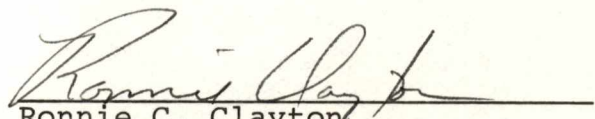
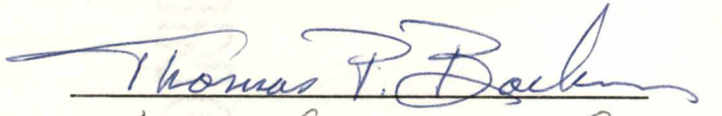
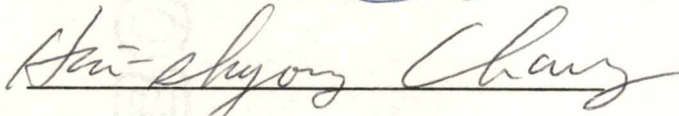
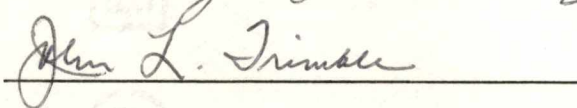


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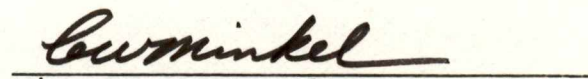
I am submitting herewith a dissertation written by Michael F. Spivey entitled "The Decision to Attach a Call Provision to Municipal Debt: Determinants and Cost." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.


Ronnie C. Clayton
Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:


Vice Provost and
Dean of The Graduate School

THE DECISION TO ATTACH A CALL PROVISION
TO MUNICIPAL DEBT:
DETERMINANTS AND COST

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Michael F. Spivey
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ABSTRACT

This dissertation examines determinants and cost of the inclusion of a call provision in general obligation municipal bond issues. Concerning determinants of the call inclusion decision the dissertation's findings suggest that the decision to include a call provision in municipal bond issues does not vary with expected movements in future interest rates. This finding suggests that issuers expect the market has assessed the potential for future profitable refunding and that the assessment is reflected in the size of the call risk premium. The results do suggest that the call provision is more likely to be included when credit market conditions become more uncertain and that large, more marketable issues are more likely to contain a call provision than small, less marketable issues. The results also show that a call provision is more likely to be attached to issues with longer average maturities and that issuers with higher debt burdens include a call provision in new issues more often than issuers who are less indebted.

Concerning the cost of the call provision, the dissertation also finds that municipal issuers must pay a call risk premium if they attach a call provision to debt issues. The results suggest that the size of the call risk premium varies inversely with expected changes in future

interest rate movements and that the call risk premium increases as future interest rates become more uncertain. The results also suggest that large, more marketable issues are assessed a smaller call risk premium than small, less marketable issues.

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CHAPTER I

INTRODUCTION

Controversy surrounds the attachment of a call provision to corporate and municipal debt. Efficient market advocates [33, 36, 48] contend that there are no logical reasons to include a call provision in the bond indenture. They argue that the call risk premium exacted for the call privilege in an efficient market would negate its potential benefits.¹ In addition, Pye [40] argues that the desire of political leaders to keep present taxes low makes the inclusion of the call provision even less likely with municipal bonds. Yet, in reality, the indentures of virtually all corporate bonds and numerous municipal bonds contain a call provision that provides the issuer the option of retiring the bonds prematurely at a specified call price.

The call risk premium compensates investors for the call risk exposure caused by the call provision.² The

¹In other words, the market will properly price the call option.

²Call risk stems from the reinvestment risk associated with purchasing callable bonds. Bondholders initially may buy bonds with the intent to hold until maturity. If interest rates fall and the bonds are called, the investor will be forced to reinvest at a lower yield and incur a financial loss if he selects a comparable investment.

amount of compensation is a function of the degree of call risk perceived by investors. An integral component of investors' assessments of call risk is expectations of future interest rate movements. Theory developed by Elton and Gruber [14] and Pye [40] indicate that the call risk premium, as measured by the yield spread between a callable and an otherwise identical noncallable bond, should increase as interest rates are expected to decline in the future. This pattern is consistent with bondholders' requirements for greater compensation for increased call risk exposure. Option pricing theory [6, 41] also suggests that the call risk premium should increase as future interest rates become more uncertain.

Issuers may benefit from the call provision for two major reasons. First, the ability to call outstanding debt gives an issuer the flexibility to remove binding restrictions stipulated in the indenture. Second, when market interest rates fall below the coupon rate of outstanding bonds, the call feature allows an issuer to replace outstanding debt with new debt obtained at lower interest costs. Thus, the call provision is a valuable option for issuers. It gives issuers the privilege to prematurely retire outstanding bonds if they so desire.

Virtually all corporate bonds are callable and empirical evidence from studies by Jen and Wert [20, 21] and Pye

[39] support that the cost of the call privilege is greatest when interest rates are high and expected to fall. Numerous municipal bonds are noncallable, especially general obligation bonds. General obligation bonds are guaranteed by the issuing municipality while revenue bonds, the second principal type of municipal bonds, are backed only by the revenue of a specific project(s). Evidence concerning the influence of expected lower interest rates on the inclusion and cost of the call provision in municipal issues is somewhat deficient.³ This dissertation will attempt to reduce this deficiency by investigating the influence of expected future interest rates and other factors on both the inclusion and cost of the call provision in municipal bond issues.

Purpose of Dissertation

Inclusion of a Call Provision

Previous research has failed to determine whether there are factors that correlate highly with the inclusion of a call provision in municipal bond issues. Are there market

³Kidwell [27] investigated the effect of varying interest rate levels on the frequency of call inclusion while Broaddus and Cook [10] did the only study which allowed for the possible influence of interest rate expectations of the cost of the call privilege.

condition, issue, or issuer characteristics that significantly influence whether an individual municipality will choose to include a call provision? This dissertation develops a binary choice model to empirically investigate this question. More specifically, this model examines (1) whether the inclusion of a call provision in municipal debt varies with changes in expectations about future interest rate movements, (2) if uncertainty about market conditions induces municipal issuers to attach a call provision to debt issues, (3) whether the marketability of a municipal bond issue influences the decision to include a call provision, (4) if a call provision is included more frequently in serial issues with longer average maturities, and (5) whether the indebtedness of the issuer influences the decision to attach a call provision.

Cost of the Call Privilege

Several studies have tested for the cost of a call provision to municipal issuers in studies actually investigating other aspects of the municipal bond market; however, only Kidwell [24, 26] specifically studied the effects of a call provision on municipal bond issuing cost. All of these studies failed to closely examine the cost of the issuer's call privilege and how certain factors may influence this cost. Therefore, this dissertation examines whether the

call privilege increases the cost of municipal debt, and if so, how does this increase in cost vary? Specifically, this dissertation will examine (1) whether the call privilege is a cost to issuing municipalities, (2) whether the market's perceptions of the direction and magnitude of interest rate movements affects the cost of the call privilege, (3) if the cost of the call privilege increases when future interest rate levels become more uncertain, and (4) whether the cost of the call privilege becomes less expensive as municipal issues are marketed to a greater number of potential investors.

Summary of the Findings

The dissertation's findings suggest that the decision to include a call provision in municipal bond issues does not vary with expected movements in future interest rates. This finding suggests that issuers expect the market has assessed the potential for future profitable refunding and that the assessment is reflected in the size of the call risk premium. The results do suggest that the call provision is more likely to be included when credit market conditions become more uncertain and that large, more marketable issues are more likely to contain a call provision than small, less marketable issues. The results also show that a call provision is more likely to be attached to issues with

longer average maturities and that issuers with higher debt burdens include a call provision in new issues more often than issuers who are less indebted.

The dissertation also finds that municipal issuers must pay a call risk premium if they attach a call provision to debt issues. The results suggest that the size of the call risk premium varies inversely with expected changes in future interest rate movements and that the call risk premium increases as future interest rates become more uncertain. The results also suggest that large, more marketable issues are assessed a smaller call risk premium than small, less marketable issues.

Organization of Dissertation

The remainder of this dissertation is organized as follows. Chapter II discusses background material concerning theoretical arguments for the value of the call provision. Chapter III presents a detailed description of the municipal bond market and presents arguments concerning the inclusion of the call provision in municipal bond issues. It also summarizes past empirical studies that tested for the influence of the call provision on municipal issue cost. Chapter IV presents the empirical model used to investigate the inclusion of the call provision and discusses the empirical findings. Chapter V presents the empirical model used to

examine the cost of the call privilege to municipal issuers and discusses the findings. The final chapter summarizes the dissertation.

CHAPTER II

THE THEORY OF THE CALL PROVISION

This chapter examines why issuers may attach a call provision to their debt, the conflict of interest between issuers and purchasers of this debt, and possible resolutions to this conflict. It concludes with a discussion of the economic rationale for the call's existence.

Why Issuers Attach the Call Provision

The call provision gives issuers greater financial flexibility than would be the case with comparable noncallable debt. It allows an issuer to modify its capital structure by eliminating debt prior to maturity whenever developments warrant such action. In the corporate sector, for example, an issuer may desire to redeem outstanding debt prematurely because of burdensome restrictive covenants in the bond indenture that may limit dividend payouts or prevent future mergers. Changes in investment preferences and costs and earnings expectations may also prompt an issuer to retire outstanding debt before maturity. There may also be a situation where an issuer has surplus revenue that could best be used for early debt retirement. Any of these situations may make a call provision beneficial to an issuer.

A stronger argument for the inclusion of a call provision revolves around a potential decline in interest rates. A call provision, given an actual decline in interest rates, allows an issuer to replace its more expensive debt with less expensive debt, thereby enabling an issuer to realize an interest savings. This use of the call provision is called refunding. Issuers generally make refunding decisions based on capital budgeting criteria. The benefit of the refunding is the present value of the after-tax interest savings over the remaining life of the issue. The cost of the refunding consists of the retirement cost of the outstanding debt and the flotation costs of issuing the new debt. A positive net present value motivates issuers to engage in refunding activities. At the time of issue, an issuer's expectations of future interest rate movements should influence his assessment of the probability of future profitable refunding. This assessment may be a major motivation behind an issuer's decision to include a call provision in the bond indenture.

Conflict of Interest Between Issuers and Purchasers

While the call option affords issuers flexibility and potential savings, it is detrimental to investors. Bond refunding causes reinvestment problems for bondholders who base investment decisions on the expectation of bonds

remaining outstanding until maturity. If investors choose to reinvest funds in comparable bond issues, they will receive lower yields. To earn a return equivalent to the yield on the original bond, investors are forced to hold lower quality investments. In this way, callable bonds expose bondholders to reinvestment risk. The degree of this risk is contingent on how easily bondholders can procure an alternative investment paying an equivalent yield.⁴

Resolutions of the Conflict of Interest

Rational investors are aware of the reinvestment risk associated with holding callable bonds. Realizing the probability that a financial loss will be incurred from an issuer's exercise of a call provision, investors demand some combination of protection and compensation for this risk exposure. The degree of protection and amount of compensation demanded is contingent upon the call risk perceived by investors.⁵ Investors' assessments of call risk are influenced by expectations of the direction and magnitude of

⁴Transactions costs and the inconvenience of restructuring the investor's portfolio must also be considered.

⁵Call risk becomes greater as the probability increases that a bond may be called and cause investors financial injury.

future interest rate movements. If investors do not expect interest rates to decline in the future, perceived call risk is reduced and demand for protection and compensation measures should decrease. However, if investors expect interest rates to decline, they will consider these measures to be more important because of increasing call risk exposure. The following sections summarize the various forms of protection and compensation measures.

Call Risk Premium

One form of compensation for investors is the call risk premium. This premium is measured as the difference in the yield to maturity of a callable bond versus an otherwise identical noncallable bond. It is the ex ante charge for the issuer's call privilege and should increase as interest rates are expected to decline, ceteris paribus.

Call Deferment Period

The call deferment feature makes a callable bond noncallable for some specified time period. For example, a thirty year callable bond may only be called during the last twenty years of its term to maturity if a ten year call deferment is stipulated. The longer the call deferment period, the shorter the time period during which investors are exposed to call risk. Longer call deferment periods should, therefore, lower the required call risk premium. This

observation is consistent with empirical studies that have shown the call risk premium to decline as the call deferment period lengthens [10, 20, 27, 39].

Call Price Premium

Another form of compensation for investors' exposures to call risk is the call price premium. This premium is a dollar amount paid to bondholders whenever the bond is actually called and compensates investors for some of the problems of reinvestment. Although the call price premium is compensation for bondholders, it may also be viewed as a degree of protection against a bond being called. The higher this premium, the lower market interest rates must fall for an issuer to find it profitable to call a bond [40]. In some cases the call price premium is fixed at an amount equal to one coupon payment; however, more frequently this premium will decline as a bond approaches maturity. Empirical studies have not found the call price premium to have any significant effect on the size of the call risk premium. This may be due to problems in measuring the call price premium since it generally varies over the life of the bond.

