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# Audit committee characteristics and debt choice: evidence from the S&P 500

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**ABSTRACT**

This study examines the impact of audit committee (AC) characteristics on firms' debt choice. Specifically, we focus on AC independence, the frequency of meetings, financial experts, gender diversity, and the gender of the AC chair. The sample of this study is composed of 300 firms listed on the S&P 500. To examine the impact of the composition of the AC on debt choice, we use Ordinary Least Squares (OLS) regression and Tobit regression. The empirical findings reveal that the number of independent directors, the ratio of female directors, and a female AC chair are positively associated with public debt. This finding is in line with **'the bank monitoring substitution hypothesis'** that the AC's mentioned features substitute for the monitoring role of the bank. On the other hand, the frequency of AC meetings and the ratio of financial experts on the AC are negatively associated with public debt. The findings of this study offer some important insights for policy implications. For instance, firms can access the public debt market by increasing the number of independent directors, improving the gender diversity of the AC, and appointing a female AC chair.

## 1. Introduction

Total debt, comprising both public debt (commercial paper, bond, debenture, etc.) and bank debt (revolving credit facility, bank overdraft, term loans, etc.), is a prominent source of external financing in the U.S. (Denis & Mihov, 2003). Hence, the choice between bank and public debt is pivotal in the corporate world. The ample literature on debt choice provides both empirical and theoretical determinants of bank and public debt (Denis & Mihov, 2003; Fama, 1985; Houston & James, 1996; Johnson, 1997; Lin et al., 2013; Marshall et al., 2016).

In this literature, firms' choice between public and bank debt stems from the level of information asymmetry and the extent of agency problems within the firm. In other words, firms' choice of public and bank debt is driven by the 'need for external monitoring' and 'effectiveness of internal governance'. A firm will need external monitoring by the private lenders (banks) when the internal information environment is opaque, causing high information asymmetry. However, the need for external monitoring is reduced if the internal governance (provided by large shareholders, independent boards, etc.) is effective.

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Consistent with the argument of Diamond (1991) and Hoshi et al. (1993), the firms with no need for external monitoring will choose public debt over bank debt and vice versa. Indeed, the reliance of firms with poor information environment on bank debt supports the notion that private lenders (banks) are better able to resolve the problem of information asymmetry and the agency problem via strong monitoring insights and stringent contract terms (Graham et al., 2008; Lin et al., 2018). This is because the private lenders (e.g., banks) have privileged access over other lenders towards the private information of the borrowers (firm), which enables the banks to exert strong external surveillance and monitoring mechanism over the opportunistic behaviour of managers and shareholders (Fama, 1985; Park, 2000). Thus, in its nature, bank debt is accompanied by an external monitoring mechanism. Unlike other lenders that are mere bystanders until a default occurs, the banks actively contribute to the firms' governance activities (Nini et al., 2012). In a nutshell, the banks offer strong external monitoring to the firms when firms are opaque and/or internal governance mechanisms are very weak.

Interestingly, firms can improve their transparency and internal governance (Melón-Izco et al., 2020) and a key institution to improve both is the audit committee (hereafter *AC*). It plays a pivotal role in ensuring the transparency of financial statements and serves as a strong internal governance mechanism (Alzeban, 2019; Carcello & Neal, 2000). The importance of the *AC* is evidenced by the regulator's interest (e.g., NYSE, NASDAQ, SEC, and SOX) regarding the role of the *AC*, particularly after the emergence of major corporate collapses (Enron and WorldCom). For instance, Li and Li (2020) posit that an independent *AC* mitigates information asymmetry and agency problems. Zhang et al. (2007) argue that firms with more independent directors and financial experts in the *AC* are less likely to experience internal control weaknesses. Similarly, an *AC* that holds more meetings provides strong oversight of financial matters by discussing complex matters, thus improving the quality of the information environment (Gebrayel et al., 2018). Aside from the former characteristics, the literature argues that females, as director and chair in the *AC*, enhance the integrity of the financial reporting process (Ittonen et al., 2010).

Yet surprisingly, a majority of the empirical and theoretical studies on the choice between public and bank debt have delved deeply into the firms' financial features (e.g., credit quality, value of collaterals, firm size, firm age, the problem of information asymmetry, and credit quality) as determinants of debt choice (Lin et al., 2013), and little efforts have been devoted to the internal governance of the firm. As an exception to this rule, Lin et al. (2013) focus on the ownership structure as an important determinant of the type of debt choice because of its impact on the quality of corporate governance and internal control systems. In this study, we intend to bridge this gap further by shedding new lights on another important but much less studied dimension of corporate governance, namely the *AC* composition. More specifically, we explore the impact of *AC* independence, meeting frequency, financial expertise, gender diversity, and gender of *AC* chair on firms' debt choice using hand-collected data of non-financial firms listed on the S&P 500 from 2010 to 2017.

Our findings reveal that *AC* independence (AC_IND) has a positive association with public debt (PD_TD). In contrast, *AC* meetings (AC_MET) and *AC* financial experts (FIN_EXP) have a negative impact on the public debt (PD_TD). Furthermore, the results show that the ratio of women directors in the *AC* (AC_FEM) and female chair (AC_CHAIR) of the *AC* are also positively associated with public debt (PD_TD).

Overall, the findings of our study are consistent with the notion that the 'disciplinary power' of AC independence (AC_IND), gender diversity (AC_FEM), and female chair (AC_FEM) of the AC may reduce the need for external monitoring, and consequently it may lead the firms to prefer public debt over bank debt.

Our study contributes to several strands of literature in the following ways. First, while controlling for the financial characteristics of firms that have been shown to act as important determinants of the choice between public and bank debt, we provide a unique focus on a key internal governance characteristic: the composition of the AC that remains the centre of attention for the regulatory bodies, particularly after the collapse of famous corporations (e.g., Enron and WorldCom). To our knowledge, ours is the first study to check the influence of various AC characteristics on the firms' debt choice in the U.S. In particular, we examine the impact of the AC independence, meeting frequency, the ratio of financial experts and female directors, and the gender of the AC chair on debt choice. Second, our study is related to Lin et al. (2013), who examine the impact of firm-level governance as approximated by the ownership structure on the firm's debt structure choice. We complement and further extend their study by providing novel evidence that the AC composition, another significant component of firm-level governance, exerts a strong influence on firms' debt choice.

The remainder of this paper proceeds as follows. In section 2, we outline the literature review and hypotheses development. We describe data collection and descriptive statistics in section 3. In section 4, we explain the research methods and empirical results. We summarise our findings in section 5.

## 2. Literature review and hypotheses development

### 2.1 Literature on the choice between public and bank debt

Prevailing theories on firms' choice of public and bank debt exhibit diverse opinions, but they can be summarised by considering: 1) the need for external monitoring and 2) the effectiveness of internal governance. Regarding the importance of external monitoring, Diamond (1991) and Hoshi et al. (1993) argue that the firms with no need for external monitoring choose public debt over bank debt. In fact, bank debt is considered as a most expensive source of financing over public debt, and it is used by the firms only when the renegotiation of debt contract or external monitoring is required (Johnson, 1997). The theoretical models of financial intermediations explain the role of banks and other private lenders as 'information producers' (Berlin & Loeys, 1988; Diamond, 1984; Fama, 1985; Leland & Pyle, 1977). This is because the bank has privileged access relative to public lenders and better access to the borrowers' private information (firm). This privileged access enables the private lenders (banks) to exert a strong control mechanism over opportunistic behaviours of managers and shareholders. Moreover, the firms may have to face liquidation or renegotiation of the bank debt contract in case of detection of opportunistic activities (Park, 2000). Consequently, bank monitoring diminishes the problems of information asymmetry, moral hazard, and agency problems and gives strong feedback to the borrowing firms to make favourable financial decisions (Berlin & Loeys, 1988; Chemmanur & Fulghieri, 1994; Rajan, 1992; Stiglitz & Weiss, 1983).

The mentioned literature supports the notion that the firms having problems of information asymmetry, managers' opportunistic behaviour, and agency problems prefer bank debt over public debt. Dhaliwal et al. (2011) and Lin et al. (2013) argue that the informational environment of the firm and financial reporting quality, respectively, are prominent determinants of debt choice, so that firms with opaque information environments and low quality of financial reporting use bank debt and, on the other hand, firms with high financial reporting quality and transparent information environment use public debt. Similarly, Hoshi et al. (1993) present the same reasons as Diamond (1991) to argue that firms with no need of external monitoring tend to finance their projects through public debt. Hoshi et al. (1993) link firms' choice between public and bank debt to the maturity of the capital market. They argue that as the well-established, non-opaque, and good credit history firms have better access to the capital market, they use public debt and the rest of the firms move towards bank debt.

