JÖNKÖPING UNIVERSITY

Försättsblad till tentamen
Cover sheet for Examination.

15961681

Anonymkod *Anonymous code*	Kurskod *Course code*	Provkod *Test code*
G W B - P M M	J A S R 2 4	1 4 0 1

Kursnamn *Course name*

Advanced Security Markets and Financial Contracts

Tentamensdatum *Examination date*	Antal lösblad *No. of loose sheets*	Kontrollräkning gjord av inlämnade lösblad *Control count of given loose sheets made*	Signatur/ *Signature*
År / *Year* Månad / *Month* Dag / *Day* 2 0 2 1 - 1 2 - 1 7	16	☒	.....

Fylls i av TENTAMENSVAKT/ *To be filled in by the INVIGILATOR*

Kontroll av legitimation/ *Control of Identification* ☒	Härmed intygas att kontroller utförts/ *The checks have been carried out* Signatur/ *Signature*
Kontroll av inlämnade lösblad/ *Control of given loose sheets* ☒	
Inlämningstid/ *Time submitted* 16:38	.....
Antal lösblad/ *No. of loose sheets* 10	

Endast Högskolans anteckningar/ *For official use only*

Totalt antal poäng/ *Total Exam Score*	Betyg på tentamen/ *Exam Grade*
91	A

Kommentarer (lärare)/ *Comments (teacher)*

Signatur (lärare)/ *Signature (teacher)*

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15961681

ADVANCED SECURITY MARKETS
AND FINANCIAL CONTRACTS
JASR24
WRITTEN EXAMINATION (1401)
2021-12-17, 14-19

AGOSTINO MANDUCHI

- Number of pages: Six. Verify that you have received the entire document.
- This examination consists of five tasks.
- Please write your answers on one side of the paper only, and write your name and personal registration number separately on each sheet.

Name:_____

Personal registration number: GWB-PMM

One calculator of an approved type, one dictionary and one standard (A4) sheet, of paper with formulae and/or notes on either one or both sides of it, prepared before the exam, are permitted.

Completed tasks (Cross the box corresponding to each question answered):

Question	1	2	3	4	5
Answered, Yes/No					
Maximum score	20	20	20	20	20
Score	14	17	20	20	20

Teacher: Agostino Manduchi

The teacher can be reached by phone at 036 10 17 56 in case of urgent questions and with the consent of the personnel; avoid abuses.

Examination regulations for students at Jönköping University

The 14th of October 2020

These instructions are based on President's decision § 755, 2018, "Regulations and guidelines for first-, second-, and third-cycle education at Jönköping University". Regulations on disruptive behaviour and cheating are found in the policy documents of the Disciplinary and Expulsion Committee. To guarantee the student's legal rights, Sweden's legislation on discrimination must be observed. The invigilator's role is to guarantee that the examination takes place in an ordered and legally secure manner. The invigilator's instructions must be followed. Cheating or disruptive behaviour during an exam are disciplinary offences that will be reported to the Disciplinary and Expulsion Committee. A disciplinary offence may lead to short- or long-term suspension from the university. The exams are scheduled on the basis of set start times. It is the same times for all days, starting at 9 a.m. and 2 p.m.

1. **Preparations.**

1.1. Register for each exam no later than ten days beforehand. If you fail to register or register late, you will not be allowed to write the exam in question.

1.2. Since hypersensitivity/allergy is relatively common, you are not allowed to bring food/snacks that contain nuts/peanuts or to wear perfume.

1.3. Be sure you know the correct time and place.

1.4. Be sure you know what aids are permitted. Ensure that your aids, if any, are "clean", with no forbidden notes or loose pages. Tabs and bookmarks without any text or marking other than chapter headings or equivalent are permitted.

1.5. Bring a valid photo ID, e.g. your driving licence or passport. Without such ID, you will not be allowed to write the exam. The JU card, if marked "Identity Card" and showing your full civic registration number, may be used as an ID document at exams.

1.6. You may bring refreshments.

1.7. Prior to a digital exam, it is always each student's responsibility to ensure that his/her JU user account will be active at the time of the exam. This is also necessary if you need to borrow a computer. If there are any problems, please contact IT Helpdesk.

