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Determinants of Capital Structure: An Expanded Assessment

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Abstract

Using a standardized methodology, we empirically evaluate 55 proposed determinants of capital structure in terms of statistical significance, economic significance, and identification. We find that robust and economically important determinants of debt ratios are relatively few in number. Nevertheless, because each determinant relates to one of five market imperfections—taxes, distress costs, information asymmetry, agency costs, or supply frictions—we draw conclusions from the evidence as a whole regarding the explanatory power of different capital structure theories. We find greater support for pecking order theory and supply-related theories, with less support for traditional tradeoff theory and agency theory.

I. Introduction

Abundant research on the determinants of capital structure has accumulated in the decades since the propositions of Modigliani and Miller (1958), yet the topic continues to be researched actively. Between 2000 and 2016, the *Journal of Finance*, *Journal of Financial Economics*, and *Review of Financial Studies* published 160 papers that study the determinants of capital structure, with the frequency increasing over that period.[1] With so much ongoing research, it is essential to sort out which of the many proposed determinants have the most robust and important effects on the capital structure decision. However, comparing the effects of different proposed determinants is difficult for two reasons. First, individual studies typically

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[1]This total does not include papers that focus on debt maturity or the capital structure of financial institutions.

test a featured capital structure determinant in isolation, without comparing it to or controlling for other recently proposed determinants. Second, different studies employ widely varying methodologies in their empirical tests, which confounds comparisons across studies. Comprehensive empirical studies—including seminal papers such as Titman and Wessels (1988) and Rajan and Zingales (1995)—address these problems by testing many proposed capital structure determinants simultaneously.[2] But much of the recent capital structure literature focuses on the impact of stakeholders that do not factor significantly in earlier comprehensive empirical studies. In this article, we undertake a new comprehensive empirical study of the determinants of capital structure that offers several new contributions to the literature.

The first contribution is that we consider a much larger set of capital structure determinants than previous comprehensive empirical studies, with our set of determinants representing all key stakeholders associated with the firm. The vast majority of the 55 proposed determinants in our study are not considered in previous papers such as Titman and Wessels (1988), Rajan and Zingales (1995), or Frank and Goyal (2009). The variables we test are not obscure; almost all of them are proposed as determinants of capital structure in papers published in top-tier finance journals. However, many of the determinants were proposed subsequent to these earlier studies (the median publication year for the variables we test is 2011), and many of the determinants come from less-accessible sources (the variables we test are compiled from over 30 different data sets). In many cases, we are able to update previously performed tests with more recent data.

Second, we test all of the proposed capital structure determinants using a standardized methodology. To understand current empirical practice, we survey the papers studying capital structure determinants that were published in three top-tier finance journals between 2000 and 2016. We find, for example, that researchers use dozens of different measures of leverage as dependent variables in the regressions in these papers.[3] We also find large methodological variation with regard to industry exclusion, control variable selection, outlier treatment, and industry definitions. To determine our standardized methodology, we document the procedures used in each of the 160 papers and adopt the most common procedures for our tests. This standardization allows for more-direct comparisons of results for the many different proposed capital structure determinants.

Third, we focus on the economic significance of the proposed determinants in addition to their statistical significance. Whereas almost all papers in the literature report the statistical significance of key coefficients, over a quarter of the papers in our sample do not discuss the economic significance of key results. Further, when

[2]See also Bradley, Jarrell, and Kim (1984), Lemmon, Roberts, and Zender (2008), Frank and Goyal (2009), Öztekin (2015), and Amini, Elmore, Öztekin, and Strauss (2021). In addition, capital structure survey papers review the existing evidence for many proposed determinants, usually without performing new empirical tests. See, for example, Chen and Kim (1979), Myers (1984), Harris and Raviv (1991), Myers (2001), Barclay and Smith (2005), Parsons and Titman (2008), and Graham and Leary (2011).

[3]The large number of leverage measures results from researchers using the following Compustat variables in various combinations: AP, AT, CH, CHE, CL, CSHO, DCVT, DD1, DLC, DLTT, LT, NP, PRCC_C, PSTKL, TXDB, TXDITC, CEQ, SEQ, and PPENT. See Mitton (2022) for more details.

economic significance is reported, a wide variety of measures of economic significance are used, making it difficult to compare economic significance across studies. In contrast, we use a standardized measure of economic significance which, in conjunction with our standardized methodology, allows us to observe which variables have the most substantive impact on business practice.

