Summer 8-5-2019

Corporate Leverage, Constraints, and Compliance

Abdullah Khaled Alnamlah
University of New Orleans, akalnaml@uno.edu

Corporate Leverage, Constraints, and Compliance

A Dissertation

Submitted to the Graduate Faculty of the
University of New Orleans
in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy
in
Financial Economics

by

Abdullah Alnamlah

B.S. Imam University, 2011
M.B.A. Chapman University, 2015
M.S. University of New Orleans, 2017

August, 2019

Acknowledgment

I am very thankful to my advisor, Professor M. Kabir Hassan, for his support. I also extend my gratitude to my committee members: Professor Walter Lane, Professor Arja Turunen-Red, and Professor Duygu Zirek. Finally, I thank all members of the University of New Orleans and Imam University as well as my wife, family, classmates, and friends for their support and feedback.

Table of Contents

List of Tables and Figures

Abstract

The first chapter evaluates the zero-leverage effect on firms' financial constraints. Moreover, using investment- and cash-to-cash-flow sensitivities as financial constraint indicators, the results suggest that unleveraged firms are expected to face lower constraints relative to leveraged firms. Lastly, the results indicate that the zero-leverage effect on firms' financial constraints is more likely stronger for smaller firms, zero-dividend firms, firms with lower proportions of tangible assets, and growth firms. The second chapter develops a new quantitative measure that reflects the extent to which a firm complies to Shariah relative to the other firms located in a certain region at a certain time. This measure can be customized to be consistent with each investor's objectives, constraints, and beliefs. We argue that the use of this measure is preferable to the existing use of ratio thresholds for the following two reasons. First, it is more Shariah-appropriate because it provides the Shariah-compliant investor with a clear understanding of the *relative* compliance status of each firm he wishes to invest in. Second, it can be incorporated into any portfolio optimization model to create a balance between improving Shariah compliance and not compromising investment returns.

JEL Classification: G31, G32, G33.

Keywords: leverage, financial constraints, zero leverage, equity screens, compliance.

CHAPTER 1

The Zero Leverage Effect on Firms' Financial Constraints

1. Introduction:

Agency problems and capital market imperfections (i.e., information asymmetries, transaction costs, taxes, etc.) make the costs of external capital greater than the opportunity cost of internal finances. As a result, firms will start financing their current and future investments using their internally generated funds. When internal finances are exhausted, the potential returns of the remaining investment opportunities are compared to the costs of external capital. If the potential returns are lower than the costs of external funds, firms will forgo some of their profitable investments. The above discussion explains why firms can be financially constrained and why firms' investments may be sensitive to the extent of internal finances.

Empirical studies show that certain firm characteristics could potentially mitigate the severity of a firm's financial constraints. Examples of such characteristics include firms with concentrated ownership, firms with management ownership, firms with high credit rating, large mature firms, multidivisional firms, and bank-connected firms. Obviously, financial constraints of firms lacking the above characteristics are more likely to be higher. Connecting between the theoretical explanations and the empirical findings, it seems clear that the above-mentioned firm characteristics do mitigate financial constraints by loosening the effects of agency problems and/or capital market imperfections. For example, Brennan and Hughes (1991) imply that larger corporations have fewer information asymmetries than smaller companies, making them more financially flexible and reducing their external financing costs. Consistent with this view, Fazzari et al. (1988) hypothesize that investment-to-cash-flow sensitivity increases as market financial frictions increase.

To our knowledge, the previous literature did not explicitly examine the level of financial constraints in zero-leverage (hereafter, ZL) firms. This study contributes to

the corporate finance literature by evaluating firms' financial constraint status across different sorts of zero- and low-leveraged firms. Over the previous few decades, researchers have proposed many financial constraint indicators. One commonly used constraint indicator is a firm's leverage ratio. Due to bankruptcy costs, companies with higher leverage outstanding are likely to have limited access to external capital and thus greater levels of financial constraints. However, several researchers document that leverage's endogeneity feature can lead to a complex non-monotonic relationship between financial constraints and leverage (e.g., Hennessy and Whited, 2007; Acharya et al., 2007). So, we argue that to understand how firms' financial constraints are associated with leverage, one needs to investigate the level of constraints across different sorts of unlevered firms using several dimensions pertaining to research methodology.

We argue that the ZL effect on firms' financial constraints is expected to vary depending on the firm lifecycle stage. For example, the ZL effect is expected to decrease as firms move towards their mature lifecycle stage. Firms in their startup or early growth stages are expected to have financial constraint levels that are extremely susceptible to leverage levels. As firms become more mature, their financial constraint levels become less affected by leverage levels. Since gauging financial constraints is crucial in this paper, we use multiple approaches for gauging financial constraints. First, we measure the ZL effect on investment- and cash-to-cash-flow sensitivities. Next, using a three-way interacted multivariate regression model, we test whether the ZL effect on investment- and cash-to-cash-flow sensitivities is different for smaller firms, zero-dividend firms, firms with lower proportions of tangible assets, and growth firms compared to larger firms, dividend-paying firms, firms with higher proportions of tangible assets, and value firms, respectively.

This paper is motivated by Strebulaev and Yang (2013), who suggest that family-companies and companies with higher management ownership likely to have lower

levels of leverage. Managers with substantial ownership are expected to be under-diversified, making their personal distress costs relatively-higher. Similarly, family members focus on maintaining the family legacy and hence try to avoid leverage due to their desire for long-term survival. Strebulaev and Yang argue that firms' governance characteristics and ownership structure are important determinants of the ZL phenomena. But there are also other possible determinants. Investigating the level of constraints within different groups of unlevered firms may contribute to understanding the motives of following conservative debt policies.

This paper hypothesizes that, on average, unlevered firms are expected to face lower financial constraints relative to leveraged firms. Moreover, the ZL effect on firms' financial constraints is more likely to be weaker for smaller firms, zero-dividend firms, firms with lower proportions of tangible assets, and growth firms. Using two alternative financial constraint measures, the results indicate that unleveraged firms have lower levels of financial constraints relative to leveraged firms. Furthermore, the negative ZL effect on firms' financial constraints is weaker for larger firms, dividend-paying firms, firms with higher proportions of tangible assets, and value firms. The results are consistent with the debt overhang theory that explains how the existence of leverage can reduce firms' value by weakening their incentive for undertaking profitable future investments (Myers, 1977). Moreover, the results suggest that firms in their early lifecycles should avoid increasing their leverage levels. This will allow them to overcome the effects of financial constraints and to utilize their valuable future investment opportunities. Finally, the results have vital implications. For example, several studies hypothesize that firms' financial constraints can have considerable effects on firms' investments, capital structure, and stock returns (e.g., Lamont et al., 2001; Hennessy and Whited, 2007).

The paper is organized as follows. Section two highlights some of the capital market imperfection theories and discusses some of the empirical studies that relate to financial constraints. Section three develops our research hypothesis. Section four

presents the data sources and methodology. Section five analyzes and reports the results. Section six concludes.

2. Theoretical Aspects and Literature Overview:

2.1. The theoretical explanation:

Modigliani and Miller (1958) traditional neoclassical investment theory implies that, in a perfect capital market, companies undertake any profitable project and the choice of financing mix is irrelevant. According to this theory, internal funds' availability does not affect investment decisions. Managers perceive the opportunity cost of internally generated funds to be the market interest rate, and they can lend and borrow at this rate. With capital market imperfections, however, prices and interest rates do not fully adjust to allow firms to undertake all desired investments. Under these circumstances, firms' investment and financing decisions are interdependent. If firm insiders have better information about the firm's risk and return than do potential investors, then external financing costs will increase relative to internal financing.

The primary insight on the effects of asymmetric information comes from Akerlof's (1970) analysis of the "lemons" problem, in which the vendors of a product have more information about its quality than do purchasers. Since outsiders cannot differentiate between good and bad investment projects, they will require higher returns from good projects to cover the losses incurred from inadvertently purchasing bad ones. Hence, insufficient internally generated funds may constrain future corporate investments. A firm is deemed as financially constrained when negative shocks decrease its investment spending. This is either because the firm cannot continue drawing from its relatively-inexpensive internal finances, or because lower collateral increases external financing costs (Fazzari et al., 1988).

Aside from information asymmetry, other frictions (e.g., tax advantages, transaction costs, agency problems, and financial distress costs) could also contribute

to explaining why external capital costs more than internally generated funds. The design of the corporate tax systems has historically brought a cost advantage to internal finances over external finances. Moreover, new share issues of seasoned equity are associated with a variety of transaction costs, including underwriting discounts, registration fees, and administrative expenses. Costs associated with monitoring and controlling the agency problems also contribute to increasing the total costs of raising external capital. The agency costs of equity arise from conflicts between shareholders who are focused on wealth maximization and managers who are focused on maximizing their personal control and power. Similarly, the agency cost of debt arises from the debt contracts' limited liability feature that incentivizes firm managers to make decisions that contradicts the lenders' interests. Finally, bankruptcy and financial distress costs, which arises when a firm has difficulties meeting its payment obligations, also contribute to increasing external financing costs.

1.2. An empirical overview:

This section will briefly highlight some of the empirical studies that examine firms' financial constraint status under different circumstances. The empirical findings suggest that certain firm-specific characteristics could potentially mitigate the severity of financial constraints by loosening the effects of agency problems and/or capital market imperfections. Examples of such characteristics include firms with concentrated institutional ownership, firms with management ownership, firms with high credit rating, dividend-paying firms, large mature firms, multidivisional firms, and bank-connected firms.

1.2.1. Ownership structure:

Jensen and Meckling (1976) focus on the conflict of interest that may occur between managers and shareholders. Managers have incentives to exploit firm assets for empire building or as perquisites. But managerial ownership may actually help align the interests of shareholders and managers, lowering agency and external

financing costs (Morck et al., 1988). However, as managerial ownership increases, monitoring managers becomes difficult because managers will have greater control over the company (McConnell and Servaes, 1990). Hence, at lower percentages of managerial ownership, the incentive alignment effect is expected to mitigate firms' financial constraints. But, after a certain percentage of managerial ownership, the entrenchment effect is expected to impair firms' ability to raise external finances (Hermalin and Weisbach, 1991).

Shleifer and Vishny (1986) imply that large stockholders with concentrated ownership have greater incentive to monitor the behavior of managers than minority stockholders. Hence, agency cost models predict that a more concentrated ownership structure decreases in the severity of financial constraints. Large stockholders, however, enjoy private control benefits that minority stockholders lack (Shleifer and Vishny, 1997). Consequently, large stockholders might have motives to hold more cash to consume their private control benefits (Faccio et al., 2001). Ozkan and Ozkan (2004) test which of the two ownership concentration effects (i.e., the monitoring effect or the private benefits effect) dominates the other. Their results suggest that concentrated ownership in itself insignificantly impacts firms' cash holdings. However, their results indicate that controlling owners' type impacts cash holdings. They find that controlling family firms are likely to hold more cash than controlling institutional firms. Furthermore, Faccio and Lang (2002) claim that controlling institutional owners are likely to provide more effective monitoring of the management than those of controlling family owners. The above studies suggest that, because they are better monitors, controlling institutional shareholders improve firms' abilities to raise external finances. Controlling family owners, on the other hand, avoid high external financing costs by holding more cash. They may, in some cases, impair firms' access to external capital due to the private benefit incentives certain family owners are subject to.

1.2.2. Dividend-paying firms:

Noting that constrained companies are not in a condition to distribute considerable amounts of dividends, Fazzari et al. (1988) categorized companies based on their payout behavior and find that cash flow sensitivity of investment is higher for companies that retain almost-all their income. Hennessy and Whited (2007) divided their sample according to firm size and dividends payouts, then evaluate external financing costs across different types of firms. They find that both large firms and high-dividend paying firms are expected to bear lower external financing costs. Ozkan and Ozkan (2004) indicate that companies with high dividends payout ratios have greater financial flexibility since they can internally raise the needed capital by cutting dividends. But dividends tend to be sticky, meaning that most companies are unwilling to cut specified dividends (Brav et al., 2005). This makes it hard for companies to rely on dividends cuts as a form of internal financing. Constraint-inducing economic shocks, however, may force firms to cut dividends if the costs associated with dividends cuts are lower than external financing costs. The above studies suggest that high dividend-paying firms may indeed be less financially constrained, but there are costs associated with dividends cuts that restrain the reliance of such cuts.

2.2.3. Large and mature firms and firms with high credit rating:

Gilchrist and Himmelberg (1995) find that cash flow sensitivity of investment is greater in small firms and firms with neither commercial paper ratings nor bond ratings, while they do not find significant sensitivities for large firms and firms with credit ratings. Other studies grouping firms by size, age, and bond rating, also support the view that small, immature firms and firms with low credit ratings face limited access to external capital (e.g., Devereux and Schiantarelli, 1990; Schaller, 1993; Chirinko and Schaller, 1995). Consistent with these studies, Vasan and Srini (1987) find that internal finances are more volatile over the business cycle in smaller firms. They show that because smaller companies have limited access to external finances during downturns than larger companies, business recessions are likely to

have a higher impact on their growth rates and investment behavior. Finally, Brennan and Hughes (1991) imply that large companies have fewer information asymmetries than small companies, suggesting that small companies may face additional external financing costs (Whited, 1992; Kim et al., 1998).

2.2.4. Multidivisional firms:

Unlike specialized firms, diversified firms are expected to have non-core segment assets that can be sold, making them less susceptible to financial distress. Specialized firms, on the contrary, are often liquidated during financial distress (Titman and Wessels, 1988). Moreover, since divisions of diversified companies have imperfectly correlated cash flows, low growth divisions' cash flows can be used to subsidize high growth low cash flow divisions (Subramaniam et al., 2011). The above arguments suggest that diversification has the effect of reducing the severity of firms' financial constraints. Supporting this view, Tong (2011) documents that cash's value is considerably lower in diversified companies than in specialized companies. In a more recent study, Erel et al. (2015) test the claim that acquisitions mitigate firms' financial constraints in target firms. They find that target firms' cash holdings, cash flow sensitivity of cash, and cash flow sensitivity of investment all decline, whereas investments increase following an acquisition. Likewise, Matvos et al. (2017) imply that diversified corporations increase their scope during times of rising external financial frictions. Their evidence supports the view that firms diversify in response to constraint-inducing capital markets.

2.2.5. Bank-connected firms:

Berlin and Loeys (1988) claim that bank lending can reduce agency problem and information asymmetry costs. This is primarily because banks have a comparative advantage in monitoring managers' actions and in analyzing information. Supporting this view, Fama (1985) suggests that banks can access private information and collect information at lower costs. Furthermore, James (1987) imply that bank credit agreement announcements convey positive signals regarding the credit-worthiness of

the borrowing firms. These studies imply that firms with greater bank debt are likely to be less financially constrained.

2.3. Cash holdings and financial constraints:

Capital market imperfections explain why some companies hold sizeable amounts of cash despite the opportunity costs associated with such holdings. In addition to the opportunity cash-holding costs, Jensen (1986) suggests that entrenched managers may waste firms' free cash flows by investing in nonprofitable projects. In view of this, Opler et al. (1999) suggest that management should set cash holdings at a level where the holdings marginal benefit equals the holdings marginal cost. The two major benefits of holding cash are emphasized by Keynes (1936), which are the costs and precautionary motives. The costs motive points out the capacity of a firm facing internal resource shortages to avoid additional costs associated with selling assets or raising external finances. The precautionary motive focuses on the costs resulting from unanticipated contingencies and foregone investments. More recently, Faulkender and Wang (2006) report that cash holdings marginal benefit is higher for firms with greater external financing costs than those with lower costs.[1]

Fama and French (2001) claim that dividend payouts are negatively related to market to book ratio. In this view, Ozkan and Ozkan (2004) propose high growth firms are likely to hold more cash to minimize foregone investment costs. Similarly, Faulkender and Wang (2006) suggest that the cash's value is higher for companies with good investment opportunities. These studies imply that firms with greater external financing costs and firms with good investment opportunities should hold more cash.[2]

[1] See also Pinkowitz and Williamson (2006).
[2] See Kaplan and Zingales (1997), Denis and Sibilkov (2010), and Almeida et al. (2011).

2.4. Leverage and financial constraints:

One commonly used proxy for financial constraints is a firm's leverage ratio. Due to bankruptcy costs, highly leveraged firms are likely to have greater external financing costs. Many financial constraints indexes (e.g., the Kaplan and Zingales (1997) index, the Cleary (1999) index, and the Whited and Wu (2005) index) use low leverage as an indicator for firms being less constrained. However, as suggested by Hennessy and Whited (2007), the use of leverage, in this case, is misleading because if bankruptcy costs increase, firms will optimally substitute equity for debt making them falsely appear less constrained. Moreover, several studies cast doubts about the use of leverage as an indicator of firms' financial constraints. Hadlock and Pierce (2010) document that leverage's endogeneity feature can lead to a complex non-monotonic relationship between financial constraints and leverage.

In the same spirit, Almeida et al. (2011) point out that firms can be financially constrained during normal times even if they have low leverage ratios. Consider the case of a small firm in an emerging economy that have very limited access to external finances and hence chooses to have low levels of leverage. Large highly-leveraged US firm, on the other hand, may easily raise external capital to fund any profitable investment opportunity. Finally, some companies may deviate from their ideal capital structure and choose not to lever up for governance considerations (Strebulaev and Yang, 2013). After investigating the economic factors that motivate companies to become zero leveraged, Strebulaev and Yang indicate that family companies and companies with higher management ownership are expected to have lower levels of leverage.

In an attempt to further examine the relation between leverage and financial constraints, several studies imply that leverage imposes constraints only for companies with weak growth opportunities (e.g., Lang et al., 1996; Aivazian et al., 2005). For diversified companies, Lang et al. (1996) document that leverage does not reduce growth for segments with strong growth opportunities but is negatively related

to growth for segments with weak growth prospects. This is because strong growth opportunities are expected to generate higher cash flows, allowing companies to easily refinance and recapitalize in the capital market. Weak growth opportunities, in the contrary, may not be sufficient to overcome the debt overhang problem or may not be recognized by external capital markets. Aivazian et al. (2005) document similar evidence using information on Canadian publicly traded companies. In contrast to these studies, McConnell and Servaes (1995) claim that leverage prompts underinvestment by showing that leverage is negatively related to corporate value for companies with strong growth prospects. McConnell and Servaes also imply that leverage mitigates overinvestment by reporting that leverage is positively related to corporate value for companies with weak growth prospects. Consistent with the underinvestment hypothesis, Acharya et al. (2007) suggest that constrained firms that anticipate strong growth prospects direct most of their excess cash flows towards reducing leverage.

3. Research Hypotheses:

Myers (1977) demonstrates that leverage increases the probability of financial distress and debt overhang, creating a tendency for firms to make decisions that are undesirable to debtholders. Moreover, Altman (1984) suggest that leverage can also result in direct and indirect bankruptcy costs, impairing access to external finances[3]. Hence, due to bankruptcy and financial distress costs, firms with high leverage outstanding are generally expected to have lower debt capacity and greater external financing costs. Based on these observations, we suggest the following hypothesis:

H1: On average, unlevered firms are expected to face lower financial constraints relative to levered firms, all things being equal.

[3] As documented by Altman (1984), indirect bankruptcy costs can include profits that a firm is expected to earn if there was no bankruptcy potential. The direct bankruptcy costs consist of accounting, legal, and other managerial costs.

Brennan and Hughes (1991) suggest that as companies grow in size, their information asymmetries tend to decrease. This implies that small firms may face greater costs of debt financing because lenders cannot distinguish between good and bad investments (Whited, 1992; Kim et al., 1998). Moreover, Vasan and Srini (1987) find that smaller firms' internal cash-flows are more volatile over the business cycle than in larger firms. Hence, smaller firms will have very limited access to credit during economic downturns because their likelihood of bankruptcy is higher. This suggests that small firms are expected to have financial constraint levels that are extremely vulnerable to their leverage levels[4]. Additionally, Titman and Wessels (1988) imply that large diversified firms have greater financial flexibility than small specialized firms, making them less likely to experience bankruptcy or financial distress[5]. This is because, if need be, large diversified firms are capable of (1) selling off some of their non-core segments or (2) subsidizing low-cash-generating-segments using funds from high-cash-generating-segments. This implies that large diversified firms' financial constraint levels are less prone to their leverage levels. Based on these observations, we suggest that:

H2: All things being equal, the ZL effect on firms' financial constraints is more likely to be weaker for larger firms relative to smaller firms.