Other less quantifiable features that may be used to lessen call risk are restrictions upon the use of the call, mandatory call provisions, and stipulation of the order in

which the bonds will be called, if actual call occurs.⁶ All of these features should reduce the uncertainty surrounding when and which bonds will be called, and subsequently reduce bondholders' exposure to call risk.

Generally, a callable bond will have a call deferment period and call price premium specified in the call provision. Less frequently, other measures that may reduce call risk are specified. As these restrictive features are added to the call provision, the declining call risk premium will cause callable and otherwise identical noncallable bonds to approach the same market price [20, 25, 39, 51].

Economic Rationale for the Call Provision

Efficient market advocates argue that there is no economic justification for the inclusion of a call provision if the market accurately assesses the call risk premium that an issuer must pay to sell callable bonds. Myers [36] argues that if bond markets are efficient, there is little worth in trying to reduce interest costs by aggressive use of the call option. If future refunding is the strategy of

⁶An example of a restriction on the use of the call would be the specification that only a particular type of funds be available for early redemption purposes, such as revenue from projects financed specifically by the bonds.

callable bond issuers, surely the other side, bondbuyers, are aware of this and will demand adequate compensation. Thus, Myers relates usage of the call option as a zero sum game, one side gains only when the other side loses. Consequently, inclusion of the call provision only appears worthwhile if an issuer has better information of future interest rate movements than the market, or an issuer desires to engage in interest rate speculation as suggested by Weingartner [48].

The literature does contain some justifications for the inclusion of a call provision. Pye [40] speculates that if borrowers had to pay the true value of the call option, they would be indifferent to its inclusion. However, he points out that given the uncertainty of future interest rate movements and possible heterogeneous expectations of those movements, the inclusion of the call provision may benefit some issuers. If some issuers perceive a greater likelihood of future interest rate decline than that perceived by the market, the call option should be included since its expected value to these issuers could exceed its expected cost.

Secondly, Pye contends that differences in degrees of risk aversion between borrowers and lenders could also be justification for the existence of a call provision. Risk aversion means that borrowers and lenders are concerned with a security's expected net return and variability of net

return. Pye argues that refunding partially offsets a firm's low profits during low interest rate periods. Thus, a call provision may allow returns for firms to be less variable than they would otherwise be with noncallable bonds, and thereby reduce risk for issuers. This reduction in risk is offset by an increase in risk to bondbuyers since the presence of a call provision will increase the variability of the net return on the bondholder's portfolio. However, the possible differences in the degree of risk aversion between the two groups could justify the existence of callable bonds. If some bond issuers are more risk averse than the marginal investor, then the call risk premium assessed by the market will be less than its value to these issuers.

Elton and Gruber [14] point out differences in portfolio composition between issuers and lenders as another possible reason for the call to have economic value for an issuer. Since an asset's riskiness is best viewed as a part of a total portfolio, whether or not an asset is risky to the holder depends upon the correlation of its return with the returns from the other assets in the portfolio. The call privilege allows corporations to reduce the variability of their returns during periods of low interest rates. If the return on the assets that compose an investor's portfolio are not perfectly correlated with the corporation's earnings, the increase in the risk of the investor's

portfolio should be smaller than the corporation's decrease in risk. Thus, the inclusion of a call provision may benefit the issuer.

Another justification for the existence of callable debt is the differential in the tax rates paid by issuers and investors. If the marginal tax rate of an issuer is greater than that of investors, then the net benefit of the call provision is the government's loss in tax revenue. Boyce and Kalotay [8] point out that interest payment schedules of callable bonds should never increase but may well decrease if refunding actually occurs. They contend that issuers with higher marginal tax rates will prefer callable bonds because of the possibility of the decreasing interest payment flows. The present value considerations resulting from their lower after-tax discount rates justify this preference. Lenders with lower tax rates will also prefer the decreasing interest payments because of their higher after-tax discount rates. As a result, they too will prefer callable bonds. Therefore, the tax rate differential may explain the widespread use of callable debt.

Marshall and Yawitz [35] add to the tax differential argument. They point out that when a bond is called, the call price premium is tax deductible by the issuer and taxed

at the lower rate as income by the investor.⁷ The tax break gained by the issuer is larger than the tax obligation incurred by the investor. In both of these arguments, the government is actually subsidizing both parties since the expected tax benefit may be shared between the borrower and lender in the yield equilibrating process.

Summary

This chapter has reviewed reasons for issuers to include a call provision in the bond indenture, the conflict of interest between issuers and bond purchasers that arise from the presence of a call provision, and possible resolutions to this conflict. The call provision gives issuers financial flexibility along with the potential for future interest payment savings; however, its presence subjects bond purchasers to call risk exposure due to the reinvestment risk associated with the calling of a bond issue.

Numerous measures exist to resolve the conflict of interest between issuers and investors with the call risk premium, call deferment period, and call price premium being the most common. The call risk premium is the ex ante

⁷Actually, since the call price premium is taxed as a capital gain, this further reduces the investor's tax rate.

charge assessed issuers for the call privilege. The call deferment prevents the bond from being called during a specified period while the call price premium is a dollar amount paid to bondholders when the bond is actually called.

This chapter also reviews economic rationale concerning the inclusion of the call provision. Efficient market advocates, such as Myers [36] and Weingartner [48], argue that the proper pricing of the call privilege by the market offsets any economic justification for the inclusion of a call provision. In contrast, arguments by Pye [40], Elton and Gruber [14], Boyce and Kalotay [8], and Marshall and Yawitz [35] offer several justifications for the inclusion of a call provision in bond issues.

CHAPTER III

THE CALL PROVISION IN THE MUNICIPAL BOND MARKET

This chapter begins with a detailed review of principal characteristics of the municipal bond market. Arguments specifying why a call provision is frequently not included in municipal bond issues are also presented. The chapter closes with a review of previous research on the call provision in the municipal bond market.

Characteristics of the Municipal Bond Market

There are more than 50,000 government entities that currently have securities outstanding in the municipal bond market. No other capital market directly services such a large number of heterogeneous issuers. Numerous types and sizes of issuers have access to the municipal market.⁸ Maturities of municipal securities range from a few months to over 50 years. The proceeds from the sale of the short maturities are used to bridge the gap between short-term expenditures and tax receipts while longer maturities are primarily used to finance capital projects. Several

⁸Types of issuers include states, counties, cities, towns, school districts, statutory authorities, and special districts such as airports, hospitals, and utilities.

characteristics of the municipal bond market distinguish it from other bond markets. The remainder of this section discusses these characteristics.

Taxation of Municipal Bonds

Coupon interest income on municipal bonds is tax free. Capital gains income is not tax exempt except when the bond is originally issued at a discount. For original issue discount bonds, interest income is tax free; however, when the bond is sold the amount above par is taxed as a capital gain. The tax treatment of municipal securities by states and localities varies. Many states and localities follow the federal tax policy for bonds issued within their borders although some states and localities may assess personal property taxes on the securities of local issuers. Income from bonds of nonlocal issuers is frequently fully taxed.

Types of Municipal Bonds

Municipal bonds are categorized as either general obligation or revenue bonds. General obligation bonds (G.O.'s) are backed by the full faith and revenue generating power of the issuer. Subsequently, the quality of general obligation debt depends on the income and property values of the local community and the total amount of debt outstanding. In most situations the issuing authority's taxing power is unconstrained and the G.O.'s are considered unlimited tax bonds.

When there is some restriction on the issuer's taxing power, such as a rate ceiling on personal property taxes, G.O.'s are considered limited tax bonds. In a few cases G.O.'s are backed not only by the issuer's full taxing power, but also by certain identifiable fees which provide additional revenues beyond the general funds. In this case, G.O.'s are double barrel bonds because of their double backing.

Revenue bonds are backed only by the revenue generating power of the specific project(s) or capital asset(s) financed by the bonds. Since revenue bonds are not backed by the full taxing power of the issuer, they are normally considered more risky than G.O.'s and subsequently will usually require higher yields than similar general obligation bonds. The projects financed by revenue bonds vary. Toll roads and bridges, water and sewer treatment plants, university dormitories, airports, hospitals, and municipal arenas are examples of projects frequently financed by revenue bonds.

Municipal revenue bond issues have increased over the past few years. Over 60 percent of all new municipal securities issued over the last four years have been revenue bonds. One reason may be that they do not burden the credit capacity of the issuer and generally do not require voter approval. Another reason may be the growth of Industrial Development Bonds (IDB's) that provide private businesses indirect access to the lower cost funds available in the

tax-exempt bond market. Although IDB's are issued by local governments, the proceeds are used to finance private businesses. Some justify IDB's because they boost the local economy by aiding the area's industrial development.

Municipal Market Operations

Method of Sale. Municipalities may sell their issues either by private placement or by public offering. Privately placed bonds are usually placed directly with a small group of local institutional buyers such as commercial banks and property and casualty insurance companies. The private placement market is an important source of funds, especially for smaller issuers.

Publicly offered bonds are underwritten by investment banking houses or by commercial banks. The underwriter purchases the issue at an agreed price and may then attempt to resell the issue to the public at a higher price. An underwriter acquires a municipal issue either through competitive bidding or a negotiated offering. Competitive bidding allows different underwriters to compete for the issue. Underwriters submit their bids to the issuer subject to the rules of the selection procedure. The winning bid is usually the one with the lowest interest cost to the issuer. Most G.O.'s are offered via the competitive bid process since it is perceived that this process provides lower

interest costs to the issuer [23, 44, 49]. Many states actually require that all G.O.'s be sold competitively. Revenue bond issues are generally left unregulated in this capacity since the repayment of these bonds is not a direct claim against the issuer's tax base.

Negotiated offerings occur when the issuer selects an underwriter to market the issue without any actual bidding taking place. A contractual agreement stating the terms of the underwriting process is negotiated by the issuer and underwriter. Issuers generally utilize underwriters with whom they have previously conducted satisfactory business dealings.

Bond Reoffering. When an underwriter is awarded an issue, he may choose to resell the bonds to the public or add them to his own investment portfolio. If the bonds are resold, they are said to be reoffered. While it is common practice to reoffer bonds, many bond issues are retained by the underwriter. This is especially true for smaller issues underwritten by commercial banks. Large bond issues generally are underwritten by a purchasing syndicate. The number of members in the purchasing syndicate depends upon the size of the issue as well as the geographic region in which the bonds are being issued. Since underwriters assume the price risk associated with reoffering an issue, as more

underwriters join a syndicate, the individual risk for each member is reduced. The bonds are then reoffered to the public through a selling group of security firms organized by the syndicate.

Interest Cost Measures. The issuer's total interest cost is composed of the underwriter's spread and bond purchasers' promised yield to maturity. The underwriter's spread is compensation to the underwriter for his role in the marketing process. The yield to maturity paid to investors is referred to as the reoffering yield (ROY). Since municipal issues are generally serial bond issues comprised of several different maturities, each maturity pays a particular reoffering yield.

There are two different measures of the total interest cost for a serial bond issue. The net interest cost (NIC) is, by far, the most widely used measure and is computed by dividing the total costs of the issue by the weighted average maturity.⁹ This measure ignores the time value of money since it simply averages the total dollar cost of the issue. True interest cost (TIC) is the other measure of total

⁹NIC =

$$\frac{\text{Total Interest Payments} + \text{Bid Discount (or - Premium)}}{[\text{par value of issue}] \times [\text{average maturity of the issue}]}$$

municipal borrowing cost. It is the interest cost realized when the present value of the issuer's future payments equals the aggregate dollar amount received by the issuer from the underwriter. TIC considers the time value of money, therefore, it realistically is a more meaningful interest cost measure to issuers than NIC.

Investors in the Municipal Bond Market

Because of their tax-exempt status, municipal securities are primarily purchased by financial institutions taxed at the full corporate tax rate or by individuals with high marginal tax rates. Commercial banks and property and casualty insurance companies are the predominant institutional buyers. Both of these institutions invest in taxable bonds up to the point where they cover operating expenses and generate profits to the level subject to full corporate taxation. Beyond that point they will only purchase tax-exempt bonds for their investment portfolios. This strategy allows them to keep taxes at a minimum. Therefore, their decisions to purchase municipal securities are not sensitive to the yields of tax-exempt bonds relative to taxable bonds. The primary determinant of their holdings of municipal securities is their expected profits. As such, the demand for municipal securities by these institutions varies directly with their expected profits.

On the other hand, demand for tax-exempt securities by individual investors is very sensitive to the yield differential between taxable and tax-exempt bonds. To draw more individual investors into the tax-exempt bond market, municipal issuers must increase tax-exempt yields relative to taxable yields in order to motivate lower tax bracketed individuals to purchase municipal securities. Periods of suppressed institutional demand for tax-exempts necessitate an increase in yields of municipal bonds relative to taxable bonds in order to clear the market.

Commercial Banks. Over the past decade, commercial banks have been the major holder of municipal securities, especially general obligation bonds. Commercial banks prefer general obligation bonds because they are generally less risky than revenue bonds. In addition, general obligation bonds apply against the pledging requirements of many states and localities that mandate that public deposits of banks be collateralized by marketable securities.