2. **During admission.**

2.1. Arrive at the latest 20 minutes before the exam starts. The door is locked at exactly the specified time.

2.2. Before entering, tick off your name on the registration list at the entrance. If you are not on the list, you will not be allowed to write the exam.

2.3. Those who arrive for the second admission, 30 minutes after the start, must be present outside the door so that the invigilator can verify their identity.

2.4. Anyone arriving more than 30 minutes late will not be allowed to sit the exam. No excuses are accepted.

2.5. Leave any outerwear and bags in their designated places.

2.6. Seat yourself in the indicated place. Only permitted aids, ID and refreshments are allowed at the desk.

2.7. All electronic equipment (mobile phones, smart watches, MP3 players, etc.) are to be switched off and kept with the outerwear and bags. Do not bring anything to the exam that you do not wish to leave unsupervised. Any sound coming from a mobile phone during an examination will be reported as both disruptive behaviour and attempted cheating. o If you consider that you have legitimate reasons to have your mobile switched on during the exam, notify the invigilator of this before the exam begins. Only exceptional reasons are accepted. The switched-on mobile (silent ringtone) is to be kept by the invigilator. If you accept a call, you must immediately stop the examination and hand in your paper.

3. **Start.**

3.1. When the invigilator locks the door and announces the start of the exam, you must immediately sit down and stay silent.

3.2. Check that you receive the correct exam paper from the invigilator and that the paper is complete. In Inspera check that you see the correct exam.

3.3. If you are registered to write two exams, you receive both papers at the beginning of the exam session. However, the individual finish times must be respected. In Inspera both exams will be visible.

4. **During the examination.**

4.1. No student may leave the exam room during the first half an hour.

4.2. There must be no communication whatsoever between the students.
4.2.1. Any communication between the candidates must go through an invigilator.

4.3. There must be no disruptive behaviour. If you feel that you are being disrupted, please inform the invigilator.

4.4. When the invigilator is performing the ID check, have your ID readily to hand.
4.4.1. If you do not have an ID that the invigilator can accept, you will be turned away from the exam.
4.4.2. If you are not on the registration list, you will be turned away from the exam.
4.4.3. When the invigilator comes to check your ID, your name must have been entered on the first page of the exam paper.

4.5. The invigilator may, at any time and without special reason, check what is on your desk. The invigilator may also leaf through permitted books to check that they do not contain forbidden notes and look inside pencil cases, sweet bags and the like.

4.6. The only writing papers that are allowed are the ones with a colored corner, provided by the invigilators during the exam.

4.7. If you visit the toilet, both name and time must be noted on the toilet list. Only one student may visit the toilet at any one time.

4.8. If you leave the room for any reason other than visiting the toilet, you are considered to have stopped the exam and may not continue writing.

5. **End.**

5.1. The invigilator lets the students know when 30 and 10 minutes of writing time remains.

5.2. When the invigilator announces that the time is up, you must stop writing immediately.

5.3. Ensure that you have written your name and civic registration number on each piece of paper that you hand in. In case you have not done this when the time is up, you must continue filling in your name and civic registration number in the presence of an invigilator.

5.4. When you hand in your paper, you must show your ID.

5.5. Even if no questions have been answered, the pre-personalised page must be handed in.

5.6. The number of submitted loose pages are counted by the invigilator and noted on the pre- personalised page.

5.7. Check that the invigilator ticks off your name correctly and notes the correct number of submitted pages.

5.8. Unless otherwise specified, you may take the exam paper with you once you have handed in your answers. You are not allowed to take the writing papers with a colored corner with you from the exam venue.

5.9. In a digital exam, you and the invigilator are to jointly note the time of submission on the attendance list.

6. **Special educational support.**

6.1. If you have been granted special educational support owing to disability and wish to have an alternative exam arrangement, register this with the examination coordinator in the case management system no later than ten days beforehand and, for information, with the responsible teacher. You must also register for the exam as usual.

