Auditor Choice and the Cost of Debt Capital for Newly Public Firms

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Abstract: We examine the impact of auditor choice on debt pricing in firms’ early public years when they particularly rely on obtaining external financing despite experiencing serious information problems. Our cross-sectional evidence suggests that retaining a Big Six auditor, which can reduce debt-related monitoring costs by enhancing the credibility of financial statements, enables young firms to lower their borrowing costs. Extant research implies that information asymmetry between borrowers and lenders is decreasing in firm age since young firms have only fledgling reputations in the capital markets. We provide evidence consistent with our prediction that choosing a Big Six auditor decreasingly affects firms’ interest rates over time. We also report evidence supporting our prediction that this time-series variation is primarily isolated in firms with short private histories, which have even worse information problems in their early public years. Overall, our research suggests that the economic value of auditor reputation declines with age as borrowers gradually shift toward depending on their own reputations to moderate costly information asymmetry.

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Key words: audit quality; firm-lender relationships; asymmetric information; contracts and reputation

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Abstract

We examine the impact of auditor choice on debt pricing in firms’ early public years when they particularly rely on obtaining external financing despite experiencing serious information problems. Our cross-sectional evidence suggests that retaining a Big Six auditor, which can reduce debt-related monitoring costs by enhancing the credibility of financial statements, enables young firms to lower their borrowing costs. Extant research implies that information asymmetry between borrowers and lenders is decreasing in firm age since young firms have only fledgling reputations in the capital markets. We provide evidence consistent with our prediction that choosing a Big Six auditor decreasingly affects firms’ interest rates over time. We also report evidence supporting our prediction that this time-series variation is primarily isolated in firms with short private histories, which have even worse information problems in their early public years. Overall, our research suggests that the economic value of auditor reputation declines with age as borrowers gradually shift toward depending on their own reputations to moderate costly information asymmetry.
1. Introduction

Helwege and Liang (1996) and Rajan and Zingales (1998) report descriptive statistics that suggest that there is a life cycle in the pattern of corporate financing, with firms more dependent on external financing in their early years. However, market frictions such as asymmetric information that can inhibit the granting of credit to deserving firms may be more severe for young firms; e.g. Leland and Pyle (1977) and Stiglitz and Weiss (1981).\(^1\) Taken together, this research implies that the information problems that young firms experience coincide with the years that they most demand external financing.

Accordingly, firms’ early public years provide an opportune setting for examining the influence of auditor choice on their interest rates. We investigate whether engaging a Big Six auditor, which has a brand name reputation for supplying a higher-quality audit according to prior research, enables young firms to reduce their debt financing costs. We predict that the benefit of external monitoring by a Big Six auditor gradually subsides with age. As information in the capital markets on young firms becomes more widely available, the impact on firms’ interest rates of relying on a Big Six auditor to lower debt monitoring costs by enhancing the credibility of financial statements should decrease over time.

Specifically, we estimate the time-series variation in the influence of auditor choice on firms’ interest rates in their first nine public years. Our panel data tests that evaluate changes within firms suit observing the evolution in the impact of auditor reputation on debt pricing. Consistent with our predictions, we report economically significant and statistically robust evidence that hiring a Big Six auditor decreasingly affects firms’ cost of debt capital over time. We also find that this time-series variation is primarily isolated in firms that have short private histories when they go public.

We make several contributions to empirical research on auditor reputation. First, although prior research extensively studies the role of auditor choice on the cost of equity capital for young public firms, there is virtually no evidence on its effect on debt pricing for these firms. This paper contributes to our understanding of this issue by estimating the influence of auditor reputation on the reduction of costly information problems in debt.

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\(^1\) In fact, empiricists frequently specify age to measure the extent of *ex ante* uncertainty about firm value; e.g. Beatty (1989), Carter and Manaster (1990), James and Weir (1990), and Ritter (1991).
markets. Second, we exploit features of panel data to more finely examine the debt pricing implications of auditor choice by young public firms. For example, we can tailor our sample selection process to precisely follow theories that specify that firms that default on their loans cannot return to the debt market. Third, in separate tests, we measure firm age as the number of years since its initial public offering and since its incorporation. These tests provide evidence on the joint influence of auditor reputation and firms’ (public and private) experience on their interest rates.

This paper continues by further developing the motivation for the empirical tests in Section 2, while Section 3 describes the sample formation process. Section 4 specifies and reports descriptive statistics on the regression variables for the tests that estimate the evolution in the impact of auditor reputation on firms’ interest rates. Section 5 presents the primary estimation methodology and results for the debt pricing tests. Finally, the conclusions in Section 6 discuss directions for future research.

2. Extant Research and Hypotheses Development

In this study, we relate the informational asymmetry that is prevalent in firms’ early public years to the role of auditing in the debt market. Analytical research suggests that large, prestigious public accounting firms concerned about protecting their investment in reputation capital have more incentive to not supply a low-quality audit at a high-quality price (DeAngelo, 1981). Similarly, Titman and Trueman (1986) and Datar et al. (1991) assume that a quality differential exists among auditors, thereby providing company insiders with a mechanism to reveal private information about firm value.² Simunic and Stein (1987) investigate the market premium over book value for a sample of firms having their equity initial public offerings and report that those engaging a Big Eight auditor, their measure of audit quality, obtain a higher premium. Further, Balvers et al. (1988), Beatty (1989), Clarkson and Merkley (1994), and others find that high-reputation auditors enable

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² Prior evidence that Big Six firms receive brand name price premia in competitive markets also implies that quality differentiation exists; e.g. Palmrose (1986), Rubin (1988), Simon and Francis (1988), and Craswell et al. (1995). Craswell et al. explain that although all public accounting firms must comply with minimum professional standards, the Big Six firms voluntarily invest in higher levels of expertise and have incentives to provide higher quality audits to protect their brand name reputations.
entrepreneurs to reduce the extent of *ex ante* uncertainty in new equity issues.\(^3\) The considerable literature on the influence of audit quality on the cost of capital in firms’ initial public offerings of shares dominates extant research.\(^4\) In contrast, no empirical studies examine the debt pricing implications of auditor selection by public firms.\(^5\)

Prior research suggests that information problems steadily subside with age as firms’ accumulate a history in the capital markets. For example, Lang (1991) provides theory and evidence that the magnitude of stock price reactions to earnings announcements diminish with age, which he interprets as indicating that firm-specific information is gradually revealed over time. Pittman (2002) reports descriptive statistics on certain characteristics of firms’ capital structures that imply that information asymmetry declines over their early public years. Similarly, Diamond (1989) argues that young firms suffer more severe asset substitution and moral hazard problems. He models the dynamics of borrowers’ incentives with lenders learning over time from observing firms’ credit records. Fortin and Pittman (2002) find evidence consistent with Diamond’s prediction that firms lower their interest rates by developing their reputations in debt markets.

Lenders may have more incentive to prefer that young firms, which are just beginning to form their reputations for debt servicing, have higher-quality audits. This implies that the marginal benefit that a higher-quality audit provides through lowering firms’ borrowing costs will be decreasing in age. Essentially, auditor reputation substitutes for the fledgling reputations of firms with short credit histories. Engaging a high-reputation auditor may contribute to the efficient resolution of contracting problems by producing

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\(^3\) A separate research stream examines whether auditor selection provides an *ex ante* signal of insurance coverage to investors in equity initial public offerings; e.g., Dye (1993), Menon and Williams (1994) and Baber et al. (1995). In addition to research on new share issues, other studies argue that the larger public accounting firms are brand name suppliers of higher-quality audits; e.g., Dopuch and Simunic (1982), Palmrose (1988), Slovin et al. (1990), Defond (1992), Davidson and Neu (1993), Defond and Jiambalvo (1993), Teoh and Wong (1993), and Becker et al. (1998).


