NTNU – Trondheim
Norwegian University of
Science and Technology

Department of Economics

Examination paper for FIN3005 – Asset Pricing

Academic contact during examination: Gunnar Bårdsen

Phone: 73 59 19 38

Examination date: 16.12.2015

Examination time (from-to): 4 hours (09.00–13.00)

Censorship date: 16.01.2016

Permitted examination support material: C / Formelsamling: Knut Sydsæter, Arne Strøm og Peter Berck (2006): Matematisk formelsamling for økonomer, 4utg. Gyldendal akademiske. Knut Sydsæter, Arne Strøm, og Peter Berck (2005): Economists' mathematical manual, Berlin.
Calculator: Casio fx-82ES PLUS, Citizen SR-270x, SR-270X College or HP 30S.

Language: English

Number of pages (front page excluded): 1

Number of pages enclosed: 0

Exam in FIN3005 Asset Pricing (Fall 2015)

Make the assumptions you find necessary.

Problem 1 (50%) An option matures at time $T > t$. The option has two underlying assets, stock 1 and stock 2. The time t prices of the two stocks are S_t^1 and S_t^2, respectively. The stocks do not pay dividends. The option is a special type of call option and has an exercise price of X. At time T when the option matures, the owner of the option can choose if he wants stock 1 or stock 2 to be the underlying asset.

a) Write down the payoff (value) π_T of the option at the time it matures.

b) Use the Martingale approach to find the time t value (π_t) of the option. (When we in class found an expression for the value of a call option, we found that $Q(S_T > X) = N(d_2)$. You are not expected to find the corresponding d-functions here. Stop when you have something similar to $Q(\cdot)$.)

c) Assume now that you would like to estimate the value of the option by using Monte Carlo simulations. To reduce the standard error of the price estimate, you decide to use a control variate. Show how you can estimate the value of the option when you use a call option written on stock 1 as a control variate.

Problem 2 (50%) A representative agent has utility from consumption $u(c) = \ln c$. He will consume at time t and $t+1$. There are two possible states at time $t+1$, s_1 and s_2. He has a subjective discount factor β. At time t he has an income y_0 and at time $t+1$ he has a state dependent income $y(s)$. Let $y(s_1) = y_1$ and $y(s_2) = y_2$. Let further $pc(s)$ be the state price for state s. The two state prices $pc(s_1) = pc_1$ and $pc(s_2) = pc_2$ are known at time t. Also the probabilities for state s_1 (π_1) and for state s_2 (π_2) are known. The corresponding discount factors are m_1 and m_2.

a) Find the optimal consumption c_0 at time t and express it in terms of y_0, y_1, y_2, pc_1, pc_2, and β.

b) Find the optimal consumption c_1 in state s_1 and express it in terms of y_0, y_1, y_2, pc_1, pc_2, m_1, and β.

c) Find the optimal consumption c_2 in state s_2 and express it in terms of y_0, y_1, y_2, pc_1, pc_2, m_2, and β.