6.2. A student with special educational support who writes a paper exam, but is entitled to use a computer, must write the entire exam either on paper or on computer.

Additional instructions concerning the present test

1. The answers must always be justified by suitable logical arguments and calculations.

2. The answers must be clear and well-structured. Multiple answers to the same question and generic arguments, effectively requiring the examiner to identify the relevant answer, will be penalised.

3. Unless otherwise stated, if a question is split into multiple parts, all parts are equally weighted.

4. Unless otherwise stated, all rates are understood as yearly rates, with discrete capitalisation.

QUESTION 1 (20 POINTS).

We can invest a given amount of funds in two assets, denoted by X and by Y. The expected rates of return on the two assets are $E\{r_X\} = 0.12$ and $E\{r_Y\} = 0.16$; the standard deviations are $\sigma_X = 0.18$ and $\sigma_Y = 0.15$. The covariance between the rates of return is $\sigma_{X,Y} = 0$.

1.1. What would be the expected rate of return and the standard deviation of the rate of return on a portfolio created by investing SEK 0.1 in asset X and SEK 0.9 in asset Y?

1.2. What would be the expected rate of return and the standard deviation of the rate of return on a portfolio created by investing SEK 0.65 in asset X and SEK 0.35 in asset Y?

1.3. Can you provide a value of x such that if we invest SEK x in asset X and SEK $1 - x$ in asset Y, we obtain a portfolio whose expected rate of return is greater than the rate of return of the portfolio in 1.2 and has a lower standard deviation?

If your answer is "yes", provide the requested value of x, as well as the expected rate of return and the standard deviation of the rate of return on the portfolio corresponding to it; if your answer is "no", explain briefly why such a value of x cannot exist, in your opinion.

QUESTION 2 (20 POINTS).

We face an investment opportunity which yields a yearly, perpetual cash-flow of SEK c, starting in one year from today. c takes on the same value each year. We believe that such value can be equal either to SEK 200, or to SEK 70. The probabilities of the two events are 0.6 and 0.4, respectively; however, we currently do not know the actual value of c. The time-0 investment required to start the project is equal to SEK 1 500, and we discount future cash-flows at the rate of 10%.

2.1. Should we take this investment opportunity, in our current "uninformed" situation?

2.2. Suppose that an "expert" can reveal to us the actual value of c, before we make our decision.

2.2.1. Would we invest in the project if we learned that c is equal to SEK 200?

2.2.2. Would we invest in the project if we learned that c is equal to SEK 70?

2.2.3. What is the largest amount of the fee that we should be willing to pay for the information provided by the expert?

2.3. Suppose that there are no trustworthy experts and that we cannot therefore learn the value of c before deciding whether to invest or not.

However, we have discovered that if we invest in the project today, then at time 1, when we receive the first cash-flow and thereby learn the actual value of c, it will be possible to liquidate the productive plant incorporating the investment. If we took advantage of this opportunity, we would then receive a (time-1) liquidation cash-flow of SEK 900 and terminate the yearly cash-flow of c.

What would be the present expected value of the project if we invested in it? Should we invest in the project or not?

Hint. In 2.3, you should first find out the optimal decision at time 1; Should we keep the plant active or liquidate it (i) if we learned that $c = 200$, (ii) if we learned that $c = 70$? It may be helpful to write down the cash-flows corresponding to the optimal course of action, in each scenario, in a table of the form of Table 1.

	$t=0$	$t=1$	$t=2$	$t=3$	...
Cash-flow if $c = 200$	...	...	...	...	...
Cash-flow if $c = 70$	...	...	...	...	...

Table 1.

QUESTION 3 (20 POINTS).

We are considering the possibility to start a company. The business project would require an initial investment of SEK 1 000 and would yield a cash-flow of SEK 1 250 in one year with probability 1.

However, we can also invest the funds in an alternative project that would also require an initial investment of SEK 1 000. This project would pay out either SEK 1 500, with probability $\frac{2}{3}$, or SEK 0, with probability $\frac{1}{3}$, also in one year.