The study of Chen et al. (2013) shows that opaque firms (firms with poor financial reporting) raise financing from private lenders (e.g., banks). Since such firms are subject to problems of information asymmetry, so the private lenders are better able to resolve the problem of information asymmetry than the public debt holders.

Regarding the importance of the effectiveness of internal governance, we have already mentioned how Lin et al. (2013) show the importance of ownership structure on the choice between public and bank debt. Nevertheless, since our interest is on the utility of the *AC* and its importance as an internal governance tool, here we will concentrate on the literature that has studied the relevant characteristics of the *AC* that indicate strong internal governance.

For instance, Armstrong et al. (2010) and Bhojraj and Sengupta (2003) postulate that an independent *AC* is expected to ensure greater independence which in results, monitors managers' self-interest activities, improve the information environment, and reduce agency conflict between firm and lenders. *AC* meetings is a common indicator of diligence, and fewer meetings show a lack of effective monitoring. Building upon this notion, Archambeault and DeZoort (2001) argue that the firm's *AC* that experiences restatements has fewer meetings frequency. Similarly, Blue Ribbon Committee (BRC; 1999) and Public Oversight Board (POB; 1993) highlight the importance of financial experts for strengthening the monitoring process. With respect to gender diversity, Srinidhi et al. (2011) argue that gender diversity in the *AC* disciplines managers' actions by exerting strong internal control. Adams et al. (2010a) also show that investors value female members' participation as female members express effective oversight. Given the mentioned discussion, various characteristics of the *AC* significantly improve internal monitoring. So, we conjecture that the discussed features of the *AC* will strengthen internal governance and substitute for bank monitoring, increasing the ratio of public debt to bank debt.

## 2.2 Audit committee independence and debt choice

The prior literature shows that *AC* independence is recognised as one of the most promising internal control factors in financial reporting (Dhaliwal et al., 2010; Pucheta-Martínez et al., 2016; Pucheta-Martínez & De Fuentes, 2007). The literature posits that independent directors improve the monitoring process in two ways. First,

independent directors do not have any psychological, personal, or economic dependence on management that may influence their opinion (Abbott et al., 2004; Carcello & Neal, 2000; Karamanou & Vafeas, 2005; Pucheta-Martínez & De Fuentes, 2007); thus, they provide a true picture of the financial health of firms to stakeholders (Karamanou & Vafeas, 2005). Second, reputational incentives motivate independent members to form a strong monitoring mechanism unique to each member of the *AC* (Abbott et al., 2004). Studies further postulate that firms having an *AC* with more independent directors and financial experts and that meets frequently have a lower frequency of earnings restatements. Firms with higher proportion of independent directors on the *AC* experience fewer internal control problems (Zhang et al., 2007). Similarly, Klein (2002) argues that a more independent *AC* adversely influences earnings management.

On the other hand, endogenous models of board composition posit that 'all else being equal' firms appoint independent directors when the firms are performing very poorly as the CEOs are not in the bargaining position (Adams et al., 2010b). Adams et al. (2010b) further argue that the main problem with the prior literature on the board is that the board composition is not exogenous but rather is influenced by the firm-level factors and previous decisions, which ultimately wields influence on the decisions of the board. Hence, endogenous models consider independent directors' appointment as a negative news for the firm, and CEO probably may not welcome any such appointment when the firm is already in problems (Fahlenbrach et al., 2010). In their model of 'optimal control of corporate boards' Harris and Raviv (2008) demonstrate that in most of the cases, shareholders prefer internally controlled boards or at least the main committees (e.g., *AC*), over the externally controlled board. In essence, the outside directors may release inside information, which may cost the firms in the form of higher agency costs, and outside control may adversely influence the shareholder value. Likewise, Adams and Ferreira (2007) show that outsiders in the board may also have some negative consequences for the firm, particularly in the 'sole board system'. This is because the insiders (managers) may hide some information if the intensity of monitoring is increased by the outside directors; consequently the outside directors may not be able to monitor effectively, with less information. The theoretical model of Raheja (2005) reveals that boards with low private benefits, more executive members, and low 'information costs' are optimal effective boards.[1]

In line with the endogeneity approach, Fraile and Fradejas (2012) argue that firms alter their board composition (more independent directors) when monitoring is required and change both board size and its composition when an advisory function is required. Similarly, the study of Black and Kim (2012) shows that board independence has a positive impact on firm outcomes. This study is based on the adoption of Korea's 1999 law which mandates large Korean firms to have 50% independent directors in their boards. Bradley and Chen (2015) argue that board independence is negatively associated with the cost of debt when the conditions are strict and leverage is low and vice versa.

The above discussion suggests that an independent *AC* enhances the transparency in financial reporting by diminishing information asymmetry and strengthening the internal monitoring mechanism. In this way, *AC* monitoring may substitute for bank monitoring, therefore leading to a lower dependence on bank financing. Thus, firms with an independent *AC* need no external monitoring and thus do not rely on public debt. In contrast, firms with fewer independent directors on the *AC* have an opaque information environment and

information asymmetry. Our argument with regard to the reliance of firms with an opaque information environment on bank debt is based on the studies by Diamond (1991) and Hoshi et al. (1993), who show that firms may select private lenders (e.g., banks) when external monitoring is required. Based upon the above arguments, we propose the following hypothesis.

**H1**: Firms with more independent directors on the *AC* rely on public debt.

### 2.3 Audit committee meetings, financial experts and debt choice

The Public Oversight Board (POB; 1993) mentions that the 'effectiveness of the *AC* is affected, first and foremost, by the expertise of members of *AC* in the areas of accounting and financial reporting, internal controls and auditing'. Similarly, the Blue Ribbon Committee (BRC; 1999) mandates that in firms, the *AC* should consist of members with financial knowledge and that at least one of the members should be a financial expert. To perform their duties effectively and efficiently, *AC* members should have enough knowledge to interpret and understand financial information. *AC* members' financial expertise enables them to perform their monitoring and advising-related duties more effectively (Bravo & Alcaide-Ruiz, 2019). An *AC* with financial experts is more likely to detect material misstatements on time than without financial experts (DeZoort & Salterio, 2001).

The number of meetings held by the *AC* also indicates that the *AC* is actively performing its monitoring role in an effective manner (Abbott et al., 2000). An *AC* that holds more meetings provides strong oversight of financial matters by discussing complex matters, thus improving the quality of financial reporting (Gebrayel et al., 2018). The frequency of *AC* meetings enhances the coordination between auditors and directors, which makes the *AC* perform its responsibilities more effectively (Blue Ribbon Committee (BRC), 1999, Public Oversight Board (POB), 1993, and Al-Mudhaki and Joshi (2004) show that *AC* that meets more frequently is better able to detect accounting irregularities and are less likely to cause restatements.

In addition to independent directors, the frequency of meetings and financial experts are highly important for strengthening internal oversight. For example, *AC* members' financial expertise enables them to perform their monitoring and advising-related duties more effectively (Bravo & Alcaide-Ruiz, 2019). In a similar vein, the frequency of *AC* meetings bridges the communication gap between auditors and directors, which makes the *AC* perform its responsibilities more effectively (Blue Ribbon Committee (BRC), 1999; Public Oversight Board (POB), 1993). Taken together, effective communication and effective oversight mitigate information asymmetry and improve the overall information environment (Srinidhi et al., 2011). Therefore, we formulate the following hypotheses:

**H2**: Firms with a high frequency of *AC* meetings raise public debt.

**H3**: Firms with an *AC* consisting of more financial experts raise public debt.

## 2.4 Gender diversity, the gender of the audit committee chair and debt choice

As discussed above, the dilemma of debt choice depends upon the problem of information asymmetry, the quality of financial reporting, the need for external oversight, and the credit quality of the firm. In this regard, the extant body of literature documents that the presence of women improves a firm's overall information environment. Female directors act more effectively than male directors to improve earnings quality (Adams et al., 2010a; Carter et al., 2003) because females are more sensitive to the risk of lawsuits and reputational losses (Francis et al., 2015; Srinidhi et al., 2011). Gender diversity on boards leads to tight monitoring (Adams & Ferreira, 2009), as women directors prefer to be part of monitoring committees (e.g., *AC*) and have a better attendance record in board meetings. Gender diversity may have different implications depending upon firms' characteristics. For instance, firms that are protected against takeovers need thorough monitoring by the board and hence benefit from gender diversity, whereas gender-diverse boards may have worse implications for other firms (Adams & Ferreira, 2009). In their study, Singh et al. (2001) argue that female directors can be found in firms that are large in size and more profitable.

