



UNIVERSITY OF
BATH

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ES22016 Money and finance

Indicative answers to seminar problems

The problems provided as part of this module are designed to apply the theories learned to practical and realistic scenarios, allowing students to apply their knowledge and practice their ability to explain real-world events using economic theories in plain English. Seminars are dedicated to discussing these problems, but we are not able to discuss all problems due to time constraints. Having additional problems allows students to practice their knowledge in preparation of the assessment; they can compare their solutions with the indicative answers provided and for any additional clarifications attend the office hours.

The below table gives an indication about the problems to be discussed in class for each topic. At times it will be not be possible to discuss each problem and at other times it might be possible to discuss an additional problem if time permits. It is expected that students are prepared to discuss all problems in each seminar.

Seminar problems	
Topic 1	1, 2
Topic 2	3, 5
Topic 3	7, 10
Topic 4	11, 14
Topic 5	15, 17
Topic 6	20, 22
Topic 7	23, 26
Topic 8	28, 29
Topic 9	33, 36
Topic 10	39, 40
Topic 11	42, 43
Topic 12	45, 46
Topic 13	51, 52
Topic 14	55, 56
Topic 15	57, 58
Topic 16	2, 3
Topic 17	10, 36
Topic 18	16, 20
Topic 19	22, 29
Topic 20	43, 48

The problems for topics 16 to 20 are taken from the textbook and the problem numbers refer to the numbers of the problems therein. These problems are not included in the problems available for this module, but have to be taken directly from the textbook. The indicative answers, however, are provided together with the answers to topics 1 to 15, using the original numbering of the problems in the textbook, but organised by topic.

The difficulty of problems will vary, as the difficulty of questions in the exam will vary, to allow for an assessment of the degree to which the learning outcomes have been met and the final mark to reflect the standards achieved. The questions discussed

in the seminar will therefore be a mix of more easy and more difficult questions. Furthermore, some problems will require the application of more than one model for a complete answer, but these are not necessarily more difficult than problems requiring the use of only a single model.

Topic 1

Problem 1

An investor who is risk-averse would always choose the option that gives the lowest risk.

Is this statement true?

Indicative answer: *This statement is not correct. Being risk averse does not mean that an investor would not take on any risk, it merely implies that investors need to obtain compensation for taking on any risk, the risk premium; the more risk averse an investor is the higher the risk premium. The risk premium comes in the form of a higher expected return than a risk-free choice could provide. Hence if the risk premium, the expected return, is sufficiently high, a risk averse investor would choose a risky option.*

Problem 2

Carefully explain the difference between moral hazard and adverse selection.

Indicative answer: *A situation that is characterised by the decision-maker having a choice of actions has the potential for moral hazard; such choices might include investments with different characteristics or the exertion of effort. Moral hazard emerges if the chosen action is in the interests of the decision-maker, but other market participants who are directly involved would prefer another action. As an example, a bank might prefer the borrower to make a low-risk investment, while the company prefers this risk to be high. In contrast, if one party of the parties agreeing an exchange are better informed than the other party, this has the potential for adverse selection. The better informed party might be able to extract more surplus from the less informed party, which is referred to as adverse selection. A better informed investor might be able to sell an asset to a less informed investor at a price he knows to be too high. In adverse selection, the losses to one party do not arise out of choices of individuals (effort, investment), but are the consequence of having different information and there are being different types of assets or economic environments. Both, moral hazard and*

adverse selection can lead to a breakdown of the market; if individuals are aware its presence, they know they will make losses from interacting with other market participants and will therefore not engage in a transaction.

Topic 2

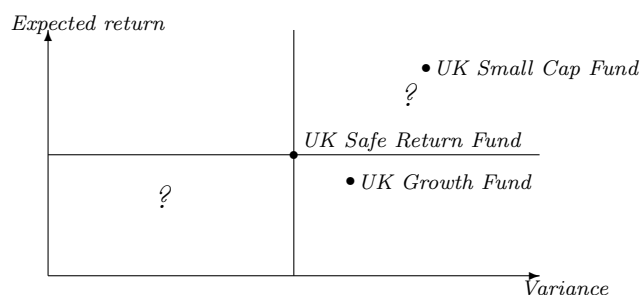
Problem 3

Michael Tippet is an independent financial advisor and while discussing investment options with a client, he points out three possible investment funds that might be suitable for the needs of his client. The first fund he has picked out, UK Small Cap Fund, invests into small listed companies and in the past has shown an annual return of 12% and a volatility in returns of 27%. Another fund, called UK Safe Return Fund, invests mainly in utility stocks and other defensive stocks, generating an annual return of 7% with an annual volatility of 13%. The final fund under consideration, UK Growth Fund, has a different investment strategy in that it not only invests into stocks, but also bonds issued by companies. Its annual return and volatility are 8% and 11%, respectively. As financial advisor, he believes that market conditions are stable and expects similar returns to those observed in the recent past also in the future from all funds. His client tells him that he finds the investment strategy followed by UK Safe Return Fund appealing and wants to consider this fund further.

- a. As his financial advisor, should Michael Tippet recommend to invest into UK Safe Return Fund?
- b. Recently, Michael Tippet has advised a different client and given that client's circumstances, he proposed to invest 40% of the monies considered into UK Small Cap Fund and 60% into UK Growth Fund. His current client dislikes risk more than his previous client, how would he change the recommended portfolio for his current client?

Indicative answer:

- a. *UK Safe Return Fund has a lower expected return than UK Growth Fund and at the same time a lower volatility (risk). Applying the mean-variance criterion, the fund should not be considered any further as it will be inferior to UK Growth Fund. Going forward, only the UK Small Cap Fund and UK Growth Fund should be considered. The below figure illustrates this and we see that UK Safe Return Fund is inferior and can thus be disregarded as long as we restrict our investment to two funds. Were we able to invest into three funds, the correlation of the funds with each other would have to be considered and we might not be able to exclude UK Safe Return Fund.*



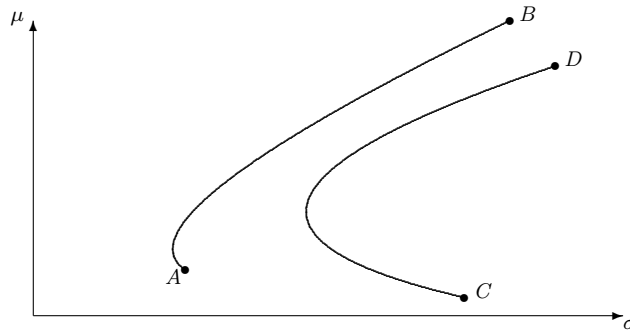
- b. He would have to recommend a lower allocation to the UK Small Cap Fund, and consequently a higher allocation into UK Growth Fund. If an investor is more risk averse, like in this case, he will seek to lower the risk he takes; this can only be achieved if the allocation to the high-risk asset, UK Small Cap Fund, is reduced and that of the asset with the lower risk, UK Growth Fund, increased.

Problem 4

During a discussion with family members, your older brother asserts with his usual confidence that diversification of investments is always beneficial. His claim is that if you only have a small number of assets you can invest in, say two, then you choose the two that have the lowest correlation as that is best for diversification.

Is your brother's claim correct?

Indicative answer: Diversification is beneficial as it reduces risks, but this has to be weighed against the risks and returns these assets generate. It is easily the case that two assets with low risks and high returns, but a high correlation are better than two assets with high risks and low returns, but a low correlation. Hence, while diversification reduces risks and is generally better, this cannot be generalised when comparing portfolios comprising of different assets with different risks and returns. In the below illustration, assets A and B have a high correlation, while assets C and D have a low correlation, but any portfolio of assets A and B are superior to a portfolio consisting of assets C and D.



Problem 5

Georgina Warren seeks advice on her investments from her long-standing investment advisor, Janice Young, with the aim of investing into stocks included in the FTSE100. Unknown to Janice Young, she has sought a second opinion from a different investment advisor. Comparing the datasheets she has obtained from both advisors about the stocks included in the FTSE100, Georgina Warren observes that both advisors agree to a large degree on the risks and returns of each stock. The recommended investments, however, differ substantially between both advisors. Janice Young recommends to invest 85% of Georgina Warren's wealth into the stock market and 15% into government bonds, while the other advisor suggested a mix of 60% to 40%. The portfolio of stocks also differs between both advisors substantially; Janice Young recommends to invest in a small number of stocks only, while the new advisor recommends a roughly equal investment into all stocks contained in the FTSE100.

Can you explain these differences in recommendations using portfolio selection theory?

Indicative answer: *The differences in the allocation into the risky assets, the FTSE100 stocks, and the risk-free asset, government bonds, might be explained through different assessments of Georgina Warren's risk aversion. If Janice Young assess her to be less risk-averse than the new advisor, this different allocation might be justified. Both advisors agree on the risks and returns of the risky assets, and thus they should agree on the composition of the risky portfolio, the optimal risky portfolio consisting of the FTSE100 stocks. Here they do not agree on this portfolio, even though they agree on the properties of all assets, this is inconsistent with portfolio selection theory. As their respective optimal risky portfolios differ, this might drive the difference in the allocation between risky and risk-free assets, rather than different assessments of Georgina Warren's risk aversion, assuming that the optimal risky portfolio of Janice Young has a lower risk than that of the second advisor. One possible explanation for the differences in the optimal risky portfolio could be that one advisor considers short sales in the stocks, while the other does not. This difference would result in different*

optimal risky portfolios.

Problem 6

At a reception in the aftermath of a meeting of financial advisors, Thomas Hartford complains to colleagues that his clients are generally not interested in his complete advice. He points out that he always recommends a selection of stocks, or occasionally other risky assets, to invest in, in addition how much their client should put into safe assets such as government bonds. In most cases, however, his clients only take up his recommendation on the stocks and other assets, ignoring his recommendation to invest into government bonds, even though this is the part he probably puts most effort in as this is very individual advice. His colleagues say that they recognise this and always wonder why clients ignore an important part of the advice.

- a. Why is it important to consider the advice on investing into government bonds?
- b. Why is the advice on investment into government bonds individualised, but the advice on investing into other assets not?

Indicative answer:

- a. *The optimal portfolio consists of the optimal risky portfolio, the stocks and other assets clients accept advice for, and a risk-free asset, the government bank. Investing into a combination of risky and risk-free assets increases the utility of investors and by failing to invest into risk-free assets they do not maximize the risk-return relationship that is available to them.*
- b. *As long as the assets considered for investment are identical across investors, the optimal risky portfolio will be identical for all investors as it is independent of their preferences; therefore financial advisors do not need to re-calculate the optimal risky portfolio for each investor. The optimal portfolio is a combination of the optimal risky portfolio and a risk-free asset. This combination will depend on the preferences of the investor, most notably the risk aversion. Financial advisors need to assess the risk aversion of each investor to obtain the optimal portfolio and hence the weight of the risk-free asset has to be determined individually for each investor.*

Topic 3

Problem 7

Estimating the Capital Asset Pricing Model for a range of large stocks listed on the London Stock Exchange, you have chosen the FTSE 100 index as your market portfolio. A friend advises that it is better to use the FTSE 250 index or even the FTSE All-Share index as your market portfolio because they cover a wider range of stocks. You argue that as you only consider stocks included in the FTSE 100 index, this is the best match for your purposes.

- a. Is your friend's suggestion an improvement on your approach?
- b. Is either of the mentioned indices the true market portfolio?
- c. Is the true market portfolio identical for all investors?

Indicative answer:

- a. *The market index should encompass all risky assets that are available to investors. As the proposed indices, the FTSE 250 and FTSE All-share index, include more companies, they would be a better benchmark from which to estimate the Capital Asset Pricing Model. The market portfolio is used as all assets must be held and hence all assets are included in the assessment of the systematic risk, which forms the basis of the Capital Asset Pricing Model. Which specific assets are considered for the purposes of estimating β_i from the model, is irrelevant in this context.*
- b. *The true market portfolio consists of more than stocks, it will include a wide variety of other assets, such as corporate bonds, real estate, commodities, cryptoassets, investments into human capital, and much more; all these constituents are not included into any stock market index. The FTSE All-Share index does even only cover those stocks listed on the London Stock Exchange, which makes a small fraction of stocks globally. Therefore, the FTSE All-Share or FTSE 250 indices are not the true market portfolio.*
- c. *Investors will have different investment opportunities, even in the absence of any constraints on investments, such as capital controls by some countries or other investment restrictions. The most obvious difference would be the investment into human capital, it would realistically only be possible to invest into your own education and knowledge. It would take extraordinary markets that would allow*

to invest into the education and knowledge of other people and obtain the rewards of this investment exclusively without the person educated reaping any rewards. It is thus that even in very well developed markets, a single market portfolio cannot exist.

Problem 8

You seek to determine the expected return of assets you consider for investment, but want to establish which risk factors are relevant to them and what their influence is. You have identified a number of firm-specific factors that affect the returns of assets, but also various macro-economic and political factors you deem relevant. Using Arbitrage Pricing Theory, you have then estimated the influence of each of these factors for a variety of assets, giving you then the expected return for each asset. A friend tells you that you make your life too difficult, he always just uses the Capital Asset Pricing Model and he is sure that it makes hardly any difference, because, after all, the influence of the market portfolio simply aggregates all the other factors that you considered.

Is you friend correct in his assessment?

Indicative answer: *Your friend is partially correct in that the market portfolio will be influenced by the factors you have identified. However, the influence on the market portfolio will be the (weighted) average influence these factors have on individual assets. Therefore, the β_i of the Capital Asset Pricing Model will reflect how much each individual asset deviates from this average influence. This will, however, be the an imperfect indicator of the influence as it only allows for a deviation from the average influence. Suppose a stock is influenced by several factors in the same way as the market, but in two factors it deviates. Consider the case where the influence of these two factors is positive for the market as a whole, but for the asset positive for one factor and negative for the other. If the two factors is highly positive, the return of the market is increased and the return of the asset should increased. However, in reality, the influence of the two factors cancel each other partially out and the influence is much less pronounced. The Capital Asset Pricing Model is not able to capture such subtleties and these deviations in influences compared to the market portfolio would only be captures in the idiosyncratic risk. Therefore the Arbitrage Pricing Theory provides a more precise framework.*

Problem 9

Your financial advisor suggests you invest in 16 stocks only, which he has handpicked for their future prospects. He points out that his chosen stocks are representative of the market as a whole, covering all the major industries that are represented. Being very conscious about the risk of stock investments, you worry about the lack of diversification given that well over 1,000 stocks are listed on the London Stock Exchange alone.

Are you right to question the approach taken by your financial advisor?

Indicative answer: *As the stocks selected are constituting a cross-section of the stock market with all major industries represented, it is reasonable to assume that the correlations between these stocks will be relatively low and be close to the average correlation within the stock market. This should allow for a large degree of diversification, which limits the level of idiosyncratic risk. Such risk will be present and not completely diversified and hence the level of risk of this portfolio could be reduced through including more stocks. However, even if concerned about risk, there are costs associated with trading large number of different stocks, fixed trading costs on the one hand, but also the costs of remaining informed about the future prospects of these stocks. These costs have to be balanced against the benefits of holding more stocks.*

Problem 10

Consider a market in which 50 stocks are traded. You have established that the average volatility of stocks is 12% p.a. and that the average correlation between stocks is 0.7. Your aim is to hold an equally weighted portfolio that consists of as few 'average' stocks as possible, but has a total risk that is no more than 10% above the systematic risk of the market.

How many stocks do you need to hold?

Indicative answer:

Identification of parameters: Average variance: $\bar{\sigma}_i = 0.12$, Average covariance: $\bar{\sigma}_{ij} = \bar{\sigma}_i^2 \times 0.7 = 0.01008$

Portfolio variance: $\sigma_P^2 = \frac{1}{N} (\bar{\sigma}_i^2 - \bar{\sigma}_{ij}) + \bar{\sigma}_{ij} = \frac{0.12^2 - 0.01008}{N} + 0.01008 = \frac{0.00432}{N} + 0.01008$

Maximum portfolio variance: $\sigma_P^2 \leq 1.1 \times \bar{\sigma}_{ij} \Rightarrow \frac{0.00432}{N} + 0.01008 \leq 1.1 \times 0.01008 \Rightarrow N \geq 4.2857$

Final result: *The investor needs to hold at least 5 stocks to achieve a total risk that is no higher than 110% of the systematic risk.*

The number of stocks required to achieve a significant reduction in total risk is usually very small, giving credence to the approach of carefully selecting wisely only a small number of stocks to achieve good diversification.