\(^5\) There is other evidence on the impact of audit quality on debt pricing. McKinley et al’s (1985) survey of bank loan officers’ perceptions of private firms’ credit applications indicates that auditor reputation, measured by the conventional Big Eight versus non-Big Eight dichotomy, does not affect loan pricing decisions. Wallace (1978) finds that choosing a Big Eight auditor lowers interest costs for municipalities. Our examination of public firms, rather than private firms, should largely avoid complications ensuing from the personal reputations and financial affairs of owners not being economically distinct from their firms.
valuable information about borrowers (see Jensen and Meckling, 1976 and Watts and Zimmerman, 1986). As there is only limited information available on young firms, lenders depend largely on firms’ disclosures to evaluate their performance and future prospects (Sengupta, 1998). Lenders would have to conduct costly information production and monitoring using alternative sources in the absence of credible financial statements for these relatively small, obscure firms. This credibility, which a high-quality auditor can enhance by, for example, improving the precision in firms’ earnings reports (DeAngelo, 1981 and Balvers et al. 1988), lowers the duplicative bonding and monitoring costs of debtholders.

Extant research suggests that Big Six auditors provide superior monitoring, especially for firms suffering from severe information problems. Francis et al. (1999) find that firms with otherwise relatively high uncertainty about reported earnings are induced to hire a Big Six auditor to bolster the credibility of their financial statements. They report evidence that this external monitoring constrains aggressive and potentially opportunistic reporting of accruals-based earnings. Similarly, Becker et al. (1998) document that firms with Big Six auditors have lower discretionary accruals, which they argue is indicative of high-quality auditors permitting firms less accounting flexibility. Teoh and Wong (1993) report that clients of Big Six auditors have higher earnings response coefficients than those of clients of non-Big Six auditors.6

Overall, this evidence implies that the higher quality of Big Six audits reduces earnings management, which is important since debt contracts engender incentives to adjust earnings through accounting changes (Sweeney, 1994) and discretionary accruals (DeFond and Jiambalvo, 1994) to avoid accounting-based covenant violations.7 Further, Teoh et al. (1998) find that earnings management prior to initial equity issues affects accruals in

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6 In addition, Skinner (1993) provides evidence that high investment opportunity firms are more apt to make income-increasing accounting choices. Lai (2002) finds that engaging a high-quality auditor curbs earnings management in these firms, which tend to experience greater information asymmetry; e.g. Myers (1977) and Diamond (1989, 1991). Rajan and Zingales (1998) report that firms have more lucrative investment projects in their early years, implying that the newly public firms in our sample would particularly benefit from external monitoring by a Big Six auditor.

7 However, other studies do not find support for the hypothesis that managers make financial reporting choices that lower the probability that their firms will violate debt covenants; e.g., Healy and Palepu (1990) and DeAngelo et al. (1994).
firms’ early public years. The reduction in uncertainty about the quality of firms’ earnings would justify lenders considering auditor choice when pricing debt contracts.

Since uncertainty in the capital markets about firms’ earnings is decreasing in firm age (Lang, 1991), young firms may particularly benefit from the observable monitoring of a Big Six auditor. In the absence of such monitoring, lenders will price protect against excessive earnings management by requiring firms not retaining a Big Six auditor to pay higher interest rates. However, interest rates for firms with a Big Six auditor will be lower since lenders will perceive that their financial statements are more credible; i.e., selecting a high-quality auditor will impound favorable information in firms’ cost of debt capital.

If lenders distinguish between levels of audit quality when determining interest rates, then this should be more detectable in a sample of young firms that have only short track records in the capital markets. This study begins by examining firms over their first nine public years to estimate the evolution in the impact of auditor reputation on borrowing costs. We expect that the high-quality monitoring of a Big Six auditor will enable young firms to better moderate information problems in their early public years, which motivates the following hypothesis (stated in alternate form):

\[ H_1: \text{The influence of auditor reputation on firms’ interest rates will become less negative with age.} \]

Our initial tests deliberately ignore that firms typically have private operating experience when they go public. Firms that already have lengthy credit histories at their IPO dates may not be able to materially further reduce information asymmetry by hiring a Big Six auditor. These firms can rely on their own good reputations to lower their interest rates, thereby largely eliminating the debt-monitoring benefit of having a high-quality audit. In fact, Ritter (1991) finds that firm performance improves the longer the duration between incorporation and initial public offering, which would support lenders perceiving credit risk to be decreasing in private age. This argument motivates the following hypothesis (also stated in alternate form):

\[ H_2: \text{The subsiding influence of auditor reputation on interest rates with age will be stronger in firms with short private histories.} \]
3. Sample Selection

The sample we use to observe the evolution in the cost of credit for maturing firms is extracted from those that went public from 1977 to 1988. A listing of the 3,458 SEC-registered initial public offerings conducted between January 1, 1977 and December 31, 1988 was obtained from Security Data Corporation. We compare this listing to the Annual Industrial and Research Compustat files to identify the IPOs for which any data is available. Table 1 reports that this screening reduces the sample to 2,180 firms.

We exclude some industries from the sample because their capital market behaviors are fundamentally different from that of other firms due to regulation and the financial nature of their operations (MacKie-Mason, 1990). We delete utilities (SIC codes from 4911 to 4941) since firms in regulated industries might have incentives to have relatively high leverage. Their stable cash flows may increase debt capacity; e.g., less credit rationing by lenders since default risk is lower. Also, asset substitution (Jensen and Meckling, 1976) and under-investment (Myers, 1977) problems are tempered by management’s discretion over investment policy being largely delegated to regulatory authorities.

Similarly, we remove firms in financial (SIC codes from 6022 to 6200), insurance (SIC codes from 6312 to 6400) and real estate (SIC codes from 6500 to 6799) industries. Explicit (or implicit) investor insurance schemes such as deposit insurance may strongly influence the credit decisions of firms such as banks and insurance companies (Rajan and Zingales, 1995). In fact, their debt-like liabilities are not strictly comparable to the debt issued by non-financial firms. Further, regulations such as minimum capital requirements may affect their capital structures (Scholes et al., 1990). Overall, the industry screening eliminates 249 firms from the sample.

This study initially follows firms from their first through their ninth public years, which results in removing those that were de-listed from the Compustat database because of mergers, acquisitions, bankruptcy, or liquidation during this period. Requiring nine consecutive years of data further reduces the sample to 897 firms. Restricting the sample

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8 In addition to utilities, other industries were regulated at different points during the 1977 to 1997 period of this study. All results reported in this paper were virtually identical when firms operating in the railroad (SIC 4011), trucking (SIC 4213), airline (SIC 4512), and telecommunications (SIC 4812 and 4813) industries were removed from the sample.
to only survivors ensures that any evidence supporting our predictions is not driven by changes to the composition of the sample over time.

We also remove firms if any of the observations necessary to construct the regression variables are missing, which lowers the sample to 693 firms. Finally, discarding extreme observations in the data, which we explain in Section 4, reduces the final sample to 288 firms (see Table 1 for a summary). As imposing these screening criteria results in attrition of almost 92 percent of the original sample, the final sample may differ systematically from the population of survivors; e.g., these restrictions might bias the sample toward larger firms in certain industries (see Table 2). Although inspection of the data suggests that the industry and calendar year clustering in the sample resembles the clustering in the initial population, we consider the econometric implications of firm attrition on the sample selection process in Section 5.

4. Regression Variables and Descriptive Statistics

This section describes the dependent and explanatory variables that are used in the empirical tests of hypotheses $H_1$ and $H_2$. We emphasize the specification of the three variables of primary interest in this study, firms’ interest rates, ages, and auditor choices. We also motivate and specify the control variables that represent other potential determinants of debt pricing; i.e., the underlying cost of capital and firm-specific characteristics. This section concludes with descriptive statistics on these variables.

4.1 Interest Rate

The dependent variable is the interest rate on the firm’s debt, which is calculated as its interest expense for the year divided by its average short-term and long-term debt during the year. High-quality firms that have been assigned a low credit rating may issue short-term debt when they expect their rating to improve (Flannery, 1986 and Kale and Noe, 1990). However, descriptive statistics indicate that this variable is a noisy proxy for the firm’s interest rate unless we trim the data to address extreme observations.

