tax advantage is: loan × interest rate × tax rate, so in the:

first year $30 \times 0.09 \times 0.3 = 0.81$

second year $20 \times 0.09 \times 0.3 = 0.54$

third year $10 \times 0.09 \times 0.3 = 0.27$

Since debt is predetermined the tax advantage should be discounted at cost of debt, i.e. 9%

$$\frac{0.81}{1.09} + \frac{0.54}{1.09^2} + \frac{0.27}{1.09^3} = 1.4061$$

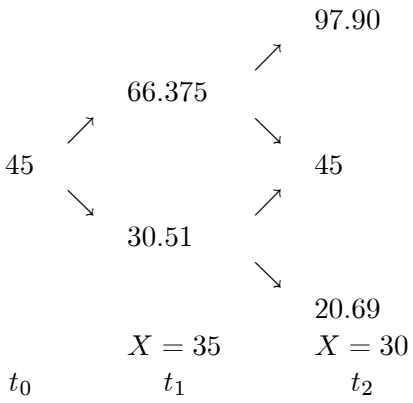
The adjusted present value is thus:

$$APV = -45 + 43.987 + 1.4061 = 0.3931 > 0$$

so Quick Drive AS should go ahead with the TOP project.

Problem 3 (weight 30%)

The sell back option is an American put with exercise prices that depend on the moment of exercise. We value the put with the binomial model. Given the parameters of the binomial process, the value tree for the cash flows from the route is:



Value tree for cash flows from the route

The equivalent martingale probability of an upward movement in the tree is:

$$p = \frac{r-d}{u-d} = \frac{1.07 - 0.678}{1.475 - 0.678} = 0.492$$

so the probability of a downward movement is $1 - 0.492 = 0.508$. When the option matures at t_2, the exercise price is €30 million and the payoff of the option is $\max[0, X - \textit{project value}]$, so for the three end nodes:

$\max[0, 30 - 97.90] = 0$

$\max[0, 30 - 45] = 0$

$\max[0, 30 - 20.69] = 9.31$

The value of this option at t_1 is 0 in the upper node and

$$\frac{0.492 \times 0 + 0.508 \times 9.31}{1.07} = 4.42$$

in the lower node. These values 'alive' have to be compared with the values 'dead', if the option is exercised at t_1, i.e. if the equipment is sold back for €35 million. Following the same procedure:

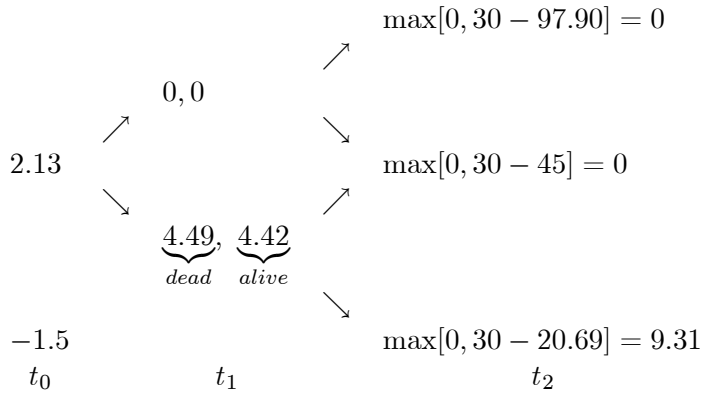
$\max[0, 35 - 66.38] = 0$

$\max[0, 35 - 30.51] = 4.49$

In the lower node the value dead is higher than the value alive, so the option should be exercised in that node at t_1. The value of the abandonment option is, thus,

$$\frac{0.492 \times 0 + 0.508 \times 4.49}{1.07} = 2.13$$

But since including the option increases the purchasing price by €1.5 million, the added value of the option is $2.13 - 1.5 = 0.63$. This is not enough to give the project a positive NPV, so the added value is too small to open the route. The calculations are summarized in the lattice below.



It is also possible to calculate the value of the project including the sell back option; the values are then the sum of the values in the two lattices.

Problem 4 (weight 10%)

Zero-leverage firms are not compatible with the capital structure theories we discussed. In the trade-off theory, firms should use some debt because of its tax benefits. In this theory zero leverage firms have a sub-optimal capital structure, which should not occur. In the pecking order theory firms prefer (short term) debt if external funds are needed, because it gives lower costs of asymmetric information. However, it allows for the possibility that profitable firms planning large investments build up considerable financial slack and, hence, have no debt.

The literature offers some possible explanations for the zero-leverage phenomenon, but these are not required for the answer. The explanations usually involve market frictions (e.g. lenders that are unable to ascertain the quality of firms' assets, particularly their growth opportunities) or timing arguments (e.g. it may be costly to issue debt under unfavourable conditions, so that it may be optimal to postpone borrowing).