

# Incomplete Markets and Portfolio Constraints: Upper and Lower Hedging Prices of Contingent Claims

## Detailed outline

1. No arbitrage pricing bounds with incomplete markets or portfolio constraints:  
Upper hedging price – infimal superreplication cost  
Lower hedging price – supremal price of saleable component of claim payoff
2. Portfolio constraint set, support function, effective domain
3. Auxiliary markets with adjusted appreciation rates
4. Characterization of upper hedging price as supremal unconstrained replication cost in auxiliary market
5. Characterization of upper hedging price with constant coefficients and path-independent payoff – unconstrained replication cost of supremal adjusted payoff function
6. Characterization of lower hedging price as infimal unconstrained replication cost in auxiliary market
7. Characterization of lower hedging price with constant coefficients and path-independent payoff – unconstrained replication cost of infimal adjusted payoff function
8. Examples: Calls, puts, short-selling and borrowing constraints

## Readings

Karatzas and Shreve, 1998, chapter 5.

Cvitanic, J. and I. Karatzas, 1993, Hedging contingent claims with constrained portfolios, *Annals of Applied Probability* 3, 652-681.

Broadie, M., J. Cvitanic, and H.M. Soner, 1998, Optimal replication of contingent claims under portfolio constraints, *Review of Financial Studies* 11, 59-79.

Bardhan, I., 1995, Synthetic replication of American contingent claims when portfolios are constrained, *Stochastic Processes and their Applications* 57, 149-165.