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9 Limitations arising from using Compustat data in this study prevents specifying variables to control for variation in firms’ interest rates due to loan characteristics; i.e. the type of creditor, debt maturity, whether the interest rate is fixed or floating, etc. To the extent that these are stable through firms’ first nine public years, these omitted variables will not affect the fixed effects regressions reported later.
Consequently, we discard firm-year observations that are outside the 5th and 95th percentiles of the pooled distribution. This procedure is frequently applied to handle scaling problems resulting from accounting-based ratios having very small denominators (Dechow, 1994). This restricts firms’ interest rates to range to a maximum of 20.7 percent, which is about 180 basis points higher than the highest prime rate in the 1977 to 1997 study period (see Table 3). Although trimming explanatory variables does not affect the expected value of the regression slopes, excessive trimming can inflate their standard errors (Fama and French, 1998). However, the trimming procedure that we apply generates standard errors that are smaller than for the regression containing all observations or for those that use alternate trimming methods.  

4.2 Firm Age

Diamond’s (1989, 1991) theory of reputation formation in debt markets predicts that interest rates will decline over time as firms’ compile good credit histories. We initially measure firm age as the number of years that have elapsed since they went public to test H1. Then, for H2, we examine whether cross-sectional differences in firms’ private ages, which is the number of years that have passed between their incorporation and initial public offering, affect the evolution in the influence of auditor choice on firms’ interest rates in their first nine public years.

4.3 Auditor Choice

Our sample has observations that cover the period from 1977 to 1997 during which mergers involving the large public accounting firms occurred. For the 1989 to 1997 portion of our sample period, we follow previous research by specifying auditor choice with a variable indicating whether the firm retains a Big Six auditor; e.g., Teoh and Wong (1993), Becker et al (1998), and Francis et al. (1999). For the 1977 to 1988 portion of our

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10 We examine the possibility that the trimming procedure chosen spuriously induces the evidence on H1 and H2 by applying the following alternate procedures for handling extreme observations and data coding errors made by Compustat. In separate tests, we discard observations outside the 1st and 99th percentiles and winsorize at the 5th and 95th and at the 1st and 99th percentiles. In addition, another specification constrains the firms’ interest rates to range from the mean prime rate for that year and the prime rate plus 0.075; i.e. observations below prime are set to prime and those above prime plus 0.075 are set to prime plus 0.075. We also re-specify to constrain their interest rates to range from prime to prime plus 0.05 and prime to prime plus 0.10. All results reported below are essentially unaffected by any of this re-specifications.
sample period, this indicator includes public accounting firms that were among the Big Eight; e.g., Simunic and Stein (1987), Balvers et al. (1988), and Beatty (1989).\textsuperscript{11}

4.4 Underlying Cost of Capital

We largely rely on the average prime rate for the year to control for changes in the underlying cost of capital. The risk-free rate and a default premium for the lender’s best customers comprise the prime rate. Firms that are not the lender’s best customers incur an additional default premium. The annual difference between the yield on BAA-rated corporate bonds and the yield on ten-year government bonds controls for aggregate variation in this default premium (Petersen and Rajan, 1994).\textsuperscript{12} However, Elton et al. (2001) report that tax premiums are also responsible for the rate spread between corporate and government bonds.\textsuperscript{13} This variable measures both the default and tax premiums.

4.5 Firm Characteristics

The following variables control for variation in interest rates attributable to firm-specific characteristics other than its reputation and auditor choice. These controls are intended to proxy for credit risk, with observably riskier borrowers predicted to pay higher interest rates.\textsuperscript{14} In fact, these financial ratios should correspond to those used by lenders when evaluating credit risk.

\textsuperscript{11} There were two mergers involving large public accounting firms in 1989. Ernst & Whinney and Arthur Young merged on May 5, 1989 to form Ernst & Young and Deloitte, Haskins, and Sells and Touche Ross merged on August 11, 1989 to form Deloitte & Touche. The “Big Six” firms were Arthur Andersen; Coopers & Lybrand; Deloitte & Touche; Ernst & Young; KPMG Peat Marwick; and Price Waterhouse. The 1998 merger of Coopers & Lybrand and Price Waterhouse to form PricewaterhouseCoopers (PwC) that reduced the Big Six to the Big Five occurred after our 1977 to 1997 sample period. For expositional convenience, we use “Big Six” throughout the paper to describe the large public accounting firms, although these are really “Big Eight” firms during the early years of our study period.

\textsuperscript{12} This data was collected from the Federal Reserve Board.

\textsuperscript{13} This tax premium is consistent with Scholes and Wolfson’s (1992) argument that corporate bonds must provide a higher return to compensate for the state taxes incurred by investors relative to the tax-free payments on government bonds.

\textsuperscript{14} Prior research finds that many of the controls specified in this section such as firm size, leverage, industry regulation, and financial distress are related to the retention of Big Six auditors (see Francis et al. 1999 for a discussion). Including proxies for these in our fixed effects regressions avoids time-varying correlated omitted variable bias with the Big Six indicator.
We predict an inverse relation between interest rates and firm size, which is measured with the natural logarithm of total assets normalized using the Consumer Price Index, since creditors perceive larger firms as less risky (Sinkey, 1998) and there are economies of scale on debt production costs (Blackwell and Kidwell, 1988 and Carey et al., 1993). The logarithmic specification that provides for the expected decreasing marginal impact of size follows extant research; e.g., Petersen and Rajan (1994) and Blackwell et al. (1998).

We also predict that interest rates will be increasing in leverage, which is defined as total short-term and long-term debt scaled by firm market value (Hempel et al., 1994; Petersen and Rajan, 1994; and Berger and Udell, 1995). The control for profitability (e.g., Petersen and Rajan, 1994 and Berger and Udell, 1995) is cash-flow from operations, which is predicted to have a negative coefficient since firms that can generate more cash internally are in a better position to service their debts. Firms that are experiencing financial distress may incur higher borrowing costs. We control for this potential determinant of debt pricing with a dummy variable indicating if the book value of common equity is negative (Graham et al., 1998).

Berger and Udell (1990) report that collateral is an important feature of more than 70 percent of all commercial and industrial loans made in the U.S. There is considerable prior evidence that interest rates are increasing in collateral (e.g., Scott and Smith, 1986; and Blackwell et al., 1998), which is consistent with the perception in the banking industry that observably risky borrowers must provide security for their loans (Morsman, 1986 and Hempel et al., 1986). This implies that the coefficient on the control for asset structure, which is the fraction of total assets in property, plant, and equipment, will be positive.

Prior research suggests that firms going public reveal information about potential market size or new product quality; if this news is favorable, then rivals in the industry follow; e.g., Stoughton et al. (2001) and Maksimovic and Pichler (2001). We rely on one-digit SIC codes to control for these industry influences on debt pricing.

Finally, we include an indicator for issue year to capture lingering variation in credit risk.\(^{15}\) Table 1 reports dramatic cyclical swings in the number of IPOs between 1977 and

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\(^{15}\) Our research design partially suppresses the influence of changing macroeconomic conditions on the time-series variation in debt pricing by aligning the data in event time starting with the first year since the firm
1988. There is considerable debate about the average quality of firms going public in hot and cold markets for new issues. Early analytical research argues that a relatively high fraction of high-quality firms choose to go public in hot markets to avoid being undervalued in cold markets; e.g. Allen and Faulhaber (1989) and Grinblatt and Huang (1989). Conversely, Loughran and Ritter (1995) provide evidence that hot markets tend to attract low-quality firms that generate poor long-run stock returns. In addition, the period of our study overlaps the proliferation of auditor litigation cases as well as changes to the incorporation and liability rules affecting public accounting firms, although Choi and Doogar (2001) provide evidence that these developments did not undermine the quality of Big Six audit clienteles (see also Dye, 1995 and Francis and Reynolds, 2000).

Table 3 reports descriptive statistics that indicate that there is substantial variation across all continuous variables. There is evidence that some control variables, especially the prime rate, default and tax premium, and size proxies, are correlated with the Big Six indicator or firm age. This raises the concern that other determinants of debt pricing might explain the observed separate and joint influence of auditor choice and age. To address potential multi-collinearity issues, we remove from the equations one at a time explanatory variables with absolute cross-correlations with auditor choice or firm age exceeding 0.15. None of these re-specifications qualitatively affects the regression results presented below.