The increase in female representation on boards during the past decade has not occurred because of an increase in the ratio of qualified females; rather, it has been the result of the demand for gender diversity in the boards (Farrell & Hersch, 2005). Adams and Funk (2012) indicate that females who are promoted to leadership positions may express similar behaviour to men and have quite different attributes compared to the average population. The theory of tokenism posits that tokens remain under performance pressure because they are more visible (Kanter, 1977). This increased visibility may induce them to perform better at an individual level but make their performance worse than that of the numeric majority. Female directors are not associated with the 'old boys' network'; hence, they monitor managers' activities more diligently and express independent thinking. Nevertheless, they may become less independent when firms increase the representation of women on boards because they join existing networks or form their own networks (Adams & Funk, 2012). Women who hold board seats are very special compared to the average population of women. They are capable of a high level of persuasion and have a larger risk appetite than male directors (Adams & Funk, 2012). Likewise, Adams (2016) argues that the participation of women on boards is not random, nor are they random members of the female community. Instead, women directors obtain their positions via a 'process of selection'. Women join the boards of better performing firms, and because women directors are in short supply, they may be in a better position to select better performing firms. Additionally, women directors are not only special compared to the average population of women but also very different from their male counterparts (Farrell & Hersch, 2005). Participation of women makes communication with investors more effective (Adams & Ferreira, 2009; Joy, 2008) and is valued by investors, as female members signal effective oversight (Adams et al., 2010a).

Regarding female chairs, the study by Li and Li (2020) posits that female chairpersons are more likely to discourage financial irregularities, which ultimately contributes to the quality of financial reporting by strengthening the internal control system. Furthermore, Man and Wong (2013) argue that compared to men, female chairs or CEOs emphasise adopting a strict governance mechanism, as females are risk averse in their decision-making.

Therefore, based on the above discussion, we present the following hypotheses:

**H4**: Firms with more female directors on the *AC* prefer public debt.

**H5**: Firms with an *AC* chaired by a female director rely on public debt.

## 3. Methodology

### 3.1 Sample construction

We empirically investigate the impact of *AC* characteristics on debt structure using a sample of non-financial U.S. firms listed on the S&P 500 from 2010 to 2017. The following considerations guide our sample selection process. First, we ensure the availability of 10-K filings and proxy statements for each of the sample firms. Second, each selected firm should have either public or bank debt in their debt structure during the sample period. This criterion leaves us with a sample of 300 non-financial firms. Additionally, we also exclude the financial firms due to their distinctive operating characteristics.

By following prior literature, the information about the public debt has been gathered from 10-K filings of the firms by following 'notes to the financial statements or balance sheet footnotes' where details about the nature of debt are generally disclosed (Denis & Mihov, 2003; Houston & James, 1996; Rauh & Sufi, 2010). Collecting data from the annual reports/10-K filings is the most reliable source of data as the mentioned source provides detailed information about the debt structure (Houston & James, 1996). Likewise, we hand-collect the data of corporate board and *AC* characteristics from firms' 'proxy statements'. Other than the 'Market-to-Book Ratio' data, based on the 'Morningstar.com' database, we collect data of firms' fundamentals from annual reports/10-K filings. The information regarding the age of the firm has been gathered from various online sources. We winsorise all of our continuous variables at 5% and 95%, except for *AC* characteristics and U.S. interest rates.[2]

### 3.2 Variables

#### 3.2.1 Dependent variable: public debt
Following prior studies, we employ the ratio of public debt (short-term + long-term) to total debt *(PD_TD)* for measuring debt choice (Lin et al., 2013). 'Public debt is defined as the sum of senior bonds and notes, subordinated bonds and notes, and commercial paper' (Lin et al., 2013). For total debt, we sum up the short-term debt and long-term debt.

#### 3.3.2 Independent variables: audit committee characteristics
We use various characteristics of *AC* like the number of independent directors (*AC_IND*), *AC* meetings (*AC_MET*), the proportion of financial experts in the *AC* (*FIN_EXP*), number of female directors in the *AC* (*AC_FEM*), and gender of *AC* chair (*AC_CHAIR*). All of the mentioned variables are discussed in detail in Table 1.

**Table 1.** Definitions and data sources.

| Variables | Description | Source |
|---|---|---|
| PD_TD | The ratio of public debt to total debt; where public debt is sum of short-term and long-term public debt and total debt is sum of short-term and long-term debt | 10-K filings |
| AC_IND | Total number of independent directors in the audit committee | Proxy Statement |
| AC_MET | Total number of meetings held by the audit committee during a year | Proxy Statement |
| FIN_EXP | The ratio of financial experts members to total number of audit committee members | Proxy Statement |
| 50%_EXP | Dummy variable equals to 1, if 50% or more than 50% members of audit committee are financial experts, and zero otherwise | Authors' Calculations |
| AC_FEM | The ratio of female members in the audit committee to total number of audit committee members | Proxy Statement |
| FEM_D | Dummy variable equals to 1 to the audit committee having at least one female member, and zero otherwise | Authors' Calculations |
| 2_FEM | Dummy variable equals to 1, if at least 2 members of audit committee are females, and zero otherwise | Authors' Calculations |
| AC_CHAIR | Dummy variable equals to 1 for audit committee chaired by female member, and zero otherwise | Proxy Statement |
| BSIZE | Log of total number of directors in the board | Proxy Statement |
| BIND_BS | The ratio of independent directors to total number of directors in the board | Proxy Statement |
| TANG | The ratio of net property, plant, and equipment to total assets | Authors' Calculations |
| AGR | It is an index change in fixed assets | Authors' Calculations |
| VOL | Standard deviation of ROA for the last five years | Authors' Calculations |
| ROA | The ratio of EBIT to total assets | Authors' Calculations |
| LEV | The ratio of long-term debt to total assets | Authors' Calculations |
| LN_SIZE | The natural log of total assets in U.S. dollars | 10-K filings |
| LN_AGE | The natural log of total number of years from the incorporation of the firm | Online Sources |
| MTB | Market value of equity divided by book value of debt | Morningstar.com |
| Z_SCORE | Defined as (3.3 * EBIT/Sales + 1.0 * Sales/TA + 1.4 * RE/TA + 1.2 * WC/TA); where EBIT is earnings before interest and taxes; Sales is total sales in U.S. dollars; TA is total assets in U.S. dollars; RE is retained earnings; and WC is working capital | Authors' Calculations |
| INT-COV | *INTCOV_D* is a dummy variable that is equal to 1 if interest cover ratio is greater than the sample's median and 0 otherwise | Authors' Calculations |
| INT_RATE | *INT_RATE* is annual interest rates in the U.S. | World Bank |

## 3.3 Control variables

We control for different firm-level factors to assess the association between *AC* characteristics and the firm's debt choice. The control variables involve: tangibility (TANG), fixed assets growth (AGR), standard deviation of ROA based on the last five years (VOL), return on assets (ROA), leverage (LEV), natural log of total assets (LN_SIZE), natural log of firm's age (LN_AGE), market to book ratio (MTB), Z_SCORE (the formula is mentioned in Table 1), credit quality dummy (INTCOV_D), and annual interest rates in the U.S. (INT_RATE). Prior studies found that these firm characteristics have a strong influence on the firm's debt structure (Lin et al., 2013; Marshall et al., 2016). Additionally, we also control board size and board independence based on (Ghafran & O'Sullivan, 2017).

