U.S. Bond Markets and Credit Spreads during the Great Depression*

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Abstract

We investigate spreads of U.S. corporate bonds over Treasuries during the period 1927-1940. By examining the cross-section of bond performance, we obtain a richer picture of how the bond market behaved than can be obtained by examining existing data series. Not only were spreads wider for a given rating, but also the distribution of ratings in the market was worse during the Depression and subsequently. We decompose spreads into liquidity and credit components, and measure contagion effects, before, during, and after the Depression.

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1 Introduction

The Great Depression was an unprecedented period of economic and financial collapse worldwide. It struck the U.S. particularly severely with industrial output falling 40% by Fall 1931 and GDP still 25% below trend six years after the recovery began (see Cole and Ohanian (2001) and Ohanian(2009)). There were several waves of banking crises in the early 1930s and deflation increased the real value of debts contracted in nominal terms (see Bernanke (1983)).

The literature on the financial aspects of the Great Depression has examined several avenues by which the real and financial sides of the U.S. economy interacted.[1] An understudied aspect of the financial side of the Great Depression in the U.S. is how the bond market operated. Although bank intermediation was the primary means by which consumers and small businesses obtained credit, large firms had the possibility of issuing bonds on the New York Stock Exchange (NYSE). Corporate bonds were not a sideline business for the NYSE on the eve of the Great Depression in 1929 but rather an integral part of the market. Hickman (1958) states that U.S. corporations had a par value of bonds outstanding of $30.0 billion in 1930. In contrast, the market capitalization of NYSE equities was roughly $60 billion in December 1928 and had fallen to about $20 billion in December 1932 (see Graham et al. (2011)). As with other forms of financing, bond markets froze during the worst years of the Depression. From a peak of $1.29 billion of new bond issues by industrial firms in 1927 the market shrunk so much that during all of 1933 only $100,000 of industrial bonds were issued throughout the U.S. The experience for railroads and utilities was not so different, these industries were able to issue just 2.0% and 3.7% by value of the amount issued in 1927 in the worst year (1933). Clearly, financing problems were not restricted to those borrowers dependent on bank intermediation.

There was an explosion of corporate debt default during the Great Depression. Giesecke et al. (2011) place the 1933-1935 period as the fourth worst default experience for the U.S. during the past 150 years with 12.88% by par value of corporate bonds defaulting during the period. The three more severe corporate defaults they find are all situated in the nineteenth century and concentrated in a single sector: railroads. In

[1] The banking system has been extensively studied (see e.g., Bernanke (1983), Calomiris and Mason (1997, 2003), Carlson (2010), Mitchener and Mason (2010), and Wicker (1996)) as has the functioning of the gold standard (see e.g., Bernanke and James (1991), Eichengreen (1995, 2008), and Hamilton (1988)), the effects of monetary deflation (see Benhabib and Spiegel (2009), Bernanke and James (1991), and Cecchetti (1992)), and monetary policy (see e.g., Friedman and Schwarz (1963), Hamilton (1988), Meltzer (1976), and Temin (1976)). Mishkin (1978) has in turn investigated how changes in households' balance sheets transmitted the effects of the Depression.

contrast the Depression witnessed a more pervasive effect on corporate debt with defaults across industrials, public utilities, and railroads. The experience of railroads may not be indicative of the experience of a diversified bond market. For example, Hickman (1958) has calculated that U.S. railroad bond defaults (28.1%) over the 1900-1943 period were almost three times as large as utility defaults (10.6%) and roughly double the rate of industrials (14.8%). The performance of the corporate bond market during the Great Depression has been studied by Durand (1942), Durand and Winn (1947), Hickman (1953, 1958, 1960), and Johnson (1967) using the NBER's *Corporate Bond Project* data. One major problem with these older studies is that there was no way to properly value callable bonds prior to the development of option pricing models by Black and Scholes (1973) and Merton (1973). As a result Durand and Winn's (1947) yield curves from 1900 to 1933 were constructed by excluding (p. 4): "bonds actually selling above call price."[2] In later years there are virtually no non-callable bonds or callable bonds selling below their call price so he includes callables and concludes that his yield curves have a 'bias'. A further complication in all of these studies is that corporate bonds were taxable whereas Treasuries were (usually) tax-exempt and no proper tax treatment was attempted. Johnson constructs yield curves by credit rating annually over the Great Depression. He finds a large widening in spreads, which peak at roughly 8% between Aaa and Baa in 1932. Researchers from Bernanke (1983) onwards have used similar figures, with an Aaa to Baa spread of 7.93% in June 1932, which he takes from the Federal Reserve's *Banking and Monetary History*, which uses data ultimately from *Moody's*. These spreads, as far as we can tell, ignore the callable feature of many bonds, any liquidity effects, as well as the adjustment necessary for corporate bonds being subject to income and capital gains taxes. Callability is more valuable the more volatile are short term interest rates, and not surprisingly volatility increased dramatically during the Great Depression. Correcting for tax and the callable features of bonds reduces the spread to around 2%, which suggests that lower quality bonds were not hit as severely by the crisis as has been previously thought.