5. Estimation Methodology and Results

We begin this section by developing our research design for examining the prediction in $H_1$ that the debt-monitoring benefit that a Big Six auditor provides through lowering firms’ interest rates gradually subsides with age. For the empirical tests of the prediction in $H_2$ that this effect will be stronger in firms with short private histories, we simply divide the sample used to test $H_1$ according to firms’ private ages when they went public.

went public, rather than in calendar time. This should reduce confounding admitted by shifts in macroeconomic conditions other than changes in the prime rate and default and tax premiums, for which we specify separate controls. Still, this alignment only coarsely controls the impact of prevailing conditions since the sample firms are not equally distributed across the IPO years; e.g., only three firms in the sample underwent an IPO in 1978, while 76 firms had their IPO in 1986.

16 The Big Six firms argued that excessive litigation costs would dissuade larger auditors from auditing risky clients, thereby impeding young, innovative firms’ access to the capital markets (Arthur Andersen et al., 1992).
5.1 Tests of H1: Firms’ Public Experience

We initially estimate the following model to examine the evolution in the impact of auditor choice on firms’ borrowing costs:

\[
INTEREST\ RATE_{it} = \alpha + \beta X_{it} + \epsilon_{it}
\]  

(1)

where \(INTEREST\ RATE_{it}\) is the interest rate incurred by firm \(i\) at time \(t\), \(\alpha\) is the intercept that is common to all firms, and \(X_{it}\) is a vector of explanatory variables. The regression variables, which Section 4 describes in more detail, are:

- \(INTEREST\ RATE_{it}\) = Interest rate is interest expense for the year divided by the average of total short-term and long-term debt at the start and at the end of the year.
- \(AGE_{it}\) = Age is the number of years that have elapsed since the firm’s IPO.
- \(BIG\ SIX_{it}\) = This is an indicator variable having a value of one when the firm retains a Big Six auditor; zero otherwise.
- \(AGE_{it}*BIG\ SIX_{it}\) = This interaction is the product of firm age and the Big Six auditor indicator variable.
- \(PRIME_t\) = Prime is the average prime rate for the year.
- \(DEFAULT_t\) = The default spread is the difference between the yield on BAA-rated corporate bonds and the yield on ten-year government bonds for the year.
- \(LEVERAGE_{it}\) = Leverage is the book value of total short-term and long-term debt deflated by firm market value (the sum of the market value of equity and the book value of total debt).
- \(CASH\FLOW_{it}\) = Cash-flow is cash-flow from operations scaled by total assets.
- \(SIZE_{it}\) = Firm size is the natural logarithm of total assets normalized using the Consumer Price Index.
- \(ASSETS_{it}\) = Asset structure is total property, plant and equipment scaled by total assets.
- \(NEG.EQUITY_{it}\) = The negative book equity dummy indicates if the book value of common equity is negative.
- \(CALENDAR_{it}\) = This is the calendar year in which the firm had its initial public offering.
- \(INDUSTRY_{i}\) = This indicates the firm’s one-digit SIC code.

We start by estimating this model using ordinary least squares under the assumption that the error term in equation (1) is independent of the explanatory variables. This generates results that are directly comparable to prior empirical research and provides the first cross-sectional evidence on the impact of auditor choice on debt pricing. However,
the panel data tests, which control for unobserved firm-specific effects to avoid omitted variable bias and to refine the observation of within-firm dynamics, that follow are our primary evidence on \( H_1 \) and \( H_2 \).

The significance of the pooled cross-sectional, time-series OLS results reported in column (1) of Table 4 are calculated with standard errors obtained using White’s (1980) heteroscedasticity correction. The negative and statistically significant coefficient on the firm age variable supports Diamond’s (1989) theory that firms’ interest rates will decline over time. This result is consistent with other evidence that the information problems that young public firms experience gradually lessen with age; e.g., Lang (1991) and Datta et al. (1999, 2000).

More relevant to this study, the negative and statistically significant coefficient on the Big Six auditor variable implies that relying on a high-quality auditor reduces the young firms’ interest rates by 75 basis points. To our knowledge, this is the first estimate of the debt pricing implications of auditor selection by public firms. In this regression, the time-series variation in the influence of auditor reputation on borrowing costs is evaluated by interacting firm age with the Big Six auditor indicator. The positive and strongly statistically significant coefficient on this interaction is consistent with the prediction in \( H_1 \) that retaining a Big Six auditor decreasingly affects firms’ interest rates with age.

Most pooled OLS results for the control variables are statistically significant in the predicted directions.\(^{17}\) The only exceptions are the estimates for the default and tax premium and for firm size, which are not correlated with firms’ interest rates in the pooled test. In fact, the results reported in column (1) of Table 4 are similar to those provided by prior cross-sectional studies; e.g. Berger and Udell (1995), Petersen and Rajan (1994, 1995) and Blackwell et al. (1998).

\(^{17}\) Although the panel data tests that follow are the main empirical evidence in this paper, the statistical significance of these cross-sectional results may be exaggerated by the serial correlation of the error terms. However, the evidence (\( p \)-value under 0.01) that the influence of auditor quality on interest rates is decreasing in firm age remains when the pooled equation (1) is re-estimated using Generalized Method of Moments (see Hansen, 1982), which produces standard errors that are not affected by serial correlation of successive observations and cross-sectional heteroscedasticity. In addition, except for the proxy for cash-flow from operations, the other variables continue to be significant in the predicted directions.
However, these results, particularly the evidence supporting $H_1$, may be driven by omitted variable bias with the explanatory variables representing unobservable firm-specific effects. We next describe the fixed effects tests that consider whether mostly between-firm effects or within-firm dynamics are responsible for the OLS results.

Suppose that the unobservable error term in equation (1), $e_{it}$, is more fully described as:

$$
e_{it} = \mu_i + e_{it}$$

(2)

where $\mu_i$ is a firm-specific component and the residual term, $e_{it}$, is a measurement error or other form of stochastic shock. The assumptions made about the relationships among $\mu_i$, $e_{it}$, and $X_{it}$ will dictate the handling of the firm-specific effect. For example, if we simply assume that $\mu_i$, $e_{it}$, and $X_{it}$ are mutually orthogonal, then we would estimate equation (1) as a random effects model containing firm-specific heteroscedasticity.

However, it is more reasonable to assume that $\mu_i$ absorbs differences in, for example, managerial quality, which would suggest that firms that survive are probably higher quality. This would imply that a positive correlation exists between $\mu_i$ and $X_{it}$, although $\mu_i$ could remain orthogonal to $e_{it}$. We address the concern that firm-specific correlated omitted variables are present in the data by specifying an intercept for each firm, $\alpha_i$, to eliminate the time-invariant $\mu_i$, thereby yielding consistent coefficient estimates:

$$INTEREST\ RATE_{it} = \alpha_i + \beta X_{it} + e_{it}$$

(3)

The results reported in column (2) of Table 4 are for a two-way fixed effects model with correction for unspecified heteroscedasticity. An $F$-test strongly rejects the null hypothesis that the constant terms (the fixed firm effects) are all identical. In the presence of the firm effects, another $F$-test supports including time-specific parameters corresponding to the prime rate and the default and tax premium for the year.

The evolution in firms’ interest rates and the influence of auditor choice during their first nine public years found in this fixed effects model, which preserves the time-series

---

18 There are many potentially important unobservable firm-specific characteristics affecting auditor choice and debt pricing. Ireland and Bristol (2002) argue that the tendency of managers to engage in non-truthful reporting may vary across firms. Firms with strong internal controls may choose a Big Six auditor since these engagements would involve lower fees because they require less audit work (Thornton and Moore, 1993).
variation while accounting for individual firm heterogeneity, mirrors the OLS results. Specifically, Diamond’s (1989) prediction that firms’ interest rates are decreasing in firm age is strongly supported. Similarly, the interaction of firm age and the Big Six auditor indicator provides evidence consistent with $H_1$ that the impact of auditor choice on firms’ interest rates becomes less negative over time.

In fact, this time-series evidence reveals that borrower and auditor reputations are economically important determinants of debt pricing. The coefficient estimate of -0.0024 on firm age implies that, on average, firms’ interest rates decrease by 216 basis points during their first nine public years. The coefficient estimate of 0.0011 on the age-Big Six auditor interaction implies that, on average, the benefit of external monitoring by a high-quality auditor drops by 99 basis points during these years. To help put these estimates in perspective, Table 3 reports that firms’ mean (median) interest rate over these nine years is 9.8 percent (9.7 percent).