### 3.4 Empirical design

To assess the impact of various *AC* characteristics on debt structure, we estimate the below-mentioned equation using OLS regressions with robust standard errors. Following prior literature, we re-estimate Eq. (1) using Tobit regressions since our dependent variable, public debt to total debt *(PD_TD)*, is truncated between 0 at left and 1 at right. Tobit regression is a frequently used technique in the literature of debt structure (Ben-Nasr et al., 2020; Houston & James, 1996; Lin et al., 2013; Marshall et al., 2016). By following, Green and Homroy (2018), we also use industry and year fixed-effects to control time-variant and omitted variable bias.

$$PD\_TD_{i,t} = \beta_0 + \beta_1 AC\_IND_{i,t} + \beta_2 AC\_MET_{i,t} + \beta_3 FIN\_EXP_{i,t} + \beta_4 AC\_FEM_{i,t}$$
$$+ \beta_5 AC\_CHAIR_{i,t} + \beta_6 BSIZE_{i,t} + \beta_7 BIND\_BS_{i,t} + \beta_8 TANG_{i,t} + \beta_9 AGR_{i,t} + \beta_{10} VOL_{i,t}$$
$$+ \beta_{11} ROA_{i,t} + \beta_{12} LEV_{i,t} + \beta_{13} LN\_SIZE_{i,t} + \beta_{14} LN\_AGE_{i,t} + \beta_{15} MTB_{i,t}$$
$$+ \beta_{16} Z\_SCORE_{i,t} + B_{17} INTCOV\_D_{i,t} + B_{18} INT\_RATE_t + \varepsilon_{i,t}$$

**Where:**

$PD\_TD_{i,t} =$ is the ratio of public debt to total debt[3]

$AC\_IND_{i,t} =$ Natural log of the number of independent directors in the audit committee

$AC\_MET_{i,t} =$ is the number of total meetings held by the audit committee

$FIN\_EXP_{i,t} =$ is the ratio of financial experts to the total number of independent directors in the audit committee

$AC\_FEM_{i,t} =$ is the number of female directors to the total number of directors in the audit committee

$AC\_CHAIR_{i,t} =$ is dummy variable equals to 1 for audit committee chaired by the female member and 0, otherwise

$BSIZE_{i,t} =$ is the log of board size

$BSIND\_BS_{i,t} =$ is the ratio of independent directors to the total number of directors in the board

$TANG_{i,t} =$ is the ratio of net property, plant, and equipment to total assets

$AGR_{i,t} =$ is an index change in fixed assets

$VOL_{i,t} =$ is the standard deviation of *ROA* for the last five years

$ROA_{i,t} =$ is the earnings before interest and tax (EBIT) to total assets

$LEV_{i,t} =$ is the ratio of long-term debt to total assets

$LN\_SIZE_{i,t} =$ is the natural log of total assets

$LN\_AGE_{i,t} =$ is the natural log of firm's age

$MTB_{i,t} =$ is the ratio of market value of equity to book value of debt

$Z\_SCORE_{i,t} =$ is "(3.3 * EBIT/Sales + 1.0 * Sales/TA + 1.4 * RE/TA + 1.2 * WC/TA), where EBIT is earnings before interest and taxes, RE is retained earnings, and WC is working capital"

$INTCOV\_D_{i,t} =$ is a dummy variable that is equal to 1 if the interest cover ratio is greater than the sample's median, and 0 otherwise

$INT\_RATE_t =$ is annual interest rates in the U.S.

**Table 2.** Descriptive statistics.

| VARIABLES | N | MEAN | p50 | SD | p25 | p75 | MIN | MAX |
|---|---|---|---|---|---|---|---|---|
| PD_TD | 2400 | 0.814 | 0.937 | 0.254 | 0.737 | 0.997 | 0.143 | 1 |
| AC_IND | 2400 | 4.317 | 4.000 | 1.069 | 4.000 | 5.000 | 1.000 | 10 |
| AC_MET | 2400 | 8.310 | 8.000 | 2.581 | 6.000 | 10.000 | 4.000 | 16 |
| FIN_EXP | 2400 | 0.605 | 0.600 | 0.303 | 0.333 | 1.000 | 0.000 | 1 |
| AC_FEM | 2400 | 0.201 | 0.200 | 0.182 | 0.000 | 0.333 | 0.000 | 0.8 |
| AC_CHAIR | 2400 | 0.172 | 0.000 | 0.378 | 0.000 | 0.000 | 0.000 | 1 |
| BSIZE | 2400 | 2.364 | 2.398 | 0.187 | 2.197 | 2.485 | 1.609 | 2.890 |
| BIND_BS | 2400 | 0.846 | 0.889 | 0.096 | 0.800 | 0.909 | 0.231 | 1 |
| TANG | 2400 | 0.279 | 0.183 | 0.233 | 0.094 | 0.433 | 0.033 | 0.774 |
| AGR | 2400 | 1.069 | 1.045 | 0.125 | 0.994 | 1.115 | 0.876 | 1.404 |
| VOL | 2400 | 0.036 | 0.024 | 0.033 | 0.013 | 0.044 | 0.005 | 0.130 |
| ROA | 2400 | 0.106 | 0.099 | 0.066 | 0.057 | 0.144 | −0.001 | 0.253 |
| LEV | 2400 | 0.621 | 0.610 | 0.171 | 0.490 | 0.730 | 0.320 | 0.970 |
| LN_SIZE | 2400 | 9.579 | 9.541 | 1.034 | 8.756 | 10.386 | 7.844 | 11.536 |
| LN_AGE | 2400 | 3.707 | 3.555 | 0.687 | 3.135 | 4.419 | 2.708 | 4.812 |
| MTB | 2400 | 4.686 | 3.250 | 4.139 | 2.100 | 5.425 | 1.000 | 17.685 |
| Z_SCORE | 2400 | 1.947 | 1.940 | 0.921 | 1.287 | 2.576 | 0.206 | 3.723 |
| INTCOV_D | 2400 | 0.500 | 0.500 | 0.500 | 0.000 | 1.000 | 0.000 | 1 |
| INT_RATE | 2400 | 3.389 | 3.25 | 0.278 | 3.25 | 3.385 | 3.25 | 4.09 |

Note: *PD_TD* is public debt to total debt; *AC_IND* is number of independent directors in the audit committee; *AC_MET* is number of audit committee meetings; *FIN_EXP* is ratio of financial experts to total number of independent members in the audit committee; *AC_FEM* is ratio of female directors to number of independent directors in the audit committee; *AC_CHAIR* is dummy variable equals to one if the audit committee is chaired by female director and zero otherwise; *BSIZE* is log of total number of directors in the board; *BIND_BS* is ratio of independent directors in the board to total number of directors in the board; *TANG* is net property, plant and equipment scaled by total assets; *AGR* is fixed assets growth; *VOL* is standard deviation of *ROA* for the last five years; *ROA* is ratio of EBIT to total assets; *LEV* is long-term debt scaled by total assets; *LN_SIZE* is natural log of total assets; *LN_AGE* is natural log of number of years since the firm's incorporation; *MTB* is ratio of market value of equity to book value of debt; *Z_SCORE* is based on formula mentioned in Table 1; *INTCOV_D* is a dummy variable which is equal to 1 if interest cover ratio is greater than the sample's median and 0 otherwise and *INT_RATE* is annual interest rates in the U.S.

### 3.5 Summary statistics

Table 2 reports the summary statistics of the study variables. The average *PD_TD* is 81%. The more reliance of U.S. firms on public debt is consistent with the studies of Ben-Nasr (2019), Ben-Nasr et al. (2020), and Li et al. (2019). Secondly, the higher average of public debt is consistent with the notion that the larger firms use public debt, as the current study is based on a sample S&P 500. Third, the secular trend in firms' reliance on public debt over time can also be evidenced in the U.S. (Li et al., 2019). The averages of *ACI_IND, AC_MET*, and *FIN_EXP* are 4.3, 8.3 (times), and 61%, respectively. These statistics are closer to those reported in the prior studies for S&P 500 firms (Anderson et al., 2004; Tai et al., 2018). The mean of *AC_FEM* is 20%, comparable to the 16% value reported by Sun et al. (2011) using the sample of U.S. firms. Likewise, the reported mean 17% of *AC_CHAIR* states that 17% of *ACs* are chaired by the women members in S&P 500 firms.