Ozkan and Ozkan (2004) suggest that firms that pay dividends are less financially constrained since they have the capacity for cutting back their dividends to fund profitable investments opportunities. Furthermore, Hennessy and Whited (2007) document that dividend-paying firms face lower costs of external capital relative to zero-dividend firms. Moreover, Fazzari et al. (1988) imply that dividend-paying firms' cash flow sensitivity of investment is lower compared to zero-dividend firms. Lastly,

[4] Schaller (1993), Devereux and Schiantarelli (1990), Chirinko and Schaller (1995), and Hadlock and Pierce (2010) also document evidence suggesting that smaller firms have lower capital access relative to larger firms.

[5] Erel, Jang, and Weisbach (2015) and Matvos et al. (2017) also document evidence suggesting that diversified corporations are less financially constrained relative stand-alone companies.

noting that they enjoy greater flexibility in dealing with financial contingencies, the bankruptcy likelihoods of firms that pay dividends are expected to be lower relative to zero-dividend firms. This indicates that dividend-paying firms' financial constraint levels are less susceptible to their leverage levels. Based on these observations, we hypothesize that:

H3: All things being equal, the ZL effect on firms' financial constraints is more likely to be weaker for dividend-paying firms compared to zero-dividend firms.

Harris and Raviv (1991) claim that there is a consensus that leverage tends to increase with fixed tangible assets. This is because tangible assets are in effect better collateral. Moreover, firms with valuable tangible assets enjoy greater financial flexibility because they can sell off some of their less-efficient assets to meet debt obligations or to finance good investment opportunities (Shleifer and Vishny, 1992). Hence, tangible assets decrease firms' bankruptcy likelihoods. This suggests that firms with high tangibility have financial constraints that are less sensitive to their leverage levels. Based on these observations, we hypothesize that:

H4: All things being equal, the ZL effect on firms' financial constraints is more likely to be weaker for firms with high tangibility compared to firms with low tangibility.

Myers' (1977) debt overhang theory explains how corporate leverage can reduce firms' value by weakening their incentive to undertake good future investments. This happens because part of the investments' profits must first be collected by debt-holders, leaving equity-holders with lower profits[6]. Myers also explains why managers often set firms' target leverage ratios relative to book as opposed to market values. This is because the amount of corporate leverage collateralized by existing assets will be more than is collateralized by future growth. Consistent with the debt

[6] or no profits in cases when the debt overhang is significant and/or when profits are low.

overhang theory, Lang et al. (1995) document a negative relation between future growth and leverage that holds regardless of which proxies used to estimate growth[7]. Hence, based on the view that growth opportunities may not be regarded as adequate collateral, may not be sufficient to overcome the debt overhang problem, or may not be recognized by external capital markets, we suggest the following hypothesis:

H5: All things being equal, the ZL effect on firms' financial constraints is more likely to be weaker for value firms compared to growth firms.

4. Data and Methodology

We use merged annual Compustat and CRSP for our accounting and financial dataset over the period 1965–2017. We exclude financial, utility, non-US, and non-publicly traded firms[8]. Following most recent capital structure papers[9], the book leverage ratio in year t of firm i is defined as follows:

$$BL_{it} = \frac{DLTT_{it} + DLC_{it}}{AT_{it}} \qquad (1)$$

Where AT refers to total assets. $DLTT$ refers to long-term debt and DLC refers to short-term debt. The market leverage ratio in year t of firm i is defined as follows:

$$ML_{it} = \frac{DLTT_{it} + DLC_{it}}{DLTT_{it} + DLC_{it} + (CSHO_{it} \times PRCC\_F_{it})} \qquad (2)$$

[7] Aivazian and Qiu (2005) and Ahn, Denis, and Denis (2006) also suggest that leverage is negatively associated with firms' future investments and growth.
[8] We exclude SIC codes from 6000 to 6999 for financial firms and codes from 4900 to 4999 for utility firms. Firms with FIC not equal to "USA" are also excluded. Finally, non-publicly traded firms with STKO equal to one and two are excluded as well.
[9] See Lemmon et al. (2008); Lemmon and Zender (2010); Leary and Roberts (2010); Graham and Leary (2010); and Strebulaev and Yang (2013).

Where *CSHO* refers to year-end share price and *PRCC_F* refers to year-end shares outstanding. Following, we present the two approaches used for assessing the level of financial constraints in ZL and AZL firms.

4.1. Cash flow sensitivity of cash:

Almeida, Campello, and Weisbach (2004) posit a model in which cash-to-cash-flow sensitivity can be used to measure a firm's financial constraint status. They imply that constrained firms' cash savings should increase when cash flows are greater, while unconstrained firms' cash holdings are unassociated to changes in cash flows. Almeida et al. categorize firms according to constraint indicators using five alternative methods: asset size, dividend payout ratios, commercial paper ratings, bond ratings, and the KZ index. They find, for each of the first four methods, that cash flow sensitivity of cash is almost-zero for unconstrained firms, but positive for constrained firms Almeida.

Following Almeida, Campello, and Weisbach (2004) and Erel et al. (2015), the dependent variable of our regression is the change in the cash-to-assets' ratio. We use the subsequent regression to assess the ZL effect on cash flow sensitivity of cash:

$$\Delta\left(\frac{Cash}{Assets}\right)_{it} = \alpha_0 + \beta_1 ZL_{it} + \beta_2 \left(\frac{Cash\ Flow}{Assets}\right)_{it} + \beta_3 (ZL_{it})\left(\frac{Cash\ Flow}{Assets}\right)_{it} + \sum_{j=4} \beta_j CONTROLS_{jit} + \delta_s + \delta_t + \varepsilon_{it} \qquad (5)$$

Where *ZL* is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. δ_s are sector binary variables controlling for sector fixed effects; δ_t are year binary variables controlling for year fixed effects. We include various firm-specific variables to control for other variables affecting the change in the cash-to-assets' ratio. Namely, we include total assets, equity capitalization, age, number of employees, sales growth, market-to-book ratio, sales-to-assets, dividend-to-assets, dividend binary variable, cash-to-assets, investment-to-assets, asset sale-to-assets, EBITDA-to-assets, share repurchases-to-assets, taxes paid-to-assets,

tangibility, and R&D-to-sales. We expect the coefficient on the *ZL* binary variable interacted with cash flow to be negative, indicating that unlevered firms are more likely to have lower cash flow sensitivity of cash (i.e., lower financial constraints) compared to leveraged firms.

Next, to test whether the ZL effect on cash flow sensitivity of cash is lower for larger firms, dividend-paying firms, firms with high tangibility, and value firms, we use the following three-way-interacted-multivariate regression:

$$\Delta\left(\frac{Cash}{Assets}\right)_{it} = \alpha_0 + \beta_1 ZL_{it} + \beta_2 \left(\frac{Cash\ Flow}{Assets}\right)_{it} + \beta_3 (ZL_{it})\left(\frac{Cash\ Flow}{Assets}\right)_{it} + \beta_4\, 3rdI_{it} + \beta_5 (3rdI_{it})\left(\frac{Cash\ Flow}{Assets}\right)_{it} + \beta_6 (ZL_{it})(3rdI_{it}) + \beta_7 (ZL_{it})(3rdI_{it})\left(\frac{Cash\ Flow}{Assets}\right)_{it} + \sum_{j=8} \beta_j CONTROLS_{jit} + \delta_s + \delta_t + \varepsilon_{it} \qquad (6)$$

Where *3rdI* is the third interacted binary variable. Our tests require for the above regression to have four separate formats. In the first format, we test whether the ZL effect on cash flow sensitivity of cash is lower for larger firms relative to smaller firms. Here, *3rdI* equals one if a firm-year observation's total assets value is above the mean sample's total assets and zero otherwise. In the second format, we test whether the ZL effect on cash flow sensitivity of cash is lower for dividend-paying firms relative to zero-dividend firms. Here, *3rdI* equals one if a firm-year observation has positive dividend and zero otherwise. In the third format, we test whether the ZL effect on cash flow sensitivity of cash is lower for firms with high tangibility relative to firms with low tangibility. Here, *3rdI* equals one if a firm-year observation's fixed-assets-to-assets ratio is above the mean sample's ratio and zero otherwise. In the last format, we test whether the ZL effect on cash flow sensitivity of cash is lower for value firms relative to growth firms. Here, *3rdI* equals one if a firm-year observation's market-to-book ratio is below the mean sample's ratio and zero otherwise

In all three formats, we expect the three-way-interacted-coefficient, β_7, to be negative. This indicates that the ZL effect on firms' cash flow sensitivity of cash is

weaker for larger firms, dividend-paying firms, firms with high tangibility, and value firms.

4.2. Cash flow sensitivity of investment:

Fazzari et al. (1988) develop a model in which financial constraints is measured by firms' investment-to-cash-flow sensitivity. The idea is that for a financially constrained firm, cash flow growths will allow it to take on more investments. Unconstrained firms' investments, on the contrary, will not change with changes in cash flows. Here, we use a similar model as for the cash-to-cash-flow sensitivity with only one change. Namely, we use investment-to-assets ratio as the dependent variable rather than the change in the ratio of cash-to-assets.

$$\left(\frac{Investment}{Assets}\right)_{it} = \alpha_0 + \beta_1 ZL_{it} + \beta_2 \left(\frac{Cash\ Flow}{Assets}\right)_{it} + \beta_3 (ZL_{it})(\frac{Cash\ Flow}{Assets})_{it} + \sum_{j=2} \beta_j CONTROLS_{jit} + \delta_s + \delta_t + \varepsilon_{it} \qquad (7)$$

Again, we expect the coefficient on *ZL* binary variable, β_3, interacted with cash flow-to-assets to be negative, indicating that unleveraged firms have, on average, lower investment-to-cash-flow sensitivity relative to leveraged firms. Additionally, we run four formats of the three-way-interacted-multivariate regression to test whether the ZL effect on investment-to-cash-flow sensitivity is lower for larger firms, dividend-paying firms, firms with high tangibility, and value firms.

$$\left(\frac{Investment}{Assets}\right)_{it} = \alpha_0 + \beta_1 ZL_{it} + \beta_2 (\frac{Cash\ Flow}{Assets})_{it} + \beta_3 (ZL_{it})(\frac{Cash\ Flow}{Assets})_{it} + \beta_4\, 3rdI_{it} + \beta_5 (3rdI_{it})(\frac{Cash\ Flow}{Assets})_{it}$$
$$+ \beta_6 (ZL_{it})(3rdI_{it}) + \beta_7 (ZL_{it})(3rdI_{it})(\frac{Cash\ Flow}{Assets})_{it} + \sum_{j=8} \beta_j CONTROLS_{jit} + \delta_s + \delta_t + \varepsilon_{it}$$

We expect the three-way interacted coefficient, β_7, to be negative in all four formats, indicating that the ZL effect on firms' cash flow sensitivity of investment is weaker for larger firms, dividend-paying firms, firms with higher proportions of tangible assets, and value firms.

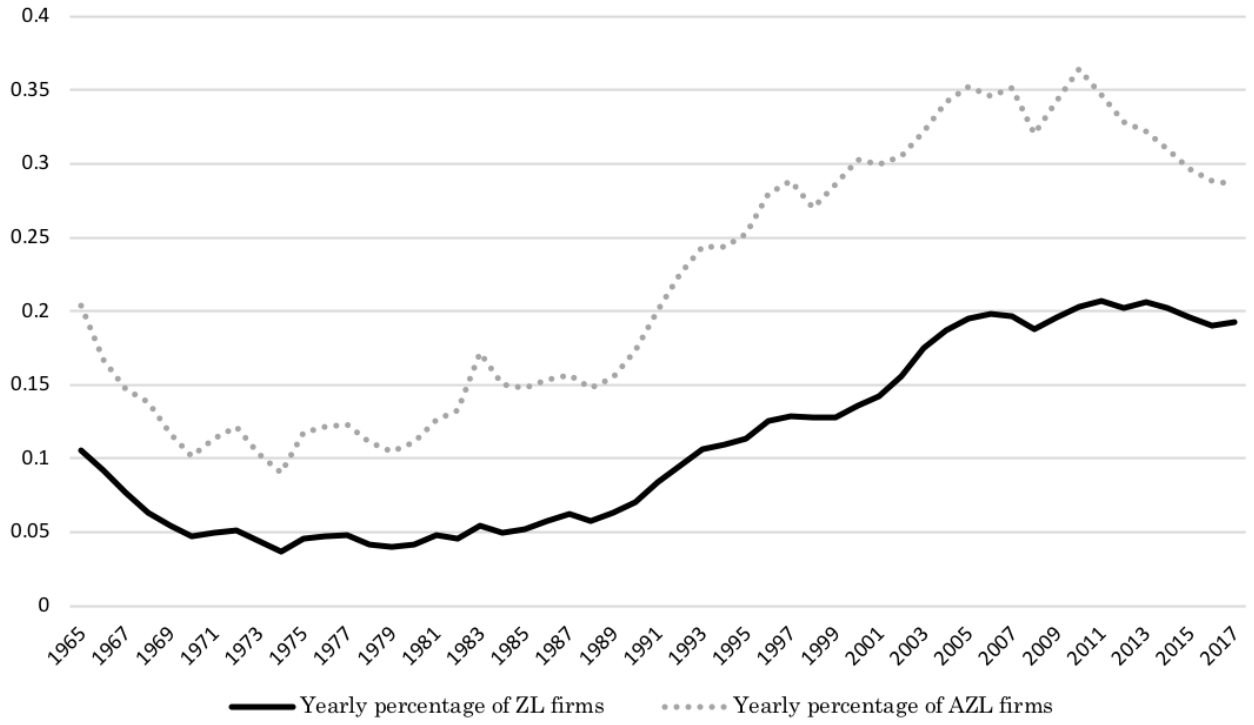
TABLE 1.1: YEARLY FREQUENCIES OF ZL AND AZL FIRMS

This table displays the yearly frequencies of ZL and AZL firms from 1965 to 2017. ZL (zero leveraged) firms are firms that have a yearly book leverage ratio of zero. AZL (almost-zero-leveraged) firms are firms that have a yearly book leverage ratio below 5%. Column Obs. reports the number of firms in a given year in the sample. Financial firms, utility firms, non-US firms, and non-publicly traded firms are excluded.

Year	ZL	AZL	Obs.	Year	ZL	AZL	Obs.
1965	0.1053	0.2040	1539	1992	0.0952	0.2253	4190
1966	0.0918	0.1669	1678	1993	0.1059	0.2439	4543
1967	0.0767	0.1467	1813	1994	0.1097	0.2437	4851
1968	0.0628	0.1381	2231	1995	0.1138	0.2527	5402
1969	0.0546	0.1165	2454	1996	0.1257	0.2799	5737
1970	0.0468	0.1016	2520	1997	0.1290	0.2885	5751
1971	0.0492	0.1132	2641	1998	0.1277	0.2700	5738
1972	0.0512	0.1217	2793	1999	0.1281	0.2858	5692
1973	0.0443	0.1027	2932	2000	0.1355	0.3028	5367
1974	0.0367	0.0902	3270	2001	0.1422	0.2998	4796
1975	0.0453	0.1175	3243	2002	0.1555	0.3052	4522
1976	0.0468	0.1212	3267	2003	0.1748	0.3220	4366
1977	0.0478	0.1231	3242	2004	0.1871	0.3419	4308
1978	0.0416	0.1110	3171	2005	0.1951	0.3520	4275
1979	0.0397	0.1048	3120	2006	0.1980	0.3457	4157
1980	0.0412	0.1110	3152	2007	0.1963	0.3516	4030
1981	0.0483	0.1260	3207	2008	0.1877	0.3204	3830
1982	0.0458	0.1327	3300	2009	0.1959	0.3428	3670
1983	0.0544	0.1720	3494	2010	0.2029	0.3640	3549
1984	0.0497	0.1502	3483	2011	0.2073	0.3464	3487
1985	0.0520	0.1477	3595	2012	0.2022	0.3283	3457
1986	0.0573	0.1531	3737	2013	0.2059	0.3221	3487
1987	0.0621	0.1566	3799	2014	0.2025	0.3096	3437
1988	0.0576	0.1478	3695	2015	0.1954	0.2967	3317
1989	0.0635	0.1553	3637	2016	0.1905	0.2888	3165
1990	0.0703	0.1730	3671	2017	0.1924	0.2860	2989
1991	0.0837	0.2007	3847	Average	0.1153	0.2318	-

FIGURE 1.1: YEARLY FREQUENCIES OF ZL AND AZL FIRMS

This figure displays the fraction of ZL and AZL firms across the years from 1965 to 2017. ZL (zero leveraged) firms are firms that have a yearly book leverage ratio of zero. AZL (almost-zero-leveraged) firms are firms that have a yearly book leverage ratio below 5%. Financial firms, utility firms, non-US firms, and non-publicly traded firms are excluded.



5. Results:

This section highlights the sample descriptive statistics and reports the results of the two models described in the previous section.

Table 1 and figure 1 report the yearly proportions of unlevered firms from 1965 to 2017. On average, 11.5% of our entire sample yearly firm observations are unlevered, from a minimum of 3.7% in 1974 to a maximum of 20.7% in 2011. An upward trend on the ZL behavior that lasted three decades (i.e., from 1980 to 2010) seems very clear. Over the period from 2000 to 2017, the average unlevered yearly firm observation is 18.7%, compared to only 4.8% from 1970 to 1987. This signifies how substantial the change in US firms leverage behavior over the past four decades. Following previous studies[10], we also report the yearly fraction of firms that are almost-zero-leveraged (hereafter, AZL). AZL firms are firms that have a book leverage ratio of less than 5%. On average, 23.1% of our entire sample yearly firm observations are AZL. About 33% can be categorized as AZL over the period from 2000 to 2017, compared to only 12.5% from 1970 to 1987. Similar to the ZL behavior, there is an impressive rising AZL behavior trend over the past four decades, from a minimum of 9% in 1974 to a maximum of 36.4% in 2010.

Table 2 reports several descriptive statistics for a sample of 194,644 yearly observations from 1965 to 2017. For each variable, the mean, median, and standard deviation values are reported. The last column reports the difference between the mean value of unleveraged and leveraged firms. The numbers in parentheses are p-values associated with the parametric two-sample t-test. Leveraged firms' average leverage ratio is 30%. Moreover, on average, unlevered firms have total assets of about $316 million, whereas levered firms have total assets of about $1,719 million. The difference in total assets between the mean value of unleveraged and leveraged firms is $1,403 million and is statistically significant. Again, equity capitalization is

[10] See Leland and Toft, 1996; Fischer et al., 1989; Goldstein et al., 2001; Ju et al., 2005; Strebulaev and Yang, 2013.

TABLE 1.2: ZL DESCRIPTIVE STATISTICS

This table reports several descriptive statistics for a sample of 197,388 yearly observations from 1965 to 2017. For each variable, the observations' number, mean, median, standard deviation are reported. Total assets and equity capitalization are reported in million USD. Values for the number of employees are reported in million units. The last column reports the difference between the mean value of unleveraged and leveraged firms. The numbers in parentheses are p-values associated with the parametric two-sample t-test.

	Zero Leverage Firms				Leveraged Firms				Significance tests
Variable	Obs.	Mean	SD	Median	Obs.	Mean	SD	Median	Difference in means
Leverage Ratio	22808	0.000	0.000	0.000	174580	0.302	0.294	0.258	.302 (0.0000)
Total Assets	22808	315.896	2270	66.849	174580	1718.7	12303	116.718	1402.818 (0.0000)
Equity Capitalization	20908	987.594	10465	129.322	155729	1895.2	12864	93.307	907.652 (0.0000)
Age	22808	17.989	12.494	16.000	174580	22.421	15.103	19.000	4.432 (0.0000)
Number of Employees	22585	2.545	17.525	0.350	172982	8.793	37.751	1.401	6.248 (0.0000)
Market-to-Book Ratio	20871	2.821	3.466	1.988	155402	1.778	4.118	1.395	-1.043 (0.0000)
Sales Growth	19333	0.099	0.599	0.094	158744	0.115	0.422	0.090	.016 (0.0000)
Sales-to-Assets	22798	1.114	1.596	0.894	174538	1.327	1.064	1.169	.213 (0.0000)
Dividend Binary Variable	22808	0.291	0.454	0.000	174580	0.415	0.493	0.000	.124 (0.0000)
Dividend-to-Assets	22801	0.022	0.098	0.000	174551	0.011	0.043	0.000	-.010 (0.0000)
Cash Flow-to-Assets	21244	0.016	0.278	0.077	158687	0.049	0.178	0.078	.033 (0.0000)
Cash-to-Assets	22808	0.399	0.271	0.350	174580	0.127	0.173	0.060	-.273 (0.0000)
Investment-to-Assets	22347	0.049	0.068	0.029	170942	0.072	0.082	0.048	.022 (0.0000)
Asset Sale-to-Assets	22808	0.065	0.326	0.000	174580	0.020	0.121	0.000	-.045 (0.0000)
EBITDA-to-Assets	22547	0.031	0.383	0.097	173671	0.091	0.201	0.121	.060 (0.0000)
Share Repurchases-to-Assets	22808	0.019	0.075	0.000	174580	0.011	0.058	0.000	-.008 (0.0000)
Taxes Paid-to-Assets	22652	0.035	0.068	0.017	174193	0.026	0.044	0.019	-.009 (0.0000)
Tangibility	22783	0.165	0.183	0.097	174255	0.316	0.229	0.265	.150 (0.0000)
R&D-to-Sales	21435	5.102	134.113	0.033	173313	1.052	74.827	0.000	-4.050 (0.0000)

TABLE 1.3: AZL DESCRIPTIVE STATISTICS

This table reports several descriptive statistics for a sample of 197,388 yearly observations from 1965 to 2017. For each variable, the observations' number, mean, median, standard deviation are reported. Total assets and equity capitalization are reported in million USD. Values for the number of employees are reported in million units. The last column reports the difference between the mean value of almost-zero-leveraged and leveraged firms. The numbers in parentheses are p-values associated with the parametric two-sample t-test.