Together, these within-firm results provide evidence on how firm and auditor reputations affect the debt pricing process over time. Young firms can lower their interest rates by acquiring a track record for repaying their debts. However, in their very early public years when firms only have short credit histories for lenders to observe, these firms most benefit from relying on the superior debt monitoring of a Big Six auditor to moderate information problems. In summary, the evidence reported in Table 4 suggests that firm age and auditor choice separately and jointly affect young public firms’ borrowing costs.

5.2 Tests of $H_2$: Firms’ Private Experience

Our research design for testing $H_1$ in the preceding section measures a firm’s age as the number of years that have elapsed since its IPO, although firms ordinarily have a private operating history when they go public. It would be interesting to examine the determinants of debt pricing for the private operating years of firms in our sample. However, since we do not have access to their financial statements for these years, we resort to coarsely testing

---

19 The coefficients on many explanatory variables, including the Big Six auditor indicator, tend to approach zero or are estimated imprecisely in the fixed effects regression. However, the theories motivating these potential determinants of debt pricing intend to explain differences across firms. Entering the firm fixed effects that remove cross-sectional variation in the data means that these hypotheses are no longer testable. Only the OLS results that are reported in column (1) of Table 4 are valid for these cross-sectional predictions.
the prediction in $H_2$ that the diminishing influence of auditor reputation on interest rates with age will be stronger in firms with short private histories.

We investigate whether cross-sectional differences in firms’ private ages affect the tests that estimate the time-series variation in the influence of auditor selection on debt pricing in firms’ early public years. This involves re-examining the evidence reported in Table 4 after bisecting the sample by firms’ median private ages, defined as the number of years between their incorporation and their IPOs.\textsuperscript{20} Prior research sorts firms by such within-sample characteristics; e.g., Rajan and Zingales (1998) and Pittman (2002).

According to Diamond’s (1989) prediction that interest rates will fall with age, the sub-sample of older firms will have more established reputations for servicing their debts. His theory implies that the interest rates of the older firms will be lower since they already have extensive histories by the time that they have their IPOs. Ritter (1991) reports that stock price performance for young public firms is increasing in the duration between incorporation and initial public offering, which would justify lenders’ reliance on private age when evaluating borrowers’ credit risk. Generally, extant research suggests that information asymmetry is worse for firms with short private histories when they go public.

Data on firms’ private ages were collected from several sources. Professor Jay Ritter of the University of Florida maintains an IPO database that provided the majority of the incorporation dates for sample firms having their initial public offerings between 1977 and 1984. For the 1985 to 1988 IPOs, Ward’s Business Directory of U.S. Private and Public Companies was the primary data source. In addition, incorporation dates were found in Moody’s International Manual, Moody’s Industrial Manual, Moody’s OTC Industrial Manual, and Directory of Corporate Affiliations.

Table 5 reports evidence for the older and younger firm sub-samples that suggests that the determinants of debt pricing in firms’ early public years depend on their private ages. First, the impact of public experience on the time-series variation in their respective

\textsuperscript{20} The median private age is eleven years, measured from year of incorporation to year of initial public offering. The distribution is highly skewed; e.g., some firms were founded more than 100 years before going public, such that mean private age is an unreliable estimate of central tendency in this sample. There are 127 firms and 128 firms in the younger and older sub-samples, respectively. We discard observations for 33 firms for which we could not determine incorporation dates.
interest rates is different. According to the fixed effects results in columns (2) and (4), the coefficient estimate on firm age is only negative and statistically significant for the sub-sample of younger firms. This implies that lenders continue to learn about this set of borrowers by observing their credit histories during their early public years. In contrast, it appears that the sub-sample of older firms have largely cemented their reputations during their private years. This evidence is consistent with descriptive statistics on firms’ borrowing costs that indicate that lenders perceive that firms in the older sub-sample have higher average quality. The older firms’ mean (median) interest rate over their first nine public years is 9.5 percent (9.5 percent), which is significantly lower that the mean (median) interest rate of 10.0 percent (9.9 percent) for the younger firms.21

Second, the pooled OLS results in columns (1) and (3) of Table 5 indicate that choosing a Big Six auditor only lowers the interest rates of the sub-sample of younger firms. These younger firms, which likely suffer from more serious asymmetric information problems, can reduce their interest rates in their early public years by relying on their auditors’ reputations as well as their own.

Finally, consistent with the prediction in H2, the declining impact over time of auditor choice is stronger in the sub-sample of younger firms.22 In fact, according to the results reported in columns (2) and (4) of Table 5, the coefficient on the age-Big Six auditor interaction is only positive and statistically significant for this set of firms; the corresponding coefficient for the sub-sample of older firms is not statistically different than zero. Overall, the evidence in this section suggests that the separate and combined impact of borrower and auditor reputations on interest rates is primarily isolated in firms with short private histories when they go public.

21 These results are also consistent with extant research that finds that private firms’ interest rates decrease with age; e.g., Petersen and Rajan (1994, 1995) and Berger and Udell (1995).

22 Although separate Hausman (1978) tests confirm that the fixed effects model is the proper design choice for examining H1 and H2, external validity is undermined because the results only apply to the firms in these samples, which only contain about 8 percent of the population of initial equity issues occurring between 1977 and 1988 (see Table 1). There are almost certainly mechanical explanations for some sample attrition such as firms not being immediately followed by Compustat; i.e., our sample selection process inadvertently excludes firms that belong in the sample of those surviving for nine public years. Since we are eager to provide evidence to justify inferences about the entire population, we re-estimate the equations with a random effects model and find evidence strongly supporting both H1 and H2. Further, Hsiao (1986) and Griliches and Hausman (1986) explain that observing consistent estimates across alternative panel data estimation techniques suggests the absence of serious errors in variables problems.
5.3 Sensitivity Analysis

This section examines the sensitivity of the reported empirical results that are consistent with $H_1$ and $H_2$ by exploring whether this evidence persists for a series of variable and sample re-specifications and alternate estimation techniques.

Interest Rate Specification

The dependent variable for the tests reported in Tables 4 and 5 is interest expense for the year divided by average short-term and long-term debt during the year. Replacing this denominator with long-term debt or the sum of short-term, long-term, and convertible debt produces qualitatively similar evidence on both $H_1$ and $H_2$.

Public Age Specification

The impact of auditor choice on firms’ interest rates may not change linearly with age. Since the influence of an additional year of public existence may decline over time, we specify various non-linear transformations of firm age (the natural logarithm of one plus age, second-order logs, square roots, and reciprocals) to provide the data more flexibility. Evidence supporting $H_1$ and $H_2$ is found for each specification. Further, $R^2$ was slightly higher in both the full (Table 4) and split (Table 5) samples with the linear specification of firm age, validating our design choice.

Sample Attrition

We compile the balanced panel data by removing firms that became bankrupt, were liquidated, were acquired, or merged with another firm during their first nine public years. Imposing these screens prevents bias from the composition of the sample changing over time. However, there are two reasons to examine certain unbalanced panels – permitting firms to leave and, in one specification, re-enter the sample during the nine years – when testing the time-series predictions.