Table 3 presents the results of the correlation matrix for the study variables. Other than the .74 correlation value of *Z_SCORE* and *ROA*, the correlations among all independent variables are under .60, indicating no multicollinearity problem in our data. The literature suggests that the correlation among the independent variables below .60 is not problematic (Usman et al., 2019). However, we also checked the multicollinearity problem using 'Variance Inflation Factor (VIF)'; the value of VIF was less than 5 for all independent variables (but not reported here). As expected, *AC_IND* positively correlates

**Table 3.** Matrix of correlations.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) PD_TD | 1 | | | | | | | | | | | | | | | | | | |
| (2) AC_IND | 0.156 | 1 | | | | | | | | | | | | | | | | | |
| (3) AC_MET | -0.057 | -0.053 | 1 | | | | | | | | | | | | | | | | |
| (4) FIN_EXP | -0.102 | -0.142 | 0.021 | 1 | | | | | | | | | | | | | | | |
| (5) AC_FEM | 0.084 | 0.067 | 0.02 | 0.061 | 1 | | | | | | | | | | | | | | |
| (6) AC_CHAIR | 0.031 | 0.084 | -0.015 | 0.059 | 0.418 | 1 | | | | | | | | | | | | | |
| (7) BSIZE | 0.112 | 0.363 | 0.117 | 0.025 | 0.092 | 0.051 | 1 | | | | | | | | | | | | |
| (8) BIND_BS | 0.062 | 0.27 | -0.074 | -0.037 | 0.044 | 0.048 | 0.072 | 1 | | | | | | | | | | | |
| (9) TANG | 0.019 | 0.116 | -0.105 | -0.119 | -0.005 | -0.046 | 0.114 | 0.002 | 1 | | | | | | | | | | |
| (10) AGR | -0.092 | -0.113 | 0.006 | 0.022 | -0.055 | -0.044 | -0.075 | -0.087 | -0.01 | 1 | | | | | | | | | |
| (11) VOL | 0.046 | -0.131 | 0.028 | -0.048 | -0.053 | 0.011 | -0.138 | -0.108 | -0.038 | 0.004 | 1 | | | | | | | | |
| (12) ROA | 0.091 | -0.034 | 0.001 | 0.026 | 0.07 | -0.012 | -0.039 | -0.122 | -0.119 | 0.018 | -0.076 | 1 | | | | | | | |
| (13) LEV | -0.003 | 0.125 | -0.06 | 0.128 | 0.052 | 0.048 | 0.13 | -0.004 | 0.096 | -0.082 | -0.095 | -0.011 | 1 | | | | | | |
| (14) LN_TA | 0.169 | 0.247 | 0.101 | -0.016 | 0.096 | -0.025 | 0.44 | 0.154 | 0.211 | -0.05 | -0.119 | -0.252 | 0.132 | 1 | | | | | |
| (15) LN_AGE | 0.08 | 0.214 | -0.105 | -0.012 | 0.124 | 0.077 | 0.275 | 0.108 | -0.017 | -0.138 | -0.15 | 0.012 | -0.022 | 0.158 | 1 | | | | |
| (16) MTB | -0.033 | -0.037 | -0.015 | 0.04 | 0.008 | 0.027 | -0.064 | -0.037 | -0.11 | 0.069 | 0.028 | 0.258 | 0.316 | -0.172 | -0.102 | 1 | | | |
| (17) Z_SCORE | 0.079 | 0.039 | -0.042 | -0.023 | 0.081 | -0.021 | 0.016 | -0.015 | -0.179 | -0.009 | -0.182 | 0.737 | -0.176 | -0.148 | 0.102 | 0.13 | 1 | | |
| (18) INTCOV_D | 0.037 | -0.021 | 0.05 | -0.04 | 0.089 | -0.008 | -0.003 | -0.016 | -0.24 | 0.031 | -0.101 | 0.554 | -0.268 | -0.079 | 0.072 | 0.104 | 0.603 | 1 | |
| (19) INT_RATE | 0.025 | 0.039 | -0.031 | 0.076 | 0.123 | 0.043 | 0.025 | 0.042 | -0.008 | 0.043 | -0.08 | -0.037 | 0.079 | 0.098 | 0.065 | 0.098 | -0.044 | -0.051 | 1 |

Note: PD_TD is public debt to total debt; AC_IND is number of independent directors in the audit committee; AC_MET is number of audit committee meetings; FIN_EXP is ratio of financial experts to total number of independent directors in the audit committee; AC_FEM is ratio of female directors to independent directors in the audit committee; AC_CHAIR is dummy variable equals to one if the audit committee is chaired by female director and zero otherwise; BSIZE is log of total number of directors in the board; BIND_BS is ratio of independent directors in the board to total number of directors in the board; TANG is net property, plant and equipment scaled by total assets; AGR is fixed assets growth; VOL is standard deviation of ROA for the last five years; ROA is ratio of EBIT to total assets; LEV is long-term debt scaled by total assets; LN_SIZE is natural log of total assets; LN_AGE is natural log of number of years since the firm's incorporation; MTB is ratio of market value of equity to book value of debt; Z_SCORE is based on formula mentioned in Table 1; INTCOV_D is a dummy variable which is equal to 1 if interest cover ratio is greater than the sample's median and 0 otherwise and INT_RATE is annual interest rates in the U.S.

with *PD_TD*, in line with **H1**. *AC_MET* is negatively correlated with *PD_TD*, which is not compatible with **H2**. In contrast to **H3**, *FIN_EXP* is negatively correlated with *PD_TD*. In line with **H4**, *AC_FEM* has a positive correlation with *PD_TD*. *AC_CHAIR* has a positive correlation with *PD_TD*, which is in line with **H5**.

## 4. Empirical results

Table 4 presents an analysis of the impact of *AC* independence (*AC_IND*), the frequency of meetings (*AC_MET*), and financial experts (*FIN_EXP*) on public debt (*PD_TD*) using OLS and Tobit regressions. Columns 1, 3, 5, and 7 report the results under the OLS method, whereas Columns 2, 4, 6, and 8 show the results using Tobit regression. As

**Table 4.** Impact of audit committee Independence, meetings and financial experts on public debt.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | OLS | TOBIT | OLS | TOBIT | OLS | TOBIT | OLS | TOBIT |
| AC_IND | 0.104*** | 0.107*** | | | | | | |
| | (0.023) | (0.028) | | | | | | |
| AC_MET | | | −0.007*** | −0.006** | | | | |
| | | | (0.002) | (0.002) | | | | |
| FIN_EXP | | | | | −0.076*** | −0.081*** | | |
| | | | | | (0.017) | (0.020) | | |
| 50%_EXP | | | | | | | −0.058*** | −0.063*** |
| | | | | | | | (0.011) | (0.013) |
| BSIZE | 0.027 | 0.021 | 0.075** | 0.069* | 0.065** | 0.062* | 0.068** | 0.065* |
| | (0.032) | (0.038) | (0.031) | (0.037) | (0.031) | (0.037) | (0.031) | (0.037) |
| BIND_BS | 0.048 | 0.006 | 0.086 | 0.049 | 0.095* | 0.050 | 0.099* | 0.054 |
| | (0.055) | (0.066) | (0.054) | (0.065) | (0.054) | (0.064) | (0.054) | (0.064) |
| TANG | −0.176*** | −0.200*** | −0.180*** | −0.202*** | −0.186*** | −0.210*** | −0.189*** | −0.213*** |
| | (0.034) | (0.041) | (0.035) | (0.041) | (0.035) | (0.041) | (0.034) | (0.041) |
| AGR | −0.116*** | −0.142*** | −0.125*** | −0.152*** | −0.121*** | −0.148*** | −0.119*** | −0.145*** |
| | (0.039) | (0.047) | (0.039) | (0.047) | (0.039) | (0.047) | (0.039) | (0.047) |
| VOL | 0.352** | 0.469** | 0.331** | 0.445** | 0.304* | 0.414** | 0.332** | 0.442** |
| | (0.167) | (0.202) | (0.167) | (0.202) | (0.167) | (0.202) | (0.167) | (0.201) |
| ROA | 0.879*** | 0.627*** | 0.895*** | 0.636*** | 0.928*** | 0.652*** | 0.933*** | 0.655*** |
| | (0.105) | (0.094) | (0.106) | (0.094) | (0.106) | (0.094) | (0.105) | (0.093) |
| LEV | −0.009 | −0.066 | −0.005 | −0.060 | 0.020 | −0.036 | 0.020 | −0.036 |
| | (0.037) | (0.044) | (0.037) | (0.044) | (0.037) | (0.045) | (0.037) | (0.044) |
| LN_SIZE | 0.044*** | 0.035*** | 0.048*** | 0.038*** | 0.047*** | 0.038*** | 0.047*** | 0.038*** |
| | (0.006) | (0.007) | (0.006) | (0.007) | (0.006) | (0.007) | (0.006) | (0.007) |
| LN_AGE | −0.007 | −0.011 | −0.009 | −0.013 | −0.006 | −0.010 | −0.006 | −0.011 |
| | (0.008) | (0.009) | (0.008) | (0.010) | (0.008) | (0.009) | (0.008) | (0.009) |
| MTB | −0.002* | −0.001 | −0.003* | −0.001 | −0.003** | −0.001 | −0.003** | −0.001 |
| | (0.001) | (0.002) | (0.001) | (0.002) | (0.001) | (0.002) | (0.001) | (0.002) |
| Z_SCORE | −0.014*** | −0.025*** | −0.015*** | −0.025*** | −0.015*** | −0.026*** | −0.015*** | −0.026*** |
| | (0.004) | (0.006) | (0.004) | (0.006) | (0.004) | (0.006) | (0.004) | (0.006) |
| INTCOV_D | −0.017 | 0.012 | −0.017 | 0.012 | −0.020 | 0.010 | −0.019 | 0.011 |
| | (0.013) | (0.015) | (0.013) | (0.015) | (0.013) | (0.015) | (0.013) | (0.015) |
| INT_RATE | 0.016 | 0.017 | 0.015 | 0.017 | 0.023 | 0.025 | 0.025 | 0.027 |
| | (0.023) | (0.027) | (0.023) | (0.027) | (0.023) | (0.027) | (0.023) | (0.027) |
| IND-FE | YES | YES | YES | YES | YES | YES | YES | YES |
| YEARS-FE | YES | YES | YES | YES | YES | YES | YES | YES |
| Constant | 0.285** | 0.560*** | 0.336** | 0.600*** | 0.287** | 0.565*** | 0.253* | 0.530*** |
| | (0.129) | (0.154) | (0.131) | (0.155) | (0.129) | (0.154) | (0.129) | (0.154) |
| $R^2$/Pseudo $R^2$ | 0.207 | 0.282 | 0.204 | 0.277 | 0.207 | 0.284 | 0.210 | 0.289 |
| Observations | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, Robust standard errors in parentheses. See, Table 1 for detail illustration of the variables. 50%_EXP; is dummy variable equals to 1, if 50% or more than 50% members of audit committee are financial experts, and zero otherwise.