As shareholders of the company-to-be, we would enjoy limited liability. The gap between SEK 1 000 and the amount of the funds that we can invest in the project, in each scenario considered below, must be covered by a bank loan. The banking sector is competitive. The banks are unable to monitor the use of the funds, and we have no opportunities to commit to choosing either one or the other project before obtaining the loan. The market (expected) rate of return on capital is equal to 8% and all agents are risk-neutral.

3.1. Could the project be financed if we had no funds to invest in the project and the nominal rate of interest on loans were equal to 8%?

3.2. Could the project be financed if we could invest SEK 400 in the project and the nominal rate of interest on loans were equal to 8%?

3.3. What is the *lowest* amount of capital that we should invest in the project in order to obtain credit, if the nominal rate of interest on loans were equal to 8%?

QUESTION 4 (20 POINTS).

Consider:

(1) A bond with maturity in four years which pays a 5% interest coupon at the end of each year.

(2) A bond with maturity in three years which pays a 4% interest coupon at the end of each year.

(3) A zero-coupon bond with maturity in five years.

All bonds in the present Question have a face value equal to SEK 1 000 and a YTM of 4%. The first coupon on the bonds in (1) and (2) is due in one year from today.

4.1. How can we use the bond in (2) to construct a hedge for a long position in ten bonds of the type in (1)?

4.2. How can we use the bond in (3) to construct a hedge for a long position in ten bonds of the type in (1)?

4.3. Suppose that we face the following constraint: The (absolute) value of the short position that we take to construct the hedge, at the current market prices, cannot be greater than SEK 10 000.

4.3.1. Does this constraint rule out the hedge constructed in 4.1?

4.3.2. Does this constraint rule out the hedge constructed in 4.2?

QUESTION 5 (20 POINTS).

A company is due to generate a single cash-flow, equal either to SEK 500 or to SEK 300, in one year. The claims on the cash-flow include both debt and equity, and the company's shareholders have limited liability. The assumptions of Modigliani-Miller irrelevance theorem are satisfied, and the risk-free rate of interest is equal to 2%.

The company's debt consists of a single bond, which entitles the creditor(s) to a payment of SEK 350 due in one year. The company's market value is equal to SEK 380.

5.1. What is the no-arbitrage market value of the company's equity?

5.2. What is the no-arbitrage value of the bond?

5.3. What is the YTM on the bond?

5.4. Consider a modified scenario in which a governmental agency guarantees the full repayment of the bond, so that the creditor(s) will receive the sum promised to them regardless of the cash-flow realised by the company. What is the value of the bond in the new scenario?

Remark. In 5.1, you should provide the *total value* of the equity. Hence, the number of shares issued by the company is irrelevant.

No writing here

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(1) $E\{r_x\} = 0,12$ $E\{r_y\} = 0,16$

$\sigma_x = 0,18$ $\sigma_y = 0,15$ $\sigma_{xy} = 0$

1.1 $x = 0,1$ $y = 0,1$

$E\{r_{P_1}\} = 0,1 \cdot 0,12 + 0,9 \cdot 0,16 = 0,156 \hat{=} 15,6\%$ //

$\sigma_{P_1}^2 = 0,1^2 \cdot 0,18^2 + 0,9^2 \cdot 0,15^2 + 2 \cdot 0,1 \cdot 0,9 \cdot 0 = 0,018549$

$\Rightarrow \sqrt{\sigma_{P_1}^2} = \sigma_{P_1} = \sqrt{0,018549} \approx 0,1362$ //

1.2 $x = 0,65$ $y = 0,35$

$E\{r_{P_2}\} = 0,65 \cdot 0,12 + 0,35 \cdot 0,16 = 0,134 \hat{=} 13,4\%$ //

$\sigma_{P_2}^2 = 0,65^2 \cdot 0,18^2 + 0,35^2 \cdot 0,15^2 + 2 \cdot 0,65 \cdot 0,35 \cdot 0 = 0,016144525$

$\Rightarrow \sqrt{\sigma_{P2}^2} = \sigma_{P_2} = \sqrt{0,016144525} \approx 0,1272$ //

1.3 x in X & $(1-x)$ in Y : Greater return & lower stdev possible?