	Almost Zero Leverage Firms				Leveraged Firms				Significance tests
Variable	Obs.	Mean	SD	Median	Obs.	Mean	SD	Median	Difference in means
Leverage Ratio	45754	0.010	0.014	0.000	151634	0.345	0.293	0.293	.336 (0.0000)
Total Assets	45754	482	4666	73.942	151634	1881	12972	125.803	1398.78 (0.0000)
Equity Capitalization	42086	1185	12357	132.133	134551	1976	12680	86.454	791.543 (0.0000)
Age	45754	18.859	13.240	16.000	151634	22.829	15.237	20.000	3.971 (0.0000)
Number of Employees	45349	3.706	23.055	0.461	150218	9.390	39.045	1.589	5.684 (0.0000)
Market-to-Book Ratio	42024	2.693	3.217	1.933	134249	1.654	4.260	1.348	-1.039 (0.0000)
Sales Growth	39483	0.122	0.564	0.103	138594	0.111	0.404	0.088	-.012 (0.0000)
Sales-to-Assets	45742	1.173	1.350	0.985	151594	1.342	1.066	1.182	.169 (0.0000)
Dividend Binary Variable	45754	0.302	0.459	0.000	151634	0.430	0.495	0.000	.128 (0.0000)
Dividend-to-Assets	45740	0.017	0.077	0.000	151612	0.011	0.042	0.000	-.006 (0.0000)
Cash Flow-to-Assets	42864	0.025	0.251	0.080	137067	0.051	0.170	0.077	.026 (0.0000)
Cash-to-Assets	45754	0.348	0.263	0.284	151634	0.101	0.143	0.050	-.247 (0.0000)
Investment-to-Assets	44938	0.054	0.066	0.035	148351	0.074	0.084	0.049	.020 (0.0000)
Asset Sale-to-Assets	45754	0.049	0.271	0.000	151634	0.018	0.103	0.000	-.031 (0.0000)
EBITDA-to-Assets	45375	0.046	0.329	0.107	150843	0.096	0.189	0.122	.050 (0.0000)
Share Repurchases-to-Assets	45754	0.016	0.076	0.000	151634	0.010	0.055	0.000	-.006 (0.0000)
Taxes Paid-to-Assets	45560	0.036	0.062	0.021	151285	0.024	0.041	0.018	-.011 (0.0000)
Tangibility	45703	0.184	0.183	0.122	151335	0.333	0.230	0.285	.149 (0.0000)
R&D-to-Sales	43939	3.647	99.313	0.019	150809	0.871	78.216	0.000	-2.776 (0.0000)

higher for leveraged firms. Moreover, age denotes the total years since a firm's information first appeared in Compustat over the period from 1965 to 2017. The average age of leveraged firms is about 22.5 years, whereas it is only 18 years for unleveraged firms. Further, it seems that ZL firms are in general high growth firms. ZL firms have, on average, a market-to-book ratio of 2.8, whereas leveraged firms' market-to-book ratio is 1.8. Additionally, relative to leveraged firms, unleveraged firms do not often pay dividends. But, when unleveraged firms do pay dividends, they are expected to pay higher dividends compared to leveraged firms. These findings are consistent with Strebulaev and Yang (2013) who report that unleveraged dividend-paying firms effectively replace payout to debt-holders with payout to equity-holders.

In summary, compared to levered firms, unlevered firms are on average smaller and younger. They are also *less* likely to have greater revenue, revenue growth, cash flows, investments, and fixed tangible assets; but they are *more* likely to have greater growth opportunities, dividends, cash holdings, asset sales, tax expenses, and R&D expenses. Table 3 indicates that AZL firms exhibit patterns similar to those of ZL firms.

Table 4 reports the coefficient values of a two-way-interacted regression. The dependent variable for columns one to four is the change in the cash-to-assets ratio. ZL is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. In this two-way interacted regression, the coefficient on cash-flow-to-assets on columns one to four signifies the cash-to-cash-flow sensitivity for leveraged firms, and the sum of this coefficient and the coefficient on the ZL binary variable interacted with cash-flow-to-assets denotes the sensitivity for unleveraged firms. For example, column one indicates that levered firms' cash-to-cash-flow sensitivity equals 6.75, while the sensitivity for unlevered firms equals 5.7 or (6.75 plus -1.05). Hence, consistent with our first hypothesis, the results show that the interacted coefficient is negative and is statistically significant, signifying that unlevered firms have a

TABLE 1.4: ZL TWO-WAY-INTERACTED-REGRESSIONS

This table displays estimates of several two-way-interacted-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *ZL* (zero leverage) is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. The coefficients on cash-flow-to-assets signify the sensitivities for leveraged firms. The coefficients on cash-flow-to-assets interacted with the ZL binary variable signify the change in the sensitivities for unleveraged firms. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ZL × Cash Flow-to-Assets	**-1.0451*** **	**-1.0431*** **	**-1.7501*** **	**-1.6406*** **	**-0.0083*** **	**-0.0172*** **	**-0.0194*** **	**-0.0176*** **
Cash Flow-to-Assets	6.7540***	6.7312***	5.6798***	5.2667***	0.0451***	0.0648***	0.0322***	0.0356***
ZL	0.1037***	0.1017***	0.1967***	0.1570***	-0.0011**	-0.0032***	-0.0033***	-0.0110***
ln (Total Assets)	0.0721***	0.0745***	0.1080***	0.1337***	-0.0127***	-0.0173***	-0.0166***	-0.0157***
ln (Equity Capitalization)	-0.0664***	-0.0687***	-0.1039***	-0.1300***	0.0126***	0.0136***	0.0128***	0.0106***
Age	0.0008***	0.0008***	0.0008***	0.0007***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
ln (Number of Employees)	0.0008	0.0006	-0.0026	-0.0041	0.0000	0.0037***	0.0036***	0.0053***
Market-to-Book Ratio	-0.0196***	-0.0195***	-0.0235***	-0.0214***	-0.0003***	-0.0005***	-0.0004***	-0.0005***
Sales Growth	0.4593***	0.4601***	0.3916***	0.3665***	0.0115***	0.0114***	0.0105***	0.0108***
Sales-to-Assets	-0.0041	-0.0035	-0.0201***	-0.0088**	0.0014***	-0.0050***	-0.0054***	-0.0046***
Dividend Binary Variable	-0.0612***	-0.0635***	-0.0735***		-0.0060***	-0.0026***	-0.0027***	
Dividend-to-Assets	-0.6663***	-0.6646***	-0.7458***		-0.0209***	-0.0201***	-0.0252***	
Cash-to-Assets	-0.3583***	-0.3591***	-0.2533***		-0.0071***	-0.0547***	-0.0496***	
Investment-to-Assets	-1.5919***	-1.6255***	-1.5464***					
Asset Sale-to-Assets	0.0493***	0.0498***			0.0127***	0.0098***		
EBITDA-to-Assets	-1.3772***	-1.4623***			-0.0364***	-0.0377***		
Share Repurchases-to-Assets	-0.6041***	-0.6074***			-0.0161***	-0.0189***		
Taxes Paid-to-Assets	-0.3830***				0.0524***			
Tangibility	-0.0468**				0.1915***			
R&D-to-Sales	-0.0386**				0.0000***			
Observations	108,622	108,673	108,811	109,686	151,613	151,747	151,999	152,000
R-squared	0.1976	0.1973	0.1772	0.1626	0.4599	0.3354	0.3312	0.3226

TABLE 1.5: AZL TWO-WAY-INTERACTED-REGRESSIONS

This table displays estimates of several two-way-interacted-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *AZL* (almost-zero-leverage) is a binary variable that equals one if a firm-year observation has a leverage ratio below 5% and zero otherwise. The coefficients on cash-flow-to-assets signify the sensitivities for leveraged firms. The coefficients on cash-flow-to-assets interacted with the AZL binary variable signify the change in the sensitivities for AZL firms. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AZL × Cash Flow-to-Assets	**-0.8005*** **	**-0.8029*** **	**-1.3079*** **	**-1.1796*** **	**-0.0087*** **	**-0.0157*** **	**-0.0185*** **	**-0.0142*** **
Cash Flow-to-Assets	6.8265***	6.8064***	5.7704***	5.3342***	0.0465***	0.0673***	0.0354***	0.0378***
AZL	0.0530***	0.0512***	0.1191***	0.0889***	-0.0004	-0.0039***	-0.0037***	-0.0111***
ln (Total Assets)	0.0682***	0.0702***	0.1031***	0.1278***	-0.0127***	-0.0175***	-0.0169***	-0.0164***
ln (Equity Capitalization)	-0.0639***	-0.0659***	-0.1008***	-0.1256***	0.0126***	0.0138***	0.0130***	0.0113***
Age	0.0008***	0.0008***	0.0008***	0.0007***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
ln (Number of Employees)	0.0015	0.0013	-0.0016	-0.0037	0.0000	0.0037***	0.0036***	0.0052***
Market-to-Book Ratio	-0.0197***	-0.0197***	-0.0236***	-0.0216***	-0.0003***	-0.0005***	-0.0004***	-0.0005***
Sales Growth	0.4589***	0.4600***	0.3928***	0.3672***	0.0115***	0.0113***	0.0104***	0.0108***
Sales-to-Assets	-0.0037	-0.0029	-0.0195***	-0.0084**	0.0014***	-0.0049***	-0.0053***	-0.0045***
Dividend Binary Variable	-0.0609***	-0.0630***	-0.0728***		-0.0061***	-0.0026***	-0.0027***	
Dividend-to-Assets	-0.6945***	-0.6923***	-0.7886***		-0.0212***	-0.0205***	-0.0255***	
Cash-to-Assets	-0.3303***	-0.3293***	-0.2247***		-0.0073***	-0.0530***	-0.0480***	
Investment-to-Assets	-1.5999***	-1.6347***	-1.5536***					
Asset Sale-to-Assets	0.0504***	0.0508***			0.0127***	0.0097***		
EBITDA-to-Assets	-1.3854***	-1.4590***			-0.0363***	-0.0374***		
Share Repurchases-to-Assets	-0.6150***	-0.6180***			-0.0164***	-0.0195***		
Taxes Paid-to-Assets	-0.3361***				0.0530***			
Tangibility	-0.0465**				0.1915***			
R&D-to-Sales	-0.0462				0.0000***			
Observations	108,622	108,673	108,811	109,686	151,613	151,747	151,999	152,000
R-squared	0.1977	0.1974	0.1766	0.1619	0.4599	0.3357	0.3315	0.3239

lower cash-to-cash-flow sensitivity (i.e., unlevered firms are less financially constrained).

We also report investment-to-cash-flow sensitivities on columns five to eight, where the dependent variable for these columns is the investment-to-assets ratio. Similar to the first four columns, the coefficients on cash-flow-to-assets on the last four columns denote the investment-to-cash-flow sensitivity for leveraged firms, while the sum of this coefficient and the interacted coefficient represents the sensitivity for unleveraged firms. Column five indicates that levered firms' investment-to-cash-flow sensitivity equals 0.0451, whereas the sensitivity for unlevered firms equals 0.0368 or (0.0451 plus -0.0083). The results are statistically significant and supports our first hypothesis. Table 5 documents similar evidence for AZL firms.

Table 6 reports the coefficient values of a three-way-interacted-multivariate regression. Similar to tables 4, the first four columns signify the cash flow sensitivity of cash while the last four columns signify the cash flow sensitivity of investment. But, in tables 6, we are testing whether the ZL effect on cash- and investment-to-cash-flow sensitivities is different for larger firms compared to smaller firms. To do that, we include a third-interacted binary variable, *Large*, that equals one if a firm-year has total assets greater than average and zero otherwise. In this specification, a *negative* three-way-interacted-coefficient implies that the ZL effect on a firm's financial constraints is *weaker* for larger firms, while a *positive* coefficient suggests a *stronger* effect. Consistent with our second hypothesis, the findings show that the three-way-interacted-coefficient is negative and is statistically significant across all eight columns. This implies that the ZL effect on firms' cash- and investment-to-cash-flow sensitivities is weaker for larger firms relative to smaller firms. Table 7 reports consistent evidence for AZL firms.

TABLE 1.6: ZL MULTIVARIATE-REGRESSIONS WITH LARGE AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *ZL* (zero leverage) is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. *Large* is a binary variable that equals one if a firm-year has total assets greater than average and zero otherwise. A negative three-way-interacted-coefficient implies that the ZL effect on sensitivities is weaker for larger firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	6.4922***	6.4666***	5.4746***	5.0530***	0.0387***	0.0476***	0.0216***	0.0246***
ZL	0.0448**	0.0421**	0.0494**	0.0099	0.0001	-0.0031***	-0.0034***	-0.0112***
ZL × Cash Flow-to-Assets	-0.6299***	-0.6280***	-0.8415***	-0.8516***	-0.0065***	-0.0138***	-0.0147***	-0.0137***
Large	-0.0066	-0.0045	0.0416***	0.0600***	-0.0067***	-0.0110***	-0.0111***	-0.0111***
Large × Cash Flow-to-Assets	0.4366***	0.4308***	0.1240*	0.0000	0.0244***	0.0678***	0.0710***	0.0709***
Large × ZL	0.0739***	0.0726***	0.2259***	0.1974***	0.0018*	0.0061***	0.0073***	0.0089***
Large × ZL × Cash Flow-to-Assets	**-0.6455*** **	**-0.6384*** **	**-1.5576*** **	**-1.2553*** **	**-0.0119** **	**-0.0208*** **	**-0.0302*** **	**-0.0300*** **
ln (Equity Capitalization)	-0.0355***	-0.0371***	-0.0586***	-0.0745***	0.0074***	0.0064***	0.0059***	0.0043***
Age	0.0009***	0.0008***	0.0009***	0.0008***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
ln (Number of Employees)	0.0292***	0.0302***	0.0414***	0.0520***	-0.0055***	-0.0040***	-0.0037***	-0.0018***
Market-to-Book Ratio	-0.0267***	-0.0270***	-0.0342***	-0.0350***	0.0007***	0.0008***	0.0009***	0.0007***
Sales Growth	0.4567***	0.4572***	0.3778***	0.3468***	0.0123***	0.0127***	0.0121***	0.0124***
Sales-to-Assets	-0.0169***	-0.0169***	-0.0418***	-0.0352***	0.0037***	-0.0019***	-0.0023***	-0.0018***
Dividend Binary Variable	-0.0638***	-0.0667***	-0.0782***		-0.0058***	-0.0022***	-0.0024***	
Dividend-to-Assets	-0.6949***	-0.6931***	-0.8170***		-0.0200***	-0.0196***	-0.0240***	
Cash-to-Assets	-0.3818***	-0.3853***	-0.2833***		-0.0033***	-0.0489***	-0.0450***	
Investment-to-Assets	-1.6498***	-1.6894***	-1.6394***					
Asset Sale-to-Assets	0.0573***	0.0585***			0.0115***	0.0081***		
EBITDA-to-Assets	-1.4399***	-1.5495***			-0.0332***	-0.0287***		
Share Repurchases-to-Assets	-0.6073***	-0.6108***			-0.0188***	-0.0254***		
Taxes Paid-to-Assets	-0.4757***				0.0722***			
Tangibility	-0.0526***				0.1941***			
R&D-to-Sales	-0.0415				0.0000***			
Observations	108,622	108,673	108,811	109,686	151,613	151,747	151,999	152,000
R-squared	0.1966	0.1962	0.1747	0.1580	0.4532	0.3250	0.3218	0.3147

TABLE 1.7: AZL MULTIVARIATE-REGRESSIONS WITH LARGE AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *AZL* (almost-zero-leverage) is a binary variable that equals one if a firm-year observation has a leverage ratio below 5% and zero otherwise. *Large* is a binary variable that equals one if a firm-year has total assets greater than average and zero otherwise. A negative three-way-interacted-coefficient implies that the AZL effect on sensitivities is weaker for larger firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	6.4644***	6.4428***	5.5000***	5.0724***	0.0392***	0.0487***	0.0232***	0.0257***
AZL	-0.0180	-0.0204	-0.0067	-0.0368**	0.0017***	-0.0023***	-0.0023***	-0.0101***
AZL × Cash Flow-to-Assets	-0.2742***	-0.2774***	-0.5408***	-0.5133***	-0.0064***	-0.0118***	-0.0129***	-0.0099***
Large	-0.0240**	-0.0220*	0.0271**	0.0465***	-0.0070***	-0.0117***	-0.0119***	-0.0123***
Large × Cash Flow-to-Assets	0.6235***	0.6180***	0.2479***	0.1025	0.0269***	0.0719***	0.0757***	0.0752***
Large × AZL	0.0930***	0.0922***	0.1753***	0.1527***	0.0018**	0.0055***	0.0063***	0.0079***
Large × AZL × Cash Flow-to-Assets	**-0.8671*** **	**-0.8653*** **	**-1.3031*** **	**-1.0559*** **	**-0.0141*** **	**-0.0229*** **	**-0.0305*** **	**-0.0289*** **
ln (Equity Capitalization)	-0.0350***	-0.0363***	-0.0572***	-0.0716***	0.0073***	0.0064***	0.0059***	0.0045***
Age	0.0009***	0.0009***	0.0009***	0.0008***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
ln (Number of Employees)	0.0280***	0.0287***	0.0398***	0.0485***	-0.0055***	-0.0039***	-0.0037***	-0.0020***
Market-to-Book Ratio	-0.0263***	-0.0265***	-0.0337***	-0.0343***	0.0007***	0.0008***	0.0009***	0.0007***
Sales Growth	0.4569***	0.4578***	0.3795***	0.3479***	0.0123***	0.0127***	0.0121***	0.0124***
Sales-to-Assets	-0.0157***	-0.0154***	-0.0398***	-0.0330***	0.0037***	-0.0019***	-0.0023***	-0.0017***
Dividend Binary Variable	-0.0635***	-0.0661***	-0.0772***		-0.0058***	-0.0023***	-0.0024***	
Dividend-to-Assets	-0.7289***	-0.7265***	-0.8492***		-0.0205***	-0.0204***	-0.0248***	
Cash-to-Assets	-0.3458***	-0.3460***	-0.2399***		-0.0049***	-0.0491***	-0.0452***	
Investment-to-Assets	-1.6533***	-1.6952***	-1.6405***					
Asset Sale-to-Assets	0.0585***	0.0596***			0.0114***	0.0080***		
EBITDA-to-Assets	-1.4504***	-1.5446***			-0.0330***	-0.0283***		
Share Repurchases-to-Assets	-0.6226***	-0.6257***			-0.0188***	-0.0257***		
Taxes Paid-to-Assets	-0.4128***				0.0715***			
Tangibility	-0.0534***				0.1942***			
R&D-to-Sales	-0.0484				0.0000***			
Observations	108,622	108,673	108,811	109,686	151,613	151,747	151,999	152,000
R-squared	0.1971	0.1967	0.1745	0.1579	0.4533	0.3250	0.3219	0.3151