Finally, we implement identification strategies, where available, for each of the proposed determinants of capital structure. We are able to find identification strategies for half of the 55 proposed determinants, and we test the proposed determinants using these strategies with our standardized methodology and updated data.

To organize our analysis, we categorize the 55 proposed determinants according to the market imperfections to which they are related. Much of capital structure research relates in some way to the impact of market imperfections (i.e., departures from the assumptions of Modigliani and Miller (1958)) on capital structure. The 55 proposed determinants we study are associated with one of five market imperfections: taxes, financial distress costs, information asymmetry, agency costs, or supply frictions. This organization allows us to map the many proposed determinants into primary capital structure theories: traditional tradeoff theory (taxes and distress costs), pecking order theory (asymmetric information), agency theory (agency costs), or supply considerations (supply frictions). Additionally, because of the large number of determinants that we study, we are able to further delineate the 55 determinants into specific frictions associated with each market imperfection. For example, within the category of financial distress costs are several different types of distress costs (e.g., customer-related costs, competitive threats, and labor-related costs) that have been hypothesized to affect the leverage decision. This organization allows us to study which specific aspects of each theory have empirical support.

Our analysis suggests that, although most of the proposed determinants have at least some support in the data, relatively few of the variables are robust and economically important determinants of corporate debt ratios in the United States. We test each determinant in 10 commonly employed specifications. Applying the standardized methodology and adjusting for multiple testing, 35 of the 55 proposed determinants are statistically significant at the 10% level in at least one of these specifications. However, only 13 of the 55 variables are significant in more than half of the specifications, and only six are significant in as many as eight specifications. We also find that the economic significance of the majority of the variables is not strong. We consider the change in the debt ratio implied by a one-standard-deviation change in each proposed determinant. Across all 55 variables, the median implied change is less than one percentage point of the debt ratio, suggesting that many proposed determinants have only a small impact on the leverage decision. Additionally, we find that most variables either lack established identification strategies or do not perform as well when we implement the identification strategies with our data and standardized methodology.

Despite the weak performance of many proposed determinants, the large number of variables that we test allows us to observe patterns in the results that speak to the relative importance of different market imperfections on the capital structure decision. We find that the variables with the strongest influence on capital structure are those that are related to information asymmetry. The proxies

for information asymmetry (analyst coverage, analyst disagreement, stock liquidity) have much stronger economic and statistical significance, on average, than the proxies for the other market imperfections, and two of the three proxies for information asymmetry have identification strategies that produce statistically significant results. The next strongest set of variables is those related to supply frictions, including variables related to credit access, such as a bond rating dummy variable, and a proxy for equity misvaluation, the historical market-to-book ratio. One implication of these findings is that these proxies for information asymmetry and supply frictions should have much greater priority as control variables in empirical models of the capital structure decision.

We find relatively weak evidence for traditional tradeoff theory, as only two out of nine variables related to taxes (depreciation tax shields, investment tax credits) and one out of 18 variables related to financial distress costs (dedicated customer relationships) have strong results in our tests. Most of the variables related to agency costs are also relatively weak, with the exception that some variables related to managerial risk-taking (e.g., the CEO's inside debt holdings and the ratio of cash to stock in CEO compensation) have strong economic and statistical significance. One takeaway from our findings is that financial claimants appear to have a much greater impact on the capital structure decision than do other stakeholders in the firm.

To further test the relevance of each of the capital structure theories, we also create composite variables for each of the five market imperfections. The composite variables combine the signals from all proposed capital structure determinants related to each market imperfection. Aggregating the data in this way allows us to test for the effects of each market imperfection across a consistent sample and time period. The results for the composite variables confirm that determinants related to asymmetric information and supply frictions have the greatest explanatory power for debt ratios. In summary, although a firm's debt ratio may be influenced by a complex set of factors, our overall analysis suggests that pecking order theory and supply considerations are the most relevant for the capital structure decision.