Testing for greater return: $x \cdot 0,12 + (1-x) \cdot 0,16 \geq 13,4\%$

$\Rightarrow 0,12x - 0,16x + 0,16 \geq 0,134$

$\Rightarrow -0,04x \geq -0,026 \quad | \cdot(-1) \; | \; :0,04$

$\Rightarrow x \leq 0,65$ //

We can also see this intuitively in 1.2 where $x = 0,65$, but since the expected return of $x <$ the expected return of y

a decrease in x must ~~decrease~~ increase the expected return.

Testing for a smaller st.Dev.:

Since x has to be $\leq 0{,}65$, x will be set to 0, so that $(1-x) = 1$

$$0 \cdot 0{,}18^2 + 1 \cdot 0{,}15^2 = 0{,}0225$$

$$\Rightarrow \sigma_{P3} = \sqrt{0{,}0225} = 0{,}15$$

Since $0{,}15 \not< 0{,}18$ the standard deviation can not be smaller.

$$x^2 \cdot 0{,}18^2 + (1-x)^2 \cdot 0{,}15^2 \leq 0{,}01644525$$

$$0{,}18^2 \cdot x^2 + 0{,}15^2 \cdot x^2 + 0{,}15^2 \leq 0{,}01644525$$

$$0{,}18 x^2 - 0{,}15 x^2 + 0{,}15^2 \leq 0{,}01644525$$

~~$0{,}18^2 \cdot x^2 + 0{,}15^2 \cdot x^2 + 0{,}15^2 \leq 0{,}01644525$~~

$$0{,}0155 \cdot x^2 \leq -6{,}0475 \cdot 10^{-3}$$

$$x^2 \leq -0{,}3901629$$

↳ Therefore a lower standard deviation with a higher return cannot be achieved. ↳ This can be attributed to the efficient frontier.

the second point is not on the efficient frontier; x between 0.17 and 0.65 (excluded) would have worked!

No writing here

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(2) $c = \begin{cases} 200 & \text{w.p. } 0,6 \\ 70 & \text{w.p. } 0,4 \end{cases}$ Investment : 1500 $r = 10\%$

2.1

$$-1500 + 0,6 \cdot \frac{200}{0,1} + 0,4 \cdot \frac{70}{0,1}$$

$$= -1500 + 1200 + 280 = -20 \text{ €}$$

when deciding "uninformed", we should not invest.

2.2.1

$$-1500 + \frac{200}{0,1} = 500 \text{ €}$$

We would invest if we knew that $c = 200$. €

2.2.2

$$-1500 + \frac{70}{0,1} = -800 \text{ €}$$

We would not invest if we knew $c = 70$. €

2.2.3

Supposing that the expert is right : should be 0.6×500

$$0,6 \cdot 200 + 0,4 \cdot 0 = 1200 \text{ ?}$$

He can charge us up to 1200, because our expectation when investing uninformed is negative.

No writing here

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2.3

	t_0	t_1	t_2	t_2	t_3	
$c = 200$	-1500	200	0	200	200	...
$c = 70$	-1500	70	900	0	0	...

at $t=1$ if $c = 200$ $\frac{200}{0,1} = 2000 > 1500$ keep plan active

if $c = 70$ $\frac{70}{0,1} = 700 < 1500$ liquidate for 900

$$PV = -1500 + \left[0,6 \cdot \frac{200}{1,1} + 0,4 \cdot \frac{70}{1,1}\right] + 0,6 \cdot \left[\frac{200}{0,1} \cdot \frac{1}{1,1}\right] + \left[0,4 \cdot \frac{900}{1,1^2}\right]$$

$$= -1500 + 134,\overline{54} + 1090,909091 + 297,5206612$$

$= 22,975$ //

We should invest in the project.

should be just 1.1 (not squared)

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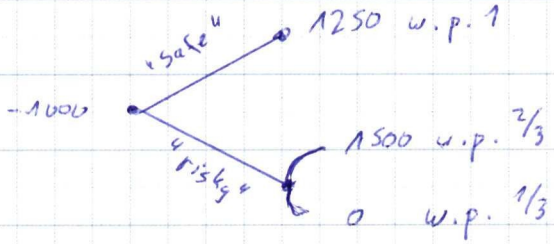
t=0 t=1