TABLE 1.8: ZL MULTIVARIATE-REGRESSIONS WITH DIVIDEND AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *ZL* (zero leverage) is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. *Dividend* is a binary variable that equals one if a firm-year has paid dividends and zero otherwise. A negative three-way-interacted-coefficient implies that the ZL effect on sensitivities is weaker for dividend paying firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	6.7405***	6.7323***	5.8073***	5.4402***	0.0429***	0.0558***	0.0232***	0.0260***
ZL	0.0240	0.0234	0.1818***	0.1413***	0.0002	-0.0020***	-0.0019***	-0.0100***
ZL × Cash Flow-to-Assets	-0.5047***	-0.5091***	-1.7015***	-1.5406***	-0.0046**	-0.0105***	-0.0121***	-0.0112***
Dividend	-0.0757***	-0.0731***	-0.0418***	-0.0354***	-0.0080***	-0.0123***	-0.0126***	-0.0119***
Dividend × Cash Flow-to-Assets	-0.0379	-0.0791	-0.4753***	-0.4428***	0.0197***	0.0960***	0.0977***	0.0871***
Dividend × ZL	0.2289***	0.2249***	0.0624**	0.0700**	-0.0024	0.0037**	0.0032*	0.0048***
Dividend × ZL × Cash Flow-to-Assets	**-1.5020*** **	**-1.4799*** **	**-0.3407** **	**-0.3143***	**-0.0206** **	**-0.0686*** **	**-0.0709*** **	**-0.0679*** **
ln (Total Assets)	0.0729***	0.0751***	0.1076***	0.1313***	-0.0126***	-0.0164***	-0.0158***	-0.0134***
ln (Equity Capitalization)	-0.0668***	-0.0689***	-0.1035***	-0.1204***	0.0124***	0.0129***	0.0120***	0.0104***
Age	0.0008***	0.0008***	0.0008***	0.0012***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
ln (Number of Employees)	0.0010	0.0008	-0.0018	-0.0046	0.0000	0.0036***	0.0035***	0.0038***
Market-to-Book Ratio	-0.0204***	-0.0204***	-0.0245***	-0.0233***	-0.0004***	-0.0006***	-0.0005***	-0.0007***
Sales Growth	0.4635***	0.4640***	0.3956***	0.3546***	0.0115***	0.0116***	0.0107***	0.0107***
Sales-to-Assets	-0.0046	-0.0040	-0.0206***		0.0014***	-0.0052***	-0.0056***	
Cash-to-Assets	-0.3596***	-0.3601***	-0.2527***		-0.0076***	-0.0562***	-0.0512***	
Investment-to-Assets	-1.5866***	-1.6188***	-1.5341***					
Asset Sale-to-Assets	0.0462***	0.0467***			0.0127***	0.0098***		
EBITDA-to-Assets	-1.4043***	-1.4812***			-0.0360***	-0.0371***		
Share Repurchases-to-Assets	-0.5952***	-0.5979***			-0.0170***	-0.0238***		
Taxes Paid-to-Assets	-0.3576***				0.0484***			
Tangibility	-0.0444**				0.1910***			
R&D-to-Sales	-0.0368***				0.0000***			
Observations	108,623	108,674	108,812	109,686	151,614	151,748	152,000	152,000
R-squared	0.1975	0.1972	0.1765	0.1645	0.4599	0.3378	0.3337	0.3234

TABLE 1.9: AZL MULTIVARIATE-REGRESSIONS WITH DIVIDEND AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *AZL* (almost-zero-leverage) is a binary variable that equals one if a firm-year observation has a leverage ratio below 5% and zero otherwise. *Dividend* is a binary variable that equals one if a firm-year has paid dividends and zero otherwise. A negative three-way-interacted-coefficient implies that the AZL effect on sensitivities is weaker for dividend paying firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	6.7553***	6.7478***	5.8431***	5.4573***	0.0435***	0.0576***	0.0256***	0.0280***
AZL	-0.0143	-0.0151	0.0922***	0.0587***	0.0010**	-0.0029***	-0.0026***	-0.0107***
AZL × Cash Flow-to-Assets	-0.3083***	-0.3127***	-1.1178***	-0.9572***	-0.0047**	-0.0102***	-0.0123***	-0.0103***
Dividend	-0.0914***	-0.0892***	-0.0566***	-0.0521***	-0.0079***	-0.0122***	-0.0126***	-0.0122***
Dividend × Cash Flow-to-Assets	0.1008	0.0667	-0.3388***	-0.2991***	0.0223***	0.0983***	0.1005***	0.0905***
Dividend × AZL	0.1981***	0.1960***	0.0941***	0.1063***	-0.0026**	0.0016	0.0013	0.0040***
Dividend × AZL × Cash Flow-to-Assets	**-1.3890*** **	**-1.3803*** **	**-0.6540*** **	**-0.6681*** **	**-0.0175** **	**-0.0460*** **	**-0.0488*** **	**-0.0488*** **
ln (Total Assets)	0.0689***	0.0707***	0.1029***	0.1257***	-0.0126***	-0.0167***	-0.0161***	-0.0142***
ln (Equity Capitalization)	-0.0644***	-0.0661***	-0.1006***	-0.1163***	0.0124***	0.0131***	0.0122***	0.0111***
Age	0.0008***	0.0008***	0.0008***	0.0012***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
ln (Number of Employees)	0.0019	0.0017	-0.0007	-0.0044	0.0001	0.0036***	0.0036***	0.0038***
Market-to-Book Ratio	-0.0206***	-0.0206***	-0.0247***	-0.0234***	-0.0004***	-0.0006***	-0.0005***	-0.0007***
Sales Growth	0.4632***	0.4641***	0.3970***	0.3550***	0.0115***	0.0115***	0.0107***	0.0106***
Sales-to-Assets	-0.0046	-0.0038	-0.0203***		0.0014***	-0.0051***	-0.0055***	
Cash-to-Assets	-0.3323***	-0.3312***	-0.2253***		-0.0081***	-0.0544***	-0.0497***	
Investment-to-Assets	-1.5903***	-1.6237***	-1.5396***					
Asset Sale-to-Assets	0.0473***	0.0478***			0.0127***	0.0098***		
EBITDA-to-Assets	-1.4132***	-1.4781***			-0.0359***	-0.0368***		
Share Repurchases-to-Assets	-0.6066***	-0.6090***			-0.0173***	-0.0243***		
Taxes Paid-to-Assets	-0.3056***				0.0495***			
Tangibility	-0.0438**				0.1910***			
R&D-to-Sales	-0.0416				0.0000***			
Observations	108,623	108,674	108,812	109,686	151,614	151,748	152,000	152,000
R-squared	0.1976	0.1974	0.1760	0.1640	0.4600	0.3380	0.3339	0.3246

Similar to table 6, table 8 also reports the coefficient values of a three-way-interacted-multivariate regression with the first four columns denoting the cash-to-cash-flow sensitivity and the last four columns denoting the investment-to-cash-flow sensitivity. But, in tables 8, we are testing whether the ZL effect is different for dividend-paying firms relative to zero-dividend firms. Here, our third-interaction binary variable, *Dividend*, equals one if a firm-year has paid dividends and zero otherwise. Consistent with our third hypothesis, the findings indicate that the three-way-interacted-coefficient is negative and is statistically significant across all eight columns, implying that the ZL effect on firms' financial constraints is weaker for dividend-paying firms. Table 9 also documents a statistically significant weaker AZL effect on firms' financial constraints for dividend-paying firms.

Our third-interaction variable for table 10 is a binary variable that equals one if a firm-year has a fixed-assets-to-assets ratio greater than average, and zero otherwise. Consistent with our fourth hypothesis, the results reveal that the three-way-interacted-coefficient is negative and is statistically significant across all eight columns, indicating that the ZL effect on firms' financial constraints is weaker for firms with greater proportions of fixed tangible assets. Interestingly, the coefficient on the ZL binary variable interacted with cash-flow-to-assets on columns five to eight lost its statistical significance when we added the third-interacted variable *Tangible*. This signifies the importance of tangibility in shaping the relationship between the ZL behavior and investment-to-cash-flow sensitivity. Also, table 11 suggests evidence consistent with our fourth hypothesis for AZL firms. Finally, the results in table 12 and 13 show that the three-way-interacted-coefficient is negative and is statistically significant across all eight columns, indicating that the ZL and AZL effects on firms' financial constraints is weaker for value firms.

Our main results are robust to many alternative specifications, including (1) using subsamples that exclude the years of the global financial crisis, (2) using different measures of leverage, (3) using different explanatory variable combinations.

TABLE 1.10: ZL MULTIVARIATE-REGRESSIONS WITH TANGIBLE AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *ZL* (zero leverage) is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. *Tangible* is a binary variable that equals one if a firm-year has a fixed-assets-to-assets ratio greater than average and zero otherwise. A negative three-way-interacted-coefficient implies that the ZL effect on sensitivities is weaker for tangible firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	6.9465***	6.9380***	6.8624***	6.5707***	0.0352***	0.0333***	0.0329***	0.0315***
ZL	0.1290***	0.1284***	0.1299***	0.0842***	-0.0030***	-0.0029***	-0.0025***	-0.0081***
ZL × Cash Flow-to-Assets	-1.2226***	-1.2267***	-1.2304***	-1.2757***	0.0017	0.0020	0.0020	0.0010
Tangible	0.0337***	0.0352***	0.0328***	0.0037	0.0450***	0.0450***	0.0450***	0.0472***
Tangible × Cash Flow-to-Assets	-0.5178***	-0.5186***	-0.4862***	-0.6902***	0.0587***	0.0598***	0.0595***	0.0548***
Tangible × ZL	0.1243***	0.1206***	0.1174***	0.1638***	0.0057***	0.0059***	0.0056***	0.0085***
Tangible × ZL × Cash Flow-to-Assets	**-0.8415*** **	**-0.8216*** **	**-0.8020*** **	**-0.8969*** **	**-0.0249*** **	**-0.0246*** **	**-0.0242*** **	**-0.0266*** **
ln (Total Assets)	0.0716***	0.0736***	0.0731***	0.1019***	-0.0129***	-0.0134***	-0.0134***	-0.0117***
ln (Equity Capitalization)	-0.0645***	-0.0667***	-0.0673***	-0.0905***	0.0126***	0.0130***	0.0130***	0.0117***
Age	0.0008***	0.0008***	0.0008***	0.0013***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
Market-to-Book Ratio	-0.0200***	-0.0201***	-0.0210***	-0.0229***	-0.0005***	-0.0004***	-0.0005***	-0.0006***
Sales Growth	0.4565***	0.4564***	0.4664***	0.4312***	0.0119***	0.0117***	0.0118***	0.0118***
Sales-to-Assets	-0.0022	-0.0028	-0.0039	0.0103***	-0.0027***	-0.0025***	-0.0026***	-0.0017***
EBITDA-to-Assets	-1.3658***	-1.4209***	-1.4615***	1.3910***	-0.0383***	-0.0335***	-0.0339***	-0.0281***
Dividend Binary Variable	-0.0593***	-0.0603***	-0.0609***	-0.0680***	-0.0056***	-0.0052***	-0.0052***	-0.0059***
Dividend-to-Assets	-0.7915***	-0.7852***	-0.7523***		-0.0320***	-0.0308***	-0.0301***	
Cash-to-Assets	-0.3650***	-0.3742***	-0.3716***		-0.0351***	-0.0339***	-0.0331***	
Investment-to-Assets	-1.5162***	-1.5127***	-1.4899***					
Asset Sale-to-Assets	0.0505***	0.0499***			0.0110***	0.0109***		
Share Repurchases-to-Assets	-0.5955***	-0.5994***			-0.0183***	-0.0162***		
Taxes Paid-to-Assets	-0.2653***				0.0483***			
R&D-to-Sales	-0.0385				0.0000***			
Observations	109,652	109,655	109,655	110,531	152,945	152,953	152,953	152,954
R-squared	0.1962	0.1962	0.1945	0.1815	0.3933	0.3926	0.3919	0.3881

TABLE 1.11: AZL MULTIVARIATE-REGRESSIONS WITH TANGIBLE AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *AZL* (almost-zero-leverage) is a binary variable that equals one if a firm-year observation has a leverage ratio below 5% and zero otherwise. *Tangible* is a binary variable that equals one if a firm-year has a fixed-assets-to-assets ratio greater than average and zero otherwise. A negative three-way-interacted-coefficient implies that the AZL effect on sensitivities is weaker for tangible firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	7.0665***	7.0601***	6.9731***	6.6940***	0.0351***	0.0329***	0.0325***	0.0315***
AZL	0.0818***	0.0808***	0.0820***	0.0398***	-0.0031***	-0.0029***	-0.0027***	-0.0083***
AZL × Cash Flow-to-Assets	-1.0110***	-1.0141***	-0.9963***	-1.0217***	0.0019	0.0025	0.0025	0.0026
Tangible	0.0372***	0.0384***	0.0354***	0.0022	0.0445***	0.0444***	0.0444***	0.0460***
Tangible × Cash Flow-to-Assets	-0.5474***	-0.5478***	-0.5046***	-0.7285***	0.0597***	0.0607***	0.0604***	0.0561***
Tangible × AZL	0.0673***	0.0659***	0.0645***	0.1001***	0.0053***	0.0056***	0.0054***	0.0086***
Tangible × AZL × Cash Flow-to-Assets	**-0.4918*** **	**-0.4851*** **	**-0.4912*** **	**-0.5284*** **	**-0.0184*** **	**-0.0176*** **	**-0.0175*** **	**-0.0190*** **
ln (Total Assets)	0.0683***	0.0698***	0.0694***	0.0949***	-0.0130***	-0.0135***	-0.0134***	-0.0121***
ln (Equity Capitalization)	-0.0621***	-0.0637***	-0.0645***	-0.0849***	0.0126***	0.0131***	0.0130***	0.0120***
Age	0.0009***	0.0009***	0.0009***	0.0013***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
Market-to-Book Ratio	-0.0201***	-0.0202***	-0.0211***	-0.0232***	-0.0005***	-0.0005***	-0.0005***	-0.0006***
Sales Growth	0.4562***	0.4565***	0.4667***	0.4318***	0.0119***	0.0118***	0.0118***	0.0118***
Sales-to-Assets	-0.0018	-0.0021	-0.0033	0.0108***	-0.0027***	-0.0025***	-0.0026***	-0.0017***
EBITDA-to-Assets	-1.3731***	-1.4125***	-1.4542***	-1.3947***	-0.0383***	-0.0335***	-0.0340***	-0.0288***
Dividend Binary Variable	-0.0581***	-0.0588***	-0.0593***	-0.0689***	-0.0056***	-0.0052***	-0.0052***	-0.0060***
Dividend-to-Assets	-0.8568***	-0.8512***	-0.8182***		-0.0326***	-0.0314***	-0.0306***	
Cash-to-Assets	-0.3388***	-0.3461***	-0.3458***		-0.0343***	-0.0332***	-0.0325***	
Investment-to-Assets	-1.5221***	-1.5197***	-1.4966***					
Asset Sale-to-Assets	0.0514***	0.0507***			0.0109***	0.0109***		
Share Repurchases-to-Assets	-0.6068***	-0.6099***			-0.0186***	-0.0164***		
Taxes Paid-to-Assets	-0.1993***				0.0487***			
R&D-to-Sales	-0.0479				0.0000***			
Observations	109,652	109,655	109,655	110,531	152,945	152,953	152,953	152,954
R-squared	0.1961	0.1960	0.1943	0.1813	0.3933	0.3926	0.3919	0.3885

TABLE 1.12: ZL MULTIVARIATE-REGRESSIONS WITH VALUE AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *ZL* (zero leverage) is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. *Value* is a binary variable that equals one if a firm-year has a market-to-book ratio lower than average and zero otherwise. A negative three-way-interacted-coefficient implies that the ZL effect on sensitivities is weaker for value firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	0.4567***	0.4505***	0.4329***	0.4314***	0.0153***	0.0317***	0.0314***	0.0306***
ZL	-0.0155***	-0.0122***	-0.0145***	-0.0150***	-0.0031***	-0.0124***	-0.0123***	-0.0123***
ZL × Cash Flow-to-Assets	-0.0027	-0.0018	-0.0056	-0.0089*	-0.0052**	-0.0086***	-0.0084***	-0.0096***
Value	-0.0141***	-0.0158***	-0.0133***	-0.0132***	-0.0080***	-0.0034***	-0.0034***	-0.0033***
Value × Cash Flow-to-Assets	0.2011***	0.1947***	0.1961***	0.1979***	0.0062***	0.0269***	0.0275***	0.0281***
Value × ZL	0.0052**	0.0067***	0.0066***	0.0065***	0.0069***	0.0026**	0.0026***	0.0025**
Value × ZL × Cash Flow-to-Assets	**-0.0625*** **	**-0.0547*** **	**-0.0465*** **	**-0.0450*** **	**-0.0166*** **	**-0.0384*** **	**-0.0389*** **	**-0.0386*** **
ln (Total Assets)	-0.0034***	-0.0037***	-0.0007	-0.0003	-0.0107***	-0.0101***	-0.0102***	-0.0100***
ln (Equity Capitalization)	-0.0057***	-0.0056***	-0.0088***	-0.0090***	0.0102***	0.0099***	0.0100***	0.0099***
Age	0.0001**	0.0001**	0.0000	0.0000	-0.0002***	-0.0002***	-0.0002***	-0.0002***
Sales Growth	0.0413***	0.0410***	0.0405***	0.0408***	0.0106***	0.0104***	0.0106***	0.0106***
Sales-to-Assets	-0.0081***	-0.0067***	-0.0085***	-0.0085***	0.0015***	-0.0025***	-0.0025***	-0.0025***
Dividend Binary Variable	-0.0120***	-0.0134***	-0.0158***	-0.0185***	-0.0061***	-0.0023***	-0.0023***	-0.0034***
Dividend-to-Assets	-0.0804***	-0.0770***	-0.0864***		-0.0330***	-0.0353***	-0.0347***	
Asset Sale-to-Assets	-0.0049***	-0.0023	-0.0033*		0.0132***	0.0062***	0.0059***	
Share Repurchases-to-Assets	-0.0711***	-0.0694***			-0.0177***	-0.0233***		
Taxes Paid-to-Assets	-0.2744***	-0.2707***			0.0222***	0.0130***		
Tangibility	-0.0672***				0.1925***			
R&D-to-Sales	0.0001***				0.0001***			
Observations	151,765	152,001	152,011	152,012	153,000	153,215	153,225	153,226
R-squared	0.2965	0.2920	0.2857	0.2850	0.4511	0.3165	0.3162	0.3157

TABLE 1.13: AZL MULTIVARIATE-REGRESSIONS WITH VALUE AS THE THIRD BINARY VARIABLE

This table displays estimates of several three-way-interacted-multivariate-regressions in which the dependent variables are the change in the cash-to-assets' ratio in columns one to four, and capital-expenditure-to-assets' ratio in columns five to eight. *AZL* (almost-zero-leverage) is a binary variable that equals one if a firm-year observation is unlevered and zero otherwise. *Value* is a binary variable that equals one if a firm-year has a market-to-book ratio lower than average and zero otherwise. A negative three-way-interacted-coefficient implies that the AZL effect on sensitivities is weaker for value firms, whereas a positive coefficient suggests a stronger effect. Year and sector fixed effects are included in all equations. Estimates with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively.