As well as providing insight into the functioning of the U.S. corporate debt market during the Great Depression our paper also sheds light on the two most important components of a bond's yield, default (or credit) risk and liquidity risk. There is an ongoing debate on the importance of these two parts which has

[2]It is not clear if Durand excluded bonds whose market prices were above their call prices only during their call periods, or whether he excluded bonds whose market prices exceeded their call price before their call period had begun.

been difficult to settle, partly due to the (current) market structure. Mahanti et al (2008) explain that (p. 275-76): "Until recently, no central data source existed for all the transactions occurring in the (corporate bond) market ... even after the establishment of the TRACE database, [there is an] absence of transactions data for all but the most liquid bonds." There is a divide between authors such as Longstaff et al (2005) and Jarrow et al (2010) who believe that credit risk is a major part of bonds' yield spreads and others such as Jones et al (1984), Elton et al (2001), Driessen (2005), Lin et al (2011), Bao et al (2011), and Huang and Huang (2012) who calculate credit risk to be of less importance than other factors, principally liquidity. The impact of a financial crisis (the subprime crisis) on bond prices is a relatively recent field of study. Dick-Neilsen et al (2012) and Friedwald et al (2012) show that prices, especially of speculative-grade bonds were strongly affected by the drying up of liquidity in the U.S. corporate bond market. Our research environment differs from that of previous authors in that they study an over-the-counter (OTC) market whereas we examine corporate bonds when they were traded on the NYSE. Giesecke et al. (2011) find that changes in credit spreads have little or no predictive power for corporate bond defaults over a period spanning a century and a half. For part of their data they use an average of Moody's Aaa and Baa rated bonds' yields. However, as we show below, sample selection and/or the failure to adequately value the callable part of these bonds means that these yield data are highly suspect.

Our study of corporate debt at the security level during the Great Depression complements the firm based approach of Graham et al. (2011). They find that more highly levered firms and firms with lower rated debt were more likely to experience financial distress, which agrees closely with the conclusions of Hickman (1958) who finds higher default rates for lower rated bonds (see his Table 33) during the Great Depression. Both Graham et al. (2011) and Bernanke (1983) state that not enough has been done to study debtor insolvency at the firm level.

2 Data

We compile data on every U.S. corporate bond for which we observe at least 25 monthly price observations between January 1927 and December 1940. We obtain price and turnover data from *The New York Times* on the last day of every month, so that our data is contemporaneous with CRSP. These data appear in the *Domestic Bonds* section of *Bond Sales on the New York Stock Exchange*. We collect bond-specific data and ratings from *Moody's Manuals* of industrials, public utilities, railroads, and banks and finance. We classify a bond as being in default if the issuer failed to meet a coupon or principal repayment, or in any way changed the terms of the issue (via negotiations with bondholders) such as extending the maturity of the bond, reducing the coupon rate, or exchanging the initial bond for another security.

We match bonds' issuers with the relevant CRSP firm and we more precisely define the industry of a firm with a 2 digit SIC classification. Since many bond issuers had been taken over by other firms by the time of our sample, or were controlled by parent companies, we track the corporation which had ultimate responsibility for making bond payments.

We have a total of 905 bonds in our dataset of which 221 are plain-vanilla bonds, 589 are callable (but not convertible), 5 are convertible (but not callable), and 90 are both callable and convertible. We cross-tabulate the bonds by industry and type in Table I. Our sample comprises 423 railroad bonds, 199 utility bonds, 267 industrial bonds, and 16 bank and finance bonds (which come mostly from real estate companies). With the exception of railroad bonds, many of which were issued in the 19th century, almost all bonds are callable. We are therefore faced with a tradeoff in estimating bond yields, we either include callable bonds (with the commensurate complications that involves) or we restrict our attention to a single slow-growing sector, railroads.