Most municipal securities held by commercial banks are also short term and of high quality. Holding short-term securities not only provides banks with desired liquidity, but also reduces interest rate risk because short maturity assets better match the short maturity liabilities of commercial banks. Banks hold high quality securities because

of liquidity requirements and because of bank regulations that requires commercial banks to hold investment grade bonds.¹⁰

The commitment of commercial banks to municipal securities has fluctuated significantly over the past several years. The investment behavior has not only been affected by expected earnings, but also has been influenced by bank loan demand and the monetary policies of the Federal Reserve System. Periods of high loan demand or contractionary monetary policy has reduced banks' bidding for municipal securities while periods of low loan demand or expansionary monetary policy has led to increased bank demand for municipal securities.

Property and Casualty Insurance Companies. Property and casualty insurance companies are also major holders of municipal securities. They prefer revenue bonds over general obligation bonds because revenue bonds offer higher yields, ceteris paribus. In addition to the tax advantages, municipal bonds provide regulatory benefits for property and casualty insurance companies. State insurance departments

¹⁰Investment grade bonds are bonds that are rated Baa and above.

utilize the amount of statutory surplus as a principal test to ascertain an insurance company's underwriting capacity. In computing statutory surplus, bonds may be valued at acquisition cost rather than market value and thereby reduce the uncertainty of a company's statutory surplus.¹¹

The relative commitment of property and casualty insurance companies to municipal securities has also fluctuated over the past several years because of the volatile earnings of these companies caused by the cyclical nature of casualty losses. Coupled with the fluctuating investment behavior of commercial banks, the fluctuating investment patterns of property and casualty insurance companies has significantly contributed to the high volatility of municipal bond yields.

Individual Investors. Recently, individual investors have become the largest holders of municipal securities. As a group individual investors have a lower tax bracket than either commercial banks or property and casualty insurance companies. Thus, they clear the market for tax-exempts after commercial banks and property and casualty insurance companies have met their needs. Individuals may acquire

¹¹ Stocks must be valued at market prices.

municipals directly through bond dealers and investment trusts, or indirectly through municipal bond mutual funds. The present profitability problems of commercial banks and property and casualty insurance companies, along with increasing municipal borrowing, has necessitated more individual investor purchases of municipal securities. To attract more individual investors, the yields on tax-exempt bonds have increased relative to the yields of taxable bonds.

Geographic Segmentation in the Municipal Bond Market

Corporate bonds appear to be close risk-adjusted substitutes for each other and, as a result, trade in an integrated and highly liquid market. However, because of informational cost differences and various state tax laws that prevent shifts of substantial numbers of investors between instruments, the municipal bond market is reputedly geographically segmented [10, 18, 29]. Geographic market segmentation implies that comparable debt instruments issued in different geographical regions are not substitutable. Consequently, demand for these instruments is dominated by local or regional investors.

Detailed financial information required to inform potential investors outside an issuer's geographic region is usually not readily available for small, infrequent bond issuers. It is therefore too costly and time consuming for

investors or underwriters to collect and disseminate information on these issuers. Issuers of small municipal issues may also find it cost prohibitive to acquire bond ratings in an attempt to convey information concerning their credit worthiness. The total dollar interest savings provided by a rating's positive signal may be less than the cost of acquiring a rating for smaller issues. Local purchasers are often already familiar with an issuer's credit worthiness and may also be interested in the economic viability of the region. Consequently, demand for small issues of municipal bonds is typically dominated by purchasers in the issuer's geographic region and are therefore either placed directly or sold by small underwriters to individual residents, local insurance companies, and area commercial banks in regional primary markets. Large bond issues of more well known municipalities generally have more detailed financial information readily available for potential underwriters and therefore tend to be reoffered in the national primary market.

Hendershott and Kidwell [18] found that while macroeconomic factors are the most important determinants of municipal borrowing costs, supply and demand conditions in regional tax-exempt markets may cause at least temporary differences between regional and national borrowing costs in the small issue tax-exempt bond market. Their study supports the existence of geographic segmentation for small municipal

bond issues. They found that small issues are most likely to be acquired by investors in the issuer's geographic region, whereas large issues are normally sold through major underwriters to investors throughout the country.

Another market segmenting factor is that many municipal issues are exempt from local taxation for local purchasers, whereas nonlocal purchasers may be subject to local taxes. These differential tax treatments may be substantial and may significantly influence the demand for bonds by investors outside an issuer's geographic region.

Given the above evidence, it appears that the municipal bond market may be geographically segmented for small bond issues. Small issues are normally placed directly with local purchasers or are underwritten by local underwriters and purchased by investors within the issuer's geographic region. As issue size becomes larger, there is an increased probability that the issue will be marketed to numerous investors beyond the issuer's geographic region.

Summary

The municipal bond market services a large number of heterogeneous issuers. Issues of various maturities are sold to finance operating and capital expenditures. Coupon interest income on municipal bonds is tax-exempt but tax treatment of this income varies for states and localities.

Income from bonds of nonlocal issuers is often fully taxed by municipalities.

There are two categories of municipal bond issues. General obligation issues are backed by the full taxing power of the issuer, whereas revenue bonds are backed only by the revenue generating power of the assets being financed by the bond issue. Revenue bonds are generally considered more risky and normally pay higher yields than comparable general obligation bonds.

Municipal issues may either be placed directly with purchasers or be publicly offered. Publicly offered bonds are sold to underwriters who may resell the bonds at a profit. Underwriters may acquire publicly offered issues through either a competitive or negotiated process. Small issues are often placed directly or are retained by underwriters in their investment portfolios. Larger issues are generally reoffered to the general public by large purchasing syndicates who employ a selling group of security firms to aid in the marketing process.

Municipal bond issues are predominately serial issues with multiple maturities. The total interest cost of the issue can be measured as the net interest cost (NIC) or the true interest cost (TIC). Unlike TIC, NIC does not account for the time value of money, nevertheless, it is much more widely used than TIC. Each maturity of a serial issue pays

a reoffering yield (ROY) that is the investor's promised yield to maturity.

Commercial banks are the principal purchasers of municipal bonds, particularly the shorter- and intermediate-term maturities. Property and casualty insurance companies also are a principal institutional purchaser of tax-exempt securities. Both of these institutions are subject to full corporate taxation. Individual investors are considered the market clearers of municipal securities after the institutions have made their purchases. Individuals purchase tax-exempts only if the yields exceed the after-tax yields of comparable taxable bonds.

There is evidence that supports the existence of geographically segmented market structure in the municipal bond market, at least for small issues. Small issues are generally marketed in local and regional bond markets and large issues are most often reoffered in the national primary market.

This section has reviewed several general characteristics of the municipal bond market. The following section presents arguments specifying why a call provision is frequently not included in tax-exempt bond issues.

Inclusion of the Call Provision
in Municipal Bond Issues

Unlike the corporate bond market, in which virtually all bonds are callable, callable bonds are less prevalent in the municipal market. There are several explanations for why this is the case.¹²

Short-Term Concerns of Politicians

Pye [40] proposed that public officials realize that the presence of a call option necessitates a premium. This translates into higher taxes now with the possibility of lower taxes in the future. Politicians are more concerned with present taxes than future possible tax savings since there is the probability that they will not be in office in the future. Therefore, they place more worth on present interest savings than the possibility of greater interest savings in the future.

Risk Aversion

Another explanation proposed by Pye is that of risk aversion. Interest savings may provide a way to reduce high deficits incurred during periods of low interest rates and high unemployment; however, it could be counterproductive

¹²These arguments generally apply to general obligation bonds since most revenue bonds are callable.

for public issuers (federal, state, and local governments) to call the bonds. Calling the bonds may reduce wealth in the private sector, consequently reducing spending by investors and thereby negating any benefit gained from calling the issue. This argument applies more so to the federal government, but, to a lesser degree, it also is applicable to state and local governments, depending upon the percentage of bondholders within their respective taxing boundaries.

Differences in Borrowing and Lending Rates

West [50] proposed another factor that reduces the appeal of the call option for municipal issuers. Even in a world of certainty where the market accurately assesses the call risk premium, West argues that municipalities will not be indifferent between issuing callable versus noncallable securities. Since a municipality is not subject to taxation of its income from investments and can issue debt that pays tax-free interest, it enjoys a lending rate higher than its borrowing rate. West presumes the lending rate as the appropriate discount rate for future interest payment savings; therefore, the net benefit of a possible future refunding will be negligible, biasing the municipality to use noncallable debt. West does point out that other factors may influence the decision concerning the inclusion of the call provision besides profitable refunding, but ceteris

paribus, the differential in borrowing and lending rates should reduce the appeal of the call provision for municipal issuers.

Zero Differential in Tax Rates

Use of the differential in tax rates between investors and issuers as a possible justification for the use of callable bonds, as proposed by Boyce and Kalotay [8] and Marshall and Yawitz [35], is mostly abrogated in the municipal market since both lenders and borrowers essentially have zero tax rates.¹³ Issuers (borrowers) are not concerned with tax deductibility of interest costs whereas investors (lenders) are not subject to taxation of interest income.¹⁴

Summary

The theory of the call provision contains contradictory arguments concerning the inclusion of a call provision by bond issuers. This section has presented several arguments that propose reasons for the reduced inclusion of the call provision in the municipal market.

¹³Some holders may be subject to a minimum tax.

¹⁴The taxation of the call price premium as a capital gain to the bondholder should also make the use of the call option less desirable.

Pye argued that short-term political concerns and the presence of risk aversion were two possible explanations for municipal issuers to place less importance to a call option. West proposed that differences in borrowing and lending rates also makes the call option a less attractive feature for municipal bond issuers. In addition, the tax differential arguments of Boyce and Kalotay and Marshall and Yawitz, as possible reasons for the inclusion of a call provision, do not apply in the municipal bond market.

All of these arguments contain the central theme that municipal issuers do not alter the decision to include a call provision based on the probability of future refunding; therefore, expectations of lower interest rates should not increase the likelihood that issues will contain a call provision. If interest rate expectations do not alter the decision to attach a call provision to municipal debt, one must question what factors do consistently influence the inclusion of a call provision. Only Kidwell [27] has attempted to analyze a possible determinant (municipal interest rate level) of an issuer's choice of callable debt. All other studies have tested for the cost of the call provision to municipal bond issuers. The following section reviews these past studies.

Previous Research

Numerous empirical studies have tested for the influence of the call provision on the interest cost of municipal issues. These studies have employed multiple regression analysis to attempt to show the relationship between measures of the tax-exempt bond yield and various explanatory variables believed to influence the yield. A measure of the call provision has consistently been among the explanatory variables. The construction of this measure has varied somewhat in these studies. The remainder of this section discusses the various measures of the call provision employed in previous research. Empirical findings of relevant past studies are also summarized.

Measures of the Call Provision

Measuring the effect of a call provision on municipal yields has differed in past empirical studies. Although the use of a call dummy variable has been the most prevalent technique employed, its use has severe limitations. First, it fails to account for the vast differences in the call provisions of tax-exempt issues. In contrast to the corporate bond market where call provisions are relatively standard, call provisions of municipal issues are quite diverse. Call deferments and call price premiums are by no means standard in their respective lengths or amounts. Secondly, use of the call dummy variable by itself dictates that the

influence of the call provision on bond yields is constant over time as well as over issues. Certain factors such as interest rate expectations, uncertainty about future interest rate movements, and the marketability of the municipal bond issue may significantly affect the influence of the call provision on yields. However, use of the call dummy variable alone fails to acknowledge these possibilities.

The length of the call deferment period has also been used as a measure of the call. Theory suggests that as the length of the deferment increases, the required yield should decline.¹⁵ This measure does account for differences in the deferment period length across callable municipal bond issues; however, the effect of varying market conditions on the call risk premium is not recognized. An increasing call deferment period should significantly reduce call risk since it actually reduces an issuer's call privilege; however, the deferment's effect on the call risk premium may vary over issues and over time.

The use of the call deferment period also implies a linear relationship between the length of the deferment and a bond's yield. Kidwell [24, 26] used the natural logarithm

¹⁵This decline in yield, or interest cost, represents the declining call risk premium.

of the deferment period in studies of the call provision in the municipal bond market. This functional form dictates that the marginal reduction in the call risk premium will decline as the call deferment lengthens. This may be more intuitively appealing, but still suffers from the above mentioned shortcomings. In addition to the natural logarithm of the call deferment period, Kidwell tested for other call features in these studies. He included the call price premium, a dummy variable indicating if the order in which serial bond issues can be called is specified, a dummy variable indicating if there are restrictions upon the use of the call provision, and a dummy variable indicating the presence of mandatory calls. These provisions, along with other control variables, were regressed against the TIC of 182 callable bonds; however, the call deferment variable was the only call feature that had a significant coefficient with the predicted sign in any of the regressions.

Broaddus and Cook [10] developed a theoretically appealing model to test for the influence of the call provision on tax-exempt bond yields. They used an interest rate expectations adjusted call risk measure that accounted for not only the length of the call deferment period, but also

accounted for the call price premium.¹⁶ This call risk measure has the desired functional form where call risk approaches zero as the spread variable, which gauges interest rate expectations, becomes highly positive. Their measure also allows call risk to be reduced by the call deferment and the call price premium. Assuming the term structure of government bond interest rates as a viable proxy for interest rate expectations, this measure has been the most compatible with the theory of the call provision.¹⁷

Findings of Past Studies

Past studies that have attempted to establish the influence of call provisions on municipal bond yields have produced diverse results. Some studies found the call measure to be statistically significant while others found the opposite. Still others found mixed results when separating the bonds into general obligation and revenue.