(3)



r = 8% = 0,08

3.1 No internal funds

If the Entrepreneur chooses safe: $-1000 + 1000 + \frac{1250 - 1000 \cdot 1,08}{1,08}$

$= 157,4074$

If he chooses "risky": $-1000 + 1000 + \frac{2}{3} \cdot \frac{1500 - 1000 \cdot 1,08}{1,08} + \frac{1}{3} \cdot 0$

$= 259,\overline{259}$

The entrepreneur would choose "risky" in this case

But if he chooses risky the banks perspective is:

$-1000 + \frac{2}{3} \cdot \frac{1000 \cdot 1,08}{1,08} = -333,\overline{3}$

The bank would therefore not grant the loan.

This means that the project could not be financed in this case. //

3.2 Internal funds of 400

Entrepreneurs perspective: "safe": $-1000 + 600 + \frac{1250 - 600 \cdot 1,08}{1,08}$

$= 157,4074$ //

"risky" $-1000 + 600 + \frac{2}{3} \cdot \frac{1500 - 600 \cdot 1,08}{1,08} + \frac{1}{3} \cdot 0 = 125,\overline{925}$

The entrepreneur would choose "safe"

Banks perspective: $-600 + \frac{600 \cdot 1,08}{1,08} = 0$

In this case the loan would be granted & the project could be financed. //

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3.3 Lowest possible internal funds to get the loan

- The entrepreneur must be indifferent between "safe" & "risky"

$$\frac{1250 - x \cdot 1{,}08}{1{,}08} = \frac{2}{3} \cdot \frac{1500 - x \cdot 1{,}08}{1{,}08}$$

$$\Rightarrow \frac{1250}{1{,}08} - x = \frac{2}{3} \cdot \left(\frac{1500}{1{,}08} - x\right)$$

$$\Rightarrow \frac{1250}{1{,}08} - x = \frac{2}{3} \cdot \frac{1500}{1{,}08} - \frac{2x}{3}$$

$$\Rightarrow -\frac{x}{3} = -\frac{1250}{1{,}08} + \frac{2}{3} \cdot \frac{1500}{1{,}08}$$

$$\Rightarrow -\frac{x}{3} = -1157{,}\overline{407} + 925{,}\overline{925} \quad | \cdot (-1) \; , \; \cdot 3$$

$$\Rightarrow x = 694{,}\overline{4}$$

$$1000 - 694{,}4 = 305{,}5$$

The lowest amount ~~to get~~ of internal funds possible is $305{,}\overline{5}$.

No writing here

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(4) Bond 1 : 0 | 50 | 50 | 50 | 1050 ; 0 1 2 3 4

Bond 2 : 0 | 40 | 40 | 1040 ; 0 1 2 3

Bond 3 : 0 | 0 | 0 | 0 | 0 | 1000 ; 0 1 2 3 4 5

} YTM = 4%

4.1 Hedge bond 1 ~~of~~ with bond 2

$$V_1(r) = \frac{50}{1{,}04} + \frac{50}{1{,}04^2} + \frac{50}{1{,}04^3} + \frac{1050}{1{,}04^4} = 1036{,}29895 //$$

$$S_1(r) = -\frac{50}{1{,}04^2} - \frac{2 \cdot 50}{(1{,}04)^3} - \frac{3 \cdot 50}{(1{,}04)^4} - \frac{4 \cdot 1050}{(1{,}04)^5} = -3715{,}44192 //$$

$$V_2(r) = \frac{40}{1{,}04} + \frac{40}{1{,}04^2} + \frac{1040}{1{,}04^3} = 1000 //$$

$$S_2(r) = -\frac{40}{1{,}04^2} - \frac{80}{1{,}04^3} - \frac{3120}{1{,}04^4} = -2775{,}09103 //$$

$$10 \cdot S_1(r) + b \cdot S_2(r) = 0$$

$$\Rightarrow b = -\frac{10 \cdot S_1(r)}{S_2(r)} = -13{,}389 // = -\frac{37154{,}4192}{2775{,}09103}$$

We need to ~~buy~~ short 13,~~8~~389 units of bond 2 to hedge the long position of 10 ~~B~~ units in bond 1 completely.