Since our sample selection precludes bonds with fewer than 25 price observations, to gain an understanding of the overall NYSE bond market we collect data on the value of new bond issues, bond redemptions (which includes bonds called before maturity, but does not include maturing bonds), and all bonds listed on the NYSE from *The New York Times'* annual financial issue.[3]

We then present summary statistics of the bonds issued by year of issue in Table II. In Panel A we see that there were many new issues of bonds in the late 1920s followed by a collapse during the Great Depression and a recovery by 1935. After the Wall Street crash of 1929 the bond market began to dry up for lower rated bonds, with average rating at issue rising from 3.56 (halfway between A and Baa) in 1929 to 1.75 in 1932 (better than Aa). The coupon rates at issue remained roughly constant until the mid 1930s when treasury

[3]The annual financial issue usually appeared on January 1, 2, or 3.

rates fell to 1-2%, and coupons dropped to roughly 4%. There was much year to year volatility in the issue size and maturity of a bond but the long-term average was $25-30 million and 25-30 years respectively. Virtually all new bonds issued in our sample were callable. We have more than 550 bonds with which to estimate yields (see Panel B) with fewer bonds at the beginning and end of our sample, mostly due to our sample design which required more than 25 price observations for a bond to be included. Unsurprisingly, there was a marked deterioration in bond quality over the period, with the average rating dropping from 2.61 in 1927 to 5.20 (worse than Ba) by 1940. The average coupon, size, and maturity are little different between newly issued and all outstanding bonds, with the exception that all outstanding bonds were generally of a longer maturity and less likely to be callable. This is principally due to long maturity railroad bonds, many of which had been issued in the late nineteenth of early twentieth century.

Due to the difficulties in pricing bonds which are both convertible and callable we delete the the callable and convertible bonds as well as the five convertible bonds which leaves us with 810. We then delete bonds which have 'exotic' call provisions leaving 758.[4] In Table III we present summary statistics of the remaining bonds, split into plain vanilla (Panel A), and callable (Panel B). Since the vast majority of plain vanilla bonds were railroad bonds (see Table I) the differences between vanilla and callable bonds are partly due to the different industries for the firms which issued these bonds. The bonds in our sample were issued between 1868 and 1938, with a time to maturity (at issue) ranging from three to 475 years. Plain vanilla bonds were usually larger when first issued (a mean size of $48.2 million) than callable bonds (with a mean of $27.8 million). The plain vanillas tended to have higher ratings at issue (1.40 vs. 2.91) and throughout the sample (3.27 vs. 3.84) than callable bonds. However, plain vanilla bonds were more likely to be in default throughout our sample, 40.1% of all bond-months, than callable bonds, 27.9%. Very few vanilla bonds used sinking funds (11.8%) compared to callable bonds (44.2%). The vast majority of vanilla bonds (93.5%) were backed by specific collateral whereas it was less common for callable bonds to have collateral (81.0%). Of the callable bonds roughly 1/4 were American-style (callable at any time during the call period) and the remainder were semi-American (callable only on coupon dates). 82.7% of the callable bonds were within

[4]We keep bonds which are callable on any date (usually after an initial non-call period), that is 'American' style, as well as bonds which are callable only on coupon dates, that is 'semi-Americans'. We exclude 'exotic' bonds which are e.g., callable on the first business day of the month, callable on the 1st of January, whose call notice periods vary over time etc.

their call periods in our sample, and the average bond had spent 8.1 years in its call period.

Once a bond has defaulted we drop the bond from the sample in terms of estimating yields and spreads. We also excluded bonds which had more than 50 years to run until maturity, since these maturities vastly exceeded the longest maturity treasury bonds. We obtain data on Treasury notes, certificates, bills and bonds from CRSP. We thank Steve Cecchetti for his data on bonds' 'exchange privileges' (see Cecchetti (1988)).

