

ETH UZH QUANTITATIVE FINANCE

MASTER THESIS

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Callable bonds in internal models for
insurers: pricing and risk

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1 Introduction

A callable bond is a type of bond that allows the issuer of the bond to retain the privilege of redeeming the bond at some point before the bond reaches its date of maturity.

In other words, on the call dates, the issuer has the right, but not the obligation, to buy back the bonds from the bond holders at a defined call price. Practically speaking, the bonds are not really bought and held by the issuer but are instead cancelled immediately.

From the above description, we could see that the callable bond can be viewed as giving the bond issuer a call option on the bond. And this is very important for the pricing of callable bond. More details will be discussed in the following chapters for callable bond pricing under different interest rate models.

Insurance company and investors usually use callable bond to make profit and hedge risk. Callable bonds usually have a higher yield, partly because of the fact that callable bonds allow the investors to have effectively sold an option to the issuer, and partly because of the smaller market size and the fact that issuers want to make the callable bonds more attractive to investors who otherwise might not want to invest in callable bonds.

Insurance firms tend to have a large diversified portfolio of assets and bonds in order to hedge the investment risk. Due to the property of a higher yield and other properties, callable bond is playing an important role in helping the investors to establish an optimized portfolio.

In this paper we are interested in the theoretical price of callable bond under various of interest rate models: CIR model, Vasecik model and Hull-White model. Besides, we will also study the risks that will influence the callable bond price under various models.

We will mainly focus on the zero coupon callable bond pricing and risk management, since the more complicated callable bond types can be viewed as derivatives of zero coupon callable bond.