Dependent Variable	Δ in Cash-to-Assets				Investment-to-Assets			
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Flow-to-Assets	0.4745***	0.4683***	0.4530***	0.4515***	0.0146***	0.0306***	0.0303***	0.0295***
AZL	-0.0065***	-0.0029***	-0.0050***	-0.0053***	-0.0024***	-0.0126***	-0.0124***	-0.0124***
AZL × Cash Flow-to-Assets	-0.0491***	-0.0496***	-0.0567***	-0.0585***	-0.0013	-0.0001	0.0005	-0.0003
Value	-0.0139***	-0.0158***	-0.0131***	-0.0130***	-0.0094***	-0.0042***	-0.0043***	-0.0042***
Value × Cash Flow-to-Assets	0.2013***	0.1941***	0.1923***	0.1942***	0.0176***	0.0407***	0.0415***	0.0422***
Value × AZL	0.0001	0.0013	0.0006	0.0006	0.0075***	0.0042***	0.0041***	0.0041***
Value × AZL × Cash Flow-to-Assets	**-0.0371*** **	**-0.0295*** **	**-0.0173** **	**-0.0167* **	**-0.0389*** **	**-0.0612*** **	**-0.0620*** **	**-0.0621*** **
ln (Total Assets)	-0.0036***	-0.0035***	-0.0008*	-0.0004	-0.0107***	-0.0108***	-0.0109***	-0.0108***
ln (Equity Capitalization)	-0.0057***	-0.0058***	-0.0088***	-0.0090***	0.0101***	0.0105***	0.0106***	0.0105***
Age	0.0001**	0.0001**	0.0000	0.0000	-0.0002***	-0.0002***	-0.0002***	-0.0002***
Sales Growth	0.0414***	0.0411***	0.0407***	0.0409***	0.0106***	0.0103***	0.0105***	0.0106***
Sales-to-Assets	-0.0078***	-0.0065***	-0.0082***	-0.0082***	0.0016***	-0.0024***	-0.0024***	-0.0025***
Dividend Binary Variable	-0.0123***	-0.0138***	-0.0162***	-0.0188***	-0.0063***	-0.0025***	-0.0024***	-0.0035***
Dividend-to-Assets	-0.0795***	-0.0758***	-0.0851***		-0.0333***	-0.0363***	-0.0356***	
Asset Sale-to-Assets	-0.0057***	-0.0031*	-0.0041**		0.0130***	0.0061***	0.0058***	
Share Repurchases-to-Assets	-0.0731***	-0.0709***			-0.0180***	-0.0248***		
Taxes Paid-to-Assets	-0.2691***	-0.2670***			0.0215***	0.0168***		
Tangibility	-0.0678***				0.1926***			
R&D-to-Sales	0.0001***				0.0000***			
Observations	151,765	152,001	152,011	152,012	153,000	153,215	153,225	153,226
R-squared	0.2972	0.2926	0.2865	0.2858	0.4515	0.3183	0.3180	0.3174

Moreover, to control for the potential survival-ship bias, we break our sample into several subsamples with shorter time periods. The results are consistent with our main empirical evidence. Furthermore, endogeneity concerns that arise from omitted variables are very common in empirical corporate finance studies. One possible remedy to the endogeneity problem is the use of a fixed effects model. A fixed-effect can capture any unobservable, low-frequency independent variable (e.g., unobservable technological differences). To address the endogeneity problem, we include firm- and year-specific intercepts in all our regressions and our main results hold.

To sum up, the empirical evidence of this paper suggests that leverage is a major factor escalating firms' financial constraints, signifying that this escalation is more pronounced for firms in their early lifecycle. The results could potentially explain the rising zero leverage behavior of US firms over the past four decades. That is, firms may follow conservative debt policies to lower their financial constraints. Other related explanations for the rising zero leverage behavior that have been documented in the literature include economic cycle effects (Cantor, 1990; Bernanke et al., 1994; Opler and Titman, 1994; and Phillips, 1995), asset liquidation respects (Shleifer and Vishny, 1992), and ownership considerations (Strebulaev and Yang, 2013).

Cantor (1990) and Opler and Titman (1994) imply that firms with high leverage are more susceptible to adverse economic shocks. These shocks may force them to cut back sharply on employment or investments. Firm with low leverage will correspondingly pick up their slack. Consistent with these studies, Bernanke et al. (1994) develop the autoregressive financial accelerator theory in which adverse exogenous shocks lower current cash flows and raises investment costs. This reduces investment spending and cash flows in later periods, proliferating the initial adverse shock. The financial accelerator effects are stronger, the deeper the economic downturn and the higher the leverage ratio. In this view, Phillips (1995) posits a model in which rivals with superior access to capital might increase output and

sustain losses to drive highly leveraged firms into insolvency. Bolton and Scharfstein (1990) suggest that the best response to predation is to lower firms' financial constraints.

Shleifer and Vishny (1992) explain that when a financially distressed firm try to sell its corporate assets during downturns, other potential buyers in the industry are expected to experience similar problems. Even if not, industry regulations may prevent them from buying distressed corporate assets. This magnifies the costs of financial distress which are associated with leverage. Moreover, declines in asset liquidity and debt capacity will reinforce each other since asset liquidity relies on debt capacity, and debt capacity depends on liquidity. As a result, highly-leveraged firms will probably survive only when corporate assets remain liquid. Lastly, Strebulaev and Yang (2013) suggest that family-owned and manager-owned firms are likely to have lower levels of leverage. This is because the owners if these firms are expected to be under-diversified and have a desire for long-term survival.

6. Conclusion:

This paper started by highlighting some of the theories explaining why firms may be financially constrained and discussing some of the empirical studies documenting that certain firm characteristics could potentially mitigate the severity of a firm's financial constraints. Several testable hypotheses are then suggested. Namely, the study proposes that unleveraged firms are expected to face lower financial constraints relative to leveraged firms and that the zero-leverage effect on firms' financial constraints is more likely to be stronger for smaller firms, zero-dividend firms, firms with lower proportions of tangible assets, and growth firms.

Indeed, the findings of this study support the hypotheses proposed. Using a large dataset of yearly firm observations that spans from 1965 to 2017, the empirical results also show an astonishing remarkable growing ZL behavior of publicly-traded US firms over the past four decades. The results are consistent with the debt

overhang theory which explains how leverage may have negative effects on a firm's value by increasing its financial constraints and weakening its ability to undertake profitable future investments. Finally, the findings are also consistent with the large body of literature suggesting that small firms, zero-dividend firms, firms with low tangibility, and growth firms face greater financial distress and bankruptcy likelihoods. Hence, these firm's financial constraint levels are more susceptible to their leverage levels compared to larger firms, dividend-paying firms, firms with high tangibility, and value firms, respectively.

REFERENCES

Acharya, V.V., Almeida, H. and Campello, M., 2007. Is cash negative debt? A hedging perspective on corporate financial policies. Journal of Financial Intermediation, 16(4), pp.515-554.

Ahn, S., Denis, D.J. and Denis, D.K., 2006. Leverage and investment in diversified firms. Journal of Financial Economics, 79(2), pp.317-337.

Aivazian, V.A., Ge, Y. and Qiu, J., 2005. The impact of leverage on firm investment: Canadian evidence. Journal of Corporate Finance, 11(1), pp.277-291.

Akerlof, G.A., 1970. The market for "lemons": Quality uncertainty and the market mechanism. The Quarterly Journal of Economics, pp.488-500.

Almeida, H., Campello, M. and Weisbach, M.S., 2004. The cash flow sensitivity of cash. The Journal of Finance, 59(4), pp.1777-1804.

Almeida, H., Campello, M. and Weisbach, M.S., 2011. Corporate financial and investment policies when future financing is not frictionless. Journal of Corporate Finance, 17(3), pp.675-693.

Altman, E.I., 1984. A further empirical investigation of the bankruptcy cost question. The Journal of Finance, 39(4), pp.1067-1089.

Berlin, M. and Loeys, J., 1988. Bond covenants and delegated monitoring. The Journal of Finance, 43(2), pp.397-412.

Bernanke, B., Gertler, M. and Gilchrist, S., 1994. The financial accelerator and the flight to quality (No. w4789). National Bureau of Economic Research.

Bettoni, A., 2000. Capital market imperfections and investment. Doctoral dissertation, University of Oxford.

Bolton, P. and Scharfstein, D.S., 1990. A theory of predation based on agency problems in financial contracting. The American economic review, pp.93-106.

Brav, A., Graham, J.R., Harvey, C.R. and Michaely, R., 2005. Payout policy in the 21st century. Journal of Financial Economics, 77(3), pp.483-527.

Brennan, M.J. and Hughes, P.J., 1991. Stock prices and the supply of information. The Journal of Finance, 46(5), pp.1665-1691.

Brown, J.R. and Petersen, B.C., 2011. Cash holdings and R&D smoothing. Journal of Corporate Finance, 17(3), pp.694-709.

Cai, J. and Zhang, Z., 2011. Leverage change, debt overhang, and stock prices. Journal of Corporate Finance, 17(3), pp.391-402.

Cantor, R., 1990. Effects of leverage on corporate investment and hiring decisions. Federal Reserve Bank of New York Quarterly Review, 15(2), pp.31-41.

Chemmanur, T.J. and Fulghieri, P., 1994. Reputation, renegotiation, and the choice between bank loans and publicly traded debt. Review of Financial Studies, 7(3), pp.475-506.

Cleary, S., 1999. The relationship between firm investment and financial status. The Journal of Finance, 54(2), pp.673-692.

Denis, D.J. and Sibilkov, V., 2009. Financial constraints, investment, and the value of cash holdings. The Review of Financial Studies, 23(1), pp.247-269.

Devereux, M. and Schiantarelli, F., 1990. Investment, financial factors, and cash flow: Evidence from UK panel data. In Asymmetric information, corporate finance, and investment (pp. 279-306). University of Chicago Press.

Dittmar, A., Mahrt-Smith, J. and Servaes, H., 2003. International corporate governance and corporate cash holdings. Journal of Financial and Quantitative Analysis, 38(1), pp.111-133.

Erel, I., Jang, Y. and Weisbach, M.S., 2015. Do acquisitions relieve target firms' financial constraints? The Journal of Finance, 70(1), pp.289-328.

Faccio, M. and Lang, L.H., 2002. The ultimate ownership of Western European corporations. Journal of Financial Economics, 65(3), pp.365-395.

Faccio, M., Lang, L.H. and Young, L., 2001. Dividends and expropriation. American Economic Review, pp.54-78.

Fama, E.F. and French, K.R., 2001. Disappearing dividends: changing firm characteristics or lower propensity to pay? Journal of Financial Economics, 60(1), pp.3-43.

Faulkender, M. and Wang, R., 2006. Corporate financial policy and the value of cash. The Journal of Finance, 61(4), pp.1957-1990.

Fazzari, S.M., Hubbard, R.G., Petersen, B.C., Blinder, A.S. and Poterba, J.M., 1988. Financing constraints and corporate investment. Brookings Papers on Economic Activity, 1988(1), pp.141-206.

Hadlock, C.J. and Pierce, J.R., 2010. New evidence on measuring financial constraints: Moving beyond the KZ index. The Review of Financial Studies, 23(5), pp.1909-1940.

Harris, M. and Raviv, A., 1990. Capital structure and the informational role of debt. The Journal of Finance, 45(2), pp.321-349.

Harris, M. and Raviv, A., 1991. The theory of capital structure. The Journal of Finance, 46(1), pp.297-355.

Hennessy, C.A. and Whited, T.M., 2007. How costly is external financing? Evidence from a structural estimation. The Journal of Finance, 62(4), pp.1705-1745.

Hermalin, B.E. and Weisbach, M.S., 1991. The effects of board composition and direct incentives on firm performance. Financial management, pp.101-112.

Hoshi, T., Kashyap, A. and Scharfstein, D., 1991. Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups. The Quarterly Journal of Economics, 106(1), pp.33-60.

James, C., 1987. Some evidence on the uniqueness of bank loans. Journal of Financial Economics, 19(2), pp.217-235.

Jensen, M.C. and Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), pp.305-360.

Kaplan, S.N. and Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? The Quarterly Journal of Economics, 112(1), pp.169-215.

Kim, C.S., Mauer, D.C. and Sherman, A.E., 1998. The determinants of corporate liquidity: Theory and evidence. Journal of Financial and Quantitative Analysis, 33(3), pp.335-359.

Lamont, O., Polk, C. and Saaá-Requejo, J., 2001. Financial constraints and stock returns. The Review of Financial Studies, 14(2), pp.529-554.

Lang, L., Ofek, E. and Stulz, R., 1996. Leverage, investment, and firm growth. Journal of Financial Economics, 40(1), pp.3-29.

Leary, M.T. and Roberts, M.R., 2005. Do firms rebalance their capital structures?. The Journal of Finance, 60(6), pp.2575-2619.

Leary, M.T. and Roberts, M.R., 2010. The pecking order, debt capacity, and information asymmetry. Journal of Financial Economics, 95(3), pp.332-355.

Lemmon, M.L. and Zender, J.F., 2010. Debt capacity and tests of capital structure theories. Journal of Financial and Quantitative Analysis, 45(5), pp.1161-1187.

Lemmon, M.L., Roberts, M.R. and Zender, J.F., 2008. Back to the beginning: persistence and the cross-section of corporate capital structure. The Journal of Finance, 63(4), pp.1575-1608.

McConnell, J.J. and Servaes, H., 1990. Additional evidence on equity ownership and corporate value. Journal of Financial Economics, 27(2), pp.595-612.

McConnell, J.J. and Servaes, H., 1995. Equity ownership and the two faces of debt. Journal of Financial Economics, 39(1), pp.131-157.

Mikkelson, W.H. and Partch, M.M., 1986. Valuation effects of security offerings and the issuance process. Journal of Financial Economics, 15(1), pp.31-60.

Minton, B.A. and Schrand, C., 1999. The impact of cash flow volatility on discretionary investment and the costs of debt and equity financing. Journal of Financial Economics, 54(3), pp.423-460.

Modigliani, F. and Miller, M.H., 1958. The cost of capital, corporation finance and the theory of investment. The American Economic Review, 48(3), pp.261-297.

Morck, R., Shleifer, A. and Vishny, R.W., 1988. Management ownership and market valuation: An empirical analysis. Journal of Financial Economics, 20, pp.293-315.

Moyen, N., 2004. Investment–cash flow sensitivities: Constrained versus unconstrained firms. The Journal of Finance, 59(5), pp.2061-2092.

Myers, S.C., 1977. Determinants of corporate borrowing. Journal of financial economics, 5(2), pp.147-175.

Opler, T., Pinkowitz, L., Stulz, R. and Williamson, R., 1999. The determinants and implications of corporate cash holdings. Journal of Financial Economics, 52(1), pp.3-46.

Opler, T.C. and Titman, S., 1994. Financial distress and corporate performance. The Journal of finance, 49(3), pp.1015-1040.

Ozkan, A. and Ozkan, N., 2004. Corporate cash holdings: An empirical investigation of UK companies. Journal of Banking & Finance, 28(9), pp.2103-2134.

Phillips, G.M., 1995. Increased debt and industry product markets an empirical analysis. Journal of Financial Economics, 37(2), pp.189-238.

Pinkowitz, L. and Williamson, R., 2002. What is a dollar worth? The market value of cash holdings. Unpublished working paper, Georgetown University.

Schaller, H., 1993. Asymmetric information, liquidity constraints, and Canadian investment. Canadian Journal of Economics, pp.552-574.

Shleifer, A. and Vishny, R.W., 1986. Large shareholders and corporate control. Journal of Political Economy, 94(3, Part 1), pp.461-488.

Shleifer, A. and Vishny, R.W., 1992. Liquidation values and debt capacity: A market equilibrium approach. The Journal of Finance, 47(4), pp.1343-1366.

Shleifer, A. and Vishny, R.W., 1997. A survey of corporate governance. The Journal of Finance, 52(2), pp.737-783.

Strebulaev, I.A. and Yang, B., 2013. The mystery of ZL firms. Journal of Financial Economics, 109(1), pp.1-23.

Subramaniam, V., Tang, T.T., Yue, H. and Zhou, X., 2011. Firm structure and corporate cash holdings. Journal of Corporate Finance, 17(3), pp.759-773.

Titman, S. and Wessels, R., 1988. The determinants of capital structure choice. The Journal of Finance, 43(1), pp.1-19.

Tong, Z., 2011. Firm diversification and the value of corporate cash holdings. Journal of Corporate Finance, 17(3), pp.741-758.

Vasan, P.V. Srini, 1987. Credit Rationing and Corporate Investment. Doctoral dissertation, Harvard University.

Whited, T.M. and Wu, G., 2006. Financial constraints risk. The Review of Financial Studies, 19(2), pp.531-559.

Whited, T.M., 1992. Debt, liquidity constraints, and corporate investment: Evidence from panel data. The Journal of Finance, 47(4), pp.1425-1460.

Williamson, O.E., 1988. Corporate finance and corporate governance. The Journal of Finance, 43(3), pp.567-591.

CHAPTER 2

A New Model for Screening Shariah Compliant Firms

1. Introduction:

When investing in the equity capital markets, countries and investors who choose to adhere to the Shariah law often apply a set of qualitative and quantitative screens to exclude equity firms that are Shariah-incompliant. Qualitative screens are sector screens through which firms primarily operating within specific Shariah-impermissible industries (e.g., tobacco products and alcoholic beverages) are excluded. Implementing sector screens is relatively straightforward and only exclude a small portion of equity firms. Firms that satisfy the qualitative screens are subject to quantitative financial screens through which only firms that are involved in a negligible impermissible activity (e.g., minor interest payments or occasional sale of liquor) are deemed as Shariah-compliant. Those with impermissible activities exceeding a subjectively-specified threshold are considered Shariah-incompliant. Unlike sector screens, financial screens are vague and apply to roughly all equity firms because almost all firms are involved in interest payments.

Although there exists an overwhelming consensus among Shariah experts that interest is a grave and sinful act in Islam, a large number of contemporary Shariah experts argue that minor impermissible acts do not render the whole firm as impermissible. The rationale behind this view is that it is almost impossible to find a firm that is fully Shariah-compliant in today's equity capital markets. Even if there are a few, they are not sufficient to absorb all the wealth of Shariah-compliant investors and they will probably be concentrated in small regions of the world putting the wealth of Shariah-compliant investors at a very high risk (DeLorenzo, 2000). In addition to that, Shariah-compliant equity investors are in most cases minority investors with limited control and voting power. If a shareholder objects an impermissible contract, but his objection was overruled by a majority vote, one cannot conclude that the contract was approved by that shareholder (Derigs and Marzban,

2008). Hence, investing in some Shariah-incompliant firms became permissible due to the absence of the ideal alternative and because there is a need that must be satisfied with the lowest harm and highest benefit. Investors are required, however, to express their disapproval against impermissible dealings and to purify their earnings from any impermissible income.

Based on the above view, a number of Shariah-compliant equity funds and index providers have emerged[11]. Most of them follow similar criteria in implementing sector screens. Remarkable discrepancies, however, exist between the different financial screens. This is mainly because specifying the threshold of non-negligible impermissible acts is purely subjective. For example, regarding the ratio of interest-bearing debt to total assets, a wide threshold dispersion ranging from 25 to 50 percent exist among the different financial screening guidelines. Beside the remarkable discrepancies, using thresholds to classify firms as "Shariah-compliant" or "Islamic" is problematic. Take the threshold of 33 percent for the debt-to-assets ratio as an example. This threshold implies that firms with a debt ratio of 34 percent are Shariah-incompliant, whereas firms with a debt ratio of 32 percent are indeed Shariah-compliant. It also implies that firms with a 15 percent debt ratio are as compliant as firms with a 5 percent debt ratio. The reality is that none of the referenced firms are fully compliant, but some are more compliant (i.e., less Shariah-sinful) than others.

The wide variations in the current Shariah-compliant equity screening practices have resulted in conflicted and inconsistent classifications, leaving the Shariah-compliant investors confused and discouraged. Moreover, with today's modern technology and big data analytics, one can easily build up models for Shariah-compliant investors that maximizes the benefits and minimizes the harms of

[11] These include for example the Dow Jones Islamic Index, Financial Times Islamic Index, Standard & Poor's Islamic Index, Morgan Stanley Capital International Islamic Index, Dubai Islamic Bank Fund, and HSBC Amanah Fund.

investing and participating in the world's equity capital markets. Thus, the development of an integrated screening framework that is customizable and understandable will surely enrich the reliability and practicality of the Shariah-compliant equity investments.

This paper posits the Weighted Average Shariah-Compliance Percentile (hereafter: WASC). This measure reflects the extent to which a firm adheres to Shariah relative to the other firms located in a certain region at a certain time. The WASC is a financial quantitative measure that ranges from zero to one and only applies to firms that satisfy the sector screens. Firms whose core business is impermissible are initially excluded and are deemed as Shariah-incompliant. Each firm that satisfies the sector screens is then given various percentile ranks. These ranks are then used to calculate the WASC. A firm with a *90% US WASC in 2015* is more Shariah-compliant than 90% of all US firms in 2015. This simple number provides the Shariah-compliant investor with a clear precise understanding of the *relative* compliance status of each firm he wishes to invest in. Hence, it is more Shariah-appropriate than the use of thresholds. Also, this single numeric figure can be easily incorporated into portfolio optimization models.

Section three provides a detailed overview and analysis of all the optional formats used to customize the WASC. The WASC can be customized by specifying the set of financial ratios, the dataset, and the weight for each of its various accounts. Current screening practitioners do not all use the same set of financial ratios when carrying out the quantitative screens. For example, there is a debate among Shariah experts as to whether use market or accounting book values to value the worth of a firm, where this value is used as a divisor for various financial ratios (Nisar and Khatkhatay, 2006). Specification of the dataset is also necessary because the WASC is a relative percentile measure. Since some equity funds may be limited to investing their asset base across certain regions, each equity fund may have distinctive datasets. Although the availability of multiple formats impairs the consistency of

equity screens, it accommodates all the existing views of Shariah experts. It can also be designed to be consistent with each portfolio's objectives and constraints, making the WASC suitable and applicable to a wide number of Shariah-compliant equity investors. There cannot be a unified format of the WASC simply because investors will always have different objectives, constraints, and views about the appropriate set of financial ratios and weights. Hence, it is expected that each screening practitioner may have distinctive sets of weights, financial ratios, datasets, and WASC values.