¹⁶The total effect of call risk exposure in their regression was measured as: $b_1 CR + b_2 CR * CD + b_3 CR * CP$ where b_1, b_2, b_3 are regression coefficients; CR = call dummy * $1/e^{s/2}$; s = spread between 20 and 7 year government bond yields; CD = length of the call deferment period; and CP = call price premium (computed as the call price at time of first call minus the price of the bond calculated using the bond's original yield to maturity).

¹⁷The authors do not discuss how much better their measure helps explain municipal interest costs than the same measure left unadjusted for expectations.

Studies Where the Call Measure Was Significant.

Hendershott and Kidwell [18] used the call dummy measure with NIC as the dependent variable in a study of the effect that regional changes in the supply of new municipal bond issues have upon individual bond yields in that region. Using both general obligation and revenue bonds and Indiana as the test area, their results indicate that the inclusion of the call provision demands a significant call risk premium.¹⁸ In the Indiana market, the call risk premium was approximately 15 basis points during the period 1970-1974.

Sorenson [42] used the call deferment period as the measure of call risk. His paper investigated the effect of the purpose of bond issue proceeds on market risk premiums for revenue bonds. Regressing this measure along with other explanatory variables against the NIC, he found a statistically significant inverse relationship between the deferment period and the yield measure. Specifically, the ordinary least squares regression estimated a decline of nearly one-half of a basis point for each additional year of the call deferment period.

¹⁸ Approximately three-fourths were general obligation bonds and one-fourth were revenue bonds.

In a study of segmentation effects on regional yield differentials in the municipal bond market, Kidwell, Koch, and Stock [29] analyzed over 4,500 new issue general obligation bonds sold competitively in all states from 1978 through 1980. The NIC and ROY were regressed onto the call dummy measure and several other explanatory variables. The empirical results show the presence of a call option to require 17, 5.7, and 8 basis points for the NIC, ROY (10), and ROY (20) yield measures respectively.¹⁹

In an examination of the benefits of acquiring private bond insurance for municipal bonds, Kidwell, Sorenson, and Wachowicz [31] found that the presence of a call provision increased a bond issue's NIC. Data was collected for all MBIA insured and noninsured serial bond issues sold during the 1975 to 1980. Multiple regression estimation on over 2,393 general obligation bonds indicated that the call risk premium was approximately 10 basis points for the sample.

In another study, Kidwell and Trzcinka [32] used over 2,500 new municipal bond issues sold competitively during 1974-1975 to test for the impact of the New York City fiscal

¹⁹ ROY (10) = reoffer yield for the ten year maturity; ROY (20) = reoffer yield for the twenty year maturity. A ROY (1) regression was also run but the call dummy measure was not significant at a 10 percent confidence level.

crisis on reoffering yields of municipal bonds. Multiple regressions showed a 14 basis point call risk premium for the five-year maturities and a 13.7 basis point call risk premium for the ten-year maturities.

Studies Not Finding the Call Measure Significant. In contrast to the above studies, other researchers have found that the presence of a call provision does not command a significant call risk premium. In a study analyzing municipal issue interest cost determinants within several categories of bond proceeds use, Benson [2] examined TIC or NIC, depending on which basis the issue was sold. Using a sample of both general obligation and revenue bonds, he found the call dummy variable to have an inconsistent effect across purpose categories. The variable was significant only in cases where the sign was negative, indicating that callable bonds sell for a lower interest cost than noncallable bonds. This, of course, is contrary to the theory of the call provision.

In a regression study of the influence of commercial bank entry into municipal revenue bond underwriting on the TIC, Hopewell and Kaufman [19] found the call dummy not significant. Their sample consisted of 340 competitively bid municipal issues sold in the summer of 1973.

When examining the impact of advanced refunding bond issues on state and local government borrowing costs, Kidwell and Hendershott [28] also found the call provision dummy variable to be statistically insignificant. The dependent variable in this study consisted of the NIC on 404 long-term serial bond issues sold both competitively and negotiated in Indiana during the period January 1970 through December 1974.

Studies with Mixed Findings. Many studies that have examined determinants of municipal bond yields have produced mixed results. One of the first studies was by Kessel [23]. The main purpose of his article was to study the effect of competition on underwriting costs, reoffering yields, and financing costs to issuers of tax-exempt bonds. Using all new issues from the spring of 1959 to the spring of 1967, Kessel conducted an experiment where he regressed the excess of the reoffering yield of a twenty-year maturity over White's index against several explanatory variables, one of these being the logarithm of the call deferment length.²⁰ Noncallable bonds were assigned a call deferment period equal to their final maturity. In a sample of 5,224 general

²⁰White's Index represents the yields of the highest quality twenty-year tax-exempt bonds.

obligation and 1,279 revenue bonds, the call measure was significantly negative as suggested by general theory. Separate regressions were then done on the general obligation and revenue bonds. The call measure was again found to be significantly negative for the sample of general obligation bonds; however, the call measure was not significant for the sample of revenue bonds.

Benson [3] investigated the effect of underwriter search on municipal interest cost. Utilizing data obtained for a sample of 319 serial municipal issues (237 G.O. and 82 Revenues) sold competitively during June, July, and August of 1973, Benson regressed the TIC against the call dummy measure and other explanatory variables. Like Kessel, he ran separate regressions on general obligation bonds, revenue bonds, and the combined sample; however, his results concerning the call were just the opposite of Kessel's results. The call measure was not significant for the combined sample or for the sample of general obligation bonds; however, the call measure was significantly positive, as theory suggests, for the sample of revenue bonds. The call risk premium for the revenue sample was 34 basis points.

None of the previously discussed research was primarily concerned with investigating the call provision. Two empirical studies, however, that did focus on the call provision also produced mixed results. In a comprehensive regression

analysis of determinants of municipal bond yields, Broaddus and Cook [10] utilized a measure for the call provision that adhered to the theory of the call provision.²¹ They conducted separate regressions using the ROY for 10, 15, and 20 year maturities as the dependent variable. Although their sample of 914 serial issues (75 percent G.O. and 25 percent Revenue) only covered a two year period, 1977-1978, they found the call measure to be statistically significant with the theoretically correct signs for the 10 and 20 year maturities for general obligation bonds.²² When analyzing revenue bonds, none of the regression coefficients for the call measure were significant. Although the call's effect on reoffering yields was significant for this period for general obligations, it was relatively small. Actually, it is somewhat surprising that the call measure was found to be significant given the time period of the study. Since this study covered a period of cyclically low interest rates where the term structure of government bonds suggested much higher future rates, it would seem that call risk would be

²¹This measure was previously described (see Footnote 16).

²²The exception was the call price premium variable. It was consistently not significant and was subsequently dropped from the equation by the authors.

negligible. One would expect, therefore, that no significant call risk premium would be required. The authors did acknowledge this period as one where interest rates were relatively low and they subsequently point out that larger effects might exist in other periods of cyclically higher rates.

In the only articles specifically examining the cost of the call provision in the municipal bond market, Kidwell [24, 26] also found mixed results. The sample utilized in both of these articles consisted of 182 (103 G.O. and 79 Revenue) callable bond issues sold during the summer of 1973. Studying the effects of a call provision on a bond's TIC, he included variables to measure numerous features of the call provision. For general obligation bonds, he found the natural logarithm of the call deferment length variable to be significant with the correct sign. Besides a call deferment variable, he also included variables that measured the call price premium, the location of notice of call, the legal period required before call, the presence of restrictions upon the use of the call, mandatory call provision, and the specific order of call. None of these variables were found to be significant. For revenue bonds, none of the coefficients of the variables entered the equation significantly with the theoretically correct sign.

In the only study investigating a possible determinant of the call inclusion decision, Kidwell [27] analyzed the relationship between call provisions on municipal bonds and the interest rate cycle. He examined how the frequency of the inclusion of the call provision, the length of the call deferment period, and the exercise of the call option vary with interest rates. In examining the variation of the frequency of the inclusion of a call provision, he regressed the percentage of total bond issues (over 9,420) that were callable for each quarter of the years 1959 through 1967 against the average Moody's index for long-term municipal bonds for the respective quarter in which the bond issues were sold. To examine the length of the call deferment period, he regressed the average call deferment period for each quarter during this time period against the respective interest rate index. His results indicated that interest rate levels do not appear to affect either a municipality's decision to include a call provision in a bond issue or the length of the call deferment period for either general obligation or revenue bonds.

To test if the exercise of the call option varies with interest rates, Kidwell examined 453 callable issues (sold during 1960) over a fourteen-year period following the date of issue. 1960 was chosen because of its cyclically high interest rates. He regressed the percentage of these bonds

called each quarter against the interest rate index for that quarter. His findings indicate that for both general obligation and revenue bonds, a larger proportion of call options will be exercised when current interest rate levels are low.

Summary

Previous studies have failed to closely investigate factors that systematically influence municipal issuers' decisions to include a call provision in bond indentures. Consequently, the following chapter of this study will analyze the inclusion of call provisions in municipal bond issues and test for determinants of an issuer's choice of callable or noncallable debt.

Empirical studies discussed in this section offer contrasting conclusions on the cost of the call provision to municipal issuers. These contradictory findings possibly occur because of a failure of these studies to account for differences in the cost of the call provision over time and over issues. Therefore, Chapter V offers corrections for many of the deficiencies of past research and then examines the cost of the call provision to municipal issuers in light of these changes.

CHAPTER IV

EMPIRICAL TESTING: INCLUSION OF THE CALL PROVISION

Many municipal bond issuers choose not to include a call provision in new debt issues? Why is this the case? Do economic considerations influence this decision? Are there any significant determinants of this choice? This chapter addresses these questions. Specifically, this study analyzes the relationship between key market condition, issue, and issuer characteristics and the inclusion of a call provision in municipal issues. We develop and model a theory of issuer choice regarding the inclusion of a call provision in new municipal debt issues.

The remainder of the chapter presents characteristics that may influence the issuer's choice of callable debt and develops specific hypotheses that will be tested.²³ The chapter also presents the methodology and findings of the empirical tests.

²³Each hypothesis is stated in the alternative hypothesis form.

Statement of Hypotheses

Market Condition Characteristics

Interest Rate Expectations. One factor to consider when investigating an issuer's choice of whether or not to include a call provision in an issue is the expected magnitude and direction of interest rate movements. Because of the potential for future interest savings, an issuer may be economically motivated to include a call provision by expectations of lower future interest rates. However, efficient markets advocates maintain that the yield equilibrating process between issuers and investors results in the correct pricing of the call privilege and may prompt both the marginal investor and marginal issuer to become indifferent between callable and noncallable bonds. If issuers must pay the appropriate call risk premium for any anticipated level of future interest rates, then changes in interest rate expectations should not significantly alter municipal issuers' decision to attach a call provision to new issues.²⁴ Arguments by Pye [40] and West [50] support this viewpoint. Pye contends that the higher call risk premium associated

²⁴This assumes that issuers and investors have homogeneous expectations of future interest rates.

with expectations of lower interest rates may actually motivate municipal bond issuers to exclude call provisions since politicians focus on the short term and concentrate on keeping present taxes low rather than speculate on savings in future periods when they may not be in office. West points out that state and local governments' possible use of their higher lending rate as the discount factor for possible future interest savings minimizes the likelihood that the present value of any future savings will exceed the call risk premium, regardless of any expected change in interest rate levels. This differential in borrowing and lending rates may actually reduce the attractiveness of the call privilege for municipal issuers, *ceteris paribus*.

From the above discussion, whether or not changes in interest rate expectations cause municipalities to significantly alter the decision to include a call provision in new issues is debatable. To help resolve this issue, the following hypothesis will be tested.

Ceteris paribus, municipal bond issuers choose to include a call provision more frequently as future interest rates are expected to decline.

Market Uncertainty. As previously discussed, the benefit of a call provision is twofold. It provides an issuer with flexibility and the potential for future interest

savings. From the flexibility standpoint, uncertainty about market conditions may prompt issuers to include a call provision since the call privilege reduces uncertainty for issuers. For example, if future situations arise that necessitate the restructuring of an issuer's debt position or warrant the removal of binding indenture restrictions, the call privilege allows the issuer to retire outstanding debt before final maturity. Consequently, as market uncertainty reduces an issuer's ability to forecast future financial needs or lessens his chances of entering into desired contractual agreements, it is expected that issuers will be more likely to attach a call provision.

From an interest savings standpoint, market uncertainty, specifically about future interest rates, may also influence the decision to include a call provision. As previously discussed, the fluctuating investment behavior of commercial banks and property and casualty insurance companies has caused municipal bonds yields to be highly volatile over the past several years. This past volatility may result in increased uncertainty about future interest rates for municipal issuers. Since the call provision is simply a call option to obtain an outstanding bond, one might expect the value of the call option to bond issuers to be affected by this uncertainty.