II. Organization of Proposed Determinants

We organize the 55 empirical proxies according to the market imperfections to which they are related, as outlined in Table 1. Column 1 lists five market imperfections that depart from the Modigliani and Miller (1958) assumptions. Column 2 lists the specific frictions related to each of the five market imperfections. Each of the frictions listed in column 2 constitutes a potential constraint on shareholder value maximization arising from shareholders' interactions with many related parties, including managers, debtholders, prospective equityholders, employees, suppliers, customers, competitors, government, acquirers, and targets. Shareholders desire some outcome from each of these related parties, but shareholder value maximization is subject to the constraints imposed by the incentives of each related party. The literature has proposed how capital structure decisions respond to or mitigate these constraints. Column 3 lists the empirical proxies that have been employed in the literature to test the effect of the specific frictions on the capital structure decision. Finally, column 4 lists a paper that is associated

TABLE 1

Proposed Determinants of Capital Structure

Table 1 summarizes the proposed determinants of capital structure, organized according to the market imperfections that give rise to the determinants. Column 1 lists the market imperfection. Column 2 lists specific frictions associated with the market imperfection. Column 3 lists the empirical proxies that have been proposed for the constraints. Column 4 lists papers related to each proxy.

Market Imperfection	Specific Friction	Empirical Proxy	Representative Paper
1	2	3	4
Taxes	Tax rates	Marginal tax rate	Graham et al. (2004)
		State tax rate increases	Heider and Ljunqvist (2015)
	Lack of tax shields	Depreciation tax shields	DeAngelo and Masulis (1980)
		Investment tax credits	Titman and Wessels (1988)
		Pension liabilities	Shivdasani and Stefanescu (2010)
		Tax shelters	Graham and Tucker (2006)
	Nontax expropriation	Corruption	Smith (2016)
		Campaign contributions	Claessens et al. (2008)
		Lobbying expenditures	Kostovetsky (2015)
Financial distress costs	Competitive threats	Import penetration	Xu (2012)
		Import tariffs	Frésard and Valta (2016)
		Trade secret protection	Klasa et al. (2018)
		Brand perception	Larkin (2013)
		Product market fluidity	Hoberg, Phillips, and Prabhala (2014)
		Industry concentration	Hoberg and Phillips (2016)
		Product similarity	Hoberg and Phillips (2016)
	Labor-related costs	Unem. insurance generosity	Agrawal and Matsa (2013)
		Employee treatment index	Bae et al. (2011)
		Labor protection laws	Serfling (2016)
		Union coverage	Matsa (2010)
	Customer/supplier-related costs	Customer R&D intensity	Kale and Shahrur (2007)
		Supplier R&D intensity	Kale and Shahrur (2007)
		Dedicated customer relationships	Banerjee et al. (2008)
		Dedicated supplier relationships	Banerjee et al. (2008)
		CDS-referenced customers	Li and Tang (2016)
	M&A-related costs	Location in industry cluster	Almazan et al. (2010)
Information asymmetry	Equity issuance costs	Analyst coverage	Derrien and Kecskes (2013)
		Analyst disagreement	Dittmar and Thakor (2007)
		Stock illiquidity	Fang et al. (2009)
Agency costs	Managerial risk-taking	CEO delta	Chava and Purnanandam (2010)
		CEO vega	Brockman et al. (2010)
		CEO inside debt holdings	Cassell et al. (2012)
		Tournament incentives	Kini and Williams (2012)
		CEO cash/stock compensation	Carlson and Lazrak (2010)
		Options traded	Gao (2010)
		Pilot CEO	Cain and McKeon (2016)
	Behavioral biases	Male CEO	Huang and Kisgen (2013)
		Military CEO	Malmendier et al. (2011)
		Share retainer	Sen and Tumarkin (2015)
		CEO age	Bertrand and Schoar (2003)
	Monitoring costs	Central location	John et al. (2011)
		Large blockholder	Berger et al. (1997)
		Outside directors	Berger et al. (1997)
		Board size	Berger et al. (1997)
		CEO tenure	Berger et al. (1997)
		Board co-option	Coles, Daniel, and Naveen (2014)
	Takeover deterrence	Takeover susceptibility	Cain, McKeon, and Solomon (2017)
		Takeover defenses	Bebchuk, Cohen, and Ferrell (2009)
Supply frictions	Poor credit access	Bond rating	Faulkender and Petersen (2006)
		CDS trading	Saretto and Tookes (2013)
		Covenant strength	Denis and Wang (2014)
		Supply uncertainty	Massa et al. (2013)
		Ratings conservatism	Baghai et al. (2014)
	Equity misvaluation	Historical M/B ratio	Baker and Wurgler (2002)
		Sin stock	Hong and Kacperczyk (2009)

with each of the empirical proxies. In the five subsections that follow, we briefly discuss the proposed determinants of capital structure associated with each of the five market imperfections and the associated specific frictions. The variables that are ultimately incorporated in the empirical analysis are noted throughout the discussion (in capital letters).