3 Method

3.1 Curve Fitting

We seek to construct yield curves for data sorted either by issuing firm, or by credit class. In both cases, we price bonds using a discount curve composed of two parts. The first part is generated using Treasury data, and is an appropriate discount curve for valuing a default-free security. We denote this $d_t^0(\tau)$. The second part is a spread curve (denoted $d_t^i(\tau)$ for the ith curve) which is multiplied by the treasury curve to generate a discount curve for a particular subset of bonds. A non-callable bond of category i can then be valued as

$$P_t^j = \sum_{k=1}^{K} CF_{t_k}^j d_t^0(t_k) d_t^i(t_k),$$

where P_t^j is the time t price of bond j and $CF_{t_k}^j$ is the k-th cash flow of the bond, occurring at time t_k. The K-th cash flow is at maturity and consists partly of coupon payment and partly of principal. We construct the curves $d_t^0(\tau)$ and $d_t^i(\tau)$ using cubic splines, with knot points set at 5, 10, 20 and 50 years (see McCulloch (1975)). Cubic splines are fit so as to minimise the squared errors of bond prices, scaled by bond durations (as in Vasicek and Fong (1982)). This avoids problems where longer maturity bonds are fit well by the curve, at the expense of shorter maturity bonds. Knot points are removed when no bonds mature on a particular segment of the curve.

For collections of bonds which include callable bonds, we must also fit volatility and mean-reversion parameters for the interest rate process (see section 3.2). Further, for corporate bonds, we must concern ourselves with the effect of taxes on the bond prices (see section 3.4. Virtually all treasury issues were either tax-exempt or held by tax-exempt institutions during this period). In both cases, additional parameters must be estimated jointly with the yield curve in question. We follow a process of eliminating knot points from our curves to ensure that we have sufficient degrees of freedom to estimate not only the curves themselves, but these additional parameters. To mitigate this simplification of the term structure, we use three month rolling windows for our estimation, whereby individual curves are fit to each month, but similar tax and dynamics parameters are used across all three months. We remove knots from the first month's curve to ensure identification of parameters, allowing us to retain a complex curve on the third month. Our results report these "third month" curves except for in January and February 1927, when we have no preceding data.

3.2 Callable Bond Pricing

Given that over 70% of our data is callable, we do not wish to discard callable bonds in estimating yield curves. Further, the inclusion of callable bonds provides us with insight as to the expectations of market participants for interest rate volatility over the life of these bonds.

We price callable bonds using the lattice method outlined in Daglish (2010). The lattice is formed so as to consistently price zero coupon bonds according to the discount curve outlined in section 3.1. We assume that short rates evolve according to the Black and Karasinski (1991) model:

$$d \log r = (\theta(t) - \lambda \log r)dt + \sigma dz,$$

where $\theta(t)$ is a function which is calibrated to generate discount rates consistent with the yield curve, λ and σ are constants, dt is an increment of time and dz is an increment of a Brownian motion. Implementing the model requires the further input of σ and λ, which are calibrated, along with the yield curve, to minimise duration weighted pricing errors.[5]

A further issue regarding the pricing of callable bonds is the notice requirement. Corporate and treasury bonds routinely required notice to be given to bondholders before the bond was called. Occasionally the

[5]When calculating duration for callable bonds, we calculate the derivative with respect to a small increase in the option adjusted spread (OAS), which effectively increases the rate at which bonds are discounted throughout the lattice.

notice periods could not be found, therefore we assume a period of one month (this is the minimum notice period we find in our data. All called bonds gave at least one month notice even where none was specifically stated in the Moody's manuals). After 1934 the SEC required formal notification of a bond call, which added roughly one month's advance warning to bondholders. After 1934 we extend notice periods for corporate bonds by a further month. To account for this mismatch between the decision date of call and the actual date of call, we use the technique outlined in d'Halluin et al. (2001). We effectively keep track of a forward price for the underlying bond, and compare this to a discounted strike price to calculate the payoff from calling.

3.3 Exchange privileges

Treasury issues during the period we study were generally tax exempt securities. Those that were not tax exempt were generally held by corporations which were themselves tax exempt (see Cecchetti (1988)). Treasury bonds frequently had exchange privileges associated with their maturity. As discussed in Cecchetti (1988), new Treasury issues were made available to subscribers at par value, with coupons chosen to generate a market price slightly in excess of par. Subscribers filled a role similar to initial public offering(IPO) subscribers, making a profit on average. Since this was a profitable activity, issues were frequently oversubscribed, and priority was frequently given to holders of maturing Treasury bond issues, who surrendered their principal repayment in exchange for newly issued bonds. Due to this priority, treasury bonds frequently traded at prices in excess of their terminal payment as maturity approached. Ignoring this effect can result in the calculation of negative interest rates for short maturity bonds, and an understatement of longer maturity interest rates.