A bond's call provision is a contingent asset whose value is a function of the value of an underlying asset. The underlying asset is the new bond issued in the bond refunding. The yield of the newly issued bond is a function of market interest rates, therefore, the value of the call option is a function of market interest rates. The call option's value on the day of exercise is measured as the difference in the market prices of callable and otherwise identical noncallable bonds. The market price of callable bonds is constrained on the upside by the call price since an issuer could call the bonds and profitably sell them at prices above the call price. The market price of noncallable bonds is unconstrained, therefore, the call option's value will be positive when market interest rates are sufficiently low to push a noncallable bond's market price above a callable bond's call price. When market interest rates are at higher levels, both a callable bond and noncallable bond will be priced equal to or below the callable bond's call price. In this range the value of the call option is zero. Since the call option's value can not be less than zero, its value depends on the probability of interest rates falling to a level where a noncallable bond's market price exceeds a callable bond's call price. This probability depends on the the variance of future interest rates. Therefore, because of the potentially profitable refunding activities provided by the call option, the greater the

uncertainty, or volatility, of future interest rate levels, the greater the expected value of the call option to an issuer. Accordingly, issuers may attach a call provision to debt more frequently as future interest rates become more uncertain. However, as in the case of interest rate expectations, efficient market advocates may argue that the call option's value, from a refunding perspective, would be properly priced regardless of the variance, or uncertainty, of future interest rates.²⁵ Issuers should realize that any increase in potential future interest savings will be offset by the increased call risk premium. Given this rationale, the decision to include a call provision may not be significantly altered by changes in the uncertainty about future interest rates.

To examine the effect of market uncertainty on the decision to include a call provision, the following hypothesis will be tested.

Ceteris paribus, increasing uncertainty about market conditions increases the likelihood that municipal issuers will attach a call provision to new debt issues.

²⁵The influence of future interest rate uncertainty on the pricing of the call privilege is examined in Chapter V.

Issue and Issuer Characteristics

Issue Marketability. Another factor that may bias an issuer's decision to include a call provision is the marketability of the bond issue. Previous discussion of geographic segmentation in the municipal bond market maintained that small municipal issues are generally either placed privately or obtained by local purchasers in regional primary markets. As issues become larger, there is an increased possibility for them to be distributed nationally. This has possible implications for the call provision. Specifically, small issues should be less likely to include a call provision than larger issues. Small issues generally appeal to a small number of local or regional investors who are knowledgeable about the issuers. Collecting and disseminating detailed financial information on municipalities offering most small issues may prove to be too costly for investors and underwriters operating outside the issuer's geographic region. Thus, the marketability of small issues is reduced and may increase the necessity for issuers to relinquish privileges that would ordinarily be included with larger, more marketable issues. Purchasers of small issues may also use their more personal relationship with an issuer to pressure the issuer to actually omit a call provision. In addition, local banks and other local institutions are frequently repeat purchasers of small debt issues offered by

municipalities. Consequently, issuers may be more willing to make concessions to these repeat purchasers concerning stipulations of the bond indenture.

As issues become larger, information collection becomes less expensive for prospective purchasers since more detailed financial information is generally available for larger issues. The larger base of potential purchasers for nationally marketed issues may make privileges generally desired by issuers less costly. There is also little chance that ultimate buyers will have input into issuers' decisions concerning stipulations of bond indentures. Therefore, larger bond issues that are marketed beyond the issuer's geographic region to large numbers of potential investors should be more likely to include a call provision than small bond issues privately placed or sold in local or regional markets. Subsequently, the following hypothesis will be tested.

Ceteris paribus, the inclusion of a call provision by municipal bond issuers is more likely as a bond issues become more marketable.

Average Maturity. Most municipal bond issues are serial issues with several different maturities. As the maturities extend further into the future, it becomes increasingly difficult for issuers to anticipate future financial needs.

Simply stated, there is more time for conditions to arise that may make the flexibility and interest savings potential afforded by the call privilege useful to an issuer. Issuers should realize this increased opportunity for the call privilege to prove beneficial; therefore,

Ceteris paribus, as the average maturity of issues increases, it becomes more likely that municipal issuers will attach a call provision to new issues.

Issuer Indebtedness. The call provision may be advantageous when an issuer has outstanding debt that he desires to retire prior to maturity. The call privilege allows an issuer to reduce his debt burden if circumstances warrant such action. As an issuer becomes more indebted, it is anticipated that he will place more importance on the flexibility and potential for interest savings provided by the call provision and will include a call provision in new debt issues. Based on this expectation, the following hypothesis will be tested.

Ceteris paribus, municipal issuers are more likely to include a call provision in new issues as they become more indebted.

Empirical Methodology

Theory of Issuer Choice

The economic theory of individual utility maximization provides a fairly complete model of individual choice.

Econometric models describing a discrete number of choices may be used to relate the conditional probability of a particular choice being made to various explanatory factors.²⁶ As it applies to this study, the choice between including or excluding a call provision in municipal issues is modeled as a function of market condition, issue, and issuer characteristics. As such, the choice probability for the two alternatives may be expressed in equation form as

$$P_{ij} = P(E_i, C_i) , \quad (4.1)$$

where P_{ij} = the conditional probability that the i^{th} issue will include, $j = 1$, or exclude, $j = 2$, a call provision, E_i = a vector of market conditions existing during the marketing of the i^{th} issue, C_i = a vector of issue and issuer characteristics of the i^{th} issue.

Because there exists unobserved, unmeasurable, and unknown variables that influence a municipality's decision to include a call provision, it is necessary to assume the existence of an issuer of some "average" bond issue whose tastes are the average over all observed characteristics. Suppose that the utility function of this issuer, U_{ij} , is

²⁶See Domencich and McFadden [13].

linear in the parameters and is approximated by

$$U_{ij} = U(E_i, C_i) = X_i' \beta, \quad (4.2)$$

where X_i is a vector of observations on variables that are constant across alternatives and represent key market condition, issue, and issuer characteristics, and β is a vector of parameters assumed common to the entire population.

To separate an individual issuer from the average, a stochastic component, e_{ij} , is added so that the utility function for individual issuers, V_{ij} , is given by

$$V_{ij} = U(E_i, C_i) + \varepsilon(E_i, C_i) = X_i' \beta + e_{ij}. \quad (4.3)$$

The stochastic component, e_{ij} , represents the possible effect of unobserved factors, measurement error, or random individual behavior. Since each municipal issuer is assumed to maximize his utility, the probability that issue i will contain a call provision is

$$P_{i1} = \text{PROB}[V_{i1} > V_{i2}], \quad (4.4)$$

or, simply, the probability that the issuer of the i^{th} issue will derive greater utility by including rather than excluding a call provision.

Since the random variables, e_{ij} , differentiate the individual issuers from the average, it is the specification of the particular joint distributions of the e_{ij} that determines the specific choice model to be utilized. In this analysis the logistic distribution is chosen entailing the use of the binary logit probability model.

The Binary Logit Model

The logit model can be viewed as an extension of regression analysis. It assumes that the log odds of an outcome is a linear function of certain explanatory variables. The log-odds form arises from the assumption that underlying choice considerations have a stochastic component that follows a logistic distribution. Since the dependent variable in this model may be interpreted as the probability of a certain choice being made given information on characteristics of the choice-making process, the logit model has intuitive appeal. A property of the logit model is that the probability prediction based on the independent variables will always lie within the desired zero-one range.²⁷

The logit model is specified as

²⁷The probit model accomplishes the same result, but is based on the cumulative normal distribution. The logit and probit probability distributions are very similar with the logit having slightly fatter tails which, consequently, makes it less sensitive than probit to outlying observations.

$$\begin{aligned}
 P_i &= \text{Prob}(Z_i > \theta_i) = F(Z_i) = F(\alpha + \beta X_i) = (1 + e^{-Z_i})^{-1} \\
 &= [1/(1 + e^{-(\alpha + \beta X_i)})] , \quad (4.5)
 \end{aligned}$$

where

P_i = probability of a municipal issuer choosing to include a call provision for observation i ,

e = base of natural logarithm ≈ 2.718 ,

$F(.)$ = cumulative logistic probability distribution,

X_i = deterministic independent variables for each observation i ,

θ_i = the threshold level of an underlying latent index (Z_i) that translates the underlying index into a decision to include or exclude a call provision; if $Z_i > \theta_i$ the issuer chooses to include a call provision; if $Z_i \leq \theta_i$ the issuer chooses to exclude a call provision.

The latent index Z_i is unobservable, of course, but the choice that an issuer makes, δ_i ($\delta_i = 1$ if call provision is included, $\delta_i = 0$ if a call provision is not included), is observed. The parameters of Z_i can thus be estimated by maximizing the binomial likelihood function

$$L = \prod_{i=1}^N P_i^{\delta_i} (1 - P_i)^{(1-\delta_i)} . \quad (4.6)$$

The population parameter estimators in the logit model are consistent and asymptotically efficient for large samples. All estimators are also asymptotically normal, which allows a counterpart of the regression t test to be applied. Specifically, the maximum-likelihood technique allows a chi-square statistic (Wald statistic) for testing if each parameter is zero. The Wald statistic is calculated by computing the parameter estimate divided by its standard error and then squaring the result. A chi-square score statistic which tests for the joint significance of the parameter estimates may also be calculated. This statistic is comparable to the overall joint F test used in multiple regression. A widely accepted assessment of the model's overall predictive ability is given by the C statistic. The C statistic represents the fraction of concordant pairs of predicted probabilities and actual observed responses (0 or 1). Specifically, looking at all pairs of observations having different responses, the statistic represents the percentage of pairs in which the observation with the higher response (1) has a higher predicted probability than the observation with the smaller response (0).

The Call Inclusion Model

As indicated in earlier discussion, the primary goal of this chapter is to examine the relationship of key market

condition, issue, and issuer characteristics with the inclusion of a call provision in municipal bond issues. To accomplish this objective the following model is estimated.

$$\text{PROB} = f[\text{TYPE} \overset{-}{\text{PURP}} \overset{+}{\text{EXP}} \overset{+}{\text{VOL}} \overset{+}{\text{LNSIZE}} \overset{+}{\text{AVMAT}} \overset{+}{\text{LNDEBT}}] , (4.7)$$

where the sign above each variable represents the expected direction of the partial relationship. An omitted sign signifies that the expected partial relationship is uncertain. The variables are defined below:

PROB = binary logit estimate of the probability that an issue contains a call provision;

TYPE = zero-one variables representing type of issuer;

LOCAL = 1 if offered by a state, county, city, or town government, else LOCAL = 0; SCHOOL = 1 if offered by a school district, else SCHOOL = 0; SPECIAL = 1 if offered by a special district or statutory authority, else SPECIAL = 0; SPECIAL is used as the excluded set;

PURP = zero-one variables representing the use of the proceeds of the issue; EDUC = 1 if the proceeds were used for educational purposes, else EDUC = 0; UTIL = 1 if the proceeds were used by utilities or for conservation purposes, else UTIL =

0; OTHER = 1 for all other use of proceeds, else
OTHER = 0; OTHER is used as the excluded set;

EXP = the geometric average annual forward rate (beginning at time $(t + 5)$), that is implied in the term structure of U.S. government bonds at time t , minus the 5 year yield. A 20 day moving average of the differential is then computed over the twenty business days prior to the sale date of the issue;²⁸

VOL = a measure of credit market volatility computed as the standard deviation of the Saloman Brothers' Weekly Index for prime grade ten-year municipal bonds for the sixteen weeks preceding the issue date;

LNSIZE = natural logarithm of the issue size in thousands of dollars in real 1977 terms;

AVMAT = average maturity of the serial issue, in years;

²⁸Mathematically,

$$EXP = [\sum_{t=-19}^t ((\text{Forward Rate})_t - (5 \text{ year yield})_t)]/20;$$

Forward Rate = $15\sqrt{(1+\text{Trs}20)^{20}/(1+\text{Trs}5)^5} - 1$ where Trs20 and Trs5 equal the rates of return on 20 and 5 year government bonds, respectively.

LNDEBT = natural logarithm of the ratio of net debt over the assessed valuation of the issuing municipality, in percentage form.

The variable, TYPE, categorizes the different types of issuers that compose the testing sample and is included in the model to control for possible differences in the frequency of call inclusion across different types of issuers. The effect of issuer type is difficult to predict since no sound argument is readily available for possible differences in the frequency of inclusion of a call provision across issuer categories. PURP is also included in the model as a control. It accounts for differences in the use of callable debt across issue purpose categories that are not captured by the type of issuer measure. Again, no sound arguments exist concerning possible differences in the frequency of inclusion of a call provision across issue purpose categories.

The variable EXP serves as a proxy for the market's perception of the magnitude and direction of future interest rate movements beginning five years from the issue date. The proxy estimate begins five years into the future because five year deferment periods are common for municipal

bonds.²⁹ The use of EXP assumes that changes in the U.S. government bond yield curve during the test period were determined by changes in interest rate expectations.³⁰ It is computed over the twenty business days preceding the date the bonds were issued to allow for decisions about issue features, such as the call provision, that are formulated prior to the date of sale. VOL measures the average volatility over the sixteen weeks preceding the day of issue.³¹ VOL serves as a proxy for both future interest rate uncertainty and overall uncertainty about market conditions.³²

The variable LNSIZE is a proxy for a bond issue's marketability. The natural logarithm is used since the marginal effect of issue marketability on the probability of

²⁹The proxy was also estimated 10 years into the future with no significant difference in results.