Topic 4

Problem 11

The shares of Trafalgar plc. trade at 431p and you are seeking information whether it is advisable to invest into this company. When collecting information about the company you establish that it has paid a dividend of 13p during the last year, having grown its dividend by 4% each year in the past and you believe that the company will be able to maintain this growth for the foreseeable future. You have further determined the volatility of the shares as 22% p.a. and its correlation with a broad market index is 0.82. This market index is expected to increase by 8% p.a. and has shown a variance of 0.04 and treasury bills yield 3.5% p.a.

- Would you recommend to purchase shares of Trafalgar plc.?
- Would your answer change if the dividend were to grow at 5% each year?
- How do you explain that such a small difference between the growth rates affects your results significantly?

Indicative answer:

- Identification of parameters:* Dividend: $D_t = 13$, growth rate: $g = 0.04$, risk-free rate: $r = 0.035$, Stock variance: $\sigma^2 = 0.22^2 = 0.0484$, market variance: $\sigma_M^2 = 0.04$, market return: $\mu_M = 0.08$, Correlation with market: $\rho = 0.82$

Determining expected stock return: Use the CAPM: $\mu_i = r + \beta_i(\mu_M - r)$, $\beta_i = \frac{\sigma_{iM}}{\sigma_M^2} = \frac{\sqrt{\sigma^2} \sqrt{\sigma_M^2} \rho}{\sigma_M^2} = \frac{0.03608}{0.04} = 0.902 \Rightarrow \mu_i = 0.035 + 0.902(0.08 - 0.035) = 0.07559$

Stock value: $P_t = \frac{1+g}{\mu_i - r} D_t = \frac{1+0.04}{0.07559 - 0.035} 13 = 380$

Final result: As the current stock price exceeds its value, the stock is not a good investment and buying it is not recommended.
- Change required:* All results from part a. can be reused as only the growth rate of dividends changes to $g = 0.05$.

Stock value: $P_t = \frac{1+g}{\mu_i - r} D_t = \frac{1+0.05}{0.07559 - 0.035} 13 = 528$

Final result: As the current stock price is below its value, the stock is a good investment and buying it is recommended.
- The value of the stock increases by nearly 40% when increasing the expected growth rate of dividends from 4% to 5%. The reason is that while the growth rate of dividends is only slightly higher, the cumulative effect is substantial. This is*

especially true if the growth rate g is close to the discount rate μ_i as in this case future dividends are growing at nearly the same rate as the discount rate, making their present value remain nearly constant year after year, adding substantial value to the stock.

Problem 12

Jones & Co. seek to expand their business and have drawn up three possible avenues for investment:

- Expanding their current business in the domestic market would require an investment of £100m and they expect to generate profits giving a return on investment of 11% each year for the foreseeable future. Having discussed this investment with their bank, the bank has agreed to grant a loan of £60m at a loan rate of 8% p.a.
- They could expand in an overseas market, investing £70m, which would generate an initial return on investment of 7%, but their profits are expected to grow by 4% every year. Their bank would provide a loan of £35m at a loan rate of 9% p.a.
- The final investment opportunity would be to diversify their business by expanding into new markets, which would require an investment of £110m, to which the bank would lend £65m at a loan rate of 9.5% p.a. The investment is expected to yield a return of 11.5% p.a. for the foreseeable future.

For these investments they are able to raise up to £100m in equity.

If Jones & Co. face equity costs of 12% p.a., what would be your advice on their investments?

Indicative answer: The investments need to be evaluated using Net Present Value. and then the optimal combination of investments chosen.

Weighted Average Cost of Capital: Cost of equity: $\mu = 0.12$

Investment 1: Investment: $I_1 = 100$, debt: $D_1 = 60$, equity: $E_1 = I_1 - D_1 = 100 - 60 = 40$, loan rate: $r_L^1 = 0.08 \Rightarrow R_1 = \mu \frac{E_1}{D_1 + E_1} + r_L^1 \frac{D_1}{D_1 + E_1} = 0.12 \frac{40}{60 + 40} + 0.08 \frac{60}{60 + 40} = 0.096$

Investment 2: Investment: $I_2 = 170$, debt: $D_2 = 35$, equity: $E_2 = I_2 - D_2 = 70 - 35 = 35$, loan rate: $r_L^2 = 0.09 \Rightarrow R_2 = \mu \frac{E_2}{D_2 + E_2} + r_L^2 \frac{D_2}{D_2 + E_2} = 0.12 \frac{35}{35 + 35} + 0.09 \frac{35}{35 + 35} = 0.105$

Investment 3: Investment: $I_3 = 110$, debt: $D_3 = 65$, equity: $E_3 = I_3 - D_3 = 110 - 65 = 45$, loan rate: $r_L^3 = 0.095 \Rightarrow R_3 = \mu \frac{E_3}{D_3 + E_3} + r_L^3 \frac{D_3}{D_3 + E_3} = 0.12 \frac{45}{65 + 45} + 0.095 \frac{65}{65 + 45} = 0.1098$

Net Present Values: Profits: $\Pi_1 = 0.11 \times 100 = 11 \Rightarrow NPV_1 = \frac{\Pi_1}{R_1} - I_1 = \frac{11}{0.096} - 100 =$

14.58

Profits: Growth rate of profits: $g = 0.04$, Initial profits: $\Pi_2 = 0.07 \times 70 = 4.9 \Rightarrow NPV_2 = \frac{1+g}{R_1-g} \Pi_2 - I_2 = \frac{1+0.04}{0.105-0.04} 4.9 - 70 = 8.40$

Profits: $\Pi_3 = 0.115 \times 110 = 12.65 \Rightarrow NPV_3 = \frac{\Pi_3}{R_3} - I_3 = \frac{12.65}{0.1098} - 110 = 5.21$

Assessment of individual investments: All investments have positive Net Present Value and all investments should be made.

Choice of investments: The company cannot finance all investments as it cannot raise sufficient equity. The maximum that can be raised is £100m and the investments require equity of £40m, £35m, and £45m, respectively. We can therefore at most make two of these investments and should choose those two that give the highest Net Present Value when combined. In this case this is investment 1 and investment 2.

Final result: Jones & Co. should expand their current business in their domestic market and expand overseas.

Problem 13

You observe that after an increase in the stock price the next price change of the stock is more likely to be positive than negative. After a decrease in the stock price, you find that the next price change is more likely to be positive than negative. You conclude that the market cannot be efficient as whatever the last observation of the price change, the price is more likely to increase than decrease.

- Is your conclusion correct, assuming you have performed appropriate statistical test supporting your observation?
- If instead, you observed that after a decrease in the stock price the next price change is more likely to be negative than positive, would your conclusion hold?

Indicative answer:

- You cannot make this conclusion. Market efficiency implies that the returns of stocks are uncorrelated over time, it makes no claims about the signs of any stock movements. The average return of a stock is positive, hence it will be more likely to observe positive price changes than negative price changes, as in this case. What is relevant is the correlation of returns, thus any variations around this trend of the stock price. Thus from your observations you cannot conclude that the market is inefficient, but you can also not conclude that it is efficient.*
- Your observation suggests serial correlation as after a positive return, positive returns are more likely and after a negative return another negative return is*

more likely. Therefore we have a positive serial correlation, which contradicts the implications of efficient markets and, provided statistical tests show a sufficiently high level of significance, you can conclude that the market in this stock is not efficient.

Problem 14

You have two companies that compete in the same market, facing comparable competitive forces. Despite them being so similar, the profits of the listed company Pillmeyer AG has grown at a rate of 4% p.a., while Hertig KG, which is privately owned, has only grown at 3% p.a. With the current owners of Hertig KG seeking to sell their company, they need to determine its value to be able to set an appropriate price. As Pillmeyer AG is listed on the stock exchange, they know that its value is €117m and according to their latest annual report they generated profits of €4.5m. Internal numbers show that Hertig KG showed profits of €1.7m.

What is the value of Hertig KG?

Indicative answer:

Identifying the problem: To value Hertig KG we need to have information on the current profits $D_2 = 1.7$, the growth rate of these profits, $g_2 = 0.03$, and the discount rate of future profits, the expected return on the equity of the company. This information is not given. As both companies are identical and subject to the same market forces, it is reasonable to assume that the expected returns on both companies are identical. We would thus turn to Pillmeyer AG and use their expected return, but this is also not given. However, we can derive this expected return.

Obtaining the expected return: For Pillmeyer AG we have $P_1 = \frac{1+g_1}{\mu_1-g_1}D_1 \Rightarrow 117 = \frac{1+0.04}{\mu_1-0.04}4.5 \Rightarrow \mu_1 = 0.08$, assuming that the expected returns for both companies are identical, we have $\mu_1 = \mu_2 = 0.08$.

Value of Hertig KG: $P_2 = \frac{1+g_2}{\mu_2-g_2}D_2 = \frac{1+0.03}{0.08-0.03}1.7 = 35.02$

Final result: The value of Hertig KG is €35.02m.

Topic 5

Problem 15

You observe the following term structure on government bonds:

Maturity (years)	1	2	3	4	5	6	7	8	9	10
Yield (% p.a.)	3.24	3.31	3.57	3.82	4.13	4.41	4.93	5.02	5.52	5.97
Maturity (years)	11	12	13	14	15	16	17	18	19	20
Yield (% p.a.)	6.08	6.12	5.86	5.68	5.52	5.35	5.27	5.22	5.20	5.19

- What is the expected yield of a 3-year bond in 4 years' time?
- How do you explain the change of the yield the 3-year bond experiences, given your answer to part a.?
- In how many years' time do you expect short-term yields to decline?
- In how many years' time do you expect the yield 5-year bonds to decline?

Indicative answer:

- Determining the relevant bonds: The bond in question matures in 7 years time, hence we need to choose the return on the 7-year bond: $(1 + 0.0493)^7$. This return needs to be equal to that of a 4-year bond bought now, $(1 + 0.0382)^4$, followed by a 3-year bond, whose yield is unknown: $(1 + r)^3$*

Solution: $(1 + 0.0493)^7 = (1 + 0.0382)^4 (1 + r)^3 \Rightarrow r = 0.0643$

Final result: The bond in question is expected to have a yield of 6.43%.
- The yield of 3-year bonds is expected to increase from 3.57% to 6.43%, this is due to the yield curve being increasing, implying that investors expected yields to increase over time.*
- An increasing yield curve implies that yields are expected to rise, while a decreasing yield curve implies that they are expected to decrease. The yield curve obtains a negative slope after 12 years, hence we would expect short term yield to decrease again in 12 years time.*
- The slope of the yield curve over a time period of 5 years becomes negative after 10 years. Hence yields on 5-year bonds are expected to fall in 10 years time.*

Problem 16

A bank has obtained deposits to the amount of \$50m from a wealthy individual and agreed to pay interest of 5.5% p.a. for a period of 2 years, while the current level of interest rates for all maturities is 5.25%. It can grant loans at the current level of interest to companies with repayments to be scheduled in 5 years. In order to completely eliminate any interest rate risk, how much loans do they need to provide to companies?

Indicative answer: We need to employ a duration-based hedge. For this, we need to obtain the duration of bonds, which in turn requires the 'bond' value. We derive these first for a nominal value of 100. The coupon payment are then the interest rate agreed multiplied by the nominal value. **Identification of parameters:** $C_1 = 0.055 \times 100 = 5.5$, $r_1 = 0.0525$, $T_1 = 2$, $C_2 = 0.0525 \times 100 = 5.25$, $r_2 = 0.0525$, $T_2 = 5$

'Bond' values: Deposits: $B_1 = \frac{5.5}{1+0.0525} + \frac{5.5}{(1+0.0525)^2} + \frac{100}{(1+0.0525)^2} = 100.46$

Loans: $B_2 = \frac{5.25}{1+0.0525} + \frac{5.25}{(1+0.0525)^2} + \frac{5.25}{(1+0.0525)^3} + \frac{5.25}{(1+0.0525)^4} + \frac{5.25}{(1+0.0525)^5} + \frac{100}{(1+0.0525)^5} = 100.00$

Duration: $D_1 = \frac{\sum_{\tau=1}^{T_1} \tau \frac{C_1}{(1+r_1)^\tau} + T_1 \frac{100}{(1+r_1)^{T_1}}}{B_1} = \frac{\frac{5.5}{1+0.0525} + 2 \frac{5.5}{(1+0.0525)^2} + 2 \frac{100}{(1+0.0525)^2}}{100.45} = 1.9481$

$D_2 = \frac{\sum_{\tau=1}^{T_2} \tau \frac{C_2}{(1+r_2)^\tau} + T_2 \frac{100}{(1+r_2)^{T_2}}}{B_2} = \frac{\frac{5.25}{1+0.0525} + 2 \frac{5.25}{(1+0.0525)^2} + 3 \frac{5.25}{(1+0.0525)^3} + 4 \frac{5.25}{(1+0.0525)^4} + 5 \frac{5.25}{(1+0.0525)^5} + 5 \frac{100}{(1+0.0525)^5}}{100} = 4.5470$

Weight of loans: $\omega_2 = \frac{D_1}{D_1 - D_2} = -0.7496$

Final result: As deposits are liabilities to banks loans are assets, having different signs, doe snot imply a short position in loans. The total amount of loans that need to be given is then $-0.7496 \times 50 = 37.4793$. The total value of loans that need to be given is \$37.4793m. The amount of loans given is less than the deposits obtains as the loans have longer durations and are therefore more sensitive to interest rate changes.

Problem 17

As an intern at Khalili Bank in the country of Avar, you are asked to provide a brief statement for a client meeting on the likely economic conditions in the next few years. You have only recently moved to Avar and are very much unaware of the economic situation. However, you observe that the yield curve has an inverse hump shape, i. e. it initially decreases and from year 4 onwards increases again.

What would be your conclusions?

Indicative answer: The yield curve gives an indication about the future development of interest rates. The initially decreasing yield curve suggests that short-term

interest rates are falling and in 4 years time they will start to increase again. This indicates that over the next four years the market expects the central bank to lower interest rates before than increasing them. Applying basic macroeconomic theory, this suggests economic growth is slowing down or a recession is entered from which Avar will emerge in approximately four years.

Problem 18

A pension fund has long-term liabilities due to commitments of future pension payments. It determines the value of these commitments by discounting at the currently prevailing interest rate for 25-year government bonds. Until pension payments have to be made, the pension fund has invested a considerable part of their reserves into Treasury Bills and comparable short-term debt instruments. They valued the instant access these investments guaranteed, without being too much affected by changing interest rates. The yields on long-term bonds have been falling recently and the pension fund made considerable losses as a consequence.

- a. Why does the pension fund suffer losses as long-term interest rates fall?
- b. How can the pension fund reduce the risk of losses from future decreases in the long-term interest rate?

Indicative answer:

- a. *A lower discount rate, here the interest rate of the long-term bonds, increases the value of the 'bond'. The 'bond' in this case is a liability of the pension fund, hence the value of their liabilities increase. This is not matched by a comparable increase in the value of assets; they are short-term bonds and as such will have shorter duration, so even if short-term interest rates were falling, the increase in the value of assets would be smaller. Hence, the value of liabilities will increase more than the value of assets, akin to debt increasing without the value of assets increasing. Thus overall the net-value of the pension fund will decrease, causing it make losses.*
- b. *If matching the duration of assets to the duration of liabilities, increases in the value of liabilities will be much better matched by an increase in the value of assets, reducing losses. Therefore, the pension fund should commence investing their reserves into long-term bonds rather than short-term bonds.*

Topic 6

Problem 19

Steaucescu SRL has purchased new machinery to upgrade and expand their current production facilities. The machinery was purchased from a manufacturer in France for a price of €12m. The main currency at which Steaucescu SRL invoices their customers is the Romanian Leu and due to recent considerable volatility of their currency, they seek to hedge their payment to their French supplier, which is due in 4 months. The current exchange rate is 5 Leu/€ and the interest rates in Romania are 7.2% p.a., while in France they are 4.8% p.a.

- a. What is the forward rate that Steaucescu SRL would obtain?
- b. Explain why the forward rate differs from the spot rate.

