title: "American style Options - Regression methods on Pricing" author: "Team DUN-Y - Dom, Uwe, Niti, YQ" date: "March 2016" output: rmarkdown::pdf_document

Abstract

In this report we introduce and analyze a simulation-based approximate dynamic programming method for pricing complex American-style options. The usual starting point is the binomial option pricing model, but we extend our analysis further by using regression methods. Our methods involve the evaluation of value functions at a finite set, consisting of "representative" elements of the state space. We show that with an arbitrary choice of this set, the approximation error can grow exponentially with the time horizon (time to expiration).

Introduction (I think this is okay for now!)

What is an 'American-style Option'

An American call or put option is a contract such that the owner may (without obligation) buy or sell some prescribed asset (called the underlying) S from the writer at any time (expiry date) T between the start date and a prescribed expiry date in the future, not just at expiry, and at a prescribed price (exercise or strike price) K. The exercise time τ can be represented as a stopping time; so that American options are an example of optimal stopping time problems. Without prescribed exercise time makes it much harder to evaluate these options. The holder of an American option is thus faced with the dilemma of deciding when, if at all, to exercise. If, at time t, the option is out-of-the-money then it is clearly best not to exercise. However, if the option is in-the-money it may be beneficial to wait until a later time where the payoff might be even bigger.

OTHER INTRO TEXT HERE

WLOG it is assumed that $\mathcal{T}$ is equal to an integer N and that allowable exercise times are seperated by a time interval of unit length.

The price of this option is then:
$$\sup_{\tau} \mathbb{E}[\alpha^{\tau} g(x_{\tau})]$$

#Conclusion (change)

From the turkish paper the conclusion (maybe not applicable to our paper) FD and tree techniques are efficient methods to price American options with single underlying security whereas simulation works well better for multi-asset American options. In this study, we focused on the LSM algorithm of Longstaff and Schwartz (2001), which is a regression-based Monte Carlo simulation method for pricing American options. When we know the early exercise boundary, pricing an American option is quite easy. In the one-dimensional case, the estimate of LSM for the early exercise boundary at the last time step does not match with the result of Black-Scholes formula and Newton Raphson method. This shows that LSM cannot estimate the boundary well. We tried to reduce the inefficiency of LSM algorithm about the input selection for the regression and improved the algorithm. It now estimates the price of an American option with less computational cost and more accurately than the LSM algorithm. Furthermore, we coded an optimization approach, which maximizes the total value at each time step, and we always had results higher than those of FD method. Therefore, it might be possible to use it as an upper bound of the American option price