mentioned above, we estimate Tobit regression because OLS estimates may be biased since our dependent variable is restricted between 0 and 1. As shown in Columns 1 and 2 of Table 4, the coefficients on *AC_IND* are significantly positive (coefficient = 0.104, *p* < 0.01, coefficient = 0.107, *p* < 0.01, respectively), which is consistent with H1. The positive impact of *AC_IND* on public debt is in line with the disciplinary power of internal governance (provided by large shareholders, independent boards, etc.), which reduces the firms' reliance on bank debt in order to avoid insulating themselves from bank monitoring. Hence, the firms having more independent directors in the *AC* do not require external monitoring and consequently rely on public debt. Likewise, the most prominent 'agency and moral hazard' models in which firms that require 'external monitoring and due diligence' rely on an 'informed lender (bank)' (Hölmstrom, 1979; Holmstrom & Tirole, 1997; Sufi, 2007) and move to the capital market after building a strong reputation (Diamond, 1991). In line with this, Denis and Mihov (2003) and Houston and James (1996) argue that the firms with intensive monitoring need (e.g., those with greater agency problems) to rely on bank debt, while firms with lower monitoring needs rely on the public debt (Denis & Mihov, 2003; Houston & James, 1996). In contrast, Columns 5 and 6 show that the coefficients on *AC_MET* are significant and negative (coefficient = −0.007, *p* < 0.01, coefficient = −0.006, *p* < 0.05, respectively). Hence, Hypothesis H2 is not supported. This result indicates that firms with active *ACs* use bank debt instead of using public debt. We consider two plausible explanations for this result. First, this finding is in line with the argument that the number of meetings increases before issuing public debt, which would then appear as a negative correlation once the debt is issued. Second, as the literature argues that the firms that rely on bank debt require intensive monitoring. On the other hand, meeting frequency is considered a most important component of *AC* effectiveness (Xie et al., 2003) and is often used as a proxy for the diligence of the *AC* (Abbott et al., 2003). Hence, in order to perform monitoring functions more diligently, the *AC* is required to meet more frequently (Sharma et al., 2009).

Similarly, the coefficients on *FIN_EXP* in Columns 5 and 6 of Table 4 are significantly negative (coefficient = −0.076, *p* < 0.01, coefficient = −0.081, *p* < 0.01, respectively), rejecting H3. This result implies that firms with a higher ratio of financial experts on their *AC* do not rely on public debt. We also confirm these findings using a dummy variable. For instance, we add a dichotomous variable equal to one if 50% or more than 50% of *AC* members are financial experts and zero otherwise. However, we find qualitatively similar findings, as shown in Columns 7 and 8 of Table 4. The negative association of *AC_FIN* with *PD_TD* may be attributed to the findings of Ghafran and O'Sullivan (2017), who argue that a lack of consensus on the exact definition of financial expertise leads academics to use different attributes to proxy for 'financial experts'; therefore, the findings cannot be easily compared. Ghafran and O'Sullivan (2017) further argue that the SEC's definition of financial experts is very broad. Similarly, Krishnan and Visvanathan (2009) investigate the impact of the SEC's narrow (only accounting experts) and broad (accounting and non-accounting) definitions on audit fees and argue that auditors who are recognised as 'only accounting experts' improve the diligence of *ACs* and; therefore, mitigate the risk of governance failure. In the current study, our proxy of

'financial experts' is also based on the SEC's broad definition of financial experts, which includes both accounting and non-accounting experts, as we collect data on *AC* characteristics from firms' proxy statements.

Table 5 lists the results of the influence of gender diversity (*AC_FEM*) and a female *AC* chair (*AC_CHAIR*) on public debt (*PD_TD*) using OLS and Tobit regression analysis. As predicted, the coefficient on *AC_FEM* in Columns 1 and 2 of Table 5 is statistically significant and positive (coefficient = 0.057, $p < 0.05$, coefficient = 0.082, $p < 0.05$, respectively). These findings remain robust after assigning a dummy variable (*FEM_D*) equal to 1 if the *AC* has at least one female member and zero otherwise, as shown in Columns 3 and 4.[4] These findings support H4 and reflect that the ratio of female directors