Indicative answer:

- a. *Identification of variables: underlying asset: is the Euro, so the current exchange rate is $S_t = \frac{1}{5} = 0.2$, financing rate $r_L = 0.072$, yield on underlying asset $r_S = 0.048$, time to maturity is to be given in years to make it consistent with the interest rates $T = \frac{4}{12} = \frac{1}{3}$
 Forward rate: $K = S_t + (r_L - r_S) T S_t = 0.2 + (0.072 - 0.048) \frac{1}{3} 0.2 = 0.2016$
 Final result: The forward rate would be 4.96 Leu/€.*
- b. *The forward rate is lower than the spot rate as the interest rate in the Romanian Leu is higher than in the Euro. This allows investors to gain higher profits from investing into the Romanian Leu than the Euro and this difference is compensated for by a lower forward rate, which can be interpreted as the equivalent of a depreciation of the Romanian Leu.*

Problem 20

RiskConsult LLP is a hedge fund that invests extensively in small listed companies that are mostly neglected by investors; their current portfolio encompasses holdings

in approximately 150 of such companies. They have achieved annual returns of 11% with a volatility of 18%, while the market showed an annual volatility of 27% and generated only 7%, although some investors were not satisfied with their investment strategy as it showed a correlation of 0.8 with the market, limiting their diversification benefits from investing into RiskConsult LLP. With some of their investments being financed through a loan, which is due to be repaid in three months time, RiskConsult LLP seeks to lock in any gains they have made to avoid having to sell holdings at a loss in the future. Due to agreements with their investors, they are not able to sell these stocks and retain the proceeds in cash as they normally would do. They have set aside a representative part of their portfolio, valued at \$15m, that they seek to sell for the repayment of the loan.

- a. Which instrument is most suitable to hedge the exposure of RiskConsult LLP?
- b. If only derivatives on the market are available, how many contracts would you need to obtain for your hedging strategy in part a.?

Indicative answer:

- a. *RiskConsult LLP should hedge their exposure through selling a futures. Their preferred strategy is to sell the stocks instantly, which is not possible, hence selling them in the future at a price already fixed now is the equivalent as it give RiskConsult LLP a set price agreed now and the sale can be delayed until the loan needs to be repaid.*
- b. *We need to determine the hedge ratio of the futures identified in part a. The hedge ration requires the β_i of the portfolio, which can be determined from the information given: $h_i = \beta_i = \frac{\sigma_{iM}}{\sigma_M^2} = \frac{0.18 \times 0.27 \times 0.8}{0.27^2} = 0.5333$. If the total position to be hedged is worth \$15m, then the value of the underlying market portfolio on which is the futures is based will have to be $0.5333 \times 15 = 8$. Thus RiskConsult LLP needs to sell futures for the equivalent of \$8m of the market portfolio.*

Problem 21

Seven years ago, a company has agreed a £25m loan with a bank at a variable loan rate that is adjusted every 3 months to the SOFR + 0.25%. As the company has mainly fixed obligations, but at the time could not find a bank offering competitive loan rates on 10-year bonds, they entered a swap agreement with their bank, which had an initial time to maturity of 10 years, matching the terms of their loan. The swap rate at the time of the agreement was 7.5% p.a. and the current term structure

Problem 22

for government bonds is

Maturity (years)	SOFR	1	2	3	4	5	6	7	8	9	10
Yield (% p.a.)	2.96	3.24	3.31	3.57	3.82	4.13	4.41	4.93	5.02	5.52	5.97

The company is generally regarded as safe by investors due to their market position and safety of business and attracts a risk-premium of 0.25% p.a..

If the interest rate on their loan has just been reset, what is the current value of their swap?

Indicative answer: We need to determine the value of fixed-rate bond they have obtained and the variable-rate bond they have swapped.

Value of variable-rate bond: As the bond has only recently been reset, it will be worth its face value, which for convenience set at $B_{var} = 100$ for now.

Value of fixed rate bond: The bond has only 3 years left, so the relevant discount rate is the 3-year bond yield, plus the risk premium the company is charged, the bond agreed had a swap rate of 7.5% and this will be the coupon payments on this bond:

$$B_{fix} = \frac{7.5}{1+0.0357+0.0025} + \frac{7.5}{(1+0.0357+0.0025)^2} + \frac{7.5}{(1+0.0357+0.0025)^3} + \frac{100}{(1+0.0357+0.0025)^3} = 110.2473$$

$$\text{Value of the swap } V = B_{fix} - B_{var} = 110.2473 - 100 = 10.2473$$

Final result: The value of the swap overall has to be based on £25m, not 100, hence the total value £2.5618m

Problem 22

As part of their investment strategy, Alliance Insurance plc has developed a small division that purchases swaps and forwards from selected banks who have agreed such contracts with their clients, but may want to divest for reasons of risk management. A junior trader is observing the negotiation between an experienced trader and her counterparty at the bank. They are discussing the terms of a USD-GBP currency swap for a nominal \$100m, which the bank has agreed for one of their leading customers. This currency swap has a remaining time to maturity of 8 years. The junior trader is astounded to hear that the insurance company has eventually bought the swap and received a payment of \$4m for purchasing this swap; he has never seen a situation where a security is bought and the seller pays the purchaser.

How do you explain this agreement?

Indicative answer: Swaps (as forwards and futures) can have a negative value. In this specific case, the value of the swap would be given by $V - B_{domestic} - eB_{foreign}$ and this can become negative if the value of the foreign 'bond' increases more than the value

of the domestic 'bond', adjusted for any changes in the exchange rate. Such a scenario is realistic if the interest rate of the foreign 'bond', here is USD bond, decreases more than that of the domestic 'bond', the one denominated in GBP, and any interest rate changes are not fully reflected by an adjustment of the exchange rate. The negative value arises in this case as the purchaser pays a higher interest rate on this foreign bond than is the current market rate, thus it overpays and would be better off issuing the bond at the current market rate, relative to the amount the purchaser receives on the domestic bond. This implicit overpayment in the swap needs to be compensated for and for the seller to get out of the swap agreement, where he overpays on the foreign bond, he is willing to offer any purchaser compensation. This compensation is then used by the purchaser to offset the overpayments they will have to make for the remainder of the swap.

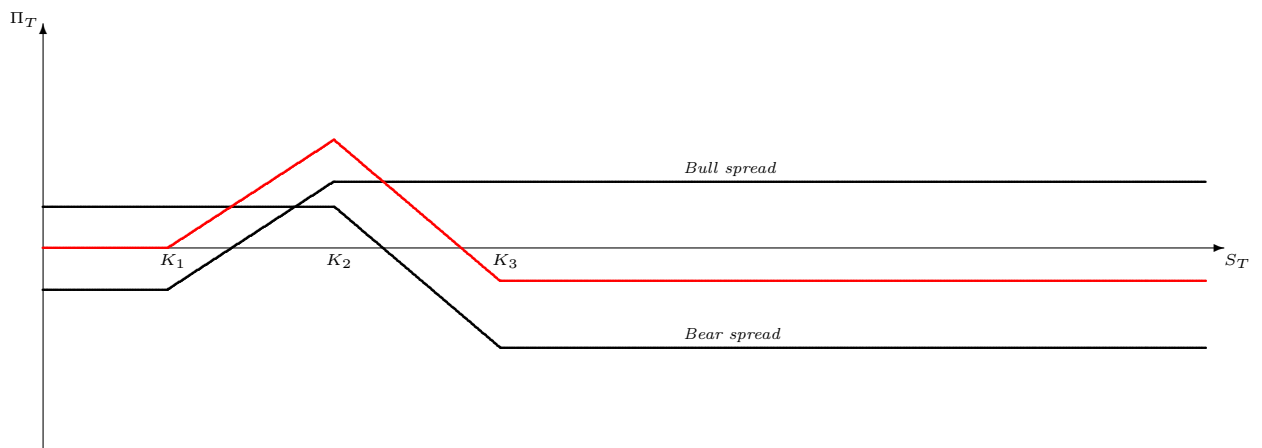
Topic 7

Problem 23

An investor has obtained information on a company, but is unsure about the impact this will have on the stock price, once it becomes publicly known. The company is seeking to expand overseas to counter increased competition in their domestic markets. This could be seen as a positive move by the company to secure future profitability and the stock price should increase. On the other hand, it can be seen as a sign that profitability in their domestic market, which makes up the majority of their current profits, is under more strain than the market has anticipated and this would reduce the stock price. Having gone through both scenarios, he believes that the stock price will either increase by about 10% if the information is seen positively, or the stock price will decrease by 20% if the information is interpreted negatively.

Develop an investment strategy using options that allows the investor to take advantage of his information.

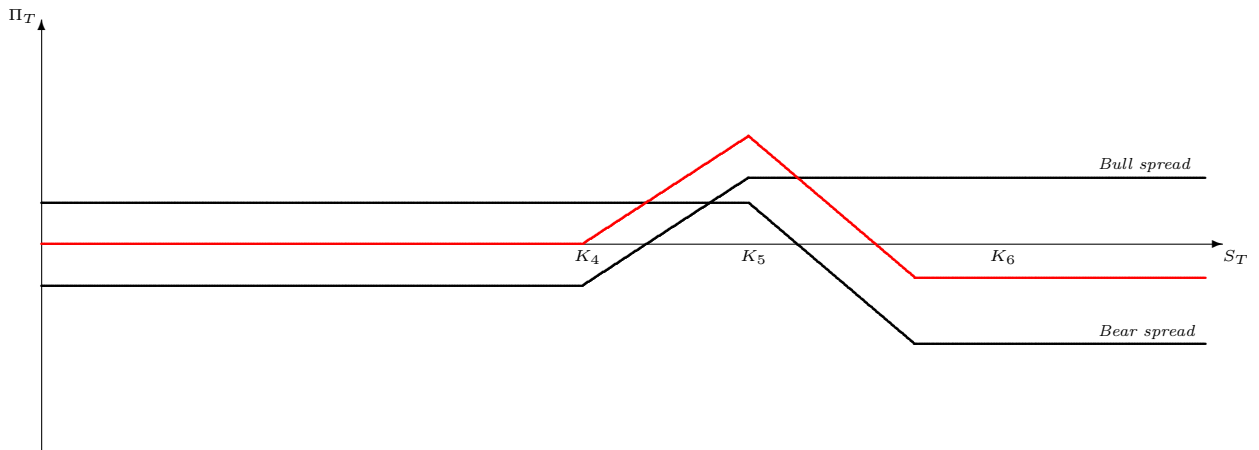
Indicative answer: *The investor should be making profits if the prices are increasing by about 10% or decreasing by about 20%. We can use bull and bear spreads with appropriate strike prices. For simplicity set the current price at 100. Then we set bull and bear spreads as follows to achieve maximum payoffs at a stock price of 80:*
Bull spread: *Select a low strike price below 80, and a higher strike price at 80*
Bear spread: *Select a low strike price at 80 and a higher strike price below 80*



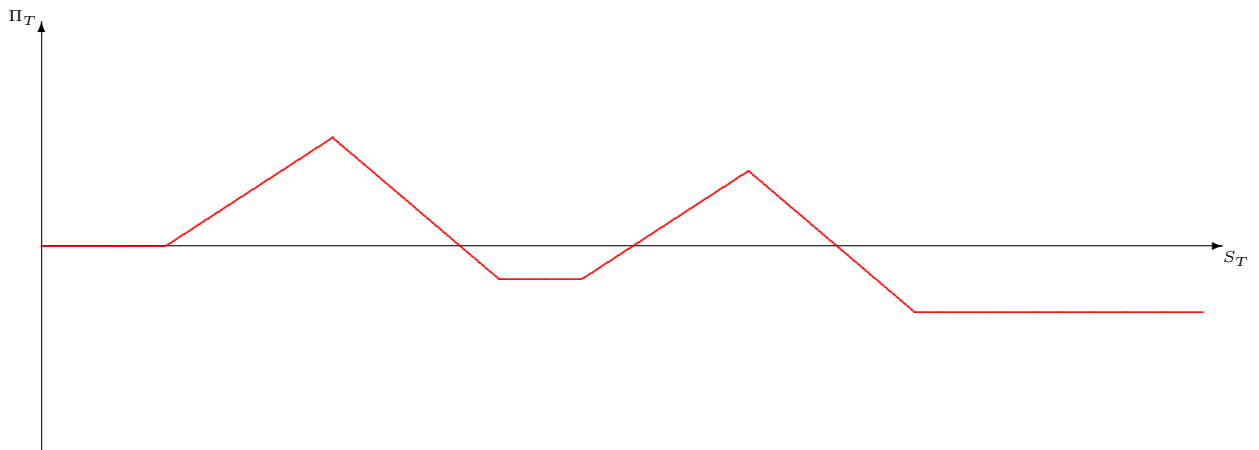
This is now repeated for strike prices for the positive impact of the information:

Bull spread: Select a low strike price below 110, and a higher strike price at 110

Bear spread: Select a low strike price at 110 and a higher strike price below 110



Combining these two, we get the desired payoff profile



Problem 24

You seek to invest further into Vamelia plc as your analysis suggests that this company will outperform many competitors in the near future. However, you have already hold

24.85% of the outstanding share as a long-term investment and financial regulations require you to make a takeover offer for all outstanding shares if your shareholding reaches 25%. You are not interested in acquiring Vamelia plc completely, and would also not have the financial resources to do so.

- a. How can you benefit from the prospects of Vamelia plc without purchasing their shares?
- b. If no derivatives on Vamelia plc are available in the market, could you use derivatives on a broader stock index to achieve a similar, although not identical outcome?

Indicative answer:

- a. *Creating a synthetic asset, combining a short put and a long call with the same strike price on Vamelia plc would generate the same payoff profile as the stock itself.*
- b. *This would not be possible as techniques like β -hedging only account for systematic price changes and not the idiosyncratic price changes that arise from specific information on a stock. Using options or other derivatives on a stock index would not generate the performance that is the result of the specific information related to Vamelia plc.*

Problem 25

Can option values be negative, like those of futures and swaps?

Indicative answer: *Option values cannot be negative. The negative values in futures and swap arise from the requirement to purchase or sell the asset in futures, or to swap the payments from assets in swaps; such an exchange has to happen even if it is loss-making for the purchaser of that derivative. With options, no such transaction is required. The purchaser of an option can let the option expire without exercising his right to buy or sell the underlying asset. He will exercise the option if it is profitable to do so, but will not exercise the option if this would cause him a loss. It is thus that the payoff of options to the purchaser can never be negative and hence the value of the option cannot be negative. The most the purchaser of an option can lose is the options premium (price) paid when purchasing the option, but this is a sunk cost as the purchase price cannot be recovered in any case and therefore does not affect the value of the option.*

Problem 26

If two portfolios have the same value at some point in the future, why will the prices of those two portfolios always be identical, even before this point in time?

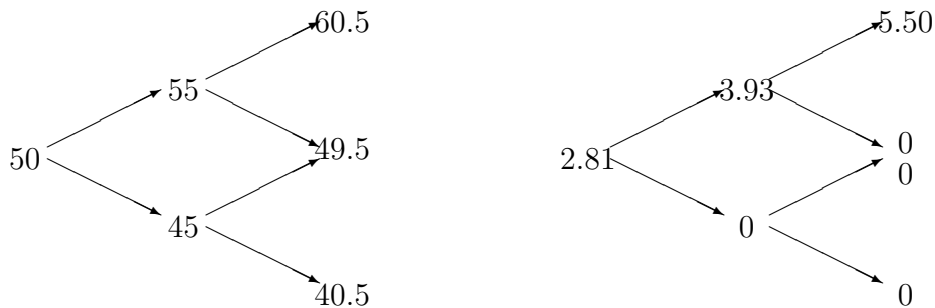
Indicative answer: *The argument is that if the prices were not identical, arbitrage could generate profits without investment, giving investors profits for free. Assume at some time T the portfolios have the same value V_T . At some time prior to this, their values are V_1 and V_2 , respectively, where $V_1 \neq V_2$. I know form a portfolio of these two portfolios by choosing 1 unit of portfolio 1 and ω units of portfolio 2. I set these values such that $V_1 + \omega V_2 = 0$, and I make no investment. We need $\omega = -\frac{V_1}{V_2}$. At time T this portfolio will be worth $\Pi_T = V_T + \omega V_T = \left(1 - \frac{V_1}{V_2}\right) V_T$. If $V_2 > V_1$, we see that $\Pi_T > 0$. If $V_2 < V_1$, we swap the portfolios 1 and 2. Only if $V_1 = V_2$ do we have $\Pi_T = 0$. If $V_1 \neq V_2$, we can generate profits without making an initial investment. Such 'free money' cannot exist as every investor could instantly generate an infinite amount of profits.*

Topic 8

Problem 27

In each time period, a stock, currently trading at £50, increases or decreases by 10% with equal probability. If you buy a European call option with a strike price of £55 maturing in 2 time periods, how much do you expect to pay if the risk-free rate is 5% per time period and the return on the stock is expected to be zero?