A. Taxes

One market imperfection, initially addressed by Modigliani and Miller (1958), is government taxation. Employing debt financing to avoid taxation is a cornerstone of traditional tradeoff theory, which suggests that higher tax rates should increase the incentive of the firm to increase leverage. Empirically demonstrating the relation between tax rates and leverage has proven challenging, in part due to complications in properly measuring corporate tax rates (see, e.g., Faulkender and Smith (2016)). Nevertheless, Graham, Lang, and Shackleford (2004) find that firms with higher marginal tax rates, carefully measured, have more debt, allowing them to take greater advantage of debt tax shields (MARGINAL_TAX_RATE). Similarly, Heider and Ljunqvist (2015) find that firms facing higher state tax rates have higher levels of debt (STATE_TAX_INCREASES).

Relatedly, firms lacking tax shields from other sources have a greater incentive to seek interest tax shields from debt financing (DeAngelo and Masulis (1980)), although Bradley et al. (1984) find a positive relation between nondebt tax shields and leverage (see Graham (2003) for further discussion). Measures of tax shields employed in earlier literature (e.g., Titman and Wessels (1988)) include depreciation tax shields and investment tax credits (DEP_TAX_SHIELDS, INV_TAX_CREDITS). More recently, Shivdasani and Stefanescu (2010) find that firms with higher pension liabilities use less debt, suggesting that tax deductions from pension contributions substitute for debt (PENSION_LIABILITIES). Also, Graham and Tucker (2006) find that firms with active tax shelters use less debt (TAX_SHELTERS).

Though not classified as a tax per se, the government also has the power to extract value from firms outside of the tax regime, and other authors have demonstrated how this power affects capital structure. Smith (2016) proposes that when corruption levels are high, firms will either increase debt to shield assets from corrupt government officials or decrease debt to take advantage of bribing opportunities. Consistent with the first effect, Smith (2016) finds that firms in more corrupt areas, as measured by the incidence of corruption convictions, have greater leverage (CORRUPTION). Desai, Foley, and Hines (2008) argue that firms that face greater political risk maintain lower leverage because political risk induces greater earnings volatility. Consistent with political connections reducing political risk (or increasing lending favoritism), several studies have demonstrated a positive association between political connections and leverage (Johnson and Mitton (2003), Khwaja and Mian (2005), Claessens, Feijen, and Laeven (2008), and Kostovetsky (2015)). We measure political connections as campaign contributions from executives and directors in the firm (see Claessens et al. (2008)) and as the extent of lobbying by the firm (see Kostovetsky (2015)) (CAMPAIGN_CONT, LOBBYING_EXP).

B. Financial Distress Costs

Costs of financial distress are another key element of traditional tradeoff theory. According to theory, higher expected financial distress costs should be associated with lower levels of debt. A wide variety of financial distress costs, involving many different parties related to shareholders, have been hypothesized in the literature. These range from direct costs of bankruptcy to indirect costs associated with

competitive threats and distress-related costs incurred by employees, customers, and suppliers.

