I. Introduction

Among credit derivatives, credit default swaps (CDSs) have been one of the most successful financial innovations of 1990s. According to Bank for International Settlements' report, the notional amount on outstanding CDSs to be $20.4 trillion in June 2006, up $10.1 trillion (99%) from June 2005. Credit default swaps are contracts that instruments to provide protection against a particular company insufficient to pay its debt. The protection buyer makes periodic payments to the protection seller at a fixed rate until the contract expires or the default occurs. If the reference company defaults, the protection buyer has the right to sell a bond of the reference company to the protection seller at the face value. The difference between the face value and the market value of the bond paid by the protection seller is called protection payment.

The pre-specified rate is also known as the CDS spread. Suppose the market quote for a CDS contract on AT&T with a principal $10 million is 20 basis points. This means that the protection buyer of this contract has to pay $20,000 annually. Once the default occurs, the protection buyer quit paying and has the right to sell the bond issued by AT&T at a face value of $10 million.

Option markets usually start to develop after the spot market for that asset is established, and this is no exception for CDS markets. A European CDS option gives its holder the right to buy or sell a CDS contract at pre-specified CDS spread on a specified date. If the reference company happens to default during the option maturity, the option is knocked out. For example, suppose a CDS call option maturing in one year can be

exercised at 200 basis points and its underlying CDS contract is five years. If the reference company does not default during the option one-year life, the buyer of this option has the right to enter a five-year CDS contract as the market price for the contract is greater than 200 basis points at the option maturity. Once the company defaults in one year, the option is knocked out.

As for an American or a Bermudan CDS option, there is a slightly difference from a European CDS option. In addition to option maturity, we usually define protection maturity in this type of options. For example, a Bermudan CDS option exercisable quarterly has option maturity one year and protection maturity five year. If the buyer exercises the option at the first quarter during the option maturity, she will enter a CDS contract for four years and three quarters. An American CDS option is similar to a Bermudan CDS option except that the former can be exercised arbitrarily during the option maturity. Once the American CDS option holder enters the underlying CDS contract, the holder has to pay accrual protection payment.

The knocked-out feature can be greatly alleviated with early-exercise characteristic of American or Bermudan CDS options. The holders can prevent themselves from options being knocked out by exercising ahead of option maturities. Suppose an American CDS option matures in one year, and the reference company suffers a huge loss so that the reference company is likely to default. By exercising immediately, the American CDS option holder not only prevents the option is knocked out but also obtains the insurance against the default.

The knocked-out feature makes the values of long term European CDS options not correspondingly high as stock options are. The reason may be that the probability of default by a reference company becomes more intense as time gets longer. In other words, a European CDS option with long option maturity is more likely to become worthless. Consequently, this causes market participants are unwilling to hold longer term European CDS options. This may be the reason why longer European CDS options are usually illiquid.

In this article, we examine how an American or Bermudan CDS call option can be priced with least-squares Monte Carlo simulation. We simulate forward CDS spreads with the dynamics of one-period CDS spreads by Brigo (2004), and calculate option prices with the least-squares method by Longstaff and Schwartz (2001). The basic assumption made in this article is that default time and interest rates are independent, and recovery rates or rates for loss given default are constant.

The remainder of this article is organized as follows. Chapter 2 reviews the literature on valuation models for CDS contracts and European CDS options. Chapter 3 specifies the dynamics of one-period CDS spreads and how we simulate forward CDS spreads. Chapter 4 provides several numerical examples on Citizens First Bancorp Inc. Finally, Chapter 5 concludes this paper.