Indicative answer:



We solve for the option price backwards. As a Call option, the payments at maturity are

$$C_{uu} = \max\{0; u^2S - K\} = \max\{0; 60.5 - 55\} = 5.5$$

$$C_{ud} = C_{du} = \max\{0; udS - K\} = \max\{0; 49.5 - 55\} = 0$$

$$C_{dd} = \max\{0; d^2S - K\} = \max\{0; 40.5 - 55\} = 0$$

We now work backwards to the first time period:

$$\Delta_u = \frac{C_{uu} - C_{ud}}{S_u(u-d)} = \frac{5.5 - 0}{55(1.1-0.9)} = 0.5, \quad B_u = \frac{1}{1+r} \frac{uC_{ud} - dC_{uu}}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 0 - 0.9 \times 5.5}{1.1-0.9} = -23.57 \Rightarrow$$

$$C_u = \Delta_u S_u + B_u = 0.5 \times 55 - 23.57 = 3.93$$

$$\Delta_d = \frac{C_{du} - C_{dd}}{S_d(u-d)} = \frac{0 - 0}{45(1.1-0.9)} = 0, \quad B_d = \frac{1}{1+r} \frac{uC_{dd} - dC_{du}}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 0 - 0.9 \times 0}{1.1-0.9} = 0 \Rightarrow$$

$$C_d = \Delta_d S_d + B_d = 0 \times 45 + 0 = 0$$

For the first time period we get

$$\Delta = \frac{C_u - C_d}{S(u-d)} = \frac{3.93 - 0}{50(1.1-0.9)} = 0.393, \quad B = \frac{1}{1+r} \frac{uC_d - dC_u}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 0 - 0.9 \times 3.93}{1.1-0.9} = -16.8429 \Rightarrow$$

$$C = \Delta S + B = 0.393 \times 50 - 16.8429 = 2.8071$$

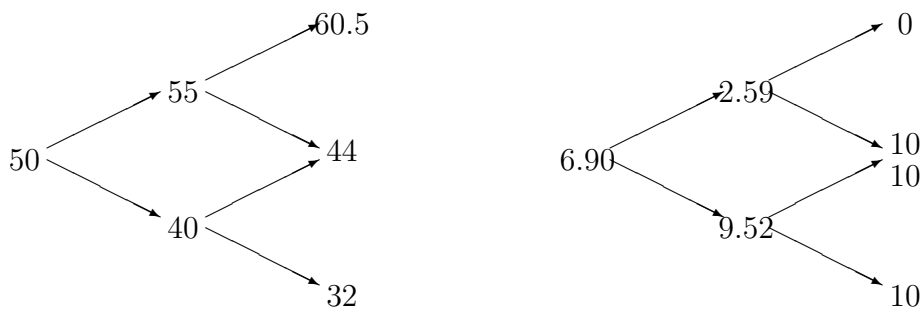
The option is worth £2.81.

Problem 28

A Digital Option is an option that pays a fixed amount if it is exercised and is otherwise similar to a standard option. A Digital Call option pays the agreed amount if at maturity the price of the underlying asset is above the strike price and a Digital Put option pays the agreed amount if at maturity the price of the underlying asset is below the strike price.

Consider a stock, currently trading at £50, which increases by 10% or decreases by 20% with equal probability. If you buy a Digital put option with a strike price of £45 maturing in 2 time periods which pays you £10, how much do you expect to pay if the risk-free rate is 5% per time period?

Indicative answer:



We solve for the option price backwards. As a Call option, the payments at maturity are

$C_{uu} = 0$ as the price is above the strike price

$C_{ud} = C_{du} = 10$ as the price is below the strike price

$C_{dd} = 10$ as the price is below the strike price

We now work backwards to the first time period:

$$\Delta_u = \frac{C_{uu} - C_{ud}}{S_u(u-d)} = \frac{0-10}{55(1.1-0.8)} = -0.6061, B_u = \frac{1}{1+r} \frac{uC_{ud} - dC_{uu}}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 10 - 0.8 \times 0}{1.1-0.8} = 35.9206 \Rightarrow C_u = \Delta_u S_u + B_u = -0.6061 \times 55 + 35.9206 = 2.5851$$

$$\Delta_d = \frac{C_{du} - C_{dd}}{S_d(u-d)} = \frac{10-10}{40(1.1-0.8)} = 0, B_d = \frac{1}{1+r} \frac{uC_{dd} - dC_{du}}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 10 - 0.8 \times 10}{1.1-0.8} = 9.5238 \Rightarrow C_d = \Delta_d S_d + B_d = 0 \times 40 + 9.5238 = 9.5238$$

For the first time period we get

$$\Delta = \frac{C_u - C_d}{S(u-d)} = \frac{2.5851 - 9.5238}{50(1.1-0.8)} = -0.4626, B = \frac{1}{1+r} \frac{uC_d - dC_u}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 9.5238 - 0.8 \times 2.5851}{1.1-0.8} = 28.0270 \Rightarrow C = \Delta S + B = -0.4626 \times 50 + 28.0270 = 6.8970$$

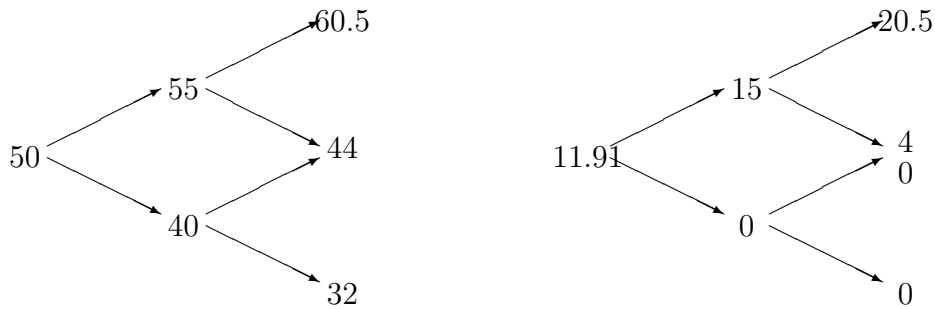
The option is worth £6.90.

Problem 29

A Barrier Option is an option that pays the normal option payoff, but only if during the life time of the option certain price limits (barriers) either have been breached or have not been breached. An 'Up-and-in' Call option allows the buyer to obtain the usual payments of a call option, provided during the life of the option, the stock price has exceeded the barrier price.

Consider a stock, currently trading at £50, which increases by 10% or decreases by 20% with equal probability. If you buy an 'Up-and-in' Call option with a strike price of £40 and a barrier at £53 maturing in 2 time periods, how much do you expect to pay if the risk-free rate is 5% per time period?

Indicative answer:



We solve for the option price backwards. As a Call option, the payments at maturity are

$$C_{uu} = \max \{0; u^2 S - K\} = \max \{0; 60.5 - 40\} = 20.5 \text{ as the barrier has been crossed}$$

$$C_{ud} = \max \{0; u^2 S - K\} = \max \{0; 44 - 40\} = 4 \text{ as the barrier has been crossed}$$

$$C_{du} = 0 \text{ as the barrier has not been crossed}$$

$$C_{dd} = 0 \text{ as the barrier has been crossed and the strike price is above the stock price at maturity}$$

We now work backwards to the first time period:

$$\Delta_u = \frac{C_{uu} - C_{ud}}{S_u(u-d)} = \frac{20.5 - 4}{55(1.1 - 0.8)} = 1, \quad B_u = \frac{1}{1+r} \frac{uC_{ud} - dC_{uu}}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 4 - 0.8 \times 20.5}{1.1 - 0.8} = -40 \Rightarrow$$

$$C_u = \Delta_u S_u + B_u = 1 \times 55 - 40 = 15$$

$$\Delta_d = \frac{C_{du} - C_{dd}}{S_d(u-d)} = \frac{0 - 0}{40(1.1 - 0.8)} = 0, \quad B_d = \frac{1}{1+r} \frac{uC_{dd} - dC_{du}}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 0 - 0.8 \times 0}{1.1 - 0.8} = 0 \Rightarrow$$

$$C_d = \Delta_d S_d + B_d = 0 \times 40 + 0 = 0$$

For the first time period we get

$$\Delta = \frac{C_u - C_d}{S(u-d)} = \frac{15 - 0}{50(1.1 - 0.8)} = 1, \quad B = \frac{1}{1+r} \frac{uC_d - dC_u}{u-d} = \frac{1}{1+0.05} \frac{1.1 \times 0 - 0.8 \times 15}{1.1 - 0.8} = -38.0952 \Rightarrow$$

$$C = \Delta S + B = 1 \times 50 - 38.0952 = 11.9048$$

The option is worth £11.91.

Problem 30

A stock, currently trading at £50 and has a volatility of 25%. You buy a European call option with a strike price of £55 maturing in 2 months, the risk-free rate is 5% p.a. and the return on the stock is expected to be 12% p.a.

- Using the Black-Scholes formula, how much do you expect to pay for this Call option?
- How much would be value of a Put option with the same characteristics?

Indicative answer:

- With all variables given on an annual basis, the time to maturity must also be

$$\text{on an annual basis, } T = \frac{2}{12} = \frac{1}{6}.$$

$$d_1 = \frac{\ln \frac{S}{K} + (r + \frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}} = \frac{\ln \frac{50}{55} + (0.05 + \frac{1}{2}0.25^2)\frac{1}{6}}{0.25\sqrt{\frac{1}{6}}} = -0.8012$$

$$d_2 = d_1 - \sigma\sqrt{T} = -0.8012 - 0.25\sqrt{\frac{1}{6}} = -0.9032$$

$$C = SN(d_1) - Ke^{-rT}N(d_2) = 50N(-0.8012) - 55e^{-0.05\frac{1}{6}}N(-0.9032) = 50 \times (1 - 0.7881) - 54.5436 \times (1 - 0.8159) = 0.5535$$

The option is worth £0.55.

- We can use the Put-Call parity: $P = C - S + Ke^{-rT} = 0.5535 - 50 + 55e^{-0.05\frac{1}{6}} = 5.0971$

The Put option is worth £5.10.

Topic 9

Problem 31

You are holding 2000 stocks whose characteristics have been discussed in problem 30.

- a. If you wanted to ensure to hedge the value of your position perfectly during the coming 2 months at a price of £55 using put options, how many put options would you have to purchase?
- b. Once you have purchased these put options, what further actions do you have to take in order to ensure your perfect hedge?

Indicative answer:

- a. We use the Δ -hedging. From problem 30 we know that $\Delta_C = N(d_1) = 1 - 0.7881 = 0.2119$. We then get $\Delta_P = \Delta_C - 1 = -0.7881$. The hedge ratio is then given by $fh = -\frac{1}{\Delta_P} = 1.2689$. For 2000 stocks, this implies that you have to purchase 2538 put options.
- b. The hedge ratio is constantly changing as the option approaches maturity (T changes) and the stock price S changes. Hence you will have to constantly adjust the number of put options held, necessitating frequent buying and selling of put options.

Problem 32

You believe to have spotted the mispricing of a call option on a leading company. The company has released new information, that has led to widespread confusion in the market about its future prospects and has reduced the price of its stocks by just over 5% during the day. At the same time, a call option has increased in value. You now believe the call option to be overpriced as its value should have gone down with the stock price.

Is it correct that you have identified the mispricing of this call option?

Indicative answer: *The option is not necessarily mispriced. Its price should indeed fall if the price of the underlying asset decreases. However, the value of the underlying asset is not the only determinant of the option price. A further reduction should be observed because the option is closer to maturity, seemingly confirming your assessment that the option is mispriced. However, option values are most sensitive to the volatility of the underlying asset. In this case the uncertainty surrounding the company's future prospects will have increased the uncertainty and thus the anticipated volatility of the stock. If the underlying asset becomes more risky, its volatility increases, the option becomes more valuable. This effect can easily outweigh the effect the change in the value of the underlying asset had on the option price. Thus the increase in the option price may well be explained by the increased volatility. Of course, specifically, this needs to be investigated using appropriate option pricing models, but the development of the option price is consistent with such models.*

Problem 33

Constantin Theopoleus is the CEO of CT Engineering E.P.E. As part of its investment programme to update their ageing machinery, the board considers the investment options and how these investments can be financed. Constantin Theopoleus intervenes at that point and states that obviously they will take a loan to finance the investment as they should be able to secure a loan at 8-9% p.a., while using equity currently costs 12-15% p.a., depending on how it is calculated. Therefore, loans are cheaper and it would increase the value of the firm to use loans when financing these investments. Is this assertion correct?

Indicative answer: *It is true that loans carry a lower interest rate than the required rate of return on equity. However, as loans are increased, leverage increases, and thereby the risks for equity. Any losses on the now enlarged assets of the company would reduce the given equity more than is the case if equity was raised. In the latter case the same losses would be distributed across more equity, leading to smaller losses per unit of equity. Of course, the same holds for profits. Therefore, overall, the risks of equity holders will increase when financing the investment by loans, which will necessitate that the required return on equity increases. These two effects offset each other exactly and the overall cost of capital for the company, the weighted average cost of capital, remains constant. As this is what determines the value of the company as a whole, not only of the equity component of the company, the value of the company is not affected. It is therefore Constantin Theopoleus is wrong and the way the investments are financed will not affect the value of the company as a whole.*

Problem 34

James Copeland is perplexed by the reaction of markets to an announcement his company has made. As the Chief Financial Officer he has made a disclosure that the company, Engineering Solutions plc, will expand its reach by opening another five offices across the country and finance the acquisition of suitable office space and the recruitment of staff by drawing on a £50m loan facility their bank has provided. Engineering Solutions plc provides engineering consultancy mainly for infrastructure projects and their main clients include Network Rail, National Highways, and major utility companies working on the establishment of wind farms as well as nuclear power plants, making their income stream highly predictable. While such a move to expand its geographical coverage was expected by the market, their share price did not react. In contrast to that, on the same day, another company, AIChip plc, made a long-anticipated announcement of expanding its business by investing into the production of high-end computer chips for use in applications involving artificial intelligence; their market is characterised by a large degree of uncertainty about future developments. Similar to Engineering Solutions plc, they announced that the expansion of their business would be financed through a loan facility provided by their bank. In this case the stock price increased by 8% after the announcement.

How can you explain the differences in the stock market reaction?

***Indicative answer:** Engineering Solutions plc is a very transparent company whose business prospects are well known due to their involvement with the public sector. There is unlikely to be much asymmetric information between the company and their investors. In contrast, the business of AIChip plc is much more opaque and it is likely that the management of the company is much better informed about their future prospects than investors. The use of equity to finance their expansion can now be interpreted as a signal by management to the market that they are confident about the prospects of their investment, which then leads to the rise in the stock price. The absence of this degree of asymmetric information between managers and investors at Engineering Solutions plc leads to a situation where the use of loans is not interpreted as a signal in the management's confidence in the investment; investors have nearly the same information as managers and hence management has nothing to signal to investors. Given that the investment was anticipated, this information would already be included into the stock price (efficient markets) and the form of financing adds no further information, hence the stock price does not react.*

Problem 35

Vijay Foods plc owns a chain of supermarkets and Vijay Singh is its main shareholder and Chief Executive Officer. Recently Vijay Foods announced that as an alternative to modernising its existing supermarkets, it could expand its business by introducing budget supermarkets in the region of Marab, where Vijay Singh is a prominent local politician with ambitions to break into national politics. With their existing supermarkets, Vijay Foods plc target mainly middle class families and the business is performing well. The budget segment is highly contested by a large number of well established operators and financial analysts have been sceptical whether Vijay Foods plc can make a successful entry into this market. Undeterred, Vijay Singh has approached his bank for a loan to finance both the modernisation of its existing supermarkets and the introduction of the new chain of budget supermarkets. His bank has declined to provide the loan and he has decided to use his considerable personal wealth to provide a private loan to the company. While the stock market had not reacted significantly when the expansion plans were announced, the stock price dropped instantly by 6% as the private loan was disclosed.

Why did the stock price drop after this announcement?