23 Constantinides and Grundy (1989) and Stein (1992) argue that convertible debt provides cost-effective financing when informational asymmetries are relatively severe such as for the young, small firms in our sample. In fact, Helwege and Liang (1996), Mayers (1998), and Krishnaswami et al. (1999) report supporting evidence that firms are more apt to issue convertible bonds in their early public years. Also, specifying only long-term debt in the denominator avoids potential confounding arising from seasonal fluctuations in firms’ short-term debt.
First, considerable attrition for reasons other than non-survival occurred when the panel was compiled by discarding observations that do not appear in all years (see Table 1). For example, Compustat simply did not follow some firms since their initial public offerings. Both the full and split-sample tests were separately re-estimated for an unbalanced panel in which firms were permitted to enter and leave the sample during the nine-year period. These results provide evidence consistent with H$_1$ (see columns (3) and (4) of Table 4) and H$_2$ (not tabulated), implying that the screening used to compile the balanced panel data does not seriously undermine external validity.\footnote{This evidence for H$_1$ and H$_2$ remains after applying more formal tests to treat this potential bias; i.e., Heckman’s (1976, 1979) two-step estimation procedure, which generates consistent estimates in the presence of attrition. This procedure eliminates the bias that could arise from omitted variables when the sample is not random. The fixed effects regression that models within-firm variation in debt pricing removes any time-invariant sample selection bias since the correction term for selectivity is absorbed in the firm-specific effect. We only examine potential attrition bias because firms may be excluded from the sample for reasons besides non-survival.}

Second, changes to the sample’s composition may affect debt pricing according to several corporate finance theories. For example, one mechanism in Diamond (1989) that generates a pattern of declining interest rates over time is having young firms that default on their debts leave the credit market. The balanced panel partially suppresses the impact of this mechanism on the evolution in the determinants of firms’ interest rates. Fortin and Pittman (2002) find that lenders refine their information about firms that survive by observing those that default. Accordingly, we re-run the hypotheses tests on unbalanced panels comprised of firms that were allowed to leave, but not return to, the sample under the assumption that borrowers that default are forever excluded from the credit market. These results (not tabulated) also provide evidence consistent with both H$_1$ and H$_2$.

\textit{Year-to-Year Tests}

We employ the following methodology to provide year-to-year evidence on the prediction in H$_1$ that the impact of external monitoring by a Big Six auditor on firms’ interest rates becomes less negative over time (Lang, 1991 and Pittman and Klassen, 2001). We re-estimate equation (1) in separate cross-sectional regressions for each of firms’ first nine public years with a random coefficients model that attributes parameter heterogeneity to stochastic variation (Hildreth and Houck, 1968). This estimation technique, which has been modified to correct for heteroscedasticity and avoids serial
correlation complications, permits cross-sectional variation in the auditor choice coefficients.

The Pearson correlation of these nine coefficients with firm age is 0.61, which is significant at the five-percent level in a one-tailed test assuming independence. However, since this correlation ignores the precision of the coefficient estimates, we run a weighted linear regression with the least weight assigned to the observations that are measured with the most error. The weighted least squares regression of the auditor choice estimates from the nine cross-sectional random coefficients models on firm age also produces evidence at the five-percent level that a positive pattern exists. Similarly, applying this procedure to the younger and older firm sub-samples provides time-series evidence at the one-percent level supporting the prediction in H$_2$ that the diminishing influence of auditor reputation on interest rates with age will be stronger in firms with short private histories.\textsuperscript{25}

\textit{Other Tests}

The evidence that the evolution in the impact of auditor choice on debt pricing is consistent with H$_1$ and H$_2$ remains after removing firms that changed their fiscal year-ends to ensure that the tests are synchronized at one-year intervals. The reported results are also not calendar year, industry, or Big Six auditor specific and represent a pervasive economic trend, rather than influential observations dominating the data. In addition, serial correlation through repeated measurements of a firm is not responsible for the evidence.\textsuperscript{26}

\textbf{6. Conclusions}

We examine the link between auditor choice and debt pricing for newly public firms. These firms particularly depend on obtaining external financing despite experiencing serious information problems in their early public years. Our cross-sectional evidence suggests that choosing a Big Six (formerly Big Eight) auditor, which can reduce debt-related monitoring costs by enhancing the credibility of financial statements, enables young firms to lower their interest rates.

\textsuperscript{25} All results described in this section are robust to OLS estimation.

\textsuperscript{26} Although a statistically significant AR(1) parameter indicates that serial correlation is important, the $t$-statistics for the test variables are similar when robust estimates of the standard errors are used.
Extant theory and evidence implies that information asymmetry between borrowers and lenders is decreasing in firm age since, for example, these firms have not had the opportunity to accumulate a lengthy credit record. Consistent with our time-series predictions, we find that the impact of auditor choice on firms’ interest rates becomes less negative with age. Our evidence suggests that the economic value of auditor reputation to the cost of credit declines over time as borrowers gradually shift toward relying on their own reputations to moderate information asymmetry.

Information problems are even worse for firms that have short private histories when they go public according to prior research. We report results from additional tests that imply that private age strongly affects the time-series variation in the influence of auditor choice on firms’ interest rates. Specifically, again consistent with our predictions, we find that although younger firms at their IPOs dates especially benefit from retaining a Big Six auditor, this influence subsides more swiftly over their first nine public years.

This research could be extended by testing the predictions in other empirical settings such as firms emerging from bankruptcy protection. These newly re-organized firms, which are beginning the process of rehabilitating their reputations with lenders, may be eager to exploit the superior debt monitoring of a Big Six auditor. In fact, this may be a cleaner setting than the newly public firms since bankrupt firms can essentially select a brand new capital structure before leaving Chapter 11 (Alderson and Betker, 1995 and Gilson, 1997). In contrast, evidence in this study suggests that the duration of firms’ pre-IPO histories affects borrowing costs in their post-IPO years. Similarly, Dittmar (2002) argues that subsidiaries divested in spin-offs can also adopt a brand new capital structure. Future research could examine the debt pricing implications of auditor choice in these firms’ early public years.

Finally, Stiglitz and Weiss (1981) and others argue that information problems are responsible for the credit rationing that firms’ experience in their early years. Empirical research on whether retaining a high-quality auditor reduces credit rationing in young firms would complement our evidence on debt pricing.
References


Heckman, J. J. “The common structure of statistical models of truncation, sample selection, and limited dependent variables and a simple estimator for such models.” Annals of Economic and Social Measurement 4 (1976): 475-492.


Table 1: Sample Selection Summary

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of SEC registered IPOs</td>
<td>32</td>
<td>38</td>
<td>62</td>
<td>149</td>
<td>348</td>
<td>122</td>
<td>685</td>
<td>357</td>
<td>355</td>
<td>728</td>
<td>415</td>
<td>167</td>
<td>3,458</td>
</tr>
<tr>
<td>Number of firms not followed by <em>Compustat</em> since initial public offering</td>
<td>(11)</td>
<td>(20)</td>
<td>(22)</td>
<td>(67)</td>
<td>(125)</td>
<td>(40)</td>
<td>(246)</td>
<td>(129)</td>
<td>(131)</td>
<td>(290)</td>
<td>(150)</td>
<td>(47)</td>
<td>(1,278)</td>
</tr>
<tr>
<td>Number of firms from utilities, financial, insurance, and real estate industries</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(11)</td>
<td>(26)</td>
<td>(7)</td>
<td>(51)</td>
<td>(24)</td>
<td>(29)</td>
<td>(53)</td>
<td>(27)</td>
<td>(12)</td>
<td>(249)</td>
</tr>
<tr>
<td>Number of firms that did not survive through their first nine years of public operation</td>
<td>(14)</td>
<td>(2)</td>
<td>(13)</td>
<td>(33)</td>
<td>(99)</td>
<td>(47)</td>
<td>(210)</td>
<td>(123)</td>
<td>(110)</td>
<td>(195)</td>
<td>(123)</td>
<td>(65)</td>
<td>(1,034)</td>
</tr>
<tr>
<td>Number of firms with missing <em>Compustat</em> observations</td>
<td>(2)</td>
<td>(2)</td>
<td>(4)</td>
<td>(8)</td>
<td>(16)</td>
<td>(6)</td>
<td>(36)</td>
<td>(21)</td>
<td>(22)</td>
<td>(49)</td>
<td>(29)</td>
<td>(9)</td>
<td>(204)</td>
</tr>
<tr>
<td>Number of firms with extreme observations</td>
<td>(3)</td>
<td>(8)</td>
<td>(12)</td>
<td>(17)</td>
<td>(50)</td>
<td>(15)</td>
<td>(92)</td>
<td>(33)</td>
<td>(37)</td>
<td>(65)</td>
<td>(55)</td>
<td>(18)</td>
<td>(405)</td>
</tr>
<tr>
<td>Number of firms in the sample</td>
<td>0</td>
<td>3</td>
<td>7</td>
<td>13</td>
<td>32</td>
<td>7</td>
<td>50</td>
<td>27</td>
<td>26</td>
<td>76</td>
<td>31</td>
<td>16</td>
<td>288</td>
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</table>
Table 2: Industry Distribution of Sample