Finally, the paper presents illustrative results using a sample of all publicly traded US firms from the year 2010 to 2016. The results are discussed and compared across different firms, years, sets of weights, and sets of financial ratios. The results indicate that firms with considerable amounts of monetary assets and liabilities will show varying WASC values depending on whether book or market values are used as ratio divisors. Moreover, the use of different sets of WASC weights may have significant effects on the WASC if there are large discrepancies between the various percentile accounts used to calculate the WASC. Lastly, the results suggest a negative relationship between each account ratio and its percentile that varies from account to another due to the changing aggregate firm behavior over time.

Section 2 briefly highlights the current Shariah-compliant equity screening practices. Section 3 analyzes all the formats used to customize the WASC. Section 4 presents a general case of the WASC. Section 5 reports the results, and section 6 concludes.

2. Current Equity Screening Practices:

All Shariah-compliant equity investors start their screens by excluding firms that primarily operate within specific impermissible industries (e.g., tobacco products and alcoholic beverages). There are three main industry classification codes used to carry

TABLE 2.1: SHARIAH INCOMPLIANT INDUSTRY CODES

This table reports the different codes for industries that are deemed as Shariah incompliant by most Shariah compliant screening practitioners. x denotes all discrete numbers from 0 to 9. xx denotes all discrete numbers from 0 to 99. xxxx denotes all discrete numbers from 0 to 9999. SIC (Standard Industry Classification) is developed in 1937 by the US government. GICS (Global Industry Classification Standard) is developed in 1999 by Standard & Poor's and MSCI. For more information, see the Dow Jones Islamic Market Indices Methodology (2018), MSCI Islamic Index Series Methodology (2015), S&P Shariah Indices Methodology (2018), and FTSE Shariah Global Equity Index Series (2018).

Panel A: SIC codes:

SIC Code	Incompliant Industries	SIC Code	Incompliant Industries
0132	Tobacco Farming	60xx	Depository Institutions
0213	Hog and Pig Farming	61xx	Nondepository Credit Institutions
2013	Sausage Products	62xx	Security & Commodity Brokers
2082	Breweries	63xx	Insurance Carriers
2084	Wineries	64xx	Insurance Agents Brokers & Service
2085	Distilleries	6797	Mortgage Institutions
21xx	Tobacco Products Manufacturers	6798	Mortgage Institutions
5181	Beer and Ale Merchant Wholesalers	7011	Casino Hotels
5182	Alcoholic Beverage Merchant Wholesalers	78xx	Motion Pictures
5194	Tobacco Merchant Wholesalers	791x	Dance Studios
5735	Musical Instrument and Supplies Stores	792x	Theatrical Producers
5736	Musical Instrument and Supplies Stores	866x	Religious Organizations
5813	Alcoholic Beverages	93xx	Public Finance
5921	Beer, Wine, and Liquor Stores	9711	Weapon Related Establishments
5993	Tobacco Stores		

Panel B: GICS codes:

GICS Code	Incompliant Industries	GICS Code	Incompliant Industries
20101010	Aerospace & Defense	30201010	Brewers
25301010	Casinos & Gaming	30201020	Distillers & Vintners
25301020	Hotels, Resorts & Cruise Lines	30203010	Tobacco
25301040	Restaurants	4010xxxx	Banks
25401020	Broadcasting	4020xxxx	Diversified Financials
25401025	Cable & Satellite	4030xxxx	Insurance
25401030	Movies & Entertainment		

out the sector screens: GICS, ICB, and SIC[12]. The benefit of using the SIC is that a firm may have multiple SIC codes based on its different business activities, whereas only one GICS and ICB code is assigned to each firm based on its core-business activity (Derigs and Marzban, 2008). Table 1 shows the different SIC codes for industries that are deemed as Shariah incompliant. Firms that satisfy the sector screens are subject to quantitative financial screens. In these screens, firms that are involved in impermissible financial contracts exceeding a subjectively-specified threshold are considered Shariah-incompliant.

Most Shariah-compliant equity investors apply four sets of quantitative financial screens: interest, debt, liquidity, and impermissible income screens[13]. Interest and debt screens merely focus on investigating the level of interest-bearing investments and finances, respectively. Since Shariah experts concur that interest is impermissible, lower threshold discrepancies are found in the different contemporary debt and interest screens relative to the monetary and impermissible income screens.

Impermissible income screens focus on investigating the level of earnings generated from Shariah-incompliant activities. It can be applied, for instance, to an airline company to measure the amount of income generated from alcohol sales. Such screens are less-frequently used by screening practitioners. This is probably because sector screens are already conducted and because current accounting standards do not require firms to disclose all income source elements. If the impermissible revenue is significant, it will most likely be reflected in the sector classifications (e.g., SIC codes). One can always conduct a thorough investigation of each firm's revenue

[12] SIC (Standard Industry Classification) is developed in 1937 by the US government. GICS (Global Industry Classification Standard) is developed in 1999 by Standard & Poor's and MSCI. ICB (Industry Classification Benchmark) is developed in 2005 by Dow Jones and FTSE.

[13] See the Dow Jones Islamic Market Indices Methodology (2018), MSCI Islamic Index Series Methodology (2015), S&P Shariah Indices Methodology (2018), and FTSE Shariah Global Equity Index Series (2018). More information about these is available in the references. Also, see Derigs and Marzban (2008) for a comprehensive review of the Shariah-compliant equity screening practices.

sources, but such an investigation is costly and impractical, especially because the reliability of the results is as good as the disclosures.

Liquidity or monetary screens focus on investigating the level of monetary assets[14]. Because not all Shariah experts have same views regarding the permissibility of monetary assets, a larger threshold dispersion is found among the different contemporary monetary screens. To understand why Shariah favors non-monetary assets (e.g., inventory and PP&E) over monetary assets (e.g., cash and cash equivalents, short- and long-term debt investments, and accounts relievable), consider these two rather extreme examples. If a firm holds cash as its only asset, then the total value of the firm's outstanding shares must equal the total value of cash held. This is because, according to Shariah, when money is traded with money, the trade must be exactly equal[15]. Similarly, if a firm holds accounts receivables and marketable securities as its only assets, then purchasing shares from that firm is viewed as purchasing debt. Shariah clearly prohibits the purchase or sale of any debt, whether it involves interest or not. Shariah experts all agree upon the restrictions involved in purchasing solo monetary assets, but they have different views in attributing the stock price to the monetary assets. The least restrictive view suggests that as long as (1) a firm holds non-monetary assets and (2) the total value of the firm's outstanding shares is in excess of total monetary assets, the firm is deemed as Shariah-compliant, because the excess value can be attributed to the non-monetary assets (Nisar and Khatkhatay, 2006).

Similar arguments that apply to monetary assets also apply to monetary liabilities. Specifically, all Shariah experts agree upon the restrictions involved in

[14] Monetary assets are assets that involve the right to receive a determinable amount of currency units. By the same token, monetary liabilities are liabilities that involve the obligation to deliver a determinable amount of currency units. Most Shariah-compliant equity investors use the term 'liquid' assets as opposed to 'monetary' assets. The accounting term 'liquid' is inappropriate in this context because it includes inventory and excludes long-term interest-bearing investments. The more appropriate and relevant accounting terminology is using the term 'monetary'.

[15] According to Shariah, the trade also must be instant.

TABLE 2.2: DEBT, INTEREST, IMPERMISSIBLE INCOME, AND MONETARY RATIOS

This table presents the main debt, interest, impermissible income, and monetary ratios used by the major Shariah-compliant equity funds and Islamic index providers. Market capitalization is the total market value of a firm's outstanding common shares at a certain time. Cash denotes cash and cash equivalents.

	Debt Ratios	Interest Ratios	Impermissible Income Ratios	Monetary Ratios
First Ratio	$\frac{Total\ Debt}{Total\ Assets}$	$\frac{Cash\ +\ Short\ Term\ Investments}{Total\ Assets}$	$\frac{Total\ Impermissible\ Income}{Total\ Revenue}$	$\frac{Accounts\ Receivable}{Total\ Assets}$
Second Ratio	$\frac{Total\ Debt}{Market\ Capitalization}$	$\frac{Cash\ +\ Short\ Term\ Investments}{Market\ Capitalization}$	-	$\frac{Accounts\ Receivable}{Market\ Capitalization}$
Third Ratio	-	$\frac{Short\ and\ Long\ Term\ Investments}{Total\ Assets}$	-	$\frac{Accounts\ Receivable + Cash}{Total\ Assets}$
Fourth Ratio	-	$\frac{Short\ and\ Long\ Term\ Investments}{Market\ Capitalization}$	-	$\frac{Accounts\ Receivable + Cash}{Market\ Capitalization}$
Sixth Ratio	-	$\frac{Short\ and\ Long\ Term\ Investments + Cash + Accounts\ Receivable}{Total\ Assets}$	-	$\frac{Short\ Term\ Investments + Cash + Accounts\ Receivable}{Total\ Assets}$
Seventh Ratio	-	$\frac{Short\ and\ Long\ Term\ Investments + Cash + Accounts\ Receivable}{Market\ Capitalization}$	-	$\frac{Short\ Term\ Investments + Cash + Accounts\ Receivable}{Market\ Capitalization}$
Eighth Ratio	-	$\frac{Total\ Interest\ Income\ and\ Expense}{Total\ Revenue}$	-	-

selling any solo debt obligations, but they have different views in carrying the debt obligations on the common stockholders. The least restrictive view suggests that due to the limited liability feature of publicly traded companies, the sale of a firm common stock is independent of the firm's debt obligations (Nisar and Khatkhatay, 2006).

3. Specifying the Ratios, the Dataset, and the Weights:

3.1. Specifying the Ratios:

Table 2 presents the main debt, interest, impermissible income, and monetary ratios used by the major Shariah-compliant equity funds and Islamic index providers.

3.1.1. Book and Market Firm Value:

One major cause of the ratio variations presented in table 2 is the disagreement over the variable representing the worth of a firm, where this variable is used as a divisor for the various financial ratios. Some funds and indexes use market capitalization[16] as a ratio divisor. But market capitalization may lead to undesirable performances for the Shariah-compliant investor when stocks are mispriced[17]. Specifically, overpriced stocks will falsely appear more Shariah-compliant whereas underpriced stocks will inaccurately appear less Shariah-compliant, leaving investors who try to optimize their degree of Shariah-compliance misled and disadvantaged[18].

Also, there is a large body of the corporate finance literature suggesting that the amount of corporate leverage collateralized by existing assets will be more than is collateralized by future growth, holding other things equal. Myers (1977) explains why managers often set firms' target leverage ratios relative to book as opposed to

[16] Or average monthly market capitalization to smooth the measure and eliminate any seasonality effects.

[17] While there is an ongoing debate over asset price drivers, both behavioral- and rational-based asset pricing theories tend to agree on the view that there may be temporary price deviations from the fundamental or efficient price.

[18] The empirical results in section five provide more discussion as to why the use of market value as a ratio divisor may disadvantage Shariah-compliant investors.

market values. He states: "it is not that book values are more accurate than stock market values, but simply that they refer to assets already in place. A significant part of many firms' market values is accounted for by assets not yet in place (i.e., by the present value of future growth opportunities)." Myers' (1977) debt overhang theory explains how corporate leverage can reduce firms' value by weakening their incentive to undertake good future investments. Consistent with the debt overhang theory, a number of empirical studies document that leverage is negatively associated with firms' market value and with future growth (e.g., Cai and Zhang (2011), Ahn et al. (2006), Aivazian and Qiu (2005), Lang et al. (1996), McConnell and Servaes (1995)). These studies imply that leverage should not be measured relative to market values because growth decreases with leverage and is not yet realized.

In summary, the use of market capitalization is advantageous in that it is independent of accounting standards discrepancies and reflects the market value of the firm, but the use of market capitalization can be: (1) inappropriate because it majorly accounts for future growth opportunities that are not yet realized, (2) disadvantageous when stocks are mispriced, (3) unstable when prices are volatile, and (4) irrelevant when prices are driven by external market factors. To reduce the effect of price volatility, some investors use average monthly market capitalization to smooth the measure.

The worth of a firm can alternatively be accounted for using total book asset value. Indeed, book values tend to be stable and reflect assets already in place, but book values are more susceptible to accounting standards discrepancies and reporting biases. To reduce the effects of accounting standards discrepancies, time must be spent in correcting for the accounting practice differences between the countries. Rajan and Zingales (1995) analyze the different accounting practices of multiple countries and point to the modifications required so that leverage measures can be internationally comparable. Alternatively, one can simply use distinctive datasets for each country to avoid the effects of accounting standards discrepancies.

3.1.2. Monetary Assets and Liabilities:

Another main cause of ratio dissimilarity presented in table 2 is the specification of monetary and interest-bearing assets used to calculate monetary and interest ratios, respectively. Clearly, there is a noticeable overlap in the monetary and interest ratios. This is because all interest-bearing assets are also monetary assets [19]. It is also important to note that some monetary assets are more Shariah-incompliant than others. For example, monetary assets that earn greater interest (e.g., bonds) are more Shariah-incompliant than monetary assets that earn less interest (e.g., certificates of deposit) or zero interest (e.g., some accounts receivables). In general, long-term interest-based investments and liabilities are more likely to be more Shariah-incompliant than short-term interest-based investments and liabilities. This is because long-term interest-based investments and liabilities imply the intent of holding these incompliant deals for longer time periods. Also, interest-yields often increase with maturity because investors often demand higher interest rates for longer-term riskier investments.

To account for this matter, interest and monetary screens can be combined and represented by one measure. This measure can be calculated as a weighted average of several monetary asset accounts with greater weights assigned to the more Shariah-incompliant monetary asset accounts[20]. The general formula for the weighted average monetary assets percentile at time t for firm i can be represented as:

$$Monetary\ Assets_{i,t} = W_{IBI} Interest\ Bearing\ Investments_{\ i,t} + W_C Cash_{i,t} + W_R Receivables_{i,t} \qquad (1)$$

[19] But not all monetary assets (e.g., some accounts receivable) are interest-bearing assets.
[20] All sorts of short- and long-term equity investments (e.g., equity stocks, investments in associates) are non-monetary assets.

Where *Interest Bearing Investments* denote the monetary investments percentile. It reflects the relative rate to which a firm coincide with Shariah in that lower proportions of its total assets are interest-bearing investments. $Cash$ denotes the cash and cash equivalents percentile and reflects the relative degree to which a firm complies with Shariah in that lower proportions of its total assets are recorded as cash and cash equivalents. $Receivables$ denotes the receivables percentile and reflects the relative extent to which a firm is more Shariah-compliant in that lower proportions of its total assets are documented as receivables. $W_{IBI}, W_C,$ and W_R denote the weights of the monetary investments percentile, cash and cash equivalents percentile, and receivables percentile, respectively.

Panel A in table three presents the different monetary asset ratios used to calculate the monetary investments percentile, cash and cash equivalents percentile, and receivables percentile. Long-term interest-bearing investments can include investments in bonds and long-term note receivable. Short-term interest-bearing investments can include investments in certificates of deposit, commercial papers, and short-term notes.

Debt screens can also be decomposed and calculated as a weighted average of several monetary liability accounts with greater weights assigned to the more Shariah-incompliant monetary liability accounts. The general formula for the weighted average monetary liabilities percentile at time t for firm i can be represented as:

$$Monetary\ Liabilities_{i,t} = W_{LD} LT\ Debt_{i,t} + W_{SD} ST\ Debt_{i,t} + W_P Payables_{i,t} \quad (2)$$

Where $LT\ Debt$ and $ST\ Debt$ denote the long- and short-term debt percentile. They reflect the relative level to which a firm is more Shariah-consistent in that lower proportions of its total liability and equity are classified as long- and short-term debt. $Payables$ denotes the payables percentile and reflects the relative scale to which a

TABLE 2.3: MONETARY ASSET AND LIABILITY RATIOS

Panel A presents the different monetary asset ratios used to calculate the long- and short-term interest-bearing investments percentiles, cash and cash equivalents percentile, and receivables percentile. Panel B presents the different monetary liability ratios used to calculate the long-term debt, short-term debt, and payables percentiles. Panel C presents the different financial margins used to calculate the interest income, interest expense, and impermissible income percentiles. Market capitalization is the total market value of a firm's outstanding common shares at a certain time. Average market capitalization is the average monthly market capitalization over a certain time period. Total interest-bearing investments can include investments in bonds, certificates of deposit, commercial papers, and notes. Cash denotes cash and cash equivalents. Receivables can include trade receivables and other current receivables. Total long-term debt can include corporate bonds, capitalized lease obligations, non-convertible debt, and other long-term debt. Total short-term debt can include current portion of long-term debt, commercial papers, convertible debt and other short-term debt. Payables can include accounts payable and income taxes payable.

Panel A: Monetary Asset Ratios:

	Interest-bearing Investment Ratios	Cash Ratios	Receivables Ratios
Using Total Assets	$\frac{\text{LT and ST Interest bearing Inves.}}{Total\ Assets}$	$\frac{Cash}{Total\ Assets}$	$\frac{Receivables}{Total\ Assets}$
Using Market Capitalization	$\frac{\text{LT and ST Interest bearing Inves.}}{Market\ Capitalization}$	$\frac{Cash}{Market\ Capitalization}$	$\frac{Receivables}{Market\ Capitalization}$
Using Average Market Capitalization	$\frac{\text{LT and ST Interest bearing Inves.}}{Average\ Market\ Capital.}$	$\frac{Cash}{Average\ Market\ Capital.}$	$\frac{Receivables}{Average\ Market\ Capital.}$

Panel B: Monetary Liability Ratios:

	Long Term Debt Ratios	Short Term Debt Ratios	Payables Ratios
Using Total Assets	$\frac{Total\ Long\ Term\ Debt}{Total\ Assets}$	$\frac{Total\ Short\ Term\ Debt}{Total\ Assets}$	$\frac{Payables}{Total\ Assets}$
Using Market Capitalization	$\frac{Total\ Long\ Term\ Debt}{Market\ Capitalization}$	$\frac{Total\ Short\ Term\ Debt}{Market\ Capitalization}$	$\frac{Payables}{Market\ Capitalization}$
Using Average Market Capitalization	$\frac{Total\ Long\ Term\ Debt}{Average\ Market\ Capital.}$	$\frac{Total\ Short\ Term\ Debt}{Average\ Market\ Capital.}$	$\frac{Payables}{Average\ Market\ Capital.}$

Panel C: Income Statement Margins:

Interest Income Margin	Interest Expense Margin	Impermissible Income Margin
$\frac{Total\ Interest\ Income}{Total\ Revenue}$	$\frac{Total\ Interest\ Expense}{Total\ Revenue}$	$\frac{Total\ Impermissible\ Income}{Total\ Revenue}$

firm adheres to Shariah in that lower proportions of its total liability and equity are recorded as payables. $W_{LD}, W_{SD},$ and W_P denote the weights of the long-term debt percentile, short-term debt percentile, and payables percentile, respectively.

Panel B in table three presents the different monetary liability ratios used to calculate the long-term debt, short-term debt, and payables percentiles. Long-term debt can include corporate bonds, capitalized lease obligations, non-convertible debt, and other long-term debt. Short-term debt can include current portion of long-term debt, commercial papers, convertible debt, and other short-term debt. Payables can include accounts payable and income taxes payable.

In addition to monetary assets and liabilities screens, other secondary screens may include interest revenue and expense screens and impermissible income screens. Unlike monetary asset and liability screens, interest screens focus on gauging and verifying interest revenue and expense levels using a firm's income statement, as opposed to using a firm's balance sheet. Impermissible income screens can also be used to verify the level of engagements in impermissible acts, other than interest, that are not captured by the sector screens. Panel C in table three presents the different financial margins used to calculate the interest income, interest expense, and impermissible income percentiles.

One major limitation of using these secondary screens is that firms tend to not report their insignificant revenue and expense constituents in their financial statements. Hence, these screens may require a thorough investigation of all the sources of each firm's revenues and expenses. But such investigations may not be robust and practical, especially because current accounting standards do not require detailed disclosers of all the revenue and expense elements.