When a firm faces financial distress, greater costs can arise from the actions of competitors. When competitive rivalry is greater, the firm may maintain lower debt levels in order to ward off predation and maintain financial flexibility to respond to competitive threats (Brander and Lewis (1986), Maksimovic (1988), Poitevin (1989), Bolton and Scharfstein (1990), and Valta (2012)). In line with this reasoning, Xu (2012) shows that firms facing greater import penetration, which increases competitive rivalry, reduce their leverage (IMPORT_PENETRATION). An alternative indicator of import penetration is presented by Frésard and Valta (2016), who study the effect of import tariffs. Higher tariffs decrease competitive rivalry and should be associated with higher leverage (IMPORT_TARIFFS). In addition, Klasa, Ortiz-Molina, Serfling, and Srinivasan (2018) show that firms that receive protection from competitors in the form of legal protection of trade secrets, which reduces competitive rivalry, increase their leverage (TRADE_SECRET_PRO). Larkin (2013) finds that firms with greater brand values, which enhances their competitive position, have higher debt ratios (BRAND_PERCEPTION). Hoberg, Phillips, and Prabhala (2014) create a text-based measure of competition, product market fluidity, which measures the extent to which rival firms' products change in relation to a given firm's products. As a measure of competitive rivalry, this variable should be negatively related to leverage, though Hoberg, Phillips, and Prabhala (2014) only test its relation with other aspects of financial flexibility (PROD_MKT_FLUIDITY). Finally, Hoberg and Phillips (2016) calculate two measures of market power based on text-based definitions of industries specific to each firm. The first is a sales-based Herfindahl index on the firm's industry, which should be positively related to leverage since greater concentration indicates less competitive rivalry (INDUSTRY_CONC). The second is a measure of product similarity of the firm relative to others in its industry, which should be negatively related to leverage since greater product similarity indicates more competitive rivalry (PROD_SIMILARITY).

Employees of the firm also incur costs related to financial distress. Employees face potential job loss or the reduction of wages and benefits, so they demand higher wages when their potential losses from financial distress are higher (see Titman (1984), Berk, Stanton, and Zechner (2010)). Consequently, firms may maintain lower leverage to avoid paying higher wages, especially when employees face higher risks. In this vein, Agrawal and Matsa (2013) argue that when the government provides greater unemployment benefits, employees face lower unemployment risk, and they show empirically that when unemployment insurance is more generous, firms have higher leverage (UNEM_INS_GENEROSITY). Bae, Kang, and Wang (2011), following Maksimovic and Titman (1991), argue that firms that have a greater need to credibly commit to providing better employee benefits use less debt to reduce employee concern about benefit loss. Bae et al. (2011) use employee treatment scores as an indication of the firm's need to establish a positive reputation with employees, and they show that firms with higher scores have lower leverage ratios (EMPLOYEE_TREATMENT). Serfling (2016) reasons that increased firing costs could either increase optimal leverage, due to decreased

unemployment risk, or decrease optimal leverage, due to increased financial distress costs (see also Simintzi, Vig, and Volpin (2015)). In accordance with the financial-distress argument, Serfling (2016) finds that labor protection laws (which increase firing costs) are associated with lower leverage (LABOR_PRO_LAWS). A final labor-related cost is that firms facing unions with bargaining power may increase debt because a greater threat of financial distress improves the firm's bargaining position in union negotiations (Bronars and Deere (1991), Perotti and Spier (1993)). Empirically confirming this reasoning, Matsa (2010) shows that firms with more-unionized workforces have greater leverage (UNION_COVERAGE).

Customers and suppliers of the firm also incur costs if the firm faces financial distress. These costs are particularly high when customers and suppliers are required to make costly relationship-specific investments in order to deal with the firm. Because relationship-specific investments decline in value when the relationship is discontinued, the firm may maintain lower debt levels in order to assure customers and suppliers that they will not default on their relationship (see Titman (1984), Maksimovic and Titman (1991)). Along these lines, Kale and Shahrur (2007), viewing R&D intensity as a measure of the need for relationship-specific investments, find that a firm's leverage is negatively related to the R&D intensity of its customers and suppliers (CUSTOMER_R&D_INT, SUPPLIER_R&D_INT). Likewise, Banerjee, Dasgupta, and Kim (2008) report that firms in dedicated relationships with their customers or suppliers have lower leverage, although for customers this only holds in durable goods industries (DED_CUSTOMER_REL, DED_SUPPLIER_REL). A firm may also maintain lower leverage in order to weather disruptions to sales if its customers default. Li and Tang (2016), following Bolton and Oehmke (2011) and Subrahmanyam, Tang, and Wang (2014), argue that firms referenced by credit default swaps (CDS) have higher bankruptcy risk. Accordingly, Li and Tang (2016), while acknowledging scenarios in which CDS trading could have an opposite effect, ultimately show that firms with a higher proportion of sales coming from CDS-referenced customers maintain lower leverage (CDS_REF_CUSTOMERS).