Following Cecchetti (1988), we calculate implied exchange privileges from bonds with short times to maturity. These reflect 'realised' exchange privileges, since they are privileges inferred from prices pending maturity. Investors prior to maturity may have been unable to anticipate these privilege values exactly (they varied from new issue to new issue and exchange privileges disappeared as a phenomenon in the 1940s). Hence, when pricing Treasury bonds, we calibrate an additional exchange privilege value for each bond (taken to be constant across the three month window), chosen along with interest rate dynamics parameters and the yield curve to minimise the squared pricing errors. We constrain these exchange privilege values to be positive and less than or equal to the maximum realised exchange privilege (\$1.66 per \$100 of principal).

3.4 Taxes and Tax Shields

In contrast to treasury notes, corporate bonds *were* subject to taxation for investors during the period 1927-1940. This taxation took two forms. First, coupon payments were subject to income tax. Second, if a bond was purchased below par(call price), capital gains tax would be applied at maturity(call date). Conversely, if a bond was purchased above par, a capital loss could be written off at maturity. After 1942, capital losses could be amortised over the life of the bond, but throughout our sample period, capital gains and losses were realised at maturity, call, or sale of the bond.

As noted by McCulloch (1975), the presence of a capital gains tax results in an endogeneity with respect to price: cash flows at maturity or call depend on the tax, which in turn depend on the price paid today. Formally, a investor would value a non-callable bond as:

$$P_t^j = \sum_{k=1}^{K-1} CF_{t_k}^j (1-tax_{income}) d_t^0(t_k) d_t^i(t_k) + \left[(CF_{t_K} - 100)(1 - tax_{income}) + 100 - (100 - P_t^j) tax_{capital}\right] d_t^0(t_K).$$

We solve this equation for P_t^j in order to extract tax-consistent valuations of non-callable bonds. For callable bonds, the capital gain is more complicated, since it could either occur at maturity, or, in the event of the bond being called early, at the date of call. In valuing callable bonds, we follow a similar process, but where the weight on P_t^j is calculated as the value of \$1 paid at termination of the bond. This valuation is performed using the same lattice as is used to price the bond.

The last consideration for callable bonds is the issue of tax shields. A corporation may face a different tax rate to its bondholders, and therefore there may be a missmatch between call policies which maximise firm value and those which minimise bond value (see Mauer and Lewellen (1987)). We model the firm's decision to call its debt in order to minimise the value of their liability (i.e. maximising the value of the equity component of the firm). We assume that on call, the firm issues an identical non-callable bond. Effectively we assume that the firm refinances so as to keep the structure of their debt identical to pre-call, presumably resulting in a one-off cash flow since the new issue will be cheaper than the call price paid to retire the old.

The firm's valuation of this noncallable bond is based on the *after tax* coupons (i.e. coupons are deflated by the firm's corporate tax rate). This bond will presumably be issued at a price which differs from par. As a result, the corporation will pay corporate tax (at maturity) if the bond is issued above par (the company will have dischaged a debt for \$100 which exceeded \$100 on its books, and therefore made a profit) or will receive a tax credit at maturity if the bond's value is below par (the company will have paid \$100 to discharge a debt with book value less than \$100). When deciding whether to call the original, callable, bond, the firm compares its valuation of the new debt to the amount it must pay the existing debtholders to call the bond issue. We assume that all bonds in our data were originally issued at par (a common practice). Therefore the tax due at the time of calling is the corporation's tax rate multiplied by \$100 minus the call price of the bond.

It is impossible to measure the marginal tax rates on capital gains (for investors), marginal income tax rates, and corporate tax rates of firms. In particular, investors who have profitable investments (or corporations who make a profit in a year) may be able to immediately use a capital loss to offset income earned elsewhere, whereas other investors/firms may have to wait to use the credit. We might also expect, given the tax-exempt nature of Treasuries, that corporate bonds may have appealed to lower marginal tax rate investors. We estimate corporate, income and (investor) capital gains rates along with yield curves and interest rate dynamic parameters, so as to minimise duration weighted pricing errors for our bonds. We estimate separate tax rate parameters for each credit rating of bond, since different ratings may attract different investor clienteles.