3.2. Specifying the Dataset:

Since the WASC is a relative measure, the dataset must be distinctively specified. The dataset can be all publicly traded companies in one country, multiple countries, one continent, multiple continents, or the entire globe. Due to economic or political reasons, some Shariah-compliant equity funds may be restricted from investing their asset base in certain countries or sectors. Also, for diversification purposes, some equity funds may initially allocate certain proportions of their asset base across different countries or sectors. Hence, each screening practitioner may have distinctive datasets that are consistent with his objectives and constraints or may have multiple datasets, one for each country or sector[21].

3.3. Specifying the Weights:

The general rule is that greater weights should be assigned to the accounts that are (1) more agreed-upon by Shariah experts, (2) more Shariah-incompliant, and (3) more reliably measured.

4. The Model:

Using equations (1) and (2), the general formula for the WASC at time t for firm i can be represented as:

$$WASC_{i,t} = W_{ML} \times (Monetary\ Liabilities_{i,t}) + W_{MA} \times (Monetary\ Assets_{i,t}) + W_{IRE} Interest\ R/E_{i,t} \quad (3)$$

0r:

$$WASC_{i,t} = W_{ML} \times (W_{LD} Long\ Term\ Debt_{i,t} + W_{SD} Short\ Term\ Debt_{i,t} + W_P Payables_{i,t}) + W_{MA} \times (W_{IBI} Interest\ Bearing\ Investments_{\ i,t} + W_C Cash_{i,t} + W_R Receivables_{i,t}) + W_{IRE} Interest\ R/E_{i,t} \quad (4)$$

Where I$nterest\ R/E$ denotes the interest revenue and expense percentile and reflects the relative rate to which a firm comply with Shariah in that it has lower

[21] Having multiple datasets can be useful to avoid the effects of accounting standards discrepancies.

interest revenue and expense margins in its income statement. W_{ML}, W_{MA}, $and\ W_{IRE}$ denote the weights of the weighted average monetary assets percentile, the weighted average monetary liabilities percentile, and the interest revenue and expense percentile, respectively.

To calculate a percentile, its relevant financial ratios are calculated for all firms in a specific region at a specific year. For each ratio (e.g., long-term debt to assets ratio), firms with a ratio of zero are initially excluded and are immediately given a percentile of 100%. Firms with a ratio higher than zero are counted and ranked numerically from bottom to top based on their ratio value. Following the Allen Hazen (1869–1930) mothed, the percentile of ratio r[22] at time t for firm i can be represented as:

$$Percentile_{r,i,t} = \frac{Rank_{r,i,t} - 0.5}{Number\ of\ Firms\ with\ a\ Positive\ Ratio_{r,t}} \qquad (5)$$

5. Illustrative Results:

To illustrate the use of the WASC, we use merged annual Compustat and CRSP datasets for all publicly traded firms in the United States over the period from 2010 to 2016. The SIC codes presented in table one are used to exclude all firms primarily operating within Shariah-impermissible industries. This resulted in excluding about 22% of our sample database. On the date each firm reports its annual financial statements, market capitalization is calculated as share price times total shares outstanding. Average market capitalization is the average monthly market capitalization over the twelve months prior to each firm's annual reporting date. All the ratios in table three are then calculated using total book assets, market capitalization, and average monthly market capitalization as ratio divisors. To get an idea of how using different ratio divisors can affect our main financial ratios, we

[22] Ratio r can be any of the ratios presented in table 3 (e.g., long-term debt to assets ratio).

TABLE 2.4: DESCRIPTIVE STATISTICS

This table reports several descriptive statistics for a sample of 19,960 yearly observations from 2010 to 2016. For each ratio, the observations' number, mean, median, standard deviation are reported. The last column reports the difference in ratio means. The numbers in parentheses are p-values associated with the parametric two-sample t-test.

Panel A: Total Assets and Market Capitalization as Ratio Divisors:

	Total Assets as a Ratio Divisor				Market Capitalization as a Ratio Divisor				Significance tests
Ratio	Obs.	Mean	SD	Median	Obs.	Mean	SD	Median	Difference in means
Interest Bearing Inv.	19756	0.0740	0.1552	0.0032	19756	0.0559	0.1200	0.0031	0.0181 (0.0000)
Cash	19685	0.1676	0.1951	0.1025	19685	0.1375	0.1557	0.0865	0.0301 (0.0000)
Receivables	19300	0.1207	0.1092	0.0996	19300	0.1421	0.1713	0.0825	-0.0214 (0.0000)
Monetary Asset	18353	0.3647	0.2580	0.3012	18353	0.2967	0.2172	0.2387	0.0680 (0.0000)
LT Debt	18086	0.1555	0.1743	0.1056	18086	0.1800	0.2345	0.0775	-0.0245 (0.0000)
ST Debt	19489	0.0431	0.0923	0.0063	19489	0.0580	0.1312	0.0057	-0.0149 (0.0000)
Payables	19640	0.0718	0.0733	0.0502	19640	0.0955	0.1391	0.0458	-0.0238 (0.0000)
Monetary Liability	16696	0.2517	0.1978	0.2264	16696	0.2562	0.2555	0.1701	-0.0045 (0.0016)

Panel B: Market Capitalization and Average Market Capitalization as Ratio Divisors:

	Average Market Cap. as a Ratio Divisor				Market Capitalization as a Ratio Divisor				Significance tests
Ratio	Obs.	Mean	SD	Median	Obs.	Mean	SD	Median	Difference in means
Interest Bearing Inv.	15970	0.0518	0.1070	0.0033	15970	0.0556	0.1180	0.0033	-0.0038 (0.0000)
Cash	15873	0.1255	0.1379	0.0812	15873	0.1348	0.1543	0.0842	-0.0093 (0.0000)
Receivables	15528	0.1362	0.1579	0.0837	15528	0.1421	0.1673	0.0847	-0.0059 (0.0000)
Monetary Asset	14656	0.2805	0.2006	0.2298	14656	0.2908	0.2115	0.2348	-0.0103 (0.0000)
LT Debt	14506	0.1772	0.2234	0.0860	14506	0.1804	0.2279	0.0877	-0.0032 (0.0000)
ST Debt	15749	0.0536	0.1171	0.0062	15749	0.0582	0.1293	0.0062	-0.0046 (0.0000)
Payables	15832	0.0888	0.1224	0.0454	15832	0.0955	0.1363	0.0470	-0.0067 (0.0000)
Monetary Liability	13355	0.2510	0.2428	0.1740	13355	0.2555	0.2464	0.1778	-0.0045 (0.0000)

TABLE 2.5: YEARLY AVERAGE RATIO FREQUENCIES

This table displays the yearly average ratio frequencies from 2010 to 2016. The ratios without parentheses are calculated using total assets as a ratio divisor. The ratios in parentheses are calculated using market capitalization as a ratio divisor. Column Observ. reports the number of firms in a given year in the sample.

Year	Interest Inv.	Cash	Receivab.	Monetary Asset	LT Debt	ST Debt	Payables	Monetary Liability	Observ.
2010	0.0747 (0.0606)	0.1675 (0.1429)	0.1316 (0.1552)	0.3763 (0.3218)	0.1299 (0.1633)	0.0450 (0.0640)	0.0762 (0.1001)	0.2380 (0.2509)	2921
2011	0.0682 (0.0653)	0.1627 (0.1609)	0.1266 (0.1694)	0.3589 (0.3353)	0.1356 (0.1793)	0.0410 (0.0645)	0.0740 (0.1141)	0.2382 (0.2651)	2833
2012	0.0681 (0.0588)	0.1582 (0.1473)	0.1251 (0.1612)	0.3533 (0.3127)	0.1479 (0.1831)	0.0426 (0.0654)	0.0735 (0.1053)	0.2508 (0.2675)	2768
2013	0.0703 (0.0471)	0.1749 (0.1248)	0.1234 (0.1276)	0.3703 (0.2729)	0.1623 (0.1698)	0.0428 (0.0491)	0.0719 (0.0831)	0.2655 (0.2435)	2813
2014	0.0770 (0.0494)	0.1746 (0.1218)	0.1177 (0.1261)	0.3723 (0.2714)	0.1745 (0.1805)	0.0437 (0.0491)	0.0708 (0.0854)	0.2796 (0.2537)	2947
2015	0.0797 (0.0562)	0.1695 (0.1357)	0.1099 (0.1337)	0.3634 (0.2872)	0.1820 (0.1934)	0.0495 (0.0591)	0.0689 (0.0940)	0.2906 (0.2617)	2923
2016	0.0804 (0.0540)	0.1679 (0.1289)	0.1103 (0.1213)	0.3617 (0.2764)	0.2010 (0.2022)	0.0553 (0.0602)	0.0715 (0.0868)	0.3130 (0.2743)	2551
Average	0.0740 (0.0559)	0.1680 (0.1375)	0.1207 (0.1421)	0.3654 (0.2966)	0.1613 (0.1812)	0.0456 (0.0587)	0.0724 (0.0956)	0.2674 (0.2591)	-

report in table 4 several ratio descriptive statistics. For each ratio, the total number of observations, mean, standard deviation, and median are reported. Panel A compares between the ratios when calculated using total assets as a ratio divisor and when calculated using market capitalization as a ratio divisor. Panel B compares between the ratios when calculated using average monthly market capitalization as a ratio divisor and when calculated using market capitalization as a ratio divisor. The last column displays a statistically and economically significant difference in means for ratios in panel A, but minor economic significance for ratios in panel B. Table 5 displays the yearly average ratio frequencies from 2010 to 2016. Of all the other ratios, the average long-term debt ratio was remarkably and continually trending up over time. The other ratios stayed relatively stable over the sample period.

Before calculating the percentiles, we break our database into seven parts, one part for each year. It is important to separate each observation year from another since the WASC is a relative cross-sectional percentile measure. Firms with a ratio of zero are initially excluded and are immediately given a percentile of 100%. For each ratio, firms with a positive ratio are counted and ranked numerically from bottom to top based on their ratio value. As per equation 5, percentiles are then calculated. As per equation 4, the WASC is then calculated for each firm using three different sets of financial ratio divisors and three different sets of weights. Table 6 displays the average ratio and percentile frequencies across ten sectors classified according to SIC major group classifications. The last column reports the number of firms in a given sector in the sample after excluding firms primarily operating within Shariah-impermissible industries. A high portion of our sample firms is operating in the manufacturing sector, whereas only 144 yearly firm observations are classified in the agricultural sector. One important observation that can be drawn from table 6 is that the average WASC across all the sectors is not widely dispersed. This is mainly because the ratios tend to offset each other (e.g., the effect of a relatively low interest-bearing investment ratio in the mining sector is offset by the effect of a relatively high long-term debt ratio).

TABLE 2.6: SECTOR AVERAGE RATIO AND PERCENTILE FREQUENCIES

This table displays the average ratio and percentile frequencies across different sectors from 2010 to 2016. The numbers without parentheses are average ratios frequencies, whereas the numbers in parentheses are average percentile frequencies. The weights of the various accounts of the WASC are reported in table 10. Column Observ. reports the number of firms in a given sector in the sample. Total assets book value is used as the ratio divisor. The ten sectors are classified according to SIC major group classifications.

Sector	SIC Code	Interest Inv.	Cash	Receivab.	Monetary Asset	LT Debt	ST Debt	Payables	Monetary Liability	WASC	Observ.
Agriculture, Forestry, Fishing	0100 to 0999	0.0477 (0.7459)	0.1032 (0.6670)	0.0940 (0.6237)	0.2449 (0.7319)	0.1606 (0.6831)	0.0333 (0.6744)	0.0601 (0.6784)	0.2540 (0.6794)	0.7030	144
Mining	1000 to 1499	0.0269 (0.8460)	0.1052 (0.6595)	0.0597 (0.7202)	0.1918 (0.8211)	0.2203 (0.6010)	0.0615 (0.7379)	0.0691 (0.5964)	0.3509 (0.6555)	0.7301	2244
Construction	1500 to 1799	0.0347 (0.7389)	0.1174 (0.5391)	0.1860 (0.4586)	0.3381 (0.7049)	0.2243 (0.5776)	0.0538 (0.6468)	0.1001 (0.4360)	0.3782 (0.5982)	0.6462	436
Manufacturing	2000 to 3999	0.0912 (0.7042)	0.2262 (0.4432)	0.1269 (0.4963)	0.4443 (0.6677)	0.1416 (0.7257)	0.0559 (0.7050)	0.0869 (0.4887)	0.2844 (0.7055)	0.6885	14286
Transport. & Public Utilities	4000 to 4999	0.0317 (0.7411)	0.0514 (0.7786)	0.0762 (0.6628)	0.1592 (0.7410)	0.3013 (0.4536)	0.0443 (0.6420)	0.0457 (0.6885)	0.3913 (0.5406)	0.6308	3875
Wholesale Trade	5000 to 5199	0.0205 (0.8482)	0.0875 (0.6683)	0.2300 (0.2821)	0.3380 (0.8019)	0.1951 (0.6352)	0.0667 (0.6536)	0.1737 (0.3119)	0.4355 (0.6264)	0.7054	1173
Retail Trade	5200 to 5999	0.0310 (0.8085)	0.1029 (0.5947)	0.0646 (0.7297)	0.1985 (0.7832)	0.2076 (0.6189)	0.0503 (0.7282)	0.1206 (0.3836)	0.3785 (0.6509)	0.7104	2018
Finance, Insurance, Real Estate	6000 to 6799	0.1536 (0.5904)	0.1811 (0.5551)	0.1214 (0.6800)	0.4560 (0.5914)	0.1833 (0.6889)	0.0784 (0.6842)	0.0425 (0.7569)	0.3042 (0.6904)	0.6459	937
Services	7000 to 8999	0.0703 (0.6989)	0.1941 (0.4619)	0.1658 (0.4371)	0.4301 (0.6621)	0.1656 (0.7022)	0.0574 (0.7021)	0.0694 (0.6211)	0.2924 (0.6981)	0.6819	5850
Public Admin.	9100 to 9999	0.1124 (0.7311)	0.2753 (0.5103)	0.0619 (0.7868)	0.4497 (0.7118)	0.0450 (0.9054)	0.1101 (0.7225)	0.0678 (0.7115)	0.2229 (0.8226)	0.7727	390
Average	-	0.0700 (0.7276)	0.1740 (0.5283)	0.1226 (0.5381)	0.3666 (0.6982)	0.1790 (0.6674)	0.0564 (0.6973)	0.0812 (0.5433)	0.3166 (0.6731)	0.6844	-

TABLE 2.7: PAIRWISE CORRELATION COEFFICIENTS

The table reports the pairwise correlation coefficients between WASC and its various percentile accounts from 2010 to 2016. Total assets book value is used as the ratio divisor. The weights of the various accounts of the WASC are reported in table 10. Correlation coefficients with superscripts ***, **, and * have a statistical significance level of one percent, five percent, and ten percent, respectively. The last row reports the correlation between each account's ratio and the account's percentile.

Percentiles	Interest Inv.	Cash	Receivab.	Monetary Asset	LT Debt	ST Debt	Payables	Monetary Liability	WASC
Interest Inv.	1.0000								
Cash	0.1044***	1.0000							
Receivab.	-0.0642***	-0.0733***	1.0000						
Monetary Asset	0.9932***	0.2049***	-0.0149***	1.0000					
LT Debt	-0.1231***	**-0.3699*** **	-0.0175***	-0.1616***	1.0000				
ST Debt	-0.1035***	-0.0746***	-0.0104**	-0.1105***	0.1561***	1.0000			
Payables	**-0.2374*** **	0.0275***	**0.2915*** **	-0.2146***	-0.0619***	**0.2551*** **	1.0000		
Monetary Liability	-0.1629***	-0.3165***	-0.0012	-0.1941***	0.8314***	0.6757***	0.1523***	1.0000	
WASC	0.6236***	-0.1014***	-0.0121**	0.6033***	0.5529***	0.4652***	-0.0397***	0.6652***	1.0000
Percentiles with Ratios	-0.7778***	-0.8402***	-0.8605**	-0.4260***	-0.0798***	-0.0761***	-0.0929***	-0.0501***	-

Table 7 reports the pairwise correlation coefficients between WASC and its various percentile accounts. Due to the weights format, WASC is highly correlated with interest-bearing investments and debt percentiles. Moreover, table 7 displays a remarkable negative correlation between the cash and long-term debt percentiles. Firms that hold greater slacks of cash tend to have lower long-term debt. Furthermore, all the monetary liability percentile accounts are negatively correlated with the interest-bearing investments percentile. This is probably because firms with high monetary liabilities outstanding are not in a condition to invest in considerable amounts of monetary assets. Lastly, the payables percentile is noticeably correlated with the interest-bearing investments, receivables, and short-term debt percentiles.

For demonstration purposes, we chose to present our results for three publicly traded US firms: Lumber Liquidators, Tesla, and General Motors. Table 8 presents the WASC for Lumber Liquidators, Tesla, and General Motors over the period from 2013 to 2015 using total assets, market capitalization, and average market capitalization as ratio divisors. As panel A indicates, Lumber Liquidators has high WASC values using all three sorts of ratio divisors. This apparently because Lumber Liquidators generally has low levels of monetary assets and liabilities, so that using different sorts of ratio divisors would not significantly affect the ratio levels. Firms with considerable amounts of monetary assets and liabilities, however, will show varying WASC values depending on the ratio divisor used.

On the one hand, firms with a high market-to-book ratio will have relatively higher WASC values when market values (e.g., market capitalization or average market capitalization) are used as ratio divisors. As indicated in panel B, because Tesla's market-to-book ratio is high across all three years, its WASC values are relatively higher when market values, as opposed to book values, are used as ratio divisors. On the other hand, firms with a low market-to-book ratio will have relatively higher WASC values when total book asset value is used as a ratio divisor. Panel C displays that General Motors' WASC values are relatively higher when book values

TABLE 2.8: WASC FOR LUMBER LIQUIDATORS, TESLA, AND GENERAL MOTORS

Panels A, B, and C present the WASC for Lumber Liquidators, Tesla, and General Motors, respectively. For each firm, the WASC is reported over the period from 2013 to 2015 using total assets, market capitalization, and average market capitalization as ratio divisors. Market-to-book ratio is also reported. Market capitalization is the total market value of a firm's outstanding common shares at the firm's annual reporting date. Average market capitalization is the average monthly market capitalization over the twelve months prior to each firm's annual reporting date.

Panel A: Lumber Liquidators Inc.

	2013	2014	2015
WASC using total assets as a ratio divisor	0.9502	0.9648	0.9166
WASC using market capitalization as a ratio divisor	0.9767	0.9772	0.8934
WASC using average market capitalization as a ratio divisor	0.9581	0.9656	0.9121
Market-to-Book Ratio	6.0455	3.6671	1.4489

Panel B: Tesla Inc.

	2013	2014	2015
WASC using total assets as a ratio divisor	0.5751	0.5046	0.5667
WASC using market capitalization as a ratio divisor	0.7828	0.7096	0.7367
WASC using average market capitalization as a ratio divisor	0.7352	0.6852	0.7123
Market-to-Book Ratio	8.6492	5.4403	4.6279

Panel C: General Motors Co.

	2013	2014	2015
WASC using total assets as a ratio divisor	0.4249	0.4134	0.3953
WASC using market capitalization as a ratio divisor	0.1649	0.1208	0.1234
WASC using average market capitalization as a ratio divisor	0.1440	0.1158	0.1012
Market-to-Book Ratio	1.1830	1.1403	1.0966

are used as ratio divisors. This is apparently because General Motors' market-to-book ratio is low across all three years.

Table 8 signifies the importance of choosing the appropriate ratio divisor to calculate the WASC. As discussed in section three of this paper, the use of market values as ratio divisors may be inappropriate in assessing Shariah compliance because they mainly reflect future growth opportunities rather than current possessions of assets and liabilities. Also, and most importantly, the use of market values is expected to lead to undesirable investment performances when stocks are mispriced.

Table 9 presents three different WASC values using three different sets of weights for General Motors for the year of 2015 using total assets as a ratio divisor. It seems that the weight effect (i.e., the use of different sets of weights) does not significantly change the WASC. Compared to the first set of weights, the second set of weights assigns different weights to the different accounts of monetary assets and liabilities, whereas the third set of weights assigns different weights to both monetary assets and liabilities and their different accounts. The weight effect may become significant if there are large discrepancies between the various percentile values used to calculate the WASC. Table 10 reports the WASC along with its various accounts for General Motors over the period from 2013 to 2015 using total assets as a ratio divisor. The WASC seems to be stable and consistent over time. To test for WASC persistence, we use the Durbin-Watson statistic and residual plots. Our unreported results show that the time series is positively autocorrelated. This implies that WASC tends to remain in an equivalent status and persist from one year to the next. In other words, future values of WASC are probabilistically predictable and depend on past and current values.