One other financial distress cost, analyzed by Almazan, De Motta, Titman, and Uysal (2010), is the inability of a firm to make acquisitions when in financial distress. If managers maintain financial slack in order to fund potential acquisitions, then a lack of available targets should be associated with higher leverage. Almazan et al. (2010) argue that firms in industry clusters have more opportunities to acquire target firms and that such firms maintain greater financial slack in anticipation of such deals. Accordingly, they show that firms located in industry clusters have lower debt ratios (INDUSTRY_CLUSTER).

C. Information Asymmetry

Information asymmetry is a market imperfection that has been hypothesized to have an important effect on capital structure. Pecking order theory (Myers and Majluf (1984)) implies that information asymmetry increases the cost of issuing equity because of negative signaling effects, so greater information asymmetry should lead to higher debt ratios. For example, greater analyst coverage should be indicative of less information asymmetry (Kelly and Ljungqvist (2012)), which

should imply lower debt ratios. Accordingly, Derrien and Kecskés (2013) report that exogenous reductions in analyst coverage lead firms to use relatively more debt (ANALYST_COV). Similarly, Dittmar and Thakor (2007) show that firms with greater analyst disagreement (a proxy for information asymmetry) use relatively more debt (ANALYST_DIS). Finally, Fang, Now, and Tice (2009) report that firms with less liquid stocks (indicating more information asymmetry) use more debt (STOCK_ILLIQUIDITY).

D. Agency Costs

Another market imperfection is the lack of incentive alignment between shareholders and managers, which has been hypothesized to influence capital structure in a number of ways. First, managers have their own risk-taking incentives, which are not always in alignment with shareholder interests. Greater managerial risk-taking incentives should be associated with greater leverage. Along these lines, although the expected direction of the effect is not always clear, Coles, Daniel, and Naveen (2006), Brockman, Martin, and Unlu (2010), and Chava and Purnanandam (2010) argue that CEOs with higher price sensitivity (delta) of their personal wealth have a weaker appetite for risk and show that firms headed by these CEOs carry less debt (CEO_DELTA). Additionally, these same authors argue that CEOs with higher volatility sensitivity (vega) of their personal wealth have a stronger appetite for risk and show that firms headed by these CEOs carry more debt (CEO_VEGA). Cassell, Huang, Sanchez, and Stuart (2012) find that CEO holdings of deferred compensation and pension benefits, which reduce the CEO's risk-taking incentive, are negatively related to leverage (CEO_INSIDE_DEBT). Kini and Williams (2012) find that firms with higher tournament incentives (as proxied by the pay gap between the CEO and senior managers) have higher leverage (TOURN_INCENTIVES). Carlson and Lazrak (2010) present a model in which managers with higher ratios of performance-insensitive pay to performance-sensitive pay have lower levels of risk aversion, and they show empirically that firms with such managers have higher leverage (CEO_COMP_RATIO). Gao (2010) argues that when managers have the ability to hedge, their sensitivity to risk is reduced, and he shows empirically that firms have higher leverage when options are traded on the firm's stock (OPTIONS_TRADED). Finally, Cain and McKeon (2016) find that firms headed by CEOs with private pilot licenses, viewed as a proxy for risk-taking behavior, have greater leverage (PILOT_CEO).

In addition to differing risk-taking incentives, managers can have behavioral biases that may not coincide with shareholder interests. Various biases may lead managers to either increase or decrease leverage. For example, Huang and Kisgen (2013) find that firms with male executives use more debt than firms with female executives (MALE_CEO). Malmendier, Tate, and Yan (2011) find that firms headed by executives with military experience use more debt, though Benmelech and Frydman (2015) find a negative relation between military service and leverage (MILITARY_CEO). Sen and Tumarkin (2015) argue that retention of shares from option exercise is an indicator of a CEO's optimism, and show that firms with CEOs that retain shares have greater leverage (SHARE_RETAINER). Bertrand and

Schoar (2003) find that firms with older CEOs use less debt, but Malmendier et al. (2011) find a positive relation between CEO age and leverage (CEO_AGE).