**Table 5.** Impact of audit committee gender diversity and gender of chair on public debt.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | OLS | TOBIT | OLS | TOBIT | OLS | TOBIT | OLS | TOBIT |
| AC_FEM | 0.057** | 0.082** | | | | | | |
| | (0.028) | (0.034) | | | | | | |
| FEM_D | | | 0.041*** | 0.053*** | | | | |
| | | | (0.011) | (0.013) | | | | |
| 2_FEM | | | | | 0.028** | 0.037** | | |
| | | | | | (0.012) | (0.015) | | |
| AC_CHAIR | | | | | | | 0.0313** | 0.0351* |
| | | | | | | | (0.0154) | (0.0181) |
| BSIZE | 0.059* | 0.056 | 0.058* | 0.054 | 0.056* | 0.045 | 0.0624** | 0.0549 |
| | (0.031) | (0.037) | (0.031) | (0.037) | (0.032) | (0.037) | (0.0314) | (0.0368) |
| BIND_BS | 0.100* | 0.056 | 0.091* | 0.047 | 0.087 | 0.055 | 0.0899 | 0.0598 |
| | (0.054) | (0.065) | (0.054) | (0.064) | (0.056) | (0.065) | (0.0563) | (0.0645) |
| TANG | −0.172*** | −0.196*** | −0.176*** | −0.201*** | −0.162*** | −0.196*** | −0.161*** | −0.195*** |
| | (0.035) | (0.041) | (0.034) | (0.041) | (0.041) | (0.041) | (0.0408) | (0.0408) |
| AGR | −0.125*** | −0.151*** | −0.124*** | −0.149*** | −0.142*** | −0.151*** | −0.141*** | −0.151*** |
| | (0.039) | (0.047) | (0.039) | (0.047) | (0.042) | (0.047) | (0.0416) | (0.0469) |
| VOL | 0.327* | 0.439** | 0.340** | 0.461** | 0.327* | 0.449** | 0.314* | 0.437** |
| | (0.168) | (0.202) | (0.167) | (0.202) | (0.184) | (0.202) | (0.183) | (0.202) |
| ROA | 0.892*** | 0.635*** | 0.862*** | 0.612*** | 0.505*** | 0.650*** | 0.502*** | 0.646*** |
| | (0.106) | (0.094) | (0.106) | (0.094) | (0.075) | (0.094) | (0.0754) | (0.0939) |
| LEV | −0.004 | −0.063 | −0.011 | −0.072 | 0.002 | −0.064 | 0.0126 | −0.0505 |
| | (0.037) | (0.045) | (0.037) | (0.045) | (0.044) | (0.045) | (0.0439) | (0.0448) |
| LN_SIZE | 0.045*** | 0.036*** | 0.045*** | 0.035*** | 0.039*** | 0.036*** | 0.0402*** | 0.0373*** |
| | (0.006) | (0.007) | (0.006) | (0.007) | (0.006) | (0.007) | (0.00622) | (0.00705) |
| LN_AGE | −0.006 | −0.011 | −0.007 | −0.013 | −0.006 | −0.010 | −0.00637 | −0.00997 |
| | (0.008) | (0.009) | (0.008) | (0.009) | (0.008) | (0.009) | (0.00781) | (0.00949) |
| MTB | −0.002 | −0.001 | −0.002 | −0.001 | −0.001 | −0.001 | −0.00163 | −0.00117 |
| | (0.001) | (0.002) | (0.001) | (0.002) | (0.002) | (0.002) | (0.00159) | (0.00169) |
| Z_SCORE | −0.014*** | −0.024*** | −0.013*** | −0.024*** | −0.015*** | −0.025*** | −0.0154*** | −0.0248*** |
| | (0.004) | (0.006) | (0.004) | (0.006) | (0.004) | (0.006) | (0.00382) | (0.00608) |
| INTCOV_D | −0.019 | 0.009 | −0.021 | 0.005 | 0.005 | 0.011 | 0.00602 | 0.0123 |
| | (0.013) | (0.015) | (0.013) | (0.015) | (0.012) | (0.015) | (0.0124) | (0.0149) |
| INT_RATE | 0.012 | 0.012 | 0.010 | 0.010 | 0.012 | 0.015 | 0.0178 | 0.0215 |
| | (0.023) | (0.028) | (0.023) | (0.027) | (0.024) | (0.027) | (0.0238) | (0.0275) |
| IND-FE | YES | YES | YES | YES | YES | YES | YES | YES |
| YEARS-FE | YES | YES | YES | YES | YES | YES | YES | YES |
| Constant | 0.305** | 0.589*** | 0.323** | 0.602*** | 0.435*** | 0.610*** | 0.386*** | 0.544*** |
| | (0.130) | (0.155) | (0.130) | (0.154) | (0.138) | (0.156) | (0.137) | (0.155) |
| $R^2$/Pseudo $R^2$ | 0.201 | 0.277 | 0.205 | 0.285 | 0.191 | 0.277 | 0.191 | 0.231 |
| Observations | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, Robust standard errors in parentheses. See, Table 1 for detailed illustration of the variables. FEM_D is dummy variable equals to 1 if the audit committee having at least one female member, and zero otherwise; 2_FEM is dummy variable equals to 1 if at least 2 members of audit committee are females, and zero otherwise

on the *AC* decreases firms' reliance on bank debt. The findings of our study lend support to the monitoring expertise of female directors that female *AC* members ensure the effectiveness of internal controls more thoroughly and strictly than male members (Parker et al., 2017), which improves the credibility of financial information (Ittonen et al., 2010), and investors' confidence in financial reporting process (Srinidhi et al., 2011). Consequently, the firms with a greater ratio of female directors on the *AC* borrow from public sources because such firms require no external monitoring by the bank. We also assign a dummy variable *(2_FEM)* equals to 1 if the *AC* consists of at least two female members and zero otherwise. However, the findings remain similar to our main results, as shown in Table 5.

Finally, we also observe a significantly positive coefficient on *AC_CHAIR* in Columns 7 and 8 of Table 5, which is in line with H5, implying that female directors and a female *AC* chair improve the information environment and disclosure quality, as the public debt market usually focuses on interpreting publicly available information. These findings support the notion that a female-led *AC* ensures the transparency of financial reporting by strengthening the internal control system (Ittonen et al., 2010; Li & Li, 2020) and is valued by the investors (Pucheta-Martínez et al., 2016), which finally helps firms in raising public debt.

Next, we move to the control variables. We find mixed results for board size *(BSIZE)* and board independence *(BIND_BS)*, as these variables remain significant in some regression models and nonsignificant in other models. However, the signs of both variables remain positive across all regressions. Overall, the positive coefficients on board size *(BSIZE)* and board independence *(BIND_BS)* are consistent with the logic that firms that have better internal governance mechanisms rely on public debt. Similarly, we find that large *(LN_SIZE)* and profitable *(ROA)* firms rely on public debt. The coefficient of growth in fixed assets *(AGR)* is statistically significant and negative, which is consistent with the financial theory that companies that are growing should rely more on bank debt, which is easier to renegotiate and can prevent debt overhang (Bolton & Scharfstein, 1996; Gertner & Scharfstein, 1991). The positive and significant coefficient on *VOL* (standard deviation of ROA for the last five years) implies that firms with more volatile earnings rely on the public debt (Marshall et al., 2016). The coefficients on *LEV, LN_AGE, MTB,* and *INTCOV_D* are negative but insignificant almost across all the regression models. Our results also show that firms with a high ratio of fixed assets to total assets (TANG) and financially distress (Z_SCORE) firms rely more on bank debt, as reported in Tables 4 and 5. Last, the coefficient on *INT_RATE* is positive but insignificant. Overall, our findings for control factors are in line with the prior literature (Boubaker et al., 2017; Lin et al., 2013; Marshall et al., 2016).

## 4.1 Robustness check

However, we also ensure the robustness of our findings in several alternate ways.

### 4.1.1 Endogeneity

To control for potential problem of endogeneity, we employ different measures based on the prior literature (Oradi & Darjezi, 2019; Usman et al., 2018). First, we run 2SLS regression by instrumenting natural log of total assets (LN_SIZE) with its lag values for

all audit committee characteristics used in this study based on the literature (Dhaliwal et al., 2010; Zalata et al., 2018).[5] In particular, while running 2SLS, first, we estimate the probability of having women in the audit committee and then we use the residuals from that estimation. Second, we use one-year lag for all audit committee characteristics (Yu, 2011). Third, the ratio of public debt to total debt is not something that is defined each period, and it usually only changes slowly over the time. Hence, we take the change in the ratio of public debt to total debt and re-estimate the baseline regressions.[6] However, the results remain qualitatively unchanged. In order to ensure the robustness of our main findings, we also introduce firm fixed effects and our main findings continue to hold. For brevity, we do not append the results of robustness but can be available upon request. We already report our findings using three different regression methods.

### 4.1.2 Probit model

The widespread empirical methodology of debt structure articulates that Logit and Probit also remain prominent models for estimating the determinants of debt choice (Ben-Nasr, 2019; Ben-Nasr et al., 2020; Bharath et al., 2008; Hadlock & James, 2002; Krishnaswami et al., 1999; Lin et al., 2013). Hence, by following prior literature, we estimate the Probit model by creating a dummy variable equals 1, if a firm has no public debt outstanding in a pertinent year and zero otherwise. This approach is based on the assumption that the firm with no public debt outstanding indicates that a particular firm has no access to public debt, or bank debt is less costly relatively to public debt (Hadlock & James, 2002). The results listed in Table 6 show that the coefficient of AC_IND remains significant and negative but the coefficient of AC_MET is insignificant but positive. Likewise, the coefficient of FIN_EXP is statistically significant and positive consistent with our main findings. The coefficients of AC_FEM and AC_CHAIR comply with our previous findings and hypotheses. To summarize, these findings imply that the results of this study are not driven by a specific method or proxy of debt choice and free from any estimation bias.

### 4.1.3 Scaling of public to total assets

To examine the firms' reliance on public debt, we re-estimate the base-line regression by scaling public debt by total assets instead of total debt by following prior research (Ben-Nasr et al., 2020; Hoshi et al., 1993). The results are the same as those of base-line regressions. We do not report these results for the sake of brevity, however, are available upon request.

### 4.1.4 Board composition

As we have already control for board size board independence in the base-line regressions. Now, we check the impact of board size board independence on public debt and find that both board components have a significant positive impact on public debt consistent with our main findings but not reported here.