***Indicative answer:** The expansion into budget supermarkets is a risky investment, which banks have seen as too risky to finance. It suggests that providing the loan would lead to risk shifting, where the use of loans to finance an investment gives an incentive to take on higher risks; the bank anticipated that rather than modernising their existing supermarkets, Vijay Foods plc would choose the riskier alternative of expanding into the budget sector of the market. It seems that investors share this view and as higher risks will lead to higher discount rates of future profits, the value of the company will reduce, resulting into the fall of the stock price. The fact that a private loan was given by Vijay Singh does not alter this assessment as that loan might be given to reap private benefits in form of increased popularity with poorer families supporting his political ambitions.*

Problem 36

Hiromara Co. is a local producer of energy drinks, but suffers from expanding international competitors taking an increasing market share. Previous launches of new products have been either a failure or lead to moderate success. They have now developed and already announced a new drink they seek to bring to the market and plan a large marketing campaign for which they need to raise ¥10bn. In many previous cases the main shareholder has agreed to finance such investments by the company

issuing new shares, but he has made it clear that his financial resources are limited and he would not be able to provide funding at the scale sought. Approaching their bank, Hiromara Co. is able to secure a loan for the required amount. Taking the willingness of the bank to provide the loan, which was only forthcoming after close scrutiny of its plans, as an endorsement of their plans, the agreement is announced publicly. Expecting a positive response from the stock market, especially as a loan has been raised, Hiromara Co. is disappointed that the stock price remains virtually unchanged.

How do you explain the lack of stock market response to the announcement of the funding of the marketing campaign through a bank loan?

Indicative answer: *Normally we would expect a company to choose a bank loan if they are confident about the prospects of the investment and this would therefore act as a positive signal to the market; here the market does not interpret the loan in this way. The reason is that Hiromara Co. was not free which form of financing to use. They seemed to have favoured equity financing, which would not signal confidence in the prospects of the new product, and only obtained a bank loan as equity finance was not available. Thus, even though a loan was taken, it would not act as a signalling device in this case.*

Topic 10

Problem 37

Fritelli SpA and Mariagno SpA are two stationary companies focussing on high-end writing utensils, such as fountain pens, and accessories. They are both targeting the same market and are fierce competitors, where neither of these two companies seems to have a meaningful advantage over the other. The companies are located within 10 minutes walk of each other in the small town of Limosine and are the result of two brothers falling out over the running of their company, resulting in the company being split. Fritelli SpA is owned to 74% by Giorgio Mariagno, who also manages the company, while Mariagno SpA is owned to 78% by Antonio Mariagno, but due to health concerns has delegated the running of the company to an outside manager and is not involved in any but the most important decisions by the company. By coincidence, both companies announce within days that they will seek to raise equity from outside investors to strengthen their balance sheets and fund further expansion of their respective business lines; the amounts sought would in both cases reduce the holdings of the current owners to below 50%. The reaction of the stock market to this announcement is very different; in the case of Fritelli SpA the stock price drops by 7 while there is no reaction in the stock price of Mariogno SpA.

How can you explain the difference in the reaction of the stock market to the announcement of raising equity?

Indicative answer: *Fritelli SpA is managed by the majority shareholder and raising equity would significantly dilute his stake in the company. This would negatively affect his incentives to exert effort when managing the company; sharing the benefits of his effort with other shareholders will result in less benefits accruing to him, while still facing the full costs of effort. The market therefore anticipates that Giorgio Mariagno would reduce the effort in running the company, resulting in a lower value, which causes the stock price to fall. On the other hand, Fritelli SpA is managed by an outside manager, which presumably has no or a much lower stake in the company. Increasing equity will not affect his incentives to exert effort as this has no effect on his benefits. Thus no changes in his effort is predicted and there is no reaction by the stock market.*

Problem 38

Alcatraz SA produces pipes and pumping stations for water and sewage companies. With many competitors in the field and utility companies employing strict tender rules for any large projects, it has become difficult for companies in this sector to remain profitable, Alcatraz SA being no exemption. Future business plans are often kept secret in this sector as to not give away information to competitors unnecessarily, however, Alcatraz SA has taken the unusual step to use an analyst conference and quite openly discuss their plans for the future development of the company. Financial analysts left the conference impressed by the openness of the company and were grateful for the insights not only into Alcatraz SA itself, but also the industry as a whole. A few weeks after this conference, Alcatraz SA announces that in order to increase their investments into the future development of the company, it will cut its dividend by 50% for the foreseeable future. This announcement took the market, as well as the financial analysts attending the conference, by surprise. However, the stock market did not react much to this announcement with the stock closing down 0.7% compared to the market overall closing down 0.6%.

How can you explain that there was no impact on the stock price after the dividend cut was announced?

***Indicative answer:** Dividends signal information if companies hold better information than investors. In this case a reduction in dividends could be seen as a lack of confidence in their future prospect. Here, however, asymmetric information has been reduced significantly with help of the analyst conference only weeks prior. It is thus that asymmetric information about the future prospects are minimal and dividend policy does not convey information, dividends become irrelevant.*

Problem 39

Röthlisberger AG has lost significant market share in recent years and performed poorly overall, resulting in the dismissal of the senior management. The new management team is seen as highly competent and convinced that the company can be turned around quickly. Having taking up their new roles, the new management team is facing an immediate need to make investments for which additional funds are required. At the board meeting, it is discussed whether the dividend should be reduced, at least temporarily, to preserve cash and reduce the amount that needs to be borrowed for the necessary investments.

Do you think a decision to cut dividends is appropriate?

Indicative answer: *It is reasonable to assume that in the difficult circumstances the company is in, there is considerable asymmetric information between the management and investors and thus dividends could be used to convey the confidence of the management in their ability to turn around the company. By cutting dividends, Röthlisberger AG does the opposite and signals that it does not have this level of confidence. Maintaining the dividend could signal that managers are confident about their restructuring plans as paying such dividends are only sustainable if sufficient profits are generated. This positive signal could be supported by obtaining a larger loan, to cover the dividend payments, sending another positive signal about the prospects of the company. In conclusion, the decision to cut dividends is ill-advised, provided there are no other constraints that drive such a decision.*

Problem 40

OfficeSolutions plc is a real estate company that owns large office spaces in many large cities to rent out as temporary locations for companies whose office undergo renovations or who have a sudden demand for additional office space. Their business has been performing very well recently and due to the lack of available office space to purchase, they have accumulated significant cash reserves. They have now approached RetailSpace plc with the aim of acquiring this company, who operate a similar business as OfficeSolutions plc, but focus on providing retail spaces. With the growth of online shopping, demand for retail space has been low and they have not performed well recently. Its acquisition by OfficeSolutions plc would however fulfill a long-term vision by the founder and CEO of OfficeSolutions plc to provide spaces for all commercial activities in town centres. In discussion with Lambrecht & Co, the investment bank advising them, they have been discussing how to pay for the acquisition. Lambrecht & Co have advised that the acquisition will not be well received by the market, but as OfficeSolutions plc seems insistent on completing the acquisition, they strongly recommend to make a cash offer rather than a stock offer. They advise that using their cash reserves to pay for the acquisitions would be seen as neutral by the market, while issuing shares in OfficeSolutions plc to the owners of RetailSpace plc would be seen as negative and will lead to a fall in the stock price.

What is the rationale for the advice given by Lambrecht & Co?

Indicative answer: *We can interpret this situation as equivalent to paying a dividend and the acquisition of RetailSpace plc as a vanity project by the founder and CEO to fulfill his ambition to be active in more markets, it is thus a moral hazard problem. Paying for the acquisition using cash, will reduce the cash reserves OfficeSolutions plc has available and therefore reduce the moral hazard in the future as the company has less resources which it can use unproductively. This would be seen as positive and should increase the stock price, but this will be balanced against acquiring a company*

that is not performing well. The advice by the investment bank seems to suggest that these two effects are roughly balanced. Using stocks to pay for the acquisition of RetailSpace plc on the other hand would see them acquire the same poorly performing company, but retain their cash reserves with the prospect of moral hazard in the future through the inefficient use of the cash reserves. This leads to the anticipated negative reaction of the stock market. It is therefore that using the cash reserves is preferable.

Topic 11

Problem 41

PLending Ltd. was founded 5 years ago to facilitate tailored peer-to-peer lending. They developed software that provides a platform for borrowers and lenders to negotiate the terms of the loan and is mainly used by high net-worth individual lenders and the borrowers are mainly mid-sized companies. These companies are mostly operating in well-established industries. The companies seeking loans are overall well-established themselves with ample public information about their business available and they typically show profitabilities that are slightly above average, all while using up-to-date technologies and ideas, although they are not at the forefront of innovations. While the platform expanded quickly and gained a loyal following by borrowers as well as lenders, it's growth has stalled in the last few months. At a strategy meeting of the Board of PLending Ltd. it is noted that the type of borrowers is rather limited to highly profitable and well-established companies in what many would describe as conventional industries. With many smaller, younger and very innovative industries struggling to secure the finance they need for developing and marketing new and innovative products and ideas, it was brought up that PLending Ltd. could seek to expand into this market segment.

As a member of the board, you argue that such a strategy would inevitably fail as you would unlikely break into this market segment. In your opinion small companies in such newly emerging industries would be either dominated by venture capitalists or banks specialising in such lending, but not peer-to-peer lending. How would you justify your stance?

Indicative answer: *The platform of PLending Ltd. reduces the costs of negotiation between borrowers and lenders and as such has found a niche in the market consisting of companies with specific characteristics. If we were seeking to attract smaller and more innovative companies, this would have two effects: firstly, given the smaller size of companies the transaction costs for each loan would increase, relative to the size of the loan. This would make the use of our platform less attractive as the costs are pretty not really varying much with the size of the loan. Therefore, we would lose our competitive edge relative to banks, where depositors face no transaction costs at all and those of borrowers will be much lower. Secondly, the transaction costs will actually increase as more innovative companies are often much more difficult to evaluate and the negotiations might prove to be more burdensome as the owners and managers are often much less professional in business dealings. On the other hand, the higher return these companies often generate, may make any negotiation costs slightly less important to them, which would work in our favour. Taken together, the higher transaction costs in dealing with the newly targeted companies, could well push us out of our niche in*

which peer-to-peer lending is sustainable and in competition with banks, we would gain only very limited new customers.

Problem 42

Since the advent of online platforms for borrowing and lending, the amount of deposits private households has gradually declined. Deposits have been invested into money market funds that are traded on an exchange and they invest in government securities mainly. In addition, direct lending portals have become increasingly popular. Potential borrowers, small firms and individuals borrowing \$10,000 or \$50,000, provide standardised information about themselves on the portal, state the purpose of the loan and suggested terms. Lenders can then evaluate these offers and make counter-offers for a loan of \$1,000 to any of the borrowers. The loans will only be paid out if the target amount is reached, i. e. 10 or 50 borrowers agree terms with a lender. Banks have reacted to this development by increasing deposit rates and hope to reverse the outflow of monies from the banking system. However, financial regulators have raised concerns about this development. While on the one hand they are concerned by the increasing risks household face by providing loans through direct lending platforms, they are also concerned about the risks they face when buying or selling money market funds as prices inevitably will vary with market demand. Consumer representatives, however, point out that these investments provide a much higher return than bank deposits and should therefore be welcomed.

Are there any other concerns about the developments observed?

Indicative answer: *There are additional concerns especially with respect to the online lending platforms. Each lender needs to evaluate a borrower individual based on the information provided. Thus for each loan, 10 or 50 such evaluations have to take place. This implies a substantial duplication of effort in evaluation of lenders but also in negotiation, causing a loss in economic efficiency. The arrangement may also not be as efficient for borrowers as they might think. Diversification of risks for borrowers will be very incomplete unless their funds are substantial, hence they are exposed to higher risks than a bank would be. This will require higher loan rates to compensate lenders for these risks, making loans potentially more expensive than they need to be. Finally, the move from deposits to money market funds and direct lending undermines the liquidity insurance provided by banks. Deposits can be withdrawn at any time and allows household to use their wealth for consumption if they wish to do so. With money market funds, they can trade these, but the price they receive will not be certain, introducing additional uncertainty to households, and direct loans cannot be accessed at all, limiting consumption choice. This will reduce economic welfare.*

Problem 43

In a period of prolonged low-interest rates during a recession in the dominant mining sector of Uralia, investors have been searching for yield. Bank deposits have interests close to zero and government bonds are only marginally higher. Local entrepreneurs have developed an online platform that allows small companies and individuals to seek loans of UR\$1,000, UR\$5,000, or UR\$10,000 at interests of 2%, 4%, or 7%, depending on the risk category they are assigned in an initial screening by the platform. All loans are fixed for 2 or 5 years. While those seeking to borrow money have to undergo an initial assessment, anyone seeking to lend money can do so. The identity of the borrower is only revealed after the loan agreement is finalised, but the amount and risk category are revealed upfront. After a rather slow start, the platform has become a popular investment tool that has been widely promoted by financial advisors and features prominently in many popular TV shows on investments. Banks notice that substantial amounts of deposits are withdrawn and transferred to loans agreed via this platform. They are naturally concerned about the competition for their own business, which often charges a higher loan rate, and would like the financial regulator to intervene.

The banks can obviously not ask the financial regulator to intervene in order to protect their own business from competition. What argument can the banks use to convince the regulator to intervene for their benefit?

***Indicative answer:** The online platform offers a mechanism to provide loans directly to borrowers. It is common that over longer time periods, individuals but also companies have unexpected needs for cash, such as a bill from a repair that was not anticipated or changes in circumstances. The direct loans do not provide a way to accommodate these requirements. Banks, on the other hand, are able to repay their deposits to all those that need access to cash. Currently lenders are attracted by higher interest on deposits, forgetting the substantial costs they may face if requiring cash. It is socially optimal to have banks conducting the lending, and all funds to be deposited with them. Therefore, while it may at the moment be individually rational for lenders to shun deposits, the overall welfare would improve if bank lending is restored fully.*

Problem 44

The reserve bank in Offen, a developing country, has as its mandate to maintain economic conditions that promotes economic and social development. It has operationalised these aims by setting as its aims to keep inflation below 10% p.a., promote a steady growth of investment, and ensure stable banks. In order to achieve these aims, the reserve bank conducts monetary policy mainly through interest rate changes at which banks can borrow from the reserve bank or deposit excess funds; it also regulates the banking system through capital and liquidity requirements. In recent years the economy has been performing well due to high commodity prices, the main export in Offen, and the reserve bank has kept interest rates high and required banks to hold substantial liquidity reserves to avoid an unsustainable expansion of the economy. The governors of the reserve bank are concerned about a recent trend in which loans are obtained not through banks, but direct lending using money market funds, which are unregulated. These money market funds often are undercutting the loan rates that banks offer and have led to a substantial expansion of lending in the economy.

While most governors are concerned about the credit growth undermining their attempt at maintaining a steady growth of the economy, Yuliana Oberamantsova raises concerns mainly about the implications for the investors in money market funds, for which no trading facilities exist so far. While there is no evidence that they are taking excessive risks that investors are not aware of, what other reasons might she have for investors to be disadvantaged? Would providing a trading platform for money market funds alleviate any concerns?

Indicative answer: *The main concern of Yuliana Oberamantsova is probably that investors cannot access their investment if and as needed, which is guaranteed for depositors in banks. This would lead to an overall lower welfare in the economy of Offen as investors would have to hold back too much cash, which is then not invested into loan, or they deposit only those amounts with banks that are often and frequently needed, increasing the cash holding by banks and lowering lending. On first sight, the provision of a trading platform would address this problem as investors would be able to sell their investment. However, the need for market clearing of these trades increases the risk to investors due to fluctuating demand and the solution would normally not be socially optimal, unlike the use of banks. Hence the concerns of Yuliana Oberamantsova are justified and while a trading platform would most likely improve the welfare, it will not be as high as banks could achieve.*

Topic 12

Problem 45

Voltera GmbH is a leading German manufacturer of electrical equipment used in a wide variety of industrial machinery. New markets have opened after the collapse of one of its main competitors and they seek to expand their business. Voltera GmbH has no meaningful experiences in the markets they seek to expand into, being both geographically different to their current main market and the type of machinery which uses their equipment is also different. While they can use some of their own resources to expand their business, they will have to rely on a loan for a substantial part of the investment. Approaching their bank, they have commenced discussion about a loan which is significantly larger than what they required thus far. During the discussion with their loan officer, they had the impression that their bank would support their investment plans. It comes therefore as a complete surprise that the loan offer obtained from the bank will only allow Voltera GmbH to finance some of the expansion. Subsequent negotiations lead to a slight increase in the loan amount offered, but it fell well short of the amount required for their initial plans. Their bank makes it clear that it is not a question of increasing the loan rate as profits from the interest is not the driver behind this decision.