4.2 Hedge bond 1 with bond 3

$$V_3(r) = \frac{1000}{1{,}04^5} \quad S_3 = 821{,}927 //$$

$$S_3(r) = \frac{-5000}{1{,}04^6} = 3951{,}57263 //$$

$$b = \frac{10 \cdot S_1(r)}{S_3(r)} = -\frac{37154{,}4192}{3951{,}57263} = -9{,}40244 //$$

A position of $-9{,}40224$ is needed in b3 to hedge b1 completely

4.3 constraint : $|V_i(r) \cdot b| \leq 10\,000$ for $i = [2,3]$

4.3.1 Testing constraint for the first hedge

$|1000 \cdot (-13,389)| = 13\,389 > 10\,000$

The constraint rules out bond2 as a hedge

4.3.2 Testing the constraint for the second hedge

$|821,977 \cdot (-9,46244)| = 7728,1193 < 10000$

The constraint does not rule out the second hedge.

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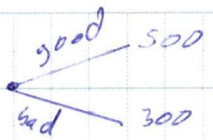

$r = 2\% = 0{,}02$

Debt: 350 Market value: 380

5.1 Value of companies equity

- The equity is not risk-free, since in the bad case the cash-flow < debt.

- Cash-flows Equity: good: $\max\{500 - 350{,}0\} = 150$

bad: $\max\{300 - 350{,}0\} = 0$

Debt cash-flows: good: $\min\{350, 500\} = 350$

bad: $\min\{350, 300\} = 300$

Replicating equity: (a) (x) (b) (y) (c)
$500 \cdot V + 1{,}02 \cdot D = 150$
(d) (x) (e) (y) (f)
$300 \cdot V + 1{,}02 \cdot D = 0$

$$x = \frac{c \cdot e - b \cdot f}{a \cdot e - b \cdot d} = \frac{150 \cdot 1{,}02 - 0 \cdot 1{,}02}{500 \cdot 1{,}02 - 300 \cdot 1{,}02} = \frac{153}{204} = V$$

$$y = \frac{a \cdot f - c \cdot d}{a \cdot e - b \cdot d} = \frac{500 \cdot 0 - 150 \cdot 300}{500 \cdot 1{,}02 - 300 \cdot 1{,}02} = -\frac{45000}{204}$$

Price of the asset: $64,491 // $= 0{,}75 \cdot 380 + \left(-\frac{45000}{204}\right)$

Replicating debt: good: $500 \cdot V + 1{,}02 \cdot D = 350$ (a, x, b, y, c)

bad: $300 \cdot V + 1{,}02 \cdot D = 300$ (d, x, e, y, f)

$$x = V = \frac{350 - 300 \cdot 1{,}02}{500 \cdot 1{,}02 - 300 \cdot 1{,}02} = \frac{51}{204} = 0{,}25 //$$

$$y = D = \frac{500 \cdot 300 - 350 \cdot 300}{204} = \frac{45000}{204} //$$

Value of the asset: $0{,}25 \cdot 380 + \frac{45000}{204} = 315{,}588$ //

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$315,588 + 64,411 \neq 380$

Answer 5.1 : Value of equity = 64,411

Answer 5.2 : Value of the bond = 315,588

5.3 YTM of the bond.

PV of the bond: 315,588

Face value of the bond: 350

$\Rightarrow 315,588 = \frac{350}{1+r}$

$\Rightarrow 315,588 \cdot (1+r) = 350$

$\Leftrightarrow r = \frac{350}{315,588} - 1 = 0,10904 \quad \hat{=} \; 10,904\%$

5.4

In this scenario the debt of the company is risk free.

Therefore, it can be discounte with the risk-free rate

$PV = \frac{350}{1,02} = 343,137254$