## Conclusion and implications

The vast majority of the literature highlights the influence of various firm-level financial characteristics, such as firm size, firm age, credit quality, and tangibility, on debt choice. However, Lin et al. (2013) have shifted the direction of the debt choice literature from

**Table 6.** Robustness results.

| VARIABLES | 1 PROBIT | 2 PROBIT | 3 PROBIT | 4 PROBIT | 5 PROBIT | 6 PROBIT | 7 PROBIT | 8 PROBIT |
|---|---|---|---|---|---|---|---|---|
| AC_IND | −0.371*** (0.139) | | | | | | | |
| AC_MET | | 0.00794 (0.0116) | | | | | | |
| FIN_EXP | | | 0.203** (0.101) | | | | | |
| 50%_EXP | | | | 0.151** (0.0620) | | | | |
| AC_FEM | | | | | −0.427** (0.167) | | | |
| FEM_D | | | | | | −0.179*** (0.0641) | | |
| 2_FEM | | | | | | | −0.205*** (0.076) | |
| AC_CHAIR | | | | | | | | −0.129* (0.0766) |
| BSIZE | −0.122 (0.188) | −0.225 (0.184) | −0.254 (0.182) | −0.262 (0.182) | −0.231 (0.182) | −0.226 (0.183) | −0.182 (0.184) | −0.231 (0.182) |
| BIND_BS | −0.499 (0.334) | −0.726** (0.326) | −0.661** (0.325) | −0.675** (0.325) | −0.669** (0.326) | −0.633* (0.326) | −0.662** (0.325) | −0.686** (0.325) |
| TANG | 0.651*** (0.202) | 0.628*** (0.202) | 0.657*** (0.203) | 0.667*** (0.203) | 0.647*** (0.203) | 0.661*** (0.203) | 0.643*** (0.203) | 0.631*** (0.203) |
| AGR | 0.667*** (0.234) | 0.706*** (0.233) | 0.695*** (0.233) | 0.686*** (0.233) | 0.699*** (0.233) | 0.699*** (0.233) | 0.694*** (0.233) | 0.696*** (0.233) |
| VOL | −5.085*** (0.999) | −4.976*** (0.996) | −4.951*** (0.998) | −5.036*** (0.998) | −4.971*** (0.999) | −5.034*** (1.001) | −5.040*** (0.998) | −4.944*** (0.997) |
| ROA | −1.168*** (0.433) | −1.219*** (0.433) | −1.243*** (0.433) | −1.240*** (0.433) | −1.189*** (0.433) | −1.115** (0.435) | −1.279*** (0.433) | −1.221*** (0.432) |
| LEV | 1.254*** (0.221) | 1.206*** (0.220) | 1.164*** (0.221) | 1.166*** (0.221) | 1.258*** (0.221) | 1.275*** (0.221) | 1.259*** (0.221) | 1.232*** (0.220) |
| LN_SIZE | −0.231*** (0.0351) | −0.232*** (0.0352) | −0.239*** (0.0351) | −0.240*** (0.0352) | −0.231*** (0.0351) | −0.231*** (0.0351) | −0.231*** (0.035) | −0.238*** (0.0351) |
| LN_AGE | 0.250*** (0.0470) | 0.239*** (0.0472) | 0.243*** (0.0469) | 0.245*** (0.0469) | 0.254*** (0.0471) | 0.255*** (0.0471) | 0.247*** (0.047) | 0.247*** (0.0469) |
| MTB | −0.0220*** (0.00839) | −0.0220*** (0.00838) | −0.0209** (0.00839) | −0.0208** (0.00839) | −0.0234*** (0.00842) | −0.0229*** (0.00840) | −0.023*** (0.008) | −0.0224*** (0.00840) |
| Z_SCORE | 0.0278 (0.0267) | 0.0284 (0.0267) | 0.0308 (0.0267) | 0.0312 (0.0267) | 0.0261 (0.0267) | 0.0248 (0.0268) | 0.029 (0.027) | 0.0277 (0.0267) |
| INTCOV_D | −0.126* (0.0725) | −0.122* (0.0724) | −0.121* (0.0725) | −0.125* (0.0725) | −0.109 (0.0726) | −0.102 (0.0729) | −0.121* (0.072) | −0.123* (0.0724) |
| INT_RATE | 0.247** (0.136) | 0.238* (0.135) | 0.226* (0.136) | 0.221 (0.136) | 0.280** (0.136) | 0.274*** (0.136) | 0.267** (0.136) | 0.255* (0.136) |
| IND-FE | YES | YES | YES | YES | YES | YES | YES | YES |
| YEARS-FE | YES | YES | YES | YES | YES | YES | YES | YES |
| Constant | −0.0869 (0.762) | −0.0314 (0.765) | −0.0965 (0.761) | −0.00656 (0.762) | −0.263 (0.766) | −0.290 (0.766) | −0.352 (0.769) | −0.117 (0.762) |
| Pseudo R$^2$ | 0.138 | 0.136 | 0.137 | 0.138 | 0.138 | 0.138 | 0.138 | 0.137 |
| Observations | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, Robust standard errors in parentheses. See, Table 1 for detail illustration of the variables.

financial characteristics to qualitative characteristics (ownership). Thus, we complement Lin et al. (2013), who find that the ownership structure is one of the most promising factors of the debt structure. In this study, we go further by focusing on how *AC* characteristics (as the most significant factor of corporate governance) impact firms' debt choice.

For this purpose, we consider a sample of 2400 observations of 300 firms listed on the S&P 500 over the period 2010–2017. The findings of this study indicate that number of independent directors in the *AC* has a positive impact on public debt. This finding is consistent with the notion that an independent *AC* ensures the transparency of the information environment; thus, firms with a rich information environment need no external monitoring by private lenders such as banks. Unexpectedly, we discover a negative association between public debt and the frequency of *AC* meetings and the ratio of financial experts on the *AC*. Our results hold after assigning a dummy variable equal to one if the *AC* consists of at least 50% financial experts and zero otherwise. Furthermore, we show that the ratio of female directors in the *AC* and a female *AC* chair positively impact public debt. Our results also hold after assigning a dummy variable equal to one if the *AC* consists of at least one female director and zero otherwise. These findings are in line with the discussion that the participation of female members makes communication with investors more effective (Joy, 2008) and investors value the participation of female members, as female members express signal oversight and independent thinking (Adams et al., 2010a). Taken together, effective communication and effective over-sight mitigate information asymmetry and improve earnings quality (Srinidhi et al., 2011). Therefore, firms with lower information asymmetry and better earnings quality prefer public debt over bank debt. To summarise, our study contributes to the body of knowledge on debt choice by providing unique evidence regarding the influence of *AC* characteristics (the most important component of corporate governance) on firms' debt choice.

Our study also offers some important insights for policy implications. Overall, firms can substitute for bank monitoring by strengthening their internal governance through the *AC*. For instance, firms can access the public debt market by increasing the number of independent directors, improving the gender diversity of the *AC*, and appointing a female *AC* chair. As mentioned above, an effective *AC* improves the firm's financial environment, and the literature also suggests that gender diversity is considered by lenders to be a positive signal. Additionally, our study's findings support the recent legislative development regarding the representation of women on boards of directors. However, like other studies that raise concerns over the SEC's definition of financial experts, we also raise the same concern based on our findings.

We would be doing an injustice if we did not mention that our evidence from a single country is a limitation of our study's results. Single-country evidence restricts the generalisability to other settings since the credit market and governance structure of U.S. firms are different from those of the rest of the world. In the future, the same study may be conducted in under-developed economies, where firms have very limited financing options. Furthermore, since our study's findings are based on large U.S. firms, all of which probably have very good disclosure and audit standards (Leuz & Verrecchia, 2000) and very high levels of public debt issuances, the implementation of SOX made the disclosure and audit standards in the U.S. more robust. Hence, researchers may consider small and mid-cap firms in the future.

## Notes

1. Firms for which shareholders and insiders have same incentives require small size boards. Likewise, the firms (e.g., technology) which relatively requires high monitoring costs by the outsiders have more insiders the boards and on other hand, firms (e.g., grocery stores) which requires low monitoring costs by the outsiders have more outside directors in the boards.
2. We also winsorise number of audit committee meetings because of some outliers in this variable.
3. Total debt is sum of short-term and long-term debt. Similarly, public debt includes short public debt and long-term public debt. We define these measures on the basis of prior literature.
4. We assign this dummy variable on the basis of the study by Oradi and Izadi (2019).
5. Using natural log of total assets is on the logic of literature that larger firms have more independent directors, financial experts and female directors in the audit committee.
6. We are grateful to the anonymous reviewer for suggesting this point.

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## Disclosure statement

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