Because of the misalignment of incentives between shareholders and managers, the firm incurs monitoring costs. When monitoring costs are higher, greater leverage can serve as a substitute monitoring device (as in Jensen (1986)). For example, John, Knyazeva, and Knyazeva (2011) argue that firms outside of central locations have greater costs of managerial oversight, and they find that firms located outside major metropolitan areas have greater debt, thereby reducing free cash flow and limiting manager–shareholder agency problems (CENTRAL_LOCATION). Monitoring is more difficult, and monitoring costs are higher when managers are entrenched. Entrenched managers may reduce leverage in order to insulate themselves from monitoring associated with debt service (Jensen (1986)), although it is also possible that entrenched managers increase leverage in order to increase their voting power (Stulz (1988)). Berger, Ofek, and Yermack (1997) find that firms with entrenched managers—as measured by the absence of large blockholders, fewer outside directors, larger boards, and longer CEO tenure—have lower levels of debt, although Becker, Cronqvist, and Fahlenbrach (2011) find no effect of large blockholders on leverage (LARGE_BLOCKHOLDER, OUTSIDE_DIRECTORS, BOARD_SIZE, CEO_TENURE). Coles, Daniel, and Naveen (2014) argue that entrenchment is better measured by the degree of co-option of the board, that is, the fraction of the board appointed after the CEO assumed office, a measure which should also be negatively related to leverage (BOARD_CO-OPTION).

Agency costs can be mitigated by the market for corporate control, which can serve as a disciplining device for managers. However, this discipline can be limited by the presence of takeover deterrence mechanisms, which include antitakeover laws and takeover defenses. If managers use debt as a takeover deterrent (Israel (1991), Zwiebel (1996)), then antitakeover laws and takeover defenses, as substitutes for debt, should be associated with lower leverage. Confirming this reasoning empirically, Garvey and Hanka (1999) show that firms protected by antitakeover laws use less debt, although Wald and Long (2007) question this finding after correcting for self-selection. A more recent and comprehensive measure of antitakeover laws, which measures the susceptibility of each firm to takeover based on an assessment of 17 antitakeover laws, is employed by Cain, McKeon, and Solomon (2017) (TAKEOVER_SUSCEPT). As a proxy for firms' takeover defenses, we use the entrenchment index discussed in Bebchuk, Cohen, and Ferrell (2009) (TAKEOVER_DEFENSES).

E. Supply Frictions

The early capital structure literature focuses on corporate demand for debt, but more recent research has also investigated the role of supply frictions on capital structure (see Graham and Leary (2011)). Baker (2009) notes that supply effects can arise from limited intermediation, investor tastes, or corporate opportunism. With regard to limited intermediation, firms that have weaker access to credit markets should have lower levels of debt. Faulkender and Petersen (2006) find that firms with access to debt markets (as proxied by having a bond rating) have greater leverage, even after instrumenting for the potential endogeneity of having a rating

(BOND_RATING). In a similar vein, Saretto and Tookes (2013) find that firms with traded CDS contracts (which allow suppliers of capital to hedge risk) have greater leverage (CDS_TRADING). Debt covenants constrain the ability of shareholders to issue additional debt, and prior literature has discussed how stronger debt covenants should be associated with lower leverage (e.g., Jensen and Meckling (1976), Roberts and Sufi (2009)). Accordingly, Denis and Wang (2014) find that the relaxation of debt covenants leads to greater debt issuance (COVENANT_STRENGTH). Massa, Yasuda, and Zhang (2013) find that firms with greater supply uncertainty in their bond investor base have lower leverage (SUPPLY_UNCERTAINTY). Finally, Baghai, Servaes, and Tamayo (2014) find that firms that are impacted more by ratings agency conservatism, which negatively impacts their access to credit, have less debt (RATINGS_CONSERV).

Supply considerations also affect the issuance of equity, in part through frictions arising from a combination of corporate opportunism and investor tastes. Baker and Wurgler (2002) argue that corporate opportunism, in the form of timing the market to issue equity when share prices are relatively high, has a persistent effect on a firm's capital structure. In empirical support of this view, Baker and Wurgler (2002) show that firms with higher historical market-to-book ratios have lower debt ratios (HISTORICAL_MB). Regarding investor tastes, Hong and Kacperczyk (2009) argue that some investors avoid "sin stocks" due to societal norms. They show that firms regarded as sin stocks have lower valuations, and thus may rely disproportionately on debt markets for financing. Hong and Kacperczyk (2009) confirm empirically that firms classified as sin stocks have higher levels of debt (SIN_STOCK).

III. Data and Methodology

As mentioned above, we do not replicate all the different methodologies employed in the various papers that propose the determinants of capital structure that we test. Rather, we test all variables using a standardized methodology guided by the most commonly used procedures in the literature. To determine the most common methodology, we examine the 160 papers that report leverage regressions in three top finance journals between 2000 and 2016 and document the methodology used in each paper.

