

Written Exam at the Department of Economics summer 2018

Pricing Financial Assets

Final Exam

August 16, 2018

(3-hour closed book exam)

Answers only in English.

This exam question consists of 2 pages in total

NB: If you fall ill during an examination at Peter Bangsvej, you must contact an invigilator in order to be registered as having fallen ill. In this connection, you must complete a form. Then you submit a blank exam paper and leave the examination. When you arrive home, you must contact your GP and submit a medical report to the Faculty of Social Sciences no later than seven (7) days from the date of the exam.

Be careful not to cheat at exams!

- You cheat at an exam, if during the exam, you:
- Make use of exam aids that are not allowed
- Communicate with or otherwise receive help from other people
- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Or if you otherwise violate the rules that apply to the exam

The Exam consists of 3 problems that will enter the evaluation with equal weights.

1. Let the time t spot price on a commodity be S_t .

(a) Two models for the commodity price are given:

$$\begin{aligned}d \ln S &= (\theta(t) - a \ln S)dt + \sigma dz \\dS &= (\theta^*(t) - a \ln S)Sdt + \sigma Sdz\end{aligned}$$

Use Ito's lemma to show that they are equivalent when $\theta(t) = \theta^*(t) - \frac{1}{2}\sigma^2$

(b) Interpret the model.

(c) What is required for the above model of the commodity price to be a model of the price under a risk neutral equivalent martingale measure \mathbb{Q} ?

2. Consider a one factor interest rate model with the following process for the instantaneous short rate r :

$$dr = m(r, t)dt + s(r, t)dz$$

(a) View the price of a zero-coupon bond with expiry at date T as a function $P_T(r, t)$. Use Ito's lemma to find an expression for the process that $dP_T(r, t)$ follows.

(b) Assume that this is modelled under a risk-neutral probability measure \mathbb{Q} . What will be the drift rate of P_T ?

(c) In some models of this form the price of the zero coupon bond can be expressed as

$$P_T(r, t) = A(t, T)e^{-B(t, T)r}$$

Show that $B(t, T)$ can be interpreted as a measure of the interest rate risk of the bond.

3. Consider a Credit Default Swap (CDS).

(a) Describe the instrument and its payment structure.

(b) Consider a tranching CDS. Explain the payment structure and define the terms *attachment point* and *detachment point*.

(c) Consider a tranching CDS on a large portfolio on underlying bonds (*names*). For a given average level of credit risk, e.g. expressed by the average credit spread on the underlying portfolio, explain how different levels of the assessed correlation of defaults of the issuers will influence the relative pricing of the tranches.