<table>
<thead>
<tr>
<th>2-Digit SIC Code</th>
<th>Number</th>
<th>Industry Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>6</td>
<td>Oil and gas extraction</td>
<td>2.1%</td>
</tr>
<tr>
<td>20</td>
<td>12</td>
<td>Food</td>
<td>4.2%</td>
</tr>
<tr>
<td>27</td>
<td>6</td>
<td>Printing and publishing</td>
<td>2.1%</td>
</tr>
<tr>
<td>28</td>
<td>10</td>
<td>Chemicals</td>
<td>3.5%</td>
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<tr>
<td>35</td>
<td>21</td>
<td>Industrial and commercial machinery</td>
<td>7.3%</td>
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<tr>
<td>36</td>
<td>35</td>
<td>Electronic and electrical equipment</td>
<td>12.2%</td>
</tr>
<tr>
<td>38</td>
<td>22</td>
<td>Measuring, analyzing, and controlling equipment</td>
<td>7.6%</td>
</tr>
<tr>
<td>39</td>
<td>5</td>
<td>Miscellaneous manufacturing industries</td>
<td>1.7%</td>
</tr>
<tr>
<td>42</td>
<td>7</td>
<td>Freight transportation and warehousing</td>
<td>2.4%</td>
</tr>
<tr>
<td>48</td>
<td>10</td>
<td>Communications</td>
<td>3.5%</td>
</tr>
<tr>
<td>49</td>
<td>6</td>
<td>Electric, gas, and sanitary services</td>
<td>2.1%</td>
</tr>
<tr>
<td>50</td>
<td>9</td>
<td>Wholesale trade – durable goods</td>
<td>3.1%</td>
</tr>
<tr>
<td>58</td>
<td>7</td>
<td>Restaurants</td>
<td>2.4%</td>
</tr>
<tr>
<td>59</td>
<td>9</td>
<td>Miscellaneous retail</td>
<td>3.1%</td>
</tr>
<tr>
<td>73</td>
<td>15</td>
<td>Business services</td>
<td>5.2%</td>
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<tr>
<td>87</td>
<td>7</td>
<td>Engineering, accounting, research, management, and related services</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

Sub-total 187  64.9%

101  Industries with fewer than 5 firms  35.1%

Total 288  100%
## Table 3: Summary Statistics

### Panel A – Continuous variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
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<tbody>
<tr>
<td>Interest rate</td>
<td>2,592</td>
<td>0.098</td>
<td>0.032</td>
<td>0.097</td>
<td>0</td>
<td>0.207</td>
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<tr>
<td>Age</td>
<td>2,592</td>
<td>5</td>
<td>2.583</td>
<td>5</td>
<td>1</td>
<td>9</td>
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<tr>
<td>Prime rate</td>
<td>2,592</td>
<td>0.091</td>
<td>0.021</td>
<td>0.088</td>
<td>0.060</td>
<td>0.189</td>
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<tr>
<td>Default and tax premium</td>
<td>2,592</td>
<td>0.020</td>
<td>0.003</td>
<td>0.020</td>
<td>0.013</td>
<td>0.031</td>
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<tr>
<td>Leverage</td>
<td>2,592</td>
<td>0.311</td>
<td>0.237</td>
<td>0.268</td>
<td>0</td>
<td>0.992</td>
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<td>Cash-flow</td>
<td>2,592</td>
<td>0.064</td>
<td>0.156</td>
<td>0.084</td>
<td>-4.535</td>
<td>0.450</td>
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<tr>
<td>Size</td>
<td>2,592</td>
<td>3.663</td>
<td>1.483</td>
<td>3.603</td>
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<td>Asset structure</td>
<td>2,592</td>
<td>0.561</td>
<td>0.354</td>
<td>0.497</td>
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<td>4.082</td>
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### Panel B – Discrete variables

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<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Big Six auditor</td>
<td>2,272</td>
<td>87.65%</td>
</tr>
<tr>
<td>Negative book equity indicator</td>
<td>74</td>
<td>2.85%</td>
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### Panel C – Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Interest Rate</th>
<th>Age</th>
<th>Prime Rate</th>
<th>Default Premium</th>
<th>Leverage</th>
<th>Cash-flow</th>
<th>Size</th>
<th>Asset Structure</th>
<th>Big Six Auditor</th>
<th>Negative Equity</th>
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<tbody>
<tr>
<td>Interest rate</td>
<td>-0.222</td>
<td>0.368</td>
<td>0.059</td>
<td>0.113</td>
<td>-0.102</td>
<td>-0.071</td>
<td>-0.029</td>
<td>-0.035</td>
<td>0.116</td>
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<tr>
<td>Age</td>
<td>-0.214</td>
<td>-0.412</td>
<td>-0.439</td>
<td>0.082</td>
<td>-0.050</td>
<td>0.102</td>
<td>0.168</td>
<td>0.069</td>
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<tr>
<td>Prime rate</td>
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<td>-0.199</td>
<td>-0.004</td>
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<td>-0.040</td>
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<td>Def. and tax premium</td>
<td>0.103</td>
<td>-0.413</td>
<td>0.100</td>
<td>-0.098</td>
<td>-0.009</td>
<td>-0.150</td>
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<tr>
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<td>-0.112</td>
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<tr>
<td>Cash-flow</td>
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<td>-0.051</td>
<td>0.011</td>
<td>-0.001</td>
<td>-0.199</td>
<td>0.108</td>
<td>0.203</td>
<td>0.041</td>
<td>-0.168</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>-0.060</td>
<td>0.092</td>
<td>-0.139</td>
<td>-0.157</td>
<td>0.163</td>
<td>0.177</td>
<td>0.012</td>
<td>0.256</td>
<td>0.054</td>
<td></td>
</tr>
<tr>
<td>Asset Structure</td>
<td>-0.019</td>
<td>0.189</td>
<td>-0.058</td>
<td>-0.022</td>
<td>0.116</td>
<td>0.064</td>
<td>-0.071</td>
<td>0.058</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Big Six auditor</td>
<td>-0.031</td>
<td>0.069</td>
<td>-0.064</td>
<td>-0.055</td>
<td>0.047</td>
<td>0.022</td>
<td>0.248</td>
<td>0.046</td>
<td>0.036</td>
<td></td>
</tr>
<tr>
<td>Neg. book equity</td>
<td>0.097</td>
<td>0.079</td>
<td>-0.048</td>
<td>-0.044</td>
<td>0.223</td>
<td>-0.284</td>
<td>0.056</td>
<td>0.015</td>
<td>0.036</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

- This table presents summary statistics for the 2,592 firm-year observations over the period 1977 to 1997 used in the hypotheses tests. Panel A presents the distributional statistics for the continuous variables and Panel B presents the distribution for the discrete variables. Tables 1 and 2, respectively, provide descriptive statistics on the calendar year and industry distributions. Panel C reports correlations for the regression variables, with Pearson correlations presented below the diagonal and Spearman correlations presented above the diagonal; related probability values are presented in parentheses.
- Continuous variables are as follows (all dollar-denominated variables are stated in millions). Interest rate is interest expense for the year divided by the average short-term and long-term debt for the year. Firm age is the number of years that have elapsed since the firm’s initial public offering. Prime rate is the average prime rate for the year. The default and tax premium is the difference between the yield on BAA-rated corporate bonds and the yield on ten-year government bonds for the year. Leverage is the book value of the sum of short-term and long-term deflated by firm market value (the sum of market value of equity and book value of total debt). Cash-flow is cash-flow from operations scaled by total assets. Firm size is the natural logarithm of total assets normalized using the Consumer Price Index. Asset structure is total property, plant and equipment scaled by total assets.
- Indicator variables are as follows. The year dummy variables indicate the calendar year in which the firm underwent its initial public offering. The industry dummy identifies the firm’s one-digit SIC code. The Big Six auditor variable indicates if the firm retains a Big Six auditor. The negative book equity dummy indicates if the book value of common equity is negative.
### Table 4: Debt Pricing Results – OLS and Fixed Effects Estimation