How can you explain that Voltera GmbH is not offered the full loan amount?

Indicative answer: *Voltera GmbH expands into markets they have limited experience in and will therefore be exposed to higher risk than they were in the past. Such risks put into question the ability of the company to repay loans, leading to credit rationing. The bank will want to ensure that the loan is repaid and will therefore not accept a too high leverage of the company. Increasing the interest would increase the amount that is due to be repaid, but this amount is irrelevant if the loan cannot be repaid in full, hence offering a higher loan rate would not induce the bank to grant a larger loan. Even though the bank is willing to support the investment, it will feel that the amount to be repaid must not be too high relative to the investment made to ensure repayment of the loan, thus requiring sufficient equity or other funding sources, to be provided by the company. Of course, any such funding sources must have a lower seniority than the bank loan.*

Problem 46

CallServices Ltd. is a long-established provider of call centers and has contracts with many retailers in the fashion industry to provide services to callers inquiring about their products, dealing with complaints, as well as managing returns and replacements. They are well known for their high level of satisfaction with customers due to employing knowledgeable phone operators. The more recent trend to replace phone conversations with online chats has been less successful for the company and customer satisfaction has become a concern. In order to overcome this problem in dealing with customers, CallServices Ltd. has developed a plan to make more use of artificial intelligence and use chat robots more widely. They have observed that other companies which have pioneered this technology have suffered significant loss in customer satisfaction and have lost very profitable contracts as a consequence. CallServices Ltd. is convinced, however, that using the expertise of their call center staff they can develop a system that exceeds the performance of their call centers.

Approaching banks about financing their investment in developing the requisite software, CallServices Ltd. get offered loans that fall short of their requirements. The loans offered would allow them to invest into the training of their existing staff and expanding their offering in the more traditional call center services, but developing the artificial intelligence would not be possible with the loans offered. Why do banks only offer loans that are insufficient to make the investment into the new technology?

***Indicative answer:** Banks will view the risks of the new technology as being high, probably too high and will not support their investment. Instead they seek to steer the company towards the more established line of business they are currently successful in and which can be seen as low-risk. As they will not be able to direct the company how to conduct their investment, they offer loans that are too small to make the new technology viable. Such credit rationing ensures CallServices Ltd. maintain low risks.*

Problem 47

Contra plc provides material for the building industry for many years. One of their main customers is BYH Ltd., the country's largest provider of prefabricated homes. BYH Ltd. has been loss-making for a long period of time while demand for standardised houses was subdued and individually designed and build houses were much more popular, despite the higher costs. Seeking to avert bankruptcy, it has been reported in the local newspaper that the current owner has approached Contra plc to explore whether they are interested in buying BYH Ltd. Rumours have it that Contra plc is interested in such a purchase, but no formal offer has been made. At the same time,

Contra plc has also planned to modernise their existing business by updating their production facilities to comply with upcoming environmental regulations. Given the financial situation of Contra plc, it is obvious that they could not conduct the modernisation and the purchase of BYH Ltd. at the same time. Contra plc. has been in negotiation with their bank on financing the modernisation of their business, but since the reports about them being interested in buying BYH Ltd. have been published, their bank has repeatedly cancelled meetings to finalise the loan and suggested that a smaller loan of approximately half the size would be sufficient to finance the first phase of a modernisation and that once this is completed, an additional loan might be sought.

How can you explain this behaviour of the bank?

Indicative answer: *This is a case akin to credit rationing. The bank seeks to prevent Contra plc from purchasing BYH Ltd. by not advancing the loan negotiations, making the purchase impossible, as well as offering a phased loan such that the purchase price for BYH Ltd. is not available. It is likely that the bank sees the purchase of BHY Ltd. as a high risk, given they are close to failing and operating in a market that shows no sign of recovery. The bank thus tries to either not give Contra plc a loan at all or a loan of a size that would not allow them to purchase BHY Ltd. The modernisation of the business can be viewed as a safe investment, which the bank would be willing to finance, but it seeks to prevent the company using the loan given for this purpose to be used for the investment into the much more risky BHY Ltd.*

Problem 48

At a meeting with fellow Chief Financial Officers at a conference, Pauline Harris shares a recent encounter with one of the banks her company uses. She reports that her company enquired about a loan for \$100m and was quoted a preliminary loan rate of 10.75% p.a., which she complained was rather high. In response to her complaining about a rather high loan rate, the loan officer at her bank told her that he could offer her a loan of \$150m for 10.25%. Pauline Harris looks at the people she is talking to and sees their puzzled faces. She continues by saying that she looked equally confused, but that it was luckily a phone conversation, so her surprise was not seen by the loan officer. Pauline remarks that somehow banks have gone crazy if they offer a larger loan at lower rates.

Is there an explanation for the offer of the bank?

Indicative answer: *It must clearly be optimal for the bank to charge a lower loan for a larger loan, despite the higher risk of non-repayment due to the higher leverage of the*

company. The bank is concerned about the expected repayment of the loan, including interest. A larger loan is less likely to be repaid in full as the outcome of the investment is less likely to cover the required repayment. The same expected repayment of a loan can now be obtained if the bank provides a larger loan at a lower loan rate. The lower loan rate will reduce the total repayments required; if the bank were to increase the loan amount, this would then lead to the same repayment requirements. Hence banks make the same profits from a smaller loan with high loan rates and a larger loan with lower loan rates.

Topic 13

Problem 49

Bank of Hampton operates a lucrative business in providing student loans on a commercial basis. They consider all students enrolled at Hampton University for a loan that would cover their tuition fees and reasonable living expenses for the duration of their degree. Such loans are then repaid with interest after graduation over either 15 or 25 years. Students are interviewed when applying for such a loan and based on the interview, together with their university application and other supporting documents, an offer of a loan may then be made. Generally students are offered a loan without having to provide any guarantees by parents, but some students and their parents choose to do so and are offered the same loan, although at a lower loan rate. Based on the information the bank has, there is no difference in the risk assessment between students that provide a guarantee through their parents or other relatives and those which do not. However, repayment rates of those providing guarantees are significantly higher.

The bank ascribes this observation to the higher effort students put in after graduation to avoid having to get their parents involved in the repayment of their student loan. Is there an alternative explanation?

Indicative answer: *Students and their relatives will know better the risks of repaying the loan, for example the desired career in well-paid jobs or in jobs that are less well paid or face higher unemployment. It will be difficult for banks to distinguish between students on that basis as it is not difficult to pretend to seek well-paid employment only to obtain the loan in the first place. It is now that students who are certain that they will be able to repay their loan out of their own employment, may want to obtain a guarantee from relatives to reduce the loan rate and hence the repayments necessary. The risk of relatives having to make payments will very small for such students and hence the lower loan rate will be beneficial. For students seeking less well-paying employment, the ability to repay the loan will be lower and a guarantee by relatives would be more likely be called upon. This makes the provision of a guarantee less profitable, despite the savings due to the lower loan rate. Hence we can interpret guarantees as a collateral.*

Problem 50

Terme Moreno SpA operates nine spa and wellness hotels across Italy. In an expansion drive a few years ago it had acquired another 6 properties to build new hotels, but these projects have been put on hold due to a deep and prolonged recession that has in particular affected the luxury market in which Terme Moreno SpA is operating in. Currently these properties are surplus to requirements, but have been retained for future development. The hotels are currently operating well below capacity and the immediate future of Terme Moreno SpA does not suggest improved business. In order to position itself better in the market, they seek to conduct a programme of wide-ranging updates of their existing hotels. Their bank agrees to financing these investments in principle, but in order to grant the loan seek collateral in form of the undeveloped properties. In addition, the bank requires Terme Moreno SpA to agree to them using their property as collateral in their own financing of this loan. The bank has hinted that without that agreement, the loan conditions would be significantly more onerous for Terme Moreno SpA, if they would be able to obtain a loan at all.

In addition to obtaining the loan in the first place, why would Terme Moreno SpA agree to such an arrangement?

***Indicative answer:** Given the current economic conditions, the loan is assessed by the bank to be very risky, and the same assessment can be expected from other banks. By allowing rehypothecation, the collateral becomes more valuable to the bank. They can use the collateral to obtain funding themselves, reducing their costs and this in turn allows them to offer better loan conditions to Terme Moreno SpA, making such an arrangement attractive. It also has to be taken into account that the properties used as collateral are held in reserve and currently do not contribute to the company's profits; thus losing them if the bank were to fail in their obligations would not immediately affect the prospects of Terme Moreno SpA, although future expansion plans if the economy performs better again might be jeopardized. Nevertheless, the benefits of better loan conditions combined with the low risk of losing an unproductive asset might make this arrangement attractive to Terme Moreno SpA.*

Problem 51

Metli AG is a Swiss pharmaceutical company that is best known for developing drugs for rare diseases using the latest advancements in science. They had some widely publicised success in recent years, but also a much larger number of failures which is less widely known. In addition to their significant research into such innovative drugs, requiring substantial investment, they also produce widely-used drugs which are sold in

pharmacies without prescriptions, providing a stable income. Having mostly financed themselves through private equity investments until recently, they now seek a loan for the general financing of working capital for the company as they seek to expand sales of their widely-used drugs into more markets that have recently been opened and where few competitors exist. Having approached a number of banks, they have been disappointed at the response they have received. All banks were only willing to provide loans well below the amount sought; while this would allow them to expand into some markets, it would fall short of their ambitions. It is only once they revealed that they would be willing to use their future income from these drugs as collateral, that banks were willing to provide loans of the size required.

How can you explain this change in loans offers by banks?

***Indicative answer:** Initially, Mettli AG has been subject to credit rationing, which upon providing collateral has disappeared. Credit rationing emerged as the banks were not convinced that the loan would be used for the low-risk expansion of their business in widely-used drugs, but thought that it might be used to finance the much more risky development of new drugs. By limiting the loan amount banks sought to prevent Mettli AG to make the risky large investments into research using their loan. Once the collateral was pledged, it became apparent to them that the low-risk expansion would be financed; collateral is usually only pledged if the risks are low as not to lose the collateral. This reduced the risk of the loans from the bank's perspective and credit rationing disappeared with this additional information, Mettli AG was able to secure the full loan.*

Problem 52

Johan Rasmussen has been repeatedly turned down for a loan for the company he leads, Rasmussen Metals. It was only after he found a specialist lender which focussed on companies in mining non-precious metals and related industries, that he was able to secure a loan to modernise his business with the latest technology. In order to obtain the loan, he had to agree to use his storage of metals as collateral and that the lender could rehypothecate this collateral. Through trade publications he has become aware that it has become a well-known problem for companies like his to obtain loans, even though they are highly profitable and can easily use their extensive holdings of metals as collateral. The same publications also state that companies larger than him do not seem to face the same constraints in financing their businesses, even though their risk might be larger due to exposure in politically unstable countries. A brief survey suggested that of larger companies only 5% of respondents had to allow rehypothecation, while for mid-sized companies this rose to 54% and small companies were often not able to gain loans at all, even when rehypothecation was offered.

How can you explain these results?

Indicative answer: *Rehypothecation is only feasible if the loan is sufficiently large, which is more likely the larger the company is as commonly the loans demanded will be larger. This would preclude small companies from accessing such loans. On the other hand, loans would be feasible for large loans even when not allowing rehypothecation, thus allowing larger companies to provide collateral only.*

Topic 14

Problem 53

Looking back through past loan agreements, Rafael Noval observes that over time loans for his company have become ever more expensive. Having set up his small company offering swimming tuition in private pools around holiday homes in southern Spain, he was offered an attractive loan rate of 6.5%, which then on renewal only 2 years later increased to 7.5% and then every year increased by 0.25% afterwards, without the general interest level being increasing during that time period. He believes that his now well established business would be much safer for banks than it was when he founded it. Looking around for alternative loans, he observes that no other bank would offer him a better loan rate. However, his friend Maya Fernandez has just set up a new business looking after gardens of holiday homes and was able to secure a loan at a loan rate of 6.75%, despite having no meaningful gardening or business experience.

How do you explain this observation?

Indicative answer: *Banks build up information on the quality of companies seeking loans over time by collecting information during the ongoing relationship. This allows them to gain an informational advantage that can be exploited by not offering competitive loan rates, knowing that the lack of information by competitors does not allow them to offer better loan conditions. Banks compete to attract companies to take out the initial loan, explaining the very low initial loan rate offered to both companies. They will then seek to recover these costs through non-competitive loan rates in future loans. Switching banks is not necessarily a solution for companies in this situation; in principle banks would compete to induce a switch of a company towards them by offering attractive loan rates. However, companies that are willing to switch to another bank for a better loan rate, are likely to do so again for the next loan and the bank is not able to recover the costs of the initially low loan rate. Hence this competition between banks for new customers only works for new companies.*

Problem 54

Rossmann Hydro Ltd. is in financial difficulties arising from large compensation costs after a hydroelectric dam they operate has caused damage to surrounding properties

due to an increasing water table that required costly mitigation measures to avoid future damage. The company is financed to a large extent by loans granted by a consortium of banks, insurance companies and pension funds. To allow Rossmann Hydro Ltd. implementing the mitigation measures, additional loans are required and knowing that the exposure of the existing lenders to their company is already high, they approached a variety of banks, who all declined a loan. When approaching their existing lenders, lengthy negotiations finally resulted in a loan being agreed, although its size was less than what was required, making the implementation of mitigation measures only possible if stretched over a longer time period.

Why would existing lenders provide a smaller than needed loan and new lenders are refusing to provide loans at all?

***Indicative answer:** If Rossmann Hydro Ltd. were to fail, the existing lenders would make significant losses and not providing additional funding would make this scenario much more likely. If they were to provide the loan, but limiting their overall exposure by not granting the full amount requested, the existing lenders would have a reasonable chance that Rossmann Hydro Ltd. would be able to recover from its difficult position and all loans are repaid. New lenders do not have to consider their existing exposure and the risks involved were too large for them to consider lending to Rossmann Hydro Ltd.*

Problem 55

AILogic Ltd. has been developing tools that helps developers improve the performance of artificial intelligence applications. They have frequently relied on short-term loans to overcome cash shortages that arose if they needed to pay their developers before payments from their customers were obtained. Seeking to keep costs down, AILogic Ltd. has always scoured the market for the best conditions at the time and taken the most favourable loan, regardless who did offer it. Since they required a loan last two years ago, the banking market has changed through the entry of a number of new banks, some newly founded and some backed by banks in other countries. Seeking offers for loans again, they observe that most banks refuse to provide a quote and state that they are only interested in long-term business relationships with companies and do not provide ad hoc loans.

What caused this change in the ability of AILogic Ltd. to obtain a loan by seeking out the best conditions?

***Indicative answer:** The new entrants to the banking market will have increased competition between banks, making it more difficult for banks to generate profits from*

transaction banking. Banks will therefore have shifted their focus towards relationship banking in markets where significant informational gains can be expected over time. It is likely that this is the case for a business like AILogic Ltd., where public information will be sparse and an understanding of the business within banks will be limited. Hence banks will focus their resources on companies that will stay with them for longer periods of time, and the indication from the past behaviour of AILogic Ltd. is that they will not commit to building such a relationship, hence they are turned down for a loan.

Problem 56

Farkas plc is a leading Hungarian supermarket chain, which for the past 20 years has used Csernai Bank for all its banking transactions, from cash handling, processing card payments, account services to providing loans to finance their company. They are currently undergoing a restructuring of their business, which has become necessary after competition from budget supermarkets had reduced their profits over the years and left them with high interest payments from ever larger loans that have been used to invest into the business. In the midst of their restructuring, the central bank announces that Csernai Bank has been put into administration due to excessive losses on mortgages given over a decade ago. While all stocks listed on the local stock exchange show losses after this announcement, Farkas plc shows losses far in excess of comparable companies.

These large losses in the value of their stock comes as a surprise to the senior management of Farkas plc. How could you explain this development?

