Written Exam for the B.Sc. or M.Sc. in Economics summer 2013

Pricing Financial Assets

Final Exam

August 8, 2013

(3-hour closed book exam)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by “eksamen på dansk” in brackets, you must write your exam paper in Danish.

This exam question consists of 2 pages in total including this page.

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

1. Consider a stock with current price S_0 that pays a constant dividend yield of q. Let C be the price of an American call, c the price of a European call, P the price of an American put, and p the price of a European put, all written on this stock and with the same exercise price K and maturity T. Assume a constant interest rate of r.
   (a) Show that $C \geq c$. What are sufficient conditions for $C = c$?
   (b) Under what general conditions may $P = p$ (No formal derivation is expected)?
   (c) Derive the call-put-parity for the European option prices
   (d) Show that
   $$S_0 \mathrm{e}^{-qT} - K \leq C - P \leq S_0 - K\mathrm{e}^{-rT}$$

2. (a) Describe the payment structure of a Credit Default Swap (CDS).
   (b) Consider a tranched CDS or synthetic CDO. Explain the payment structure and define the terms *attachment point* and *detachment point*.
   (c) Consider a tranched CDS or synthetic CDO on a large portfolio on underlying issuers (names). For a given average level of credit risk, e.g. expressed by the credit spread on the portfolio, explain how different levels of the assessed correlation of defaults of the issuers will influence the relative pricing of the tranches.

3. The HJM-model describes the simultaneous evolution of the full term structure of interest rates. Let the evolution of instantaneous forward rates contracted at t for time T be described by the Ito-process
   $$df(t,T) = m(t,T,\Omega)dt + s(t,T,\Omega)dz$$
   where Ω is a set of state variables.
   (a) Under certain conditions we have the following no-arbitrage condition for the drift term:
   $$m(t,T,\Omega) = s(t,T,\Omega) \int_t^T s(t,\tau,\Omega)d\tau$$
   Comment on this result, and in particular explain under which probability measure it is derived.
   (b) As a special case let $s(t,T,\Omega)$ be a constant. Derive the process followed by forward rates. Comment on the distribution of the forward rates.
   (c) Certain models of the term structure can be calibrated to be consistent with an intial given term structure. How is this achieved in simple one-factor models as e.g. the Ho-Lee model? How is this achieved in the HJM-model?