**OLS regression**

\[
\text{INTEREST RATE}_i = \alpha + \gamma_t + \beta_1 \text{AGE}_i + \beta_2 \text{PRIME}_i + \beta_3 \text{DEFAULT}_i + \beta_4 \text{LEVERAGE}_i + \beta_5 \text{CASH-FLOW}_i + \beta_6 \text{SIZE}_i + \beta_7 \text{ASSETS}_i + \beta_8 \text{NEG.EQUITY}_i + \epsilon_i 
\]

**Fixed effects regression**

\[
\text{INTEREST RATE}_i = \alpha_i + \beta_1 \text{AGE}_i + \beta_2 \text{PRIME}_i + \beta_3 \text{DEFAULT}_i + \beta_4 \text{LEVERAGE}_i + \beta_5 \text{CASH-FLOW}_i + \beta_6 \text{SIZE}_i + \beta_7 \text{ASSETS}_i + \beta_8 \text{NEG.EQUITY}_i + \epsilon_i 
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prediction</th>
<th>Balanced Panel</th>
<th>Unbalanced Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pooled OLS</td>
<td>Fixed Effects</td>
</tr>
<tr>
<td>Intercept</td>
<td>?</td>
<td>0.0924***</td>
<td>0.1151***</td>
</tr>
<tr>
<td>Age</td>
<td>-</td>
<td>-0.0032***</td>
<td>-0.0024***</td>
</tr>
<tr>
<td>Big Six auditor</td>
<td>-</td>
<td>-0.0075**</td>
<td>-0.0017</td>
</tr>
<tr>
<td>Age* Big Six auditor</td>
<td>+</td>
<td>0.0016***</td>
<td>0.0011**</td>
</tr>
<tr>
<td>Prime rate</td>
<td>+</td>
<td>0.3140***</td>
<td>0.3126***</td>
</tr>
<tr>
<td>Default and tax premium</td>
<td>+</td>
<td>-0.2121</td>
<td>-0.3049*</td>
</tr>
<tr>
<td>Leverage</td>
<td>+</td>
<td>0.0171***</td>
<td>0.0078**</td>
</tr>
<tr>
<td>Cash-flow</td>
<td>-</td>
<td>-0.0040*</td>
<td>0.0003</td>
</tr>
<tr>
<td>Size</td>
<td>-</td>
<td>0.0001</td>
<td>-0.0067***</td>
</tr>
<tr>
<td>Asset structure</td>
<td>+</td>
<td>0.0026*</td>
<td>0.0046</td>
</tr>
<tr>
<td>Negative book equity</td>
<td>+</td>
<td>0.0183***</td>
<td>0.0127***</td>
</tr>
<tr>
<td>indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td></td>
<td>0.175</td>
<td>0.503</td>
</tr>
<tr>
<td>F-statistic</td>
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<td>155.16°</td>
</tr>
<tr>
<td>Number of observations</td>
<td></td>
<td>2,592</td>
<td>2,592</td>
</tr>
</tbody>
</table>

**Notes:**

This table presents regression results for the debt pricing models using pooled cross-sectional, time-series ordinary least squares (OLS) and two-way fixed effects estimation for the firms’ first through ninth years of public operation. The balanced sample is compiled by discarding the entire time-series of firms if any missing observations are encountered in the nine years. The unbalanced panel is compiled by discarding only the firm-year when missing observations are encountered. The dependent variable and the explanatory variables are specified in Table 3. The OLS regressions include unreported dummy variables identifying the firm’s one-digit SIC code and the calendar year of its initial public offering. Regression equation F-statistics significant at less than 0.001 are identified by a ° superscript. In this table, the subscripts i and t identify firms and time, respectively. The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**), and 0.01 (***).
Table 5: Debt Pricing OLS and Fixed Effects Regression Results – Balanced Panel Partitioned by Private Age at IPO Date

### OLS regression

\[ \text{INTEREST RATE}_i = \alpha + \gamma t + \beta_1 \text{AGE}_i + \beta_2 \text{PRIME}_i + \beta_3 \text{DEFAULT}_i + \beta_4 \text{LEVERAGE}_i + \beta_5 \text{CASH-FLOW}_i + \beta_6 \text{SIZE}_i + \beta_7 \text{ASSETS}_i + \beta_8 \text{NEG.EQUITY}_i + \beta_9 \text{INDUSTRY}_i + \epsilon_i \]

### Fixed effects regression

\[ \text{INTEREST RATE}_i = \alpha_i + \beta_1 \text{AGE}_i + \beta_2 \text{PRIME}_i + \beta_3 \text{DEFAULT}_i + \beta_4 \text{LEVERAGE}_i + \beta_5 \text{CASH-FLOW}_i + \beta_6 \text{SIZE}_i + \beta_7 \text{ASSETS}_i + \beta_8 \text{NEG.EQUITY}_i + \epsilon_i \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prediction</th>
<th>Older Firms</th>
<th>Younger Firms</th>
<th>Older Firms</th>
<th>Younger Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>?</td>
<td>0.0894***</td>
<td>0.0739***</td>
<td>0.0932***</td>
<td>0.1238***</td>
</tr>
<tr>
<td>Age</td>
<td>-</td>
<td>-0.0024**</td>
<td>-0.0008</td>
<td>-0.0050***</td>
<td>-0.0035***</td>
</tr>
<tr>
<td>Big Six auditor</td>
<td>-</td>
<td>-0.0011</td>
<td>0.0141**</td>
<td>-0.0114***</td>
<td>-0.0060</td>
</tr>
<tr>
<td>Age* Big Six auditor</td>
<td>+</td>
<td>0.0003</td>
<td>-0.0010</td>
<td>0.0034***</td>
<td>0.0025***</td>
</tr>
<tr>
<td>Prime rate</td>
<td>+</td>
<td>0.2768***</td>
<td>0.2815***</td>
<td>0.3372***</td>
<td>0.3381</td>
</tr>
<tr>
<td>Default and tax premium</td>
<td>+</td>
<td>-0.4153</td>
<td>-0.4460°</td>
<td>-0.0152</td>
<td>-0.1268</td>
</tr>
<tr>
<td>Leverage</td>
<td>+</td>
<td>0.0194***</td>
<td>0.0075</td>
<td>0.0158***</td>
<td>0.0023</td>
</tr>
<tr>
<td>Cash-flow</td>
<td>-</td>
<td>-0.0092</td>
<td>-0.0001</td>
<td>0.0048</td>
<td>0.0025</td>
</tr>
<tr>
<td>Size</td>
<td>-</td>
<td>0.0023***</td>
<td>-0.0067**</td>
<td>-0.0012**</td>
<td>-0.0091***</td>
</tr>
<tr>
<td>Asset structure</td>
<td>+</td>
<td>0.0058**</td>
<td>0.0095°</td>
<td>0.0001</td>
<td>-0.0026</td>
</tr>
<tr>
<td>Negative book equity indicator</td>
<td>+</td>
<td>0.0089*</td>
<td>0.0047</td>
<td>0.0232***</td>
<td>0.0195***</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td></td>
<td>0.186</td>
<td>0.476</td>
<td>0.224</td>
<td>0.535</td>
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<tr>
<td>F-statistic</td>
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<td>11.98°</td>
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</tr>
<tr>
<td>Number of observations</td>
<td></td>
<td>1,152</td>
<td>1,152</td>
<td>1,143</td>
<td>1,143</td>
</tr>
</tbody>
</table>

Notes:

This table presents regression results for the debt pricing models for older and younger firms using ordinary least squares and two-way fixed effects estimation for the firms’ first through ninth years of public operation. The balanced sample discards the entire time-series of firms if any missing observations are encountered in the nine years. Older firms are defined as those for which the duration of their private history, which is measured as the number of years that have elapsed between their incorporation and their initial public offering, is above the median for the sample. Younger firms are defined as those with private histories that are shorter than the median for the sample. The dependent variable and the explanatory variables are specified in Table 3. The OLS regressions include initial public offering year and one-digit SIC code industry dummy variables; coefficient estimates for these are not reported. Regression equation F-tests significant at less than 0.001 are identified by a ° superscript. In this table, the subscripts i and t identify firms and time, respectively. The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**), and 0.01 (***).