Indicative answer: *Farkas plc will likely be affected in two ways. Firstly, the accumulated information on its company that Csernai Bank holds will be lost with its demise, or at least severely diminished as its loan officers and other decision-makers will be employed by different banks in the future. This loss of information on Farkas plc is most likely to result in higher loan rates in the future as banks first need to assess their risks and collect information. This is exacerbated by the company being in a restructuring process. It is usually banks already having an exposure in a company facing financial difficulties that will continue to provide loans in order to increase their chances of having existing loans repaid. With Csernai Bank being in that position and if it were to be liquidated, no lender with such an interest in Farkas plc exists, making it less than sufficient financial resources for the restructuring are available from new banks. The higher loan costs will reduce future profits, having a negative impact on the stock price and the less likely completion of their restructuring process will put the survival of Farkas plc even more at risk, also negatively affecting the stock price.*

Topic 15

Problem 57

The banking system of Badenia is under significant stress. After the collapse of a large regional bank, depositors have been concerned about their bank failing and have been withdrawing deposits in large quantities, demanding cash or transferring their deposits overseas. Thus far the central bank has provided liquidity assistance to the banks affected, but the deposit withdrawals have not subsided despite assurances to the public that other banks are not affected in the same way as the regional bank and are safe. Prior to the recent events, the banks in Badenia were renowned for their conservative lending policy and been criticised often for not taking sufficient risks. Foreign banks, hedge funds, insurance companies and pension funds observe the events in Badenia and see a good opportunity to purchase high-quality loans these banks have provided at a discount. The widespread interest in these loans makes discounts to their true value small, limiting the profits of these foreign buyers. While initially the purchase of loans by foreigners is seen negatively, once the discussion about these purchases becomes more widespread, deposit withdrawals stop as suddenly as they began.

Politicians explain this development with the desire of the population to prevent a foreign takeover of their banks. Are they correct?

***Indicative answer:** The relatively high prices foreign buyers pay for the assets of banks, the loans, results in banks being able to generate cash easily, allowing them to repay deposits that are withdrawn without negatively affecting the claims of deposits retained with banks. This increases how much withdrawals are needed before remaining depositors make a loss, changing the overall expectations of depositors. If their expectations about deposit withdrawals falls below the critical threshold, the bank run stops and the banking system will stabilise. It is therefore not the patriotism of depositors that stopped the bank run, but the increased liquidity of assets increasing the threshold for expectations of banks runs, which was not exceeded any more.*

Problem 58

Reacting to banking crises in neighbouring countries, the government of Ruthenia decides to introduce a deposit insurance scheme to promote economic growth through building more trust in the banking system. Banks are required to pay a premium of 0.4% of their average deposits for the previous three years towards financing the deposit insurance, which will be government-backed, but operated privately through a designated company. The premium of 0.4% has been determined by actuaries on the basis of past risks banks have taken when giving loans as well as the leverage of banks. After five years operating the deposit insurance scheme, it is audited and the actuaries involved in assessing the adequacy of the premium charged, report that the risks banks take have increased and therefore a premium of 0.55% of deposits would be more adequate. The central bank as the relevant banking regulator objects to this increase in the deposit insurance premium by claiming that in the next audit the actuaries will return and demand an even higher premium and therefore suggest that the premium should be increased even more.

Is the central bank right in their demand?

Indicative answer: On the one hand they are right, the premium most likely will increase after the next audit, but this will be the case for any premium that has been fixed in this way; it does not provide a long-term solution. Banks facing a fixed deposit insurance premium have an incentive to recover these costs by providing loans which yield a higher return; such higher returns are only possible if the risks are increased, necessitating a higher deposit insurance premium. Alternatively they might seek to provide more loans, increasing their leverage, and that way increase the risk of bank failure. Hence the risks will increase with a higher deposit insurance premium, necessitating an ever higher premium, entering a vicious cycle. For a long-term solution, the deposit insurance premium must be tailored to the risks the bank is taking.

Problem 59

Garabito is dominated by two banks, which share the market for loans as well as deposits about equally and their characteristics are very similar. An economic crisis brought on by the fall in the global market price for agricultural products has increased the losses from loans to both banks. One bank, First Garabito Bank, is facing a bank run as depositors fear the safety of their deposits in light of the losses the bank has accumulated on its loans. The other bank, National Garabito Bank, does not experience a bank run. Experts at the central bank are unable to explain this observation as they can see no difference between the banks, losses are similar in both banks and even the characteristics of depositors are nearly identical.

Can you offer an explanation?

Indicative answer: Depositors will withdraw their deposits if they believe they are not safe, that is by retaining them in the bank they will make a loss due to the losses of the bank from loans and the withdrawal of other depositors, reducing the cash reserve and increasing the losses of the bank through the forced sale of asset below their value. Future withdrawals of deposits cannot be observed but expectations must be formed. These expectations might differ between the two banks and can be crucial in a bank run being instigated. If the losses of banks are small, the banks will always be able to meet the demand of depositors by selling assets, even if they all withdraw; similarly if the losses are sufficiently high, losses will be too high to be able to meet the demands of all depositors, even if no deposits are withdrawn. In these cases a bank run would not (would) occur. There is an intermediate range of losses, however, where remaining depositors face a loss only if a sufficiently large number of depositors withdraws as in this case the accumulation of losses from loans and the sale of assets are large enough. If only few depositors were to withdraw, there are no losses for remaining depositors. In the case of Garabito, it seems that the expectations at First Garabito Bank are such that a large fraction of deposits will be withdrawn, while at National Garabito Bank this expectation is low and no bank run occurs. With expectations becoming self-fulfilling, and involving n^{th} -level reasoning about the behaviour of other depositors, minute differences between depositors might cause such different outcomes.

Problem 60

Lodomia has a banking system that caters on the one hand to its domestic population, but it is also a major off-shore centre seeking to attract wealthy individuals. While all banks are serving both types of customers, they are by law required to provide banking services to any legal resident demanding it, they have different degrees of reliance on one or the other market. To improve the trust in the banking system by local residents and foreign residents alike, the government of Lodomia has decided to introduce deposit insurance for all banks. This decision was driven by a number of bank failures in neighbouring countries that lead to an increased anxiety in Lodomia about the stability of their banks. During the consultation with banks about the introduction of the deposit insurance scheme, some banks suggest that no deposit insurance should be provided, while other banks are suggesting there should be deposit insurance with an upper limit.

Why do banks make such different suggestions on the introduction of deposit insurance?

Indicative answer: The incentives of banks will depend on the type of customers

they attract mostly. If banks are attracting mostly wealthy depositors investing larger sums, prefer no deposit insurance to ensure that competition between banks is not adversely affected. Deposit insurance increases competition between banks as their offerings are identical from the perspective of depositors, all deposits are fully insured and competition between banks would be perfect. On the other hand, banks attracting smaller depositors, mostly local residents, would prefer a deposit coverage for these deposits. Their rationale is that is reduced their costs as they do not need to pay a risk-premium on deposits, given any risks are covered by the deposit insurance, thus increasing their profits, while still being able to generate profits from larger deposits by foreign depositors.

Topic 16

Problem 2

In Samia, Makka Holinen is the head of new listings at the local stock exchange. Looking back over the past few years, she finds new listings in the technology sector have overall performed disappointingly, while those in more traditional sectors have been more successful. Having taken into account the higher risks in the technology sector, this effect still persists and has led to discussions whether the listing requirements for technology stocks should be tightened. Makka points out that while this would obviously improve the quality of listings, it would mainly be achieved by reducing the number of listings in this sectors, rather than improve the quality of companies itself. She points out that improving the prospects of technology companies is generally more difficult than for traditional sectors, not least due to rapid technological progress and uncertain demand structures for new products. Instead, she suggests to look at how listing are conducted and see whether the processes contribute to this development. The role of investment banks should be looked at in particular.

Why would investment banks distort the listing of companies such that technology stocks are faring worse than traditional stocks?

Indicative answer: *Investment banks have information on the prospects of companies and can thus more clearly distinguish between companies of different qualities. This gives companies on the one hand an incentive to take measures to improve the quality of their company, i. e. improve performance, such that they can sell shares at a higher price. On the other hand, a company that promises a good performance, is clearly distinguished from other companies and will be able to sell shares at a high price, reducing the need for further improving their performance. If the costs of improving performance are low, the higher price paid for an issue will provide the main incentive to increase performance. With traditional sectors being more easily able to do so, we should see this effect dominate. In the technology sector, however, these costs are much higher as improving the performance is more difficult to achieve. Here the clearer distinction between companies of different qualities due to investment banks might well induce companies to forego some performance and thus accept a lower share price, in order to save costs. This will result in a lower performance of technology stocks. It is not the investment bank itself that causes this 'distortion', but the effect their superior information and how this is conveyed to investors that causes this effect.*

Problem 3

Carlos Severiano has recently taken early retirement in lieu of redundancy and received a significant lump-sum in compensation. He seeks to invest this money into the stock market for long-term returns, but has not the requisite knowledge to evaluate the prospects of companies. Therefore, he seeks to acquire relevant information from a small investment bank to aid his decision-making. Upon reviewing the files he received, covering a wide range of companies, he notices that information on many companies seems to be missing and any information provided in the pack is negative in that they suggest the companies will be performing worse than expected. He complains to his contact at the investment bank that they have not provided him with information on the other companies. They respond that he has received the full set of reports they have available and only been charged for those companies he has received information on.

Why is there no information on many companies and what is the likely outlook for those companies not included?

***Indicative answer:** Information cannot be verified by those buying it, hence they have to rely on investment banks providing credible evidence for its existence. They do this by holding trading positions consistent with the information they sold. However, positive information would require banks to hold long positions, something they would also do in the absence of any information, thus positive news cannot be credibly communicated. Therefore, companies on which positive news is available are not included in the pack. Only where negative information is to be reported can the investment bank communicate this credibly through holding a short position in the stock. These companies have been included into the pack. Carlos can conclude that information on the companies not included is positive, although the magnitude of this positive information will be unknown.*

Problem 4

Nusinia has strict regulations on financial services and any activities are strictly controlled, with any public statements requiring government approval and banks generally not allowed to buy or sell securities. As the government sees any activity by banks with suspicion and against the national interest, not many banks have entered the market in Nusinia. This has resulted in virtually non-existing capital markets for bonds or stocks. Business gently pressure the government to allow capital markets to develop in order that they can finance future investments more easily and attract some foreign capital. The government is hesitant and claims that investment banks

offer no real benefits as they just take a slice of any capital raised, adding little value in the process. Using online platforms allows investors to buy and stocks or bonds, so investment banks are no longer needed.

Do investment banks add any value beyond distributing stocks and shares?

Indicative answer: *Investment banks are typically better informed than the general public. While they could sell this information to the public, it is difficult to convince the public that they have actually obtained this information as verification for its existence is difficult. Investment banks would have to hold the securities in such a way that it reflects the information provided; this cannot be done for positive information, limiting the information that can be made public credibly. If they are buying securities from sellers directly and then re-selling them to investors, their desire to make profits from this transaction reveals the belief of investment banks truthfully. Apart from conveying this information, this also allows for transactions to go ahead at all, as the adverse selection problem becomes less severe. This might also induce companies to work more such that they can increase the value of their stocks or bonds and thereby increase value to investors. However, if the costs of improving or maintaining company value is sufficiently high, they might be induced to reduce efforts as any dilution of value due to possible lower values are eliminated. Therefore, investment banks do not only merely pass on securities, but they add value in that they directly or indirectly reveal information about the company issuing these securities.*

Problem 7

Chandapoon Ramaswamy is a well-known trader who has made a name for himself through frequent appearances on television, mostly on programmes concerning stock market developments, but also in mainstream news reports to answer questions on significant events in the stock market. Given his status as a well-known and highly successful trader, he has set up his own company that allows subscribers to receive regular trading tips through email prior to the start of the trading day. The number of subscribers to his newsletter has been very low and not improved significantly over time, despite being given effectively free advertising opportunities during his television appearances. A common response he has heard from the public when asked why they do not subscribe to his newsletter, was that if the tips he gives, are that good, he surely has used them already and it will now be too late to make profits. The fortunes of his newsletter significantly improve once Chandapoon Ramaswamy starts to publish his trading records in nearly real-time format and changes the focus of his newsletters on warnings of stocks that he believes will be underperforming in the short run. The number of subscribers significantly increases in a short period of time.

How can you explain the sudden success of the newsletter?

Indicative answer: *By publishing his trading records, Chandapoon Ramaswamy provides information on how he has acted on information he has obtained. As long as his trading record is consistent with the information he has provided in his newsletters, subscribers can verify that he actually holds the information. While only negative information can directly be verified from his trading, it would be attractive for him to copy the impact positive information has on his trading even if not holding this positive information. The absence of negative news can be interpreted as positive news; this makes the newsletter more valuable to subscribers and therefore he will gain more clients.*

Topic 17

Problem 10

Rolltech plc. has made an offer to buy their competitor Glide Inc. from its current owner. Both companies are well established with their main business focussing on ball-bearings for a wide range of applications. After months of negotiation, the deal fell through as the current owner did not accept the direction the business would take, with a stronger focus on energy generation rather than transport solutions. A few days after the negotiations had been terminated, the investment bank of Rolltech plc. sends its invoice for the termination fee that had been agreed and at the same time offers a detailed debrief for senior management to discuss ways forward. The CEO is livid about being presented with such a bill as he has come out of the negotiations with no benefits for the company. While he accepts that this was part of the contract they signed and was thus payable, he continues to rant in the debrief the coming week that now he understands why the investment bank did not really advise him well. He claims that as they were being apid anyway, they had no interest in the outcome whatsoever and should have put more effort in advising him better.

How would you as a member of the team advising Rolltech plc. react to this allegation?

***Indicative answer:** Firstly, the termination fee covers only some of the costs of the investment bank and therefore completing the merger would have been in the investment bank's interest as they are making a loss from this deal that never was. In addition, the termination fee is not extra income for the investment bank as the full fee on completion of the deal would have been added on top of the termination fee. The termination fee was set so that it was not in the interests of the investment bank to abandon the deal while the company wanted to continue with it. While in general, there is such a problem and the investment bank might give up too easily, the termination fee was set such that this was not to happen. As much as the investment bank did not push for a completion of the deal which is not in the interests of the company, only to earn a higher fee. This was perfectly balanced with the termination fee that was agreed.*

Problem 13

PrecGlass Inc. has been bought by PrecisionMeasure plc., both supplying laboratories with highly specialised glass and measurement products, respectively. Both, having taken advice from investment banks during the acquisition, are subsequently unhappy about the advice given. While not agreeing on much as the acquisition was not entirely friendly and tension between the business are still high, both feel they have been pressured by their investment banks into a deal that could have been much better. PrecGlass Inc. mainly complains about the way its main shareholders and senior managers have been integrated into the management structure of the joint company and PrecisionMeasure plc. thinks they have overpaid. Both blame their advisors for this situation. After the investment banks both suggested to reject the initial offer, in both cases they wanted to continue to negotiate and hope for a better offer, but the investment bank strongly suggested to accept the deal they finally agreed, on after the first revision.

Can it be that both parties can be aggrieved into accepting deals that could have been improved?

***Indicative answer:** It is reasonable to assume that both companies had contingent fee contracts as this is standard and as such investment banks generally push companies to accept deals more readily than is optimal for the company in the circumstances. This could apply to both sides as they have different interests as shown here, such as the price paid and the integration of management structures, both affecting the merger benefits. With other contracts, such as conditional fee contracts or fixed fees, the investment bank would have advised them to accept the first offer, while here they suggested to reject an offer that was very likely to improve. While there is a clear conflict of interest, the contingent contract minimises it.*

Problem 15

The CEO of Hammond plc., a national house builder, has been in very preliminary talks with the CEO of Paring plc., a competitor, about a possible merger. Both have signalled interest and decided to take things to the next level. Presenting this state of discussions to the board of Hammond plc., the board is critical about employing an investment bank for advice. Some members state that of course the investment bank will advise us to go ahead with the merger, it's how they make money, whether it's good for the company or not.

Are they correct in their criticism of investment banks' incentives?

Indicative answer: Investment banks have an interest in companies completing deals. To achieve this, they will advise to accept offers that a company itself would not want to accept but would prefer attempting to negotiate better conditions. They do so as with longer negotiations their costs increase, this might include having to decline giving advice on other deals as their resources are bound, while not obtaining higher fees, or even putting the currently agreed fee at risk if a better deal is not agreed and the merger abandoned. However, these conflicts of interest are minimized through the use of contingent fee contracts. Here the investment bank also benefits from increased merger values as their fees increase accordingly. While there are incentives to suggest to companies they accept conditions that could be improved on and where it would be beneficial for companies to hold out for them, the contingent fee contract limits the extent of this issue.