Employing a standardized methodology clearly involves a tradeoff. On one hand, we gain the ability to make direct comparisons of the economic and statistical significance of the many variables that we test. On the other hand, we lose the ability to tailor empirical tests according to nuances in methodology that might be important for testing individual variables. How much we lose in the standardized approach depends on how essential the various methodological decisions are to the tests of individual variables. Mitton (2022) shows that authors of corporate finance studies usually state no reason for decisions such as dependent variable selection and outlier treatment, suggesting that many methodological decisions are made somewhat arbitrarily. Nevertheless, it should be kept in mind that our study is less about supporting or discrediting any one proposed determinant, and more about observing broad-based patterns in a large set of determinants.

A. Dependent Variables

One important methodological issue is the decision of which measure of leverage to use as the dependent variable. The existing literature uses many different dependent variables in leverage regressions and makes various arguments for or against certain measures. We base our decision on current practice. We find that the most commonly used dependent variable is some measure of book leverage, which is used in 64% of the papers in our sample. The next most common dependent variable is some measure of market leverage, which is used in 39% of the papers.[4] Following current practice, we use book leverage as our primary dependent variable, but we also report results for market leverage. The literature uses many different definitions of book leverage and market leverage, so we use the most commonly used definitions, as described in the Appendix. The data come from Compustat for the years 1990–2016. Summary statistics for all variables are reported in Table A1.

B. Explanatory Variables

The discussion in Section II outlines the theory behind the 55 capital structure determinants that we test. We create these variables using data from over 30 different data sources. Some of the variables come from data gathered by researchers outside of standard data sets and represent a significant effort on the part of the researchers, many of whom generously agreed to share their data for this study. In the interest of brevity, we do not describe the details of the construction of each variable here. In the Appendix, we provide definitions and data sources for all variables. Correlations of the 55 proposed determinants are reported in the Table A2.

C. Control Variables

In addition to the primary explanatory variables of interest, we include a set of control variables in our regressions. Given that the capital structure literature has used many different control variables over time, the decision of which to include is not obvious and could affect our inferences. To determine which control variables are considered most important by researchers we examine our sample of 160 papers. Table 2 reports the results of our analysis of control variable usage. Column 1 of Table 2 lists the most commonly used control variables in the papers in our sample. Column 2 reports the usage rate of each control variable among all papers and shows that four variables stand out as the most commonly used controls in leverage regressions: firm size (86% usage rate), profitability (81%), growth opportunities (76%), and asset tangibility (64%). The next two most common control variables, investment (31%) and volatility (28%), are used somewhat frequently, and the remaining controls much less so.

Even when agreeing on the inclusion of variables, researchers do not necessarily agree on the appropriate proxies for these factors. For example, to control for

[4]The next most common dependent variable, some measure of long-term debt, is used in 17% of the papers. The percentages sum to greater than 100% because many papers report tests with multiple dependent variables.

TABLE 2

Control Variables Used in Leverage Regressions in Top Finance Journals

Table 2 reports statistics on the usage of control variables in 160 papers reporting leverage regressions in three top finance journals between 2000 and 2016. For each control variable, the table reports the percentage of all papers using the control in leverage regressions (column 2), the most common measure used and its usage rate (columns 3 and 4), and the sign of the coefficient on the variable among papers reporting coefficients for the variable (columns 5–7). "Ambiguous coefficient" means either that the variable was not statistically significant in the paper or that the paper reported both positive significance and negative significance in different specifications.

	Among All Papers	Among Papers Including Control		Among Papers Reporting Coefficient		
Control Variable	Control Included in Regressions (%)	Most Common Measure	Usage Rate of Most Common Measure (%)	Significant Positive Coefficient (%)	Significant Negative Coefficient (%)	Ambiguous Coefficient (%)
1	2	3	4	5	6	7
Size	86	log(Total assets)	54	63.6	14.0	22.3
Profitability	81	Return on assets	92	7.8	73.3	19.0
Growth opportunities	76	Market-to-book ratio	66	23.1	48.1	28.7
Asset tangibility	64	PP&E/Total assets	80	72.6	10.5	16.8
Investment	31	R&D/Total