Contingent Claims Pricing

Detailed outline

1. European contingent claims
2. No-arbitrage price or replication cost as $\mathcal{P}^*$-expected discounted payoff ("risk-neutral" pricing)
3. The Markovian financial market
   (a) The fundamental valuation PDE (Feynman-Kac Theorem)
   (b) Hedging and replicating trading strategies
4. Examples
   (a) Options
   (b) Forward contracts
   (c) Futures contracts

Readings

Domenico Cuoco's lecture notes, parts IV and V.

Karatzas and Shreve, 1998, chapter 2.

Duffie, chapters 5 and 6.

Black, F. and M. Scholes, 1973, The pricing of options and corporate liabilities, *Journal of Political Economy* 81, 637-654.

Merton, R., 1973, Theory of rational option pricing, *Bell Journal of Economics and Management Science* 4, 141-183.

Breeden, D., and R. Litzenberger, 1978, Prices of state-contingent claims implicit in option prices, *Journal of Business* 51, 621-51.

Duffie, D. and R. Stanton, 1992, Pricing continuously resettled contingent claims, *Journal of Economic Dynamics and Control* 16, 561-573.

Problems

1. Derive the (Margrabe) valuation formula for a European option to exchange asset 1 for asset 2 under the assumption that each asset's dividend rate and volatility is nonstochastic. Describe the dynamics of the replicating trading strategy.

2. Derive the (Merton) European call option valuation formula in the case that both the underlying stock and the zero-coupon bond maturing on the option expiration date have nonstochastic volatility and the stock has a nonstochastic dividend rate. Determine the replicating trading strategy.

3. Suppose the market coefficients are constant. Derive the (Black-Scholes) European call and put option valuation formulas (with dividends) and the replicating trading strategies.

4. In the constant coefficients case, compute the value of a claim that pays the average stock price from 0 to T.