Problem 36

Spice & More plc. has recently acquired a competitor and while integrating this company into their own operations, they discover that there are significant problems with the ability of their customers to pay outstanding invoices. The wide customer base was one of the main reasons for the acquisition. Given they have made it clear to the investment bank advising them that this was their main objective, they are unhappy with the advice given by the investment bank to proceed once they had conducted a due diligence assessment of their competitor in confidence. The CEO of Spice & More plc. in particular points out that the way the investment bank is paid, provides the investment bank with strong incentives for the acquisition to be completed. He points in particular to a clause where the majority of the fee is payable to the investment bank only if the acquisition is completed, while only a small break-up fee would be payable otherwise. He argues that the investment bank was driven by their desire to complete the acquisition such that they could obtain their fee, but instead should have either advised on abandoning the acquisition or negotiated a much lower price.

How would the investment bank respond to this complaint?

Indicative answer: The investment bank should point out that while they receive the majority of their fee income only once the acquisition is completed, they do not have only an interest in such a completion. Firstly, a break-up fee was agreed and that would have allowed the investment bank to obtain some fee income regardless of the outcome of the acquisition. Furthermore, it is not that the investment bank only obtains a higher fee income if the acquisition is completed, but they will also face significantly higher costs. These costs for continuing with the acquisition after the due-diligence assessment are a dis-incentive for the investment bank to continue recommending the acquisition if they think it is not in the interest of their client. These two aspects are optimally balanced to ensure the advice the investment bank gives is honest and in the

interest of their client.

Topic 18

Problem 16

Modern Antiques Ltd. buys and restores used furniture and sell these online and in a small number of stores around the country. They have been a family business since they were founded over 30 years ago, but now some family members want to leave the business and in order to prepare for an envisaged expansion of their business, they seek a listing on the stock exchange. They are a well-recognised name in the furniture business with a solid outlook, steady income, and their expansion of the business is generally seen as a positive move. In preparing their forthcoming public offering, they have been meeting with their investment bank and been told the usual procedure is to gauge the market interest through book building, and based on the feedback returned there, set an offer price. This offer price would then be guaranteed by the investment bank. Thomas Asburton, the majority shareholder and CEO, is surprised by this procedure. Sounding a little bit annoyed he says to the investment banking team he meets with: "So, I pay you a lot of money to underwrite these shares, but you do only do so once you know that it will sell at that price? This sounds like a great business model for you, buy what you already sold and then charge a big fee on top. If you just sound out the market, you are not doing anything, I cannot see why that is good for us."

Being in the investment banking team, how would you respond?

Indicative answer: *Book-building is in the interest of Modern Antiques Ltd. as that way we can gauge the full market demand. If we do not know for certain the market demand, which we will not if we have to rely on our inferences of investor interest alone, we will have to set a price which guarantees to sell all the shares based on those inferences. We will have to deduct a safety margin from the price to cover any potential losses. This safety margin is not needed if book-building is used as we base this on actual demand. Therefore, you should receive more for your shares. The fee covers our work, which moves from analysing the market demand to trying to sell your company to investors and creating this demand. This involves much less uncertainty for us and you if we base this on actual demands. Thus your company benefits and the final firm commitment contract is your final insurance in case something unexpected happens in the market during the last few days between closing the book-building and taking actual orders.*

Problem 19

Hoffmann Ltd. has appointed a lead underwriter who now seeks to assemble a syndicate to ensure a wider investors base can be reached. To this effect, members of the team at Hoffmann Ltd. pressure their lead underwriter to increase the size of the syndicate from the proposed five investment banks. They argue that by including more banks, they could reach a wider range of investors, making the issue more successful, even if it costs them a bit more to compensate for the larger number of investment banks involved. The lead underwriter resists this move and points out that this would be counterproductive to the issue. Hoffmann Ltd. is accusing their investment bank of refusing to increase the syndicate size so they can obtain a larger share of the fees and it is purely for the investment banks' own benefit, rather than improving the success of the issue.

Is the lead underwriter right in suggesting to limit the syndicate size to five members?

***Indicative answer:** Increasing the syndicate size, also increases the moral hazard of investment banks in that they may not put the requisite efforts into selling the issue to potential investors. With their contribution to the success being small, they may want to free-ride on the efforts of others and as all banks think alike, the overall effort level will decrease. This can then well have the effect of the revenue raised from the issuance of the security to reduce.*

Problem 20

Ramsey Inc. is a family-owned business mainly specialising in the production of pipes for chemical plants and power stations. Having grown significantly in recent years and seeking to expand overseas, they have decided to raise capital through a listing on the stock exchange. In preparing for the first steps in the process, the board, consisting of 7 family members, has to decide on the approach to appoint an investment bank as underwrite for their issue. Having very little knowledge of the procedures involved, never having had dealings with investment banks before, and a relationship with a commercial bank that does not offer underwriting services, they do not know how to approach an investment bank. During the discussion, quickly two factions emerge, one wants to appoint a single underwriter but have them compete for this business through a tendering process, while the other faction wants to approach an investment bank exclusively, which they have heard lots of good comments about, but because of their limited size, suggest this investment bank should form a syndicate with other banks.

Which approach is preferable?

Indicative answer: Both approaches are not optimal. A single underwriter, as was noted, might not have sufficient contacts with investors and many potential investors might be left out, resulting in issuing the shares at a price lower than could have been possible. Here a syndicate, if not too large to avoid moral hazard in making an effort, might well be beneficial. If putting the underwriting out to tender, the uncertainty for investment banks participating as to who obtains the contract, will result in sub-optimal search efforts and hence not all investors interested in the shares will be identified. This will also lead to a lower than necessary price for the issue. Hence neither approaches are optimal, though the losses from which approach is higher, cannot easily be determined. It is preferable to appoint an investment bank directly as lead underwriter and let them appoint a syndicate, avoiding both problems leading to lower search efforts.

Problem 37

Gerhard Bank AG has been hired by Inform GmbH to manage their initial public offering. During the first meeting between the investment banking team and the working group from Inform GmbH managing the process internally, the investment bankers explain in detail the process of going public from this point until the shares are listed on the local stock exchange. When explaining the book-building mechanism they seek to employ, the Chief Financial Officer of Inform GmbH interjects that this sounds way too complicated to him. Why does Gerhard Bank AG go to such great lengths of determining the price and share allocation if all that is needed is an auction platform for investors to submit bids. Similarly, why do banks buy the shares first and then sell them on just a few days later, this seems an unnecessary step.

How would you explain the advantages of the processes typically followed in underwriting?

Indicative answer: The processes investment banks follow serve two purposes, firstly to minimize the conflicts of interests between investment banks and their clients and secondly to maximize the issue price, while still selling the full issue. Investment banks need to attract investors to subscribe to the issue and to this effect they make use of their contacts. Making use of their contacts will be costly and they need to ensure that investors provide any interest in the issue truthfully. The costs associated to investment banks when contacting potential investors can lead to a moral hazard situation where the investment bank will not exert the level of effort that is optimal for their client, the issuer of the security. The contractual arrangements ensure that the investment banks exert optimal effort levels from the perspective of their client, while at the same time the book-building mechanism has been shown to generate the highest issue price for the client.

Topic 19

Problem 22

Longsoft plc. has recently gone public and generally the offering has been judged a success with high investor demand and a price realised at the upper end of the initial estimate. At the debriefing a week after the listing, Longsoft plc.'s team complain about the high level of underpricing. Having seen the allocation, they see that the investment bank benefitted a range of long-standing clients that have a known allegiance with their lead underwriter. Their stance is that those investors should have paid more and the investment bank has been giving them free money at their expense. The underwriter points out that while these investors are loyal clients of theirs, they are well informed and would not participate if they do not obtain adequate returns. On being prompted to justify how a return of nearly 30% would be adequate rather than excessive in a market where annual returns are about 10-15%, the investment bank representative looks around his team in search for an answer.

How would the lead underwriter justify the underpricing?

***Indicative answer:** The underpricing is needed to provide an incentive for such informed investors to reveal their information correctly. Informed investors revealing their interest in the shares will cause the issue price to be higher. Thus, there is an incentive to not reveal the information they have and that way the issue would be priced lower and informed investors could then pick the shares up in the IPO at a lower price. The underpricing, and the allocation of shares that goes with it, is their reward for providing this information truthfully. It benefits Longsoft plc. as the issue price was higher than it would otherwise have been.*

Problem 23

Sterling & Co. is a boutique investment bank specialising in the issuing of fixed income instruments to issuers from smaller and emerging countries. It has a range of investor contacts, ranging from highly sophisticated hedge fund managers to wealthy, but not very informed, individuals. One such wealthy individual, Jorge Sobrano, has recently

changed his broker to Sterling & Co. and on this broker's advice participated in a zero-bond issue by a large government-backed road construction company in a developing country and he was allocated a large amount, his full subscription. Shortly after the bond starts trading, it falls below its issue price and Jorge Sobrano complains to his broker about being used by Sterling & Co. as a dumping ground for bad issues. Also, he adds, he had never his full subscription being honored, only now when he makes a loss.

How can you convince Jorge Sobrano that this is an unfortunate start to their relationship and how will you seek to maintain his custom?

***Indicative answer:** Some issues are turning out to be less popular than we think and in this case many of our traditional clients were choosing to not buy the bonds. This will then inevitably lead to customers who do not share that view being allocated a larger fraction of the issue, as in your case. While this might look like the bonds have been dumped, this is not the case, the investment bank believed in the value, but unfortunately was mistaken. However, there will also be more successful bond issues in the future, and those issues will be over-subscribed. This will allow the investment bank to allocate the bond also to Jorge Sobrano, allowing him to recover the losses just made.*

Problem 29

Looking at the trading in the first few days after an IPO, you observe that more underpricing is commonly associated with more trading volume, but also with stock prices that fluctuate less. As you work in the newly set-up department for investor relations of Abbott Ltd. and prepare for the upcoming IPO of the company, you suggest in a meeting with senior management that they should aim for very little underpricing. The benefits in terms of trading volume and less fluctuations for the stock price does not really affect the company at all, while underpricing costs money. In addition, you question how there can be a relationship between underpricing and trading, as stock markets are difficult to predict. The investment banks that have joined the meeting, look down on their papers as you make this remark and hold back laughing.

Why are you wrong in your assertion?

***Indicative answer:** Firstly, underpricing and trading volume are connected. A high underpricing will result in many investors losing out on the allocation of shares, but many would be interested even at the higher price and seek to buy, while others that have been allocated shares do not value them highly and would be willing to sell.*

The higher the underpricing, the more such investors are found and hence the more trading occurs. This trading results in lower volatility, which reduces investor risk, and therefore investors will require a lower risk premium, which reduces the cost of capital of companies, making them more valuable. Thus companies benefit from it. Of course these benefits have to be weighed against the losses from receiving lower proceeds due to underpricing.

Problem 38

The Competition Commission investigates the behaviour of investment banks in IPOs. They have heard the view of companies who have recently gone public that underpricing to them is equivalent to an additional fee they have to pay and which is not detailed in the underwriting contract. One company director suggested that investment banks should issue the stocks at their full value and instead charge a higher fee for their services. This way the costs of going public would become more transparent to companies.

Would this suggested transparency work?

Indicative answer: *Underpricing does not directly benefit the investment bank, but those investors that subscribe to the issue and are allocated shares. Hence, while it might be seen as a fee by companies, it is not a fee that is paid to investment banks. Of course, most shares are allocated to investors that have provided the investment bank with information during the book-building process and are duly rewarded with an allocation of shares. It can be argued that investment banks should pay these investors out of the underwriting fees they charged companies, rather than relying on underpricing. But underpricing has a number of additional benefits, it reduces the threat and costs of any legal actions against the investment bank and/or the company, enables a liquid market in the stocks from the start of the listing, and can attract investors to weaker IPOs that would otherwise not be successful. These benefits could be included into the fee investment banks charge, but they would be cumulative, rather than allowing them to occur concurrently. This reduces the overall costs to companies and thus underpricing is an efficient mechanism to ensure a successful IPO.*

Topic 20

Problem 42

Contex plc. is a leading provider of technology for contactless payments. Their business is going strongly and they have attracted a number of analysts providing positive coverage of their prospects. The head on the investor relations team that is also the first point of contact for financial analysts seeking information about the company, is overall very satisfied with the reports published by the analysts. There is, however, one analyst whose reports, although overall positive, are consistently much less upbeat than any other analyst report. He puts this down to some bad blood between the investment bank this analyst works for and the CEO of Contex plc. After a dispute over advice received in an acquisition a few years ago, he has made it clear to that bank, they as long as he has any say, they will never again advise the company on any transactions.

Is it correct to attribute the less positive coverage to the dispute on previous advice?

***Indicative answer:** The investment bank the analyst concerned works for has no prospect of obtaining future business from Contex plc. As usually companies prefer positive coverage and by giving future business to those most positive about their prospects, they incite analysts to be more positive to gain this business. In this case the incentive to seek future business from the company does not work as they have been excluded by the CEO from any such business. Consequently their reports will not be that positive as that of others seeking such business. Therefore, the less positive coverage of the analyst is not a revenge on Contex plc. but the consequence of not being considered for future investment banking business.*

Problem 43

Looking across analyst reports and comparing their recommendations as well as forecasts, you notice when comparing the affiliation of analysts with investment banks, that if investment banks had been advising a company on any transaction in the last few years, the reports were usually more positive than those that did not advise

the company, even though these were still more positive than would be justified by subsequent performance.

Are you right to attribute this observation to the fact they have been advising the company recently and the overall positive, although less positive, coverage of all the other analysts to their hope of advising the company in the future?

Indicative answer: *It is not the past business that drives this result, but the future business that might be gained. Investment banks that have been used in the past are most likely investment banks that will be chosen in the future again. Hence, to make themselves attractive to the company, these banks issue reports that are overly positive. This would be the case whether they had advised the company in the past or not. Thus any investment bank seeking the business of the company should be submitting overly positive reports. In addition, all analysts rely on access to the company to gain more information for a better assessment of the company. If such access is more easily given by companies if the coverage is positive, they will bias their reports accordingly. This will bias the reports of all analysts, while those seeking, or having a realistic chance of gaining future investment banking business from the company, have an additional incentive to provide positive coverage, leading to an even more biased view.*

Problem 45

Priska Romain is the CEO of SwissMade Plc., a holding company with a portfolio of Swiss-based producers covering the high-end of the market, such as mechanical watches, medical equipment, and specialist construction machines. During a rather informal meeting with financial analysts and journalists at the reception held for the opening of a new headquarter, she responds to questions how it is that her company is consistently underperforming the predictions of analysts. In her reply she embarrasses the present analysts by stating that if their employers would not tout for business by trying to please her with ever more upbeat public statements, they might be a bit more realistic in what can be achieved. Another problem, she says, is not only that they try to be unnecessarily positive, but that many analysts seem to have very little understanding of the company and do not understand much of the industry she operates in. So going back to study those finance and strategy book might improve things. A junior analyst says that they are not paid for the business she gives to his bank, but his and other pay packages are purely based on the quality of their reports. Priska Romain, laughs and says that in that case he probably should pay the bank to work there. Before turning away, she says, in the old days it was analysts like you openly vying for business and I am sure you were on a bonus if I signed up, but things have not really changed since then.

Can you explain why the quality of reports seems unchanged despite the changes that

have occurred?

Indicative answer: *Banks used to base the pay of analysts on their contribution to gaining investment banking business through positive reports that attract companies. The change that is referred to, is that payment can now only be based on the performance of the financial analyst in producing reports. However, banks have changed the way contracts are structured such that while formally they are only based on the quality of analyst reports, they provide exactly the same incentives as the old contracts, so the quality of financial analysts has not improved.*

Problem 48

Constantin Bulgakin is a financial analyst providing coverage for a range of companies in the pharmaceutical industry. Due to regulatory changes, his employment contract has been amended and rather than obtaining a fraction of the revenue the companies generate for his employer, he will only be rewarded for the accuracy of his reports. He fears that this new arrangement will lead to a reduction in his remuneration and he will lose access to companies that he relies on to provide him with information for his reports.

Are these concerns justified?

Indicative answer: *The investment bank can structure his contract such that his remuneration will not change overall. Using a high base salary that is commensurate with his current remuneration based on the amount of revenue his contacts to the companies generate, he will not be worse off. He will not lose access to companies as they would still want to relay information to the analysts covering them, in exchange for positive reports; this will also ensure that he obtains sufficient information to provide reports that are as accurate as previously.*



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