³⁰It would be technically more correct to measure each individual issuer's expectations of interest rate movements. This is, of course, not possible. However, it seems safe to assume that issuers have no better information than the market concerning future interest rates. Based on this assumption, the use of EXP is appropriate.

³¹Varying this time period from eight weeks to as much as thirty-two weeks did not significantly change the findings.

³²It is acknowledged that past interest rate volatility may, in fact, be a weak proxy for overall market uncertainty and for the interest rate volatility expected by investors as the first call date approaches.

inclusion is expected to diminish. LNDEBT measures the indebtedness of an issuer relative to the total assessed valuation. The use of the natural logarithm rests upon the expected diminishing marginal effect of the issuer's indebtedness on the decision to include a call provision.

The Data

The study uses 1,438 new issue long-term general obligation bonds issued in the state of Texas during 1977 through 1983. This time span includes periods where interest rates are relatively high and expected to fall as well as periods where interest rates are relatively low and expected to rise. There was, in fact, a broad range of values for all the variables used in this study. This suggests that this time period is suitable for empirical testing of the proposed hypotheses. Only general obligation bonds are used for this study since virtually all revenue bonds issued in the state of Texas during this time period were callable.

The decision to use only Texas bonds comes from the need for detailed, accurate information and the infeasibility of trying to collect this information for more than one state. Also, Texas was chosen because the large number of bond issues offered each year provides adequate observations for the logistic regression techniques. Additionally, better control of such regional factors as bank pledging

requirements and state tax treatment of bond income is possible when using bonds from only one state.

The sources used to collect the data include the Public Securities Association (PSA) long term municipal bond tape, Moody's Government and Municipal Manual, Federal Reserve Statistical Release H.15: Selected Interest Rates, and Saloman Brothers' Municipal Bond Yield Index Weekly Series.

Table 1 presents descriptive statistics for the sample. Of the sample, 1087 bond issues (75 percent) were callable, and 351 (25 percent) were noncallable. Although the influence of other factors is not held constant, preliminary analysis of the data offers some interesting inferences. The average interest cost for callable bonds is about 93 basis points above that for noncallable bonds. Figure 1 shows that, almost without exception, the average interest cost was substantially higher for callable bonds for each quarter of the test period. This suggests that the call privilege may consistently cost issuers of new municipal debt securities. Further, the figure shows that the cost of the call privilege varies significantly over the test period.³³

³³The cost of the call privilege, and how it varies over time and issues, will be examined more closely in the next chapter. This figure also does not hold all necessary controls constant.

TABLE 1
Mean Statistics for Callable and Noncallable Issues
(1977-1983)

Characteristic	Total Sample	Callable	Noncallable
Number of Issues	1,438	1,087	351
Net Interest Cost (NIC)	8.35%	8.57%	7.64%
Expectations Measure (EXP)	0.168%	0.135%	0.271%
Interest Rate Level (INT) (%)	6.77%	6.76%	6.84%
Interest Rate Volatility (VOL)	0.220	0.223	0.200
Issue Size in millions of real 1977 dollars	4.015	4.177	3.536
<u>Issue Size Categories in Millions (%)</u>			
Issue Size ≤ \$2.5 (SIZE1)	51.23	48.68	59.36
\$2.5 < Issue Size ≤ \$5 (SIZE2)	24.75	26.11	23.32
Issue Size > \$5 (SIZE3)	24.72	25.21	17.32
Average Maturity (AVMAT)	12.38	14.19	6.66
Debt-to-Assessed Value	23.13%	25.73%	14.88%
<u>Issuer Type (%)</u>			
Local Governments (LOCAL)	9.87	7.32	17.93
School District (SCHOOL)	47.85	43.47	61.75
Special Districts and Statutory Authorities (SPECIAL)	42.28	49.21	20.32
<u>Issue Purpose (%)</u>			
Education (EDUC)	48.01	43.80	61.35
Utilities (UTIL)	40.47	46.84	20.31
All Other Uses (OTHER)	11.52	9.36	18.34
Deferment Period	9.71	9.71	N/A

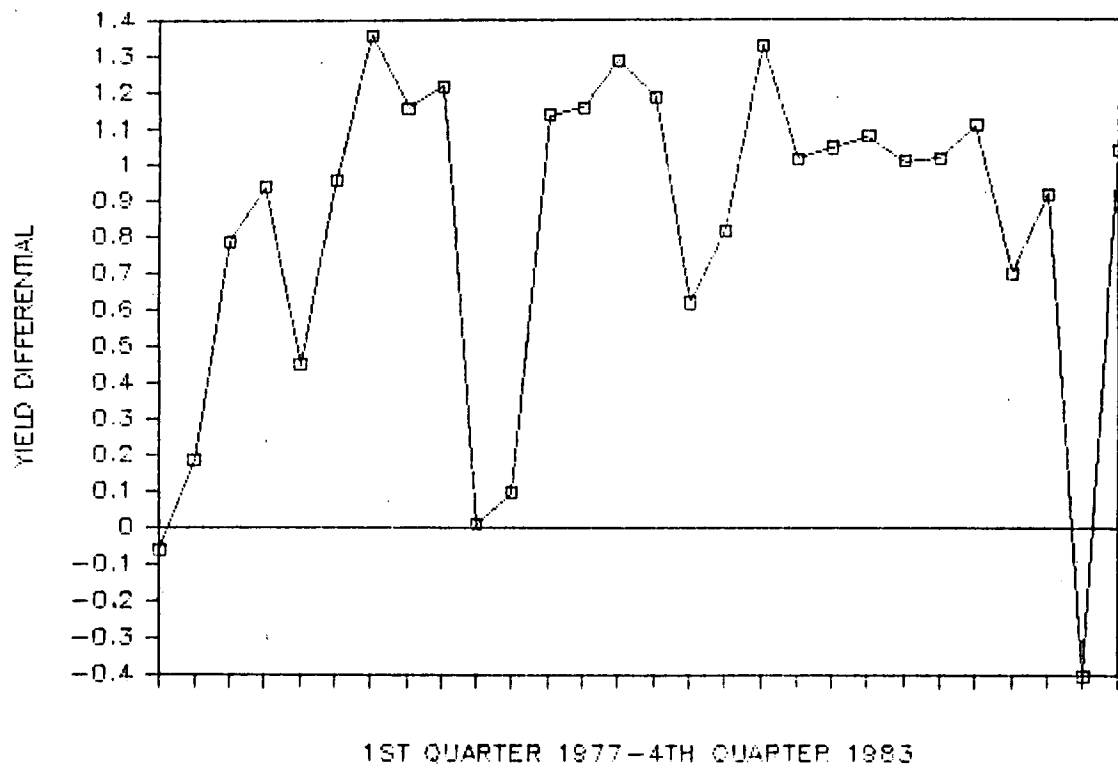


Figure 1
Callable-Noncallable Yield Differential

As Table 1 also shows, compared to callable bonds, the average noncallable bond tends to be smaller in issue size, have a shorter average maturity, and tends to be offered by issuers with lower indebtedness. These comparisons support the previously proposed issue marketability, average maturity, and issuer indebtedness hypotheses, respectively.

Of the callable bonds, only 7.32 percent were sold by local governments compared to almost 18 percent for noncallable bonds. Nearly half of the callable bonds in this sample were offered by special districts and statutory authorities, while approximately 44 percent were issued by school districts. School districts were the major issuer (62 percent) of noncallable bonds followed by special districts and statutory authorities (20 percent).

Over 46 percent of all callable bond issues in the sample were issued for utility and conservation purposes, followed by 43 percent and 9 percent for educational and all other combined purposes, respectively. For the noncallable bond issues, over 61 percent were for educational purposes, followed by 20 percent for utility and conservation purposes, and the remaining 18 percent for all other combined purposes.

The Empirical Findings

Table 2 presents the results of three logit estimates used to test the previously stated hypotheses. Neither the type of issuer control variables (LOCAL, SCHOOL) nor issue purpose control variables (EDUC, UTIL) were statistically significant at the 10 percent level. Use of each category as the excluded set failed to show any significant differences between either the type of issuer variables or issue purpose variables.

Interest Rate Expectations

The estimated coefficient for EXP was not statistically significant in Equation 4.7. This implies that the decision to include a call provision in municipal bond issues is not significantly altered by expectations of future interest rate levels. This result is consistent with the arguments of efficient market advocates. This finding does not mean that municipal issuers do not hope to enjoy future interest payment savings when they include a call provision. It simply suggests that issuers anticipate that the market assesses the potential for profitable refunding as well as issuers and properly prices the call privilege accordingly. As a result, issuers view that the probability that the call provision will be a net economic benefit to them is

TABLE 2

Binary Logit Estimates of Issuer's Call Inclusion
Choice Probability^a

Explanatory Variable	EQ(4.7)	EQ(4.8)	EQ(4.9)
<u>Controls</u>			
CONSTANT	-4.8039 (32.16) ^b	-5.3369 (35.22) ^b	-2.3784 (23.04) ^b
LOCAL	-0.7185 (2.27)	-0.7027 (2.56)	-0.8169 (3.00)
SCHOOL	-2.0742 (2.65)	-2.0355 (2.52)	-2.3596 (3.10)
EDUC	1.6875 (1.67)	1.6833 (1.88)	1.8027 (2.14)
UTIL	0.5318 (1.52)	0.5343 (1.52)	0.4432 (1.04)
<u>Hypotheses</u>			
EXP	-0.1206 (0.71)		-0.1159 (0.73)
INT		0.0756 (1.77)	
VOL	2.5396 (14.36) ^b	2.0643 (6.69) ^b	1.9051 (11.57) ^b
LNSIZE	0.3171 (14.35) ^b	0.3188 (14.55) ^b	
SIZE2			0.4647 (4.10) ^c
SIZE3			0.7258 (10.93) ^b
AVMAT	0.2926 (182.6) ^b	0.2957 (184.9) ^b	0.2940 (190.6) ^b
LNDEBT	0.3685 (19.94) ^b	0.3866 (20.99) ^b	0.3528 (18.90) ^b
Sample Size	1438	1438	1438
Model Chi-Square	436.2 ^b	441.2 ^b	483.8 ^b
Model C Statistic	0.892	0.892	0.892

^aChi-Square test statistics given in parentheses.

^bSignificant at the 1 percent level.

^cSignificant at the 5 percent level.

unchanged by expected interest rate movements. In other words, issuers know that profitable refunding is more likely when interest rates are higher and expected to fall, but the market knows this as well and will demand compensation in the form of a higher call risk premium, ceteris paribus.³⁴

As an additional test of the interest rate expectations hypothesis, another proxy for expected interest rate movements, INT, is used in place of EXP in Equation 4.8. INT is the average of Saloman Brothers' weekly index for prime grade ten year maturity municipal bonds over the four weeks preceding the week the issue was sold.³⁵ Periods of relatively high interest rates may be construed to reflect periods where market participants perceive a high probability of future interest rate decline. Periods of low interest rates may be perceived to afford little chance for further decline. The coefficient of INT is not significant, suggesting that issuers do not significantly vary the decision to include a call provision in new debt issues with changes in

³⁴An alternative explanation of this finding is that the empirical test is not powerful enough to reject the null hypothesis. EXP may also be an improper proxy for issuer's expectations of interest rate movements.

³⁵This measure represents the overall average level of municipal interest rates that existed during the period the issue was being prepared to market.

interest rate levels.³⁶ This finding is consistent with evidence provided by Kidwell [27] and also supports the results obtained when EXP was used.

Market Uncertainty

The coefficient of VOL is positive and significant at the 1 percent level in each equation in Table 3. This implies that, ceteris paribus, uncertainty of future market conditions increases the chances that a new bond issue will be callable. The flexibility provided by the call privilege appears to be more desirable to municipalities as market uncertainty increases. Issuers apparently place more importance on the call provision as market uncertainty reduces their ability to forecast future financial needs or reduces their chances of entering into desired contractual agreements. The significantly positive sign of VOL may also convey that increasing uncertainty about future interest rate levels increases the expected value of the call option and motivates issuers to attach a call provision to new debt issues. The findings of the interest rate expectations

³⁶INT minus a moving average of INT over the eighteen months prior to the date of issue was also used as a proxy. Use of this measure assumes that market participants during this test period expected interest rate levels to regress to a normal, or average, level. The coefficient of this measure also was not significant.

TABLE 3
Prediction Success Tables

Equation	Actual Choice	<u>Predicted Choice</u>	
		Noncallable	Callable
(4.7)	Noncallable	214	137
	Callable	38	1049
	Percent Correct	76.1	87.0
	Overall Percent Correct = 87.9		
(4.8)	Noncallable	211	150
	Callable	17	1060
	Percent Correct	92.5	87.6
	Overall Percent Correct = 88.4		
(4.9)	Noncallable	212	149
	Callable	18	1059
	Percent Correct	92.2	87.7
	Overall Percent Correct = 88.4		

expectations hypothesis, however, suggest that this conclusion is not warranted.³⁷

Issue Marketability

Previous discussion suggests that smaller issues are less marketable and are very often acquired directly by local purchasers such as commercial banks, or purchased by regional underwriters and reoffered locally. As issue size increases, it becomes more likely for an issue to be marketed beyond the issuer's geographic region to a larger base of potential investors. The positive sign and significance of the coefficient of LNSIZE in Equations 4.7 and 4.8 suggest that issues are more likely to contain a call provision as they become larger and more marketable. This finding supports the argument that issuers of less marketable issues are more apt to relinquish privileges that are ordinarily included with more marketable issues.

To further test the issue marketability hypothesis, dummy variables representing different issue size categories

³⁷ Exploratory analysis was undertaken to investigate if excessive multicollinearity existed between variables in the model, in particular VOL and EXP. The evidence suggests that excessive collinearity was not a problem. The sign and significance of VOL was not altered when EXP or INT was omitted from the model. The coefficients of neither EXP nor INT were significant when VOL was omitted from the model.

in real 1977 terms are substituted for LNSIZE in Equation 4.9. $SIZE2 = 1$ when $\$2,500,000 < \text{issue size} \leq \$5,000,000$, else $SIZE2 = 0$; $SIZE3 = 1$ when $\text{issue size} > \$5,000,000$, else $SIZE3 = 0$; $\text{issue size} \leq \$2,500,000$ constitute the excluded set. The coefficient of $SIZE2$ and $SIZE3$ are positive and significant at the 1 percent level and indicate that each progressively larger size category is increasingly more likely to include call provisions than the excluded set ($\text{issue size} \leq \$2,500,000$). This result further supports that municipal bond issues are more likely to contain a call provision as they become more marketable.

Average Maturity

The significance and positive sign of AVMAT in each of the three equations provides evidence that call provisions are more likely to be included in issues with longer average maturities. This finding suggests that issuers place more importance on the the flexibility and potential for interest savings provided by the call privilege as an issue's average term to maturity extends further into the future.

Issuer Indebtedness

The coefficient of LNDEBT is also positive and significant at a 1 percent level in all the equations. This result indicates that issuers place more importance on the call privilege as their indebtedness increases. Issuers with

larger debt burdens appear to place more importance on the possible use of the call privilege.

The intent of this study is not the development of a model to accurately predict whether an issue would or would not contain a call provision, yet the results are encouraging regarding the predictive ability of the models. The chi-squared statistic against random choice was significant at the 1 percent level for each model. The predictive accuracy for each model was approximately 88 percent. The prediction success table for each model (Equations 4.7-4.9) is shown in Table 3.³⁸

³⁸It is noted that a holdout sample could be used to examine the predictive ability of each model. This could be a topic for future research.

CHAPTER V

EMPIRICAL TESTING: COST OF THE CALL PRIVILEGE

The previous chapter investigated the influence of several characteristics on the inclusion of a call provision in municipal bond issues. In this chapter the investigation is carried further by examining the cost of the call provision to municipal issuers and how this cost may vary. The first section of this chapter develops specific hypotheses regarding the cost of the call provision.³⁹ The second section presents the methodology that will be used to test the hypotheses and the final section presents the results of the hypotheses testing.

Statement of HypothesesThe Cost of the Call Privilege

The call provision gives the issuer the privilege of retiring a bond issue prior to final maturity. Although previous discussion suggests municipalities are less interested in including a call provision than corporate issuers, it is agreed that municipal issuers should pay a premium

³⁹The hypotheses are also stated in alternative form in this chapter.

for the call privilege. The size of the premium should be an increasing function of investor's exposure to call risk. Call risk results from the probability of bondholders suffering financial injury from the future exercise of the call privilege. One feature that reduces a bondholder's exposure to call risk is the call deferment period. As the length of the call deferment period increases, the value of the call privilege to the issuer diminishes due to the bond's non-callability during the deferment period. Rational investors should recognize that the value of the call privilege declines as it is deferred further into the future and demand compensation accordingly. Therefore, the first hypothesis to be tested acknowledges the effect of the call deferment on the call privilege and examines the cost of the call privilege to municipal bond issuers.

Ceteris paribus, the call risk premium required by bond purchasers is an increasing function of the issuer's call privilege.

Interest Rate Expectations

The results of the previous chapter indicate that changes in interest rate expectations do not cause the inclusion of a call provision in municipal issues to significantly vary. This finding suggests that issuers anticipate

that any expected change in interest rates will be reflected in the cost of the call privilege. Specifically, issuers realize that the call risk premium should increase as future interest rates are expected to decline because of the increasing call risk borne by bondholders. Conversely, the call risk premium should decrease when there is little perceived opportunity for interest rates to decline. This is because the bondholder's chance of suffering financial injury from the exercise of the call privilege relatively small. To examine the actual influence of expected changes in interest rates on the cost of the call privilege, the following hypothesis will be tested.

Ceteris paribus, the cost of the issuer's call privilege increases as interest rates are expected to decline.

Interest Rate Uncertainty

In the previous chapter option pricing theory was utilized to argue that the expected value of the call option increases during periods of high uncertainty about future interest rate levels. In an efficient capital market, the increase in the expected value of the call option should result in a higher call risk premium. Subsequently, the following hypothesis is tested to examine if greater uncertainty about future interest rates causes a larger call risk premium to exist at the time of issue.

Ceteris paribus, the cost of the call privilege to municipal issuers increases as future interest rate levels become more uncertain.

Issue Marketability

It was previously shown that small, less marketable issues distributed in regional primary markets are less likely to contain a call provision than large issues marketed nationally. The reduced marketability of small issues may force issuers to pay larger premiums for privileges specified in the bond indenture, such as the call privilege. The increased marketability of large issues increases the supply of potential bond purchasers and may lower the cost of privileges maintained by municipal issuers. Therefore, larger, more marketable issues will require a lower premium for the call privilege than small, less marketable issues. This contention is tested in the following hypotheses.

Ceteris paribus, the cost of an issuer's call privilege decreases as the marketability of the bond issue increases.

Empirical Methodology

To address the above hypotheses, ordinary least squares will be used to explain the interest costs of municipal bonds. Several studies have been done on determinants of

municipal bond interest costs. Many variables have been shown to consistently influence the interest cost of new long-term municipal bond issues. As a result, a somewhat standardized model can be established from which the major hypotheses of this chapter may be tested.

The basic regression equation can be expressed in the following functional form:

$$NIC = f[\overset{+}{INT}, \overset{-}{NBIDS}, \overset{-}{LNSIZE}, \overset{+}{RATG}, \overset{+}{VOL}, \overset{+}{AVMAT}] , (5.1)$$

where

NIC = issuer net interest cost of the serial issue
in percent;

INT = prevailing market interest rate as measured by
the average yield in percent on ten year prime
grade municipals issued during the week the
issue was sold, as reported by Saloman Brothers;

NBIDS = the number of bids received on the issue;

LNSIZE = the natural logarithm of the issue size in
thousands of dollars in real 1977 terms as
deflated by the annual GNP deflator;

RATG = Moody's credit rating in dummy variable form;

Aaa = 1, all others equal 0; Aa = 1, all

others equal 0; A = 1, all others equal 0; Baa = 1, all others equal 0; nonrated bonds and bonds rated Ba and lower are the excluded set;

VOL = a measure of credit market yield volatility computed as the standard deviation of the Solomon Brother's Index for the sixteen weeks preceding the issue;

AVMAT = the average maturity of the serial issue, in years.

Numerous studies [23, 24, 29, 31, 42] have found these variables to be important determinants of the interest costs of new long-term serial municipal bond issues. The expected signs of each of the coefficients are specified above the equation. An omitted sign signifies that the expected sign of the coefficient is uncertain.

Discussion of the Variables

NIC. The net interest cost is the most widely used measure of interest cost in past municipal bond studies. This cost is composed of the bondholder's promised yield to maturity and the underwriter's spread. This measure is used as the dependent variable since the major purpose of this chapter is to examine the influence of the call privilege on the total interest cost of a municipal bond issue.

INT. The prevailing market interest rate has been shown to be a major determinant of municipal bond interest costs. Higher market interest rates will increase the required yields of municipal issues.

NBIDS. The number of bids received on a bond issue is a measure of market competition for the bond issue. Previous studies have shown that increased competition for an issue will normally reduce the interest cost of the issue. The expected sign for the coefficient of this variable is negative.

LNSIZE. The size of a bond issue has been shown to have a positive impact on municipal bond interest cost in some past studies [29, 44] and a negative impact in other prior studies [4, 49]. Tanner [44] argued that since demand for an issue is downward sloping, the increase in supply caused by large issues will result in higher interest costs. However, Benson et al. [4] contend that increased marketability should reduce the interest costs of large size issues. The fixed nature of underwriting costs also lends support to reduced total interest costs for larger issues. Given these conflicting arguments, the expected sign of this variable is uncertain; however the natural log of the size variable is used since a diminishing effect of issue size on interest costs is anticipated.

RATG. Moody's ratings have frequently been used as a measure of bond credit risk. As issuers acquire higher ratings, bond purchasers perceive less likelihood of issuer default. As such, using nonrated bonds and bonds rated Ba and lower as the excluded set, the coefficients of the rating dummies are expected to yield negative signs.

VOL. Credit market uncertainty has been shown to have a positive influence of tax-exempt bond yields. Investors and underwriters perceive high credit market uncertainty as added exposure to default and interest rate risk and demand compensation for the additional risk. A positive sign is expected for this variable.

AVMAT. Previous studies have shown that municipal bond interest costs increase with maturity. The municipal bond yield curve is argued to be continually upward sloping due to the dominant commercial bank demand for short-term securities. As a result, interest costs increase as the average maturity of a bond issue increases. Hence, the expected sign of this variable is positive.

The Data

The data set employed in Chapter IV is also used in the estimation of the cost of the call provision. Twelve issues were excluded because of incomplete information concerning

the call price premium. The mean and range of the variables used in the multiple regressions are given for the remaining 1,426 new general obligation bond issues in Table 4.

The Empirical Findings

Before testing the various hypotheses, Equation 5.1 is estimated to determine how well the control variables explain the issue borrowing cost. Table 5 shows the results of this estimation. The coefficient of each of the control variables was significant with the expected sign. The coefficient of LNSIZE was significant with a positive sign supporting the arguments of Tanner [44]. The high adjusted R^2 of .919 attests that the control variables explain the variation in net interest costs of municipal issues very well.

The Cost of the Call Privilege

To test the cost of the call privilege to municipal issuers, the call measure CALL is added to the model in Equation 5.2. It is defined as follows:

$$CALL = \frac{(YEARS TO FINAL MATURITY - CALL DEFERMENT PERIOD)}{YEARS TO FINAL MATURITY}$$

(5.2)

Since a callable bond is noncallable during the deferment period, CALL is a measure of the bonds actual callability. It measures the proportion of a bond's term to

Table 4

Descriptive Statistics for General Obligation Bonds
Used in Cost of the Call Privilege Regressions
(1977-1983)

	Mean	Range
<u>Variable</u>		
Number of Issues	1,426	
Net Interest Cost (NIC)	8.43%	2.59% to 15.0%
Interest Rate Level (INT)	6.79%	4.01% to 11.5%
Number of Bids (NBIDS)	3.252	0 to 20
Log of Issue Size (LNSIZE)	7.661	3.55 to 10.94
<u>Bond Ratings(Percent)</u>		
AAA	4.34%	
AA	7.21%	
A	21.00%	
BAA	34.73%	
Nonrated bonds and bonds rated lower than BAA	32.72%	
Interest Volatility (VOL)	0.219	0.044 to 0.714
Average Maturity (AVMAT) (years)	12.912	1 to 27
Call Privilege Measure (CALL)	0.313	0 to .958
Call Price Premium (CPP)	6.81%	2.60% to 11.11%
Interest Expectations Measure (EXP)	0.144%	1.37% to 1.39%

Table 5

Regression Estimates for New Issue
General Obligation Bonds
(NIC the Dependent Variable)

Explanatory Variable	EQ(5.1)	EQ(5.2)	EQ(5.3)	EQ(5.4)	EQ(5.5)
<u>Controls</u>					
Constant	0.838 (4.17)	1.022 (5.17)	-0.250 (-1.27)	0.021 (0.11)	-0.292 (-1.18)
INT	1.083 (87.1)	1.077 (88.3)	1.219 (86.8)	1.225 (88.3)	1.223 (88.1)
NBIDS	-0.088 (-9.29)	-0.081 (-8.67)	-0.063 (-7.35)	-0.064 (-7.58)	-0.067 (-7.81)
LNSIZE	0.072 (2.88)	0.041 (1.62)	0.033 (1.44)	0.034 (1.54)	0.081 (2.59)
AAA	-2.055 (-17.3)	-2.006 (-17.3)	-1.968 (-18.5)	-1.976 (-18.8)	-1.969 (-18.8)
AA	-2.012 (-21.1)	-1.978 (-21.2)	-1.860 (-21.7)	-1.850 (-21.8)	-1.833 (-21.6)
A	-1.629 (-23.9)	-1.593 (-23.8)	-1.525 (-24.8)	-1.541 (-25.5)	-1.529 (-25.2)
BAA	-1.000 (-19.6)	-0.962 (-19.1)	-0.907 (-19.7)	-0.921 (-20.2)	-0.914 (-20.1)
VOL	1.324 (8.35)	1.21 (7.78)	0.917 (6.39)	0.698 (2.48)	0.611 (4.94)
AVMAT	0.027 (11.3)	0.044 (5.87)	0.032 (9.97)	0.045 (10.4)	0.043 (9.87)
EXP			0.781 (12.9)	0.677 (11.2)	0.677 (11.0)
<u>Hypotheses</u>					
CALL		1.048 (8.08)	1.134 (9.42)	0.136 (0.71)	1.642 (2.24)
CALL*EXP			-0.659 (-4.49)	-0.370 (-2.45)	-0.378 (-2.50)
CALL*VOL				4.163 (6.61)	4.215 (6.69)
CALL*LNSIZE					-0.194 (-2.13)
Adjusted R ²	0.919	0.922	0.935	0.937	0.937
F Statistic	1795.9	1696.4	1711.7	1631.3	1518.9
Sample Size	1426	1426	1426	1426	1426

*T Statistics are in parentheses.

maturity that allows the issuer to utilize the call privilege. Bonds without a call provision are assigned a call deferment period equal to the years to final maturity.

CALL, therefore, provides a continuous measure of the issuer's call privilege. The coefficient of CALL is positive and significant at the 1 percent level.⁴⁰ This result indicates that the issuer's cost increases as proportionately more time is allowed for the issuer to exercise the call privilege and provides evidence that the market recognizes that the value of the call privilege increases as the deferment period decreases. The coefficient of CALL suggests that a 1 percent increase in an issuer's call privilege increases the issuer's cost by approximately one basis point.⁴¹ This resulted in approximately a 33 basis point

⁴⁰The variable CALL*CPP was also initially included in Equation 5.2 to examine the influence of the call price premium on the cost of the issuer's call privilege. The construction of this variable allowed the size of the call price premium to have a greater impact on the interest cost of a municipal bond as the bond's callability increased. Since the call price premium reduces the financial injury suffered by bondholders when the bond is called, the required call risk premium for the issuer's call privilege was expected to decline as the call price premium increased. However, the coefficient of CALL*CPP was not significant and was dropped from the equation.

⁴¹ $\delta \text{NIC} / \delta \text{CALL} = 1.048$; if $\text{CALL} = .01$ then $\delta \text{NIC} = .01048$ $\approx$ 1 basis point.

call risk premium for the average issue during the test period (1977-1983).⁴²

Interest Rate Expectations

To test whether the cost of the call privilege is influenced by expectations of the magnitude and direction of future interest rate movements, the variable CALL*EXP is added to the model in Equation 5.3.⁴³ EXP is also entered in the equation to account for any independent effect of the expectations measure on the interest cost of municipal issues.⁴⁴ The negative sign and significance of the coefficient of CALL*EXP suggests that EXP is a viable measure of interest rate expectations. This finding indicates that the cost of the call privilege varies inversely with expected interest rate movements. For example, a one percentage point decline in EXP will result in approximately a 21 basis point increase in the call risk premium for the average issue in the sample.⁴⁵ The results of this test suggests that

⁴²Mean call measure = .313; $[1.048]*CALL = [1.048]*[.313] = .328 \approx 33$ basis points.

⁴³EXP is the same measure presented in Chapter IV.

⁴⁴Entering EXP and CALL*EXP in the equation allows both the intercept and slope to vary with changes in the interest rate expectations measure.

⁴⁵ $\delta EXP = -1\%$; $\delta \text{Call Risk Premium} = -.659*[CALL*(-1)] = -.659*[(.313)*(-1)] = .206 \approx 21$ basis points.

the market equitably prices the call privilege based on expected interest rate movements and gives credence to municipal issuers' decision not to vary the inclusion of a call provision with changes in interest rate expectations.⁴⁶

Interest Rate Uncertainty

The variable $CALL*VOL$ is entered in Equation 5.4 to test for the influence of uncertainty about interest rate movements on the cost of the call privilege. VOL is a measure of past interest rate volatility and is used as a proxy for uncertainty about future interest rates. The estimated coefficient of $CALL*VOL$ is significant and has the expected positive sign. This result indicates that the cost of the call privilege to municipal issuers does increase as the market becomes more uncertain about future interest rate levels. For the average issue during the test period, this

⁴⁶An alternative variable, $CALL*INT$, was also used to test the expectations hypothesis. When interest rates are relatively high, investors perceive that interest rates will probably decline in the future. As a result, investors will require compensation for the additional call risk exposure. When interest rates are relatively low, investors may foresee little chance of further decline; therefore, the cost of the issuer's call privilege should decline. The estimated coefficient of $CALL*INT$ was positive and significant at the 1 percent level and supports the hypothesis that investors require higher call risk premiums when interest rates are high and expected to fall.

uncertainty added between 5.7 to 93 basis points to the cost of the call privilege.⁴⁷

Issue Marketability

As discussed earlier, small, less marketable municipal bond issues tend to be purchased by regional underwriters and reoffered locally or purchased directly by regional investors. As issues become larger in size, their marketability increases and enhances the probability of distribution in the national primary market. To test the influence of an issue's marketability on the cost of the call privilege for municipal issuers, the variable CALL*LNSIZE is included in Equation 5.5. The significantly negative sign of CALL*LNSIZE indicates that the cost of the call privilege declines with the marketability of an issue. For example, the cost of the call privilege for a \$5 million issue would be approximately 10 basis points less than for a \$1 million issue, ceteris paribus.⁴⁸ This suggests that issues

⁴⁷ Minimum value of VOL = .044; maximum value = .714;
 $4.163 * [CALL * VOL] = 4.163 * [(0.313) * (.044)] = .0573 \approx 5.7$
 basis points; $4.163 * [(0.313) * (.714)] = .9303 \approx 93$ basis
 points.

⁴⁸ Call Risk Premium = $\{-0.194 * [CALL * LN(5M)]\} -$
 $\{-0.194 * [CALL * LN(1M)]\} = [-0.194 * (0.313 * 8.517)] -$
 $[-0.194 * (0.313 * 6.908)] = -0.097 \approx 10$ basis points. This
 computation uses the mean call privilege measure for both
 issues.

marketed on a national basis to more potential investors incur a lower cost for the call privilege.

To support the above findings, the sample was stratified into three issue size categories and Equation 5.2 was estimated for each category. Table 6 presents the regression estimates of CALL. The results confirm that the cost of the call privilege decreases as the marketability of an issue increases, *ceteris paribus*. This provides evidence that the cost of the call privilege to municipal issuers does vary with the breath of the market in which the issues are sold.

Table 6
NIC Regression Estimates Over Issue Size Categories

Issue Size	Call Coefficient	T Ratio	Cost of Call Privilege *
Size<=\$2.5M	1.211	6.023	37.9 basis points
\$2.5M<Size<=\$5M	0.695	2.456	21.8 basis points
Size>\$5M	0.515	2.974	16.2 basis points

*The cost of the call privilege is computed using the average call measure for the entire sample.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Previous empirical studies have not attempted to determine a subset of characteristics that correlate highly with the inclusion of a call provision in bond issues. In addition, few past studies have investigated how the cost of the call privilege varies over time and over issues. Virtually all corporate bond issues contain a call provision, however, numerous general obligation municipal bonds do not. The availability of callable as well as noncallable municipal bond issues affords the opportunity to investigate determinants and cost of the call provision. This dissertation has utilized new issue general obligation bonds sold in Texas during 1977 through 1983 to examine determinants of the decision to include a call provision in municipal securities and the cost of that decision.

The Call Privilege

A call provision gives an issuer the privilege of retiring outstanding bonds prior to final maturity. The call privilege has potential value for an issuer because (1) it gives the issuer the flexibility to restructure its debt position or retire debt with burdensome restrictive covenants in the bond indenture, and (2) it allows the

issuer to refund the debt instrument and enjoy an interest savings if interest rates decline appreciably.

While the call privilege has potential value for an issuer, it may cause financial injury to investors. If interest rates fall and the bond is called, an investor will be forced to reinvest in an instrument paying a lower risk-adjusted yield. Because of the risk that a callable bond will be retired prior to maturity and cause investors financial injury, the call privilege should not be free for issuers. In fact, the yield equilibrating process in efficient markets should result in the proper pricing of the call privilege and leave the marginal investor indifferent between callable and otherwise noncallable bonds.

When interest rates are high and expected to fall, the call privilege will be of more value to issuers; however, efficient market advocates argue that the increased value of the call privilege to the issuer will require equitable compensation to investors for the increased risk that future refunding will occur. Thus, the marginal issuer should not base his decision to issue callable or noncallable bonds on expected changes in interest rate levels.

The above arguments apply to the call privilege in either the corporate, municipal, or U.S. government bond markets. Several arguments, specific to municipal bonds, support the contention that an expected decline in interest

rate levels should not alter the issuer's decision to attach a call provision. West [50], for example, argues that the use of the municipality's higher lending rate as the discount factor for any projected interest payment savings would probably cause the present value of any savings to be less than the call risk premium. Thus, expectations of lower interest rates should not cause municipal issuers to vary the decision to include a call provision in bond issues.

Given the previous discussion, numerous questions concerning the inclusion and cost of the call provision surface. Does the probability of expected economic savings based on expected future interest rate movements alter the issuer's decision to attach a call provision, or do other factors determine why a bond issue contains a call provision? Does the call privilege cost the issuer, and if so, is this cost influenced by factors such as expected changes in interest rates? These questions have been examined in this dissertation. Specifically, concerning the inclusion of a call provision, this research has utilized a binary logit model to examine (1) whether the inclusion of a call provision in municipal bonds varies with changes in expectations of future interest rate levels, (2) whether increasing uncertainty about market conditions prompts issuers to attach a call provision to new issues, (3) if the

marketability of a bond issue influences the decision to include a call provision, (4) if a call provision is included more frequently in issues with longer average maturities, and (5) whether issuers with larger debt burdens are more likely to include a call provision in new issues. In investigating the cost of the call privilege to municipal issuers, this study has used ordinary least squares regression to examine (1) whether the call privilege is a cost to municipal issuers, (2) how the market's perceptions of the direction and magnitude of interest rate movements affects the cost of the call privilege, (3) whether the cost of the call privilege increases as future interest rate levels become more uncertain, and (4) if the marketability of a bond issue affects the cost of the call privilege.

Summary of the Findings and Conclusions

The evidence generated from the estimates regarding the inclusion of a call provision in municipal bonds indicate:

1. That municipal bond issuers do not significantly alter the decision to include a call provision in new issues based on expected changes in interest rate levels. This suggests that issuers expect that the market has assessed the potential for future profitable refunding and that the assessment will be reflected in the size of the call risk premium.

2. That increasing uncertainty about market conditions enhances the chances that an issue will be callable. This implies that the flexibility provided by the call provision becomes more desirable as uncertainty about market conditions increases.

3. That issues are more likely to contain a call provision as they become larger and more marketable. It appears the lower marketability of small issues may necessitate that issuers relinquish certain privileges that would ordinarily be included with larger, more marketable issues. This result could also indicate that local purchasers who normally acquire small, less marketable issues utilize a more personal relationship to pressure issuers to omit a call provision.

4. That issuers are more likely to include a call provision in issues with longer average maturities. This suggests that the flexibility and potential for interest savings provided by the call privilege is more desirable to issuers as an issue's average term to maturity increases.

5. That the relative indebtedness of an issuer is also a good predictor of the inclusion of a call provision.

The results of the test concerning the cost of the call privilege to municipal bond issuers have the following implications:

1. The call privilege is costly to issuers of municipal bonds. The results show that the call risk premium for the average issue during the test period was approximately 33 basis points.

2. The cost of the call privilege to issuing municipalities varies inversely with expected interest rate movements. This result suggests that the pricing of the call privilege reflects expected interest rate movements and supports municipal issuers' decision not to alter the inclusion of a call provision based on expected changes in interest rates.

3. Uncertainty about future interest rates increases the cost of the call privilege for municipal issuers. Using past interest rate volatility as a proxy for future interest rate uncertainty, the results show that such uncertainty adds between 5.7 and 93 basis points to the cost of the call privilege for the average issue during the test period.

4. Large, more marketable issues incur a smaller call risk premium for municipal bond issuers than small, less marketable issues.

In summary, the evidence presented by this dissertation indicates that municipal issuers must pay a premium for the call privilege at the time of issue and that this premium varies inversely with expected interest rate movements. The adjustment in the cost of the call privilege may explain why

the test results show that municipal issuers do not vary the decision to include a call provision with expected changes in interest rate levels. The findings show that other factors such as market uncertainty, the average maturity of the issue, and the relative indebtedness of the issuer influence the decision to include a call provision in a bond issue. Test results also indicate that issuers must pay more for the call privilege when there is considerable uncertainty about interest rate movements. In addition, the evidence also shows that call provisions are more likely to be included in large, more marketable issues and that the cost of the call privilege decreases as issues are marketed to a larger number of potential investors.

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VITA

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