3.5 The Liquidity Component of Yields

3.6 Option Adjusted Spreads

Having now derived a model for bond prices which incorporates the value of callable components and tax effects, we can compute a meaningful measure of the extent to which an individual corporate bond's value differs from a comparable treasury. We do this by calculating an Option Adjusted Spread (OAS) for the bond. To find the OAS, we begin by pricing the bond using a lattice calibrated to *Treasury discount factors*, using volatility parameters and tax rates for the bond's particular credit class. We then perturb all interest rates in the lattice used to price the particular bond. We vary this spread until the lattice correctly prices the bond. Effectively, we calculate the size of the parallel shift which must be applied to the treasury curve in order for it to be used to price this bond. Positive numbers indicate that the bond is less valuable than a comparable treasury, while negative numbers indicate a greater value.[6]

4 Results

In Table IV, Panel A we show the distribution of bonds in our sample across time and across credit classes. Consistent with the results of Hickman (1958) there is a marked deterioration in the credit quality of bonds, as assessed by Moody's. In 1927 there were 135 Aaa ranked bonds in our sample, by 1940 there are only 16 of this rating. At the other end of the spectrum, in 1927 there were just 3 B ranked bonds, but by 1940 31 bonds were rated in this category. In Panel B we present annual data on the OAS of the bonds in our sample. These figures have not been adjusted for liquidity effects, therefore the negative spreads for Aaa bonds may reflect the more desirable feature of them, increased liquidity through trading on the NYSE. In contrast Treasuries were traded via the more opaque dealer market. We see a flare up in spreads on all credit ratings between 1931-1933. The average spread over 1931-33 jumped by 47 basis points for the Aaa class over the average level in 1927-29. In contrast the spread for Baa bonds jumped by 91 basis points, and B bonds by 291 basis points over the same time horizon.

In Graph 1 we present the information contained in Table IV at monthly frequency. We see that B and Ba rated bonds' spreads widened well before the others, and although there were relatively few bonds in these lower ranked classes at the start of the sample, the spreads started to widen well before the stock market crash of October 1929. In contrast there is little increase in the more highly rated bonds' spreads over the sample, although it must be remembered that Moody's was quickly removing bonds from the Aaa and Aa categories as the Depression progressed. Finally, the spreads on the lower rated bonds increased

[6]This method differs slightly from a conventional OAS calculation in-so-far as we use interest dynamics for corporate bonds rather than for Treasuries. We do this for two reasons. First, we believe that many lower rated corporate bonds may have had more volatile interest rate processes than Treasuries, resulting in relatively larger call option values (although this is mitigated by the fact that these options are further out of the money). Second, between March 1934 and October 1938, no callable Treasuries were traded, therefore we are unable to estimate interest rate dynamics for the Treasury market.

towards the end of our sample as World War Two began in Europe.

Our estimation of yield curves is complicated by the issue that financial distress and eventual default may not occur evenly through a bond's life, but rather there is a concentration of risk at maturity. As Johnson (1967) puts it: "most of them [the firms] refinance in the bond markets - the success of which depends upon the earning power and financial position of the [firm]." Harold (1938) viewed short-maturity bonds as being generally safer than their longer lived cousins although: "short maturities become an element of weakness in crisis periods." Such a phenomenon has become known as 'crisis-at-maturity.' The difficulty of refinancing may differ between credit classes, with higher rated bonds easy to roll-over in times of trouble, but lower rated bonds difficult or impossible to refinance. Johnson finds evidence of such an effect during the Depression with an upward sloping yield curve for high quality bonds from 1933 onwards combined with a downward sloping curve for lower quality bonds. Bondholders anticipated, correctly, major problems for lower rated firms which wished to refinance debt during the Depression. He is however, unable to quantitatively distinguish between rising yields that are due to credit risk and those that are due to liquidity issues.

The majority of bonds in our sample are callable, and our method generates estimates of the implied volatilities (that value the option component of those bonds) of instantaneous interest rates that market participants expected. In Table V we present these implied volatilities by year and credit class. There are two implied volatilities, the short-term, which indicates the expected volatility over very short horizons, and the long-term, which indicates the expected volatility over infinite horizons. We also present the implied volatilities that can be constructed from those Treasury bonds which are callable. The short-term volatilities are remarkably constant across time and across credit class for the corporate bonds, at a little under 10%. In contrast, due to relatively few callable Treasury issues, the implied volatility for instantaneous government interest rates fluctuate a lot from year to year, peaking as World War Two approaches, but also spiking during 1930 and 1932. Long-term volatilities are also fairly constant across the corporates and through time, at around 6%. Again, our estimates of Treasury long-term volatilities are much more variable.

5 Conclusion

We examine the performance of the corporate and Treasury bond markets in the U.S. during the Great Depression. We find strong evidence that market spreads widened during this period, although not by as much as previous authors have found. Correcting valuations for the option component of callable debt, which was the majority of outstanding corporate liabilities in this period, is of critical importance.

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