Table 11 reports the WASC along with its various accounts for Lumber Liquidators, Tesla, and General Motors for the year of 2015 using total assets as a

TABLE 2.9: WASC AND PERCENTILE ACCOUNTS FOR GENERAL MOTORS IN 2015

This table reports the WASC along with its various percentile accounts for General Motors for the year of 2015 using total assets as the ratio divisor. All financial ratios used to calculate the WASC are also reported in parentheses. Three different WASC values are presented using three different sets of weights. The numbers in brackets denote the weights of the various accounts of the WASC.

GM 2015	2015	Weight 1	Weight 2	Weight 3
Interest-bearing Investments	0.2937 (15%)	[70%]	[85%]	[85%]
Cash	0.5765 (8%)	[20%]	[10%]	[10%]
Receivables	0.3655 (14%)	[10%]	[05%]	[05%]
Monetary Assets	-	0.3575 [45%]	0.3256 [45%]	0.3256 [35%]
Long Term Debt	0.5561 (22%)	[55%]	[55%]	[55%]
Short Term Debt	0.3363 (10%)	[35%]	[40%]	[40%]
Payables	0.2397 (12%)	[10%]	[05%]	[05%]
Monetary Liabilities	-	0.4476 [55%]	0.4524 [55%]	0.4524 [45%]
Interest R/E	-	-	-	0.5436 [20%]
WASC	-	0.4070	0.3953	0.4263

TABLE 2.10: WASC AND PERCENTILE ACCOUNTS FOR GENERAL MOTORS FROM 2013 TO 2015

This table reports the WASC along with its various percentile accounts for General Motors over the period from 2013 to 2015 using total assets as the ratio divisor. All financial ratios used to calculate the WASC are also reported in parentheses. The numbers in brackets denote the weights of the various accounts of the WASC.

GM	Weights	2013	2014	2015
Interest-bearing Investments	[85%]	0.2771 (15%)	0.2876 (15%)	0.2937 (15%)
Cash	[10%]	0.4870 (12%)	0.5079 (11%)	0.5765 (8%)
Receivables	[05%]	0.3891 (14%)	0.3523 (14%)	0.3655 (14%)
Monetary Assets	[45%]	0.3037 (41%)	0.3129 (40%)	0.3256 (36%)
Long Term Debt	[55%]	0.6635 (13%)	0.6093 (18%)	0.5561 (22%)
Short Term Debt	[40%]	0.3682 (9%)	0.3698 (8%)	0.3363 (10%)
Payables	[05%]	0.2387 (14%)	0.2522 (13%)	0.2397 (12%)
Monetary Liabilities	[55%]	0.5242 (36%)	0.4957 (39%)	0.4524 (45%)
WASC	-	0.4249	0.4134	0.3953

TABLE 2.11: WASC FOR LUMBER LIQUIDATORS, TESLA, AND GENERAL MOTORS IN 2015

This table reports the WASC along with its various percentile accounts for Lumber Liquidators, Tesla, and General Motors for the year of 2015 using total assets as the ratio divisor. All financial ratios used to calculate the WASC are also reported in parentheses. The numbers in brackets denote the weights of the various accounts of the WASC.

2015	Weights	Lumber Liquidators Inc.	Tesla Inc.	General Motors Co.
Interest-bearing Investments	[85%]	1.0000 (0.0%)	0.8635 (0.3%)	0.2937 (15%)
Cash	[10%]	0.6426 (6%)	0.4015 (15%)	0.5765 (8%)
Receivables	[05%]	0.7303 (4%)	0.8569 (2%)	0.3655 (14%)
Monetary Assets	[45%]	0.9508 (10%)	0.8170 (17%)	0.3256 (36%)
Long Term Debt	[55%]	0.8681 (4%)	0.5079 (25%)	0.5561 (22%)
Short Term Debt	[40%]	1.0000 (0.0%)	0.1771 (33%)	0.3363 (10%)
Payables	[05%]	0.2247 (13%)	0.2337 (13%)	0.2397 (12%)
Monetary Liabilities	[55%]	0.8887 (17%)	0.3618 (71%)	0.4524 (45%)
WASC	-	0.9166	0.5667	0.3953

ratio divisor. All financial ratios used to calculate the WASC are also reported in parentheses. Lumber Liquidators seem to have low proportions of monetary assets and liabilities, making it more Shariah compliant than 91.66% of publicly traded US firms in 2015. It does not carry any interest-bearing investments or short-term debt and hence was given a percentile of 100% for both accounts. On the contrary, Tesla carries very significant proportions of short-term debt and hence was given a short-term debt percentile of 17.71%. This percentile means that Tesla's short-term debt obligations are more Shariah compliant than only 17.71% of publicly traded US firms in 2015. Stated differently, in terms of Shariah compliance, Tesla's holdings of short-term debt are worse than 82.29% of publicly traded US firms in 2015.

Figure 1 displays the ratios and percentiles of the various WASC accounts for General Motors over the period from 2010 to 2016 using total assets as a ratio divisor. It seems clear that there exists a negative relationship between each ratio and its percentiles. Though, this negative relation is not perfect and varies from each account to another due to the changing aggregate firm behavior over time. For example, while General Motors' interest-bearing investments ratio remained constant at 15% from 2013 to 2015, its interest-bearing investments percentile *increased* gradually from 27.71% to 29.37% over the same time period. This is probably because US firms have, on average, experienced an *increase* in the interest-bearing investments ratio over the sample period (i.e., aggregate US firms' interest-bearing investments behavior has *worsened* from the Shariah stand-point).

Figure 2 displays the ratios and percentiles of monetary assets and liabilities along with the WASC for Lumber Liquidators, Tesla, and General Motors over the period from 2010 to 2016 using total assets as a ratio divisor. Since firms were ranked from bottom to top based on their ratio value, firms with the highest ratio for a given account will always have the lowest percentile for that account. Also, firms with the second highest ratio will always have the second lowest percentile and so on. For example, figure 2 shows that, relative to the other two firms, Lumber Liquidators has

FIGURE 2.1: WASC'S ACCOUNTS FOR GENERAL MOTORS FROM 2010 TO 2016

These figures report the ratios and percentiles of the various WASC accounts for General Motors over the period from 2010 to 2016 using total assets as a ratio divisor. The weights of the various accounts of the WASC are reported in table 10. The correlation between interest-bearing investments percentile and ratio is -0.9455. The correlation between cash percentile and ratio is -0.9841. The correlation between receivables percentile and ratio is -0.9678. The correlation between long term debt percentile and ratio is -0.9929. The correlation between short term debt percentile and ratio is -0.9672. The correlation between payables percentile and ratio is -0.9587. The correlation between monetary assets percentile and ratio is -0.6369. The correlation between monetary liabilities percentile and ratio is -0.9891.

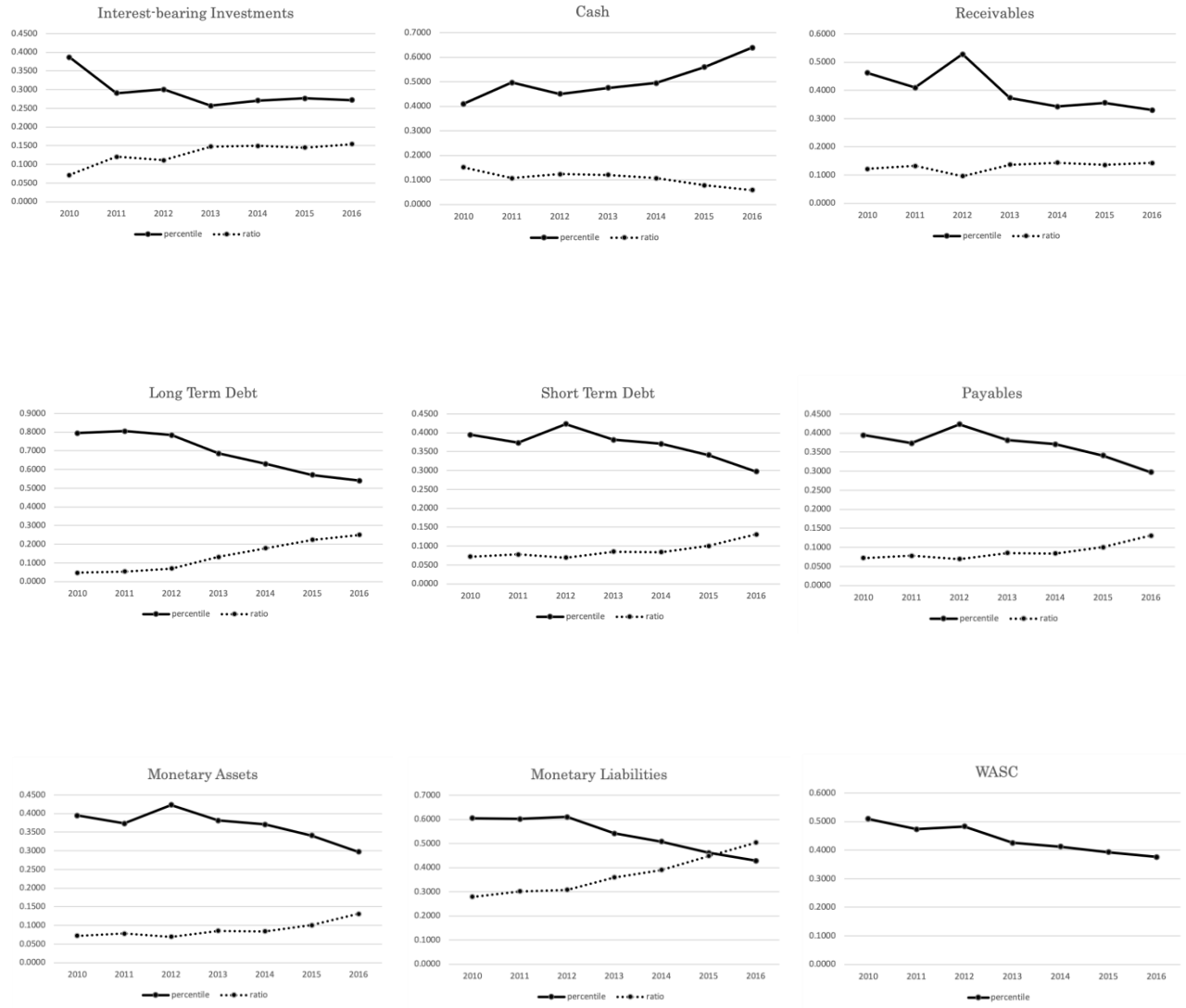
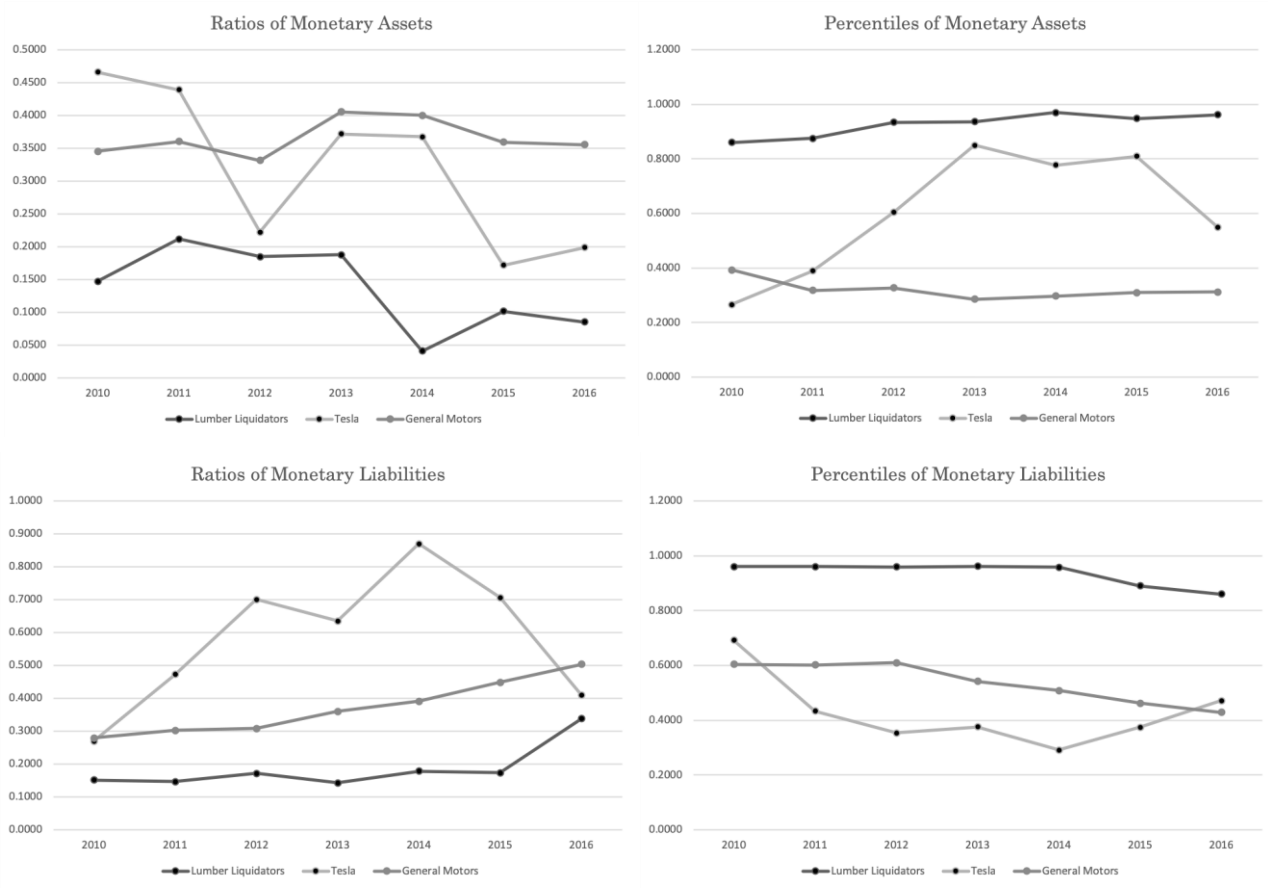
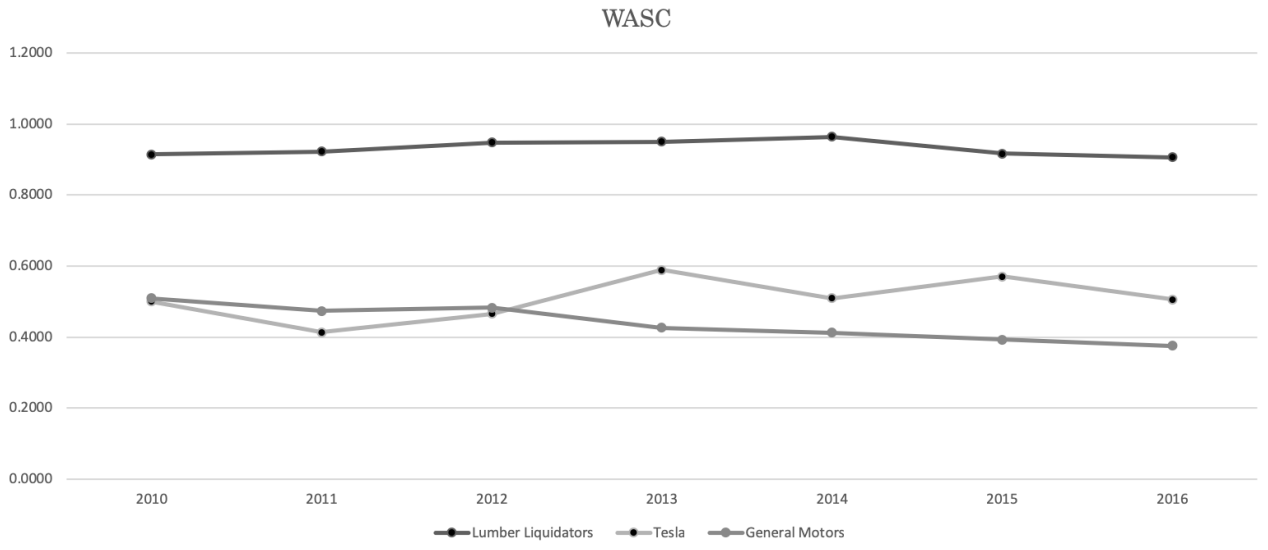


FIGURE 2.2: MONETARY ASSETS AND LIABILITIES FROM 2010 TO 2016

These figures report the percentiles and ratios of monetary assets and liabilities along with the WASC for Lumber Liquidators, Tesla, and General Motors over the period from 2010 to 2016 using total assets as the ratio divisor. The weights of the various accounts of the WASC are reported in table 10.





the lowest monetary assets ratio, but the highest monetary assets percentile over the sample period.

6. Conclusion:

This paper develops a financial quantitative measure (i.e., WASC) that reflects the rate to which a firm complies with Shariah relative to other firms located in a certain region at a certain time. The appealing feature of the WASC is its capability of translating financial Shariah-compliance assessments into a simple single precise quantitative number, which then can be tested and compared over time and across firms. The WASC can be used by academics to proxy for financial Shariah-compliance and by fund managers to create a balance between optimizing investment returns and Shariah compliance.

In few words, the paper started with providing a brief review of current Shariah-compliant equity screening practices. Next, it continued with analyzing all the optional formats used to customize the WASC by specifying the region, set of weights, and set of financial ratios. The general formula for the WASC is then presented. Finally, the paper concluded by showing and discussing illustrative results using a sample of all publicly traded US firms from the year 2010 to 2016.

REFERENCES

Ahn, S., Denis, D.J. and Denis, D.K., 2006. Leverage and investment in diversified firms. Journal of Financial Economics, 79(2), pp.317-337.

Aivazian, V.A., Ge, Y. and Qiu, J., 2005. The impact of leverage on firm investment: Canadian evidence. Journal of Corporate Finance, 11(1), pp.277-291.

Cai, J. and Zhang, Z., 2011. Leverage change, debt overhang, and stock prices. Journal of Corporate Finance, 17(3), pp.391-402.

DeLorenzo, Y.T., 2000, April. Shariah supervision of Islamic mutual funds. In 4th Annual Harvard Forum on Islamic Finance. Harvard University, Cambridge, MA.

Derigs, U. and Marzban, S., 2008. Review and analysis of current Shariah-compliant equity screening practices. International Journal of Islamic and Middle Eastern Finance and Management, 1(4), pp.285-303.

Dow Jones, 2018. Dow Jones Islamic Market Indices Methodology. available at: https://us.spindices.com/documents/methodologies/methodology-dj-islamic-market-indices.pdf

Elnahas, A., Ismail, G., Elkhatib, R. and Hassan, M.K., 2019. Religiosity and Corporate Social Responsibility. Working paper.

FTSE, 2018. FTSE Shariah Global Equity Index Series. available at: https://www.ftse.com/products/downloads/FTSE_Shariah_Global_Equity_Index_Series.pdf

Lang, L., Ofek, E. and Stulz, R., 1996. Leverage, investment, and firm growth. Journal of Financial Economics, 40(1), pp.3-29.

McConnell, J.J. and Servaes, H., 1995. Equity ownership and the two faces of debt. Journal of Financial Economics, 39(1), pp.131-157.

MSCI, 2015. MSCI Islamic Index Series Methodology. available at: https://www.msci.com/eqb/methodology/meth_docs/MSCI_April15_Islamic_Indexes_Methodology.pdf

Myers, S.C., 1977. Determinants of corporate borrowing. Journal of Financial Economics, 5(2), pp.147-175.

Nisar, S., Khatkhatay, M.H., 2006. Shariah-compliant equity investments: An assessment of current screening norms. In 4th Annual Harvard Forum on Islamic Finance. Harvard University, Cambridge, MA.

Rajan, R.G. and Zingales, L., 1995. What do we know about capital structure? Some evidence from international data. The Journal of Finance, 50(5), pp.1421-1460.

Standard & Poor's, 2018. S&P Shariah Indices Methodology. available at: https://us.spindices.com/documents/methodologies/methodology-sp-Shariah-indices.pdf

VITA

Abdullah Alnamlah was born in Riyadh, Saudi Arabia. He received his bachelor's degree in Finance and Investment from Imam University in 2011 and his MBA from Chapman University in 2015. He joined the University of New Orleans in 2015 and earned a PhD and Master of Science in Financial Economics in 2019. His research interest includes corporate leverage, real estate finance and investment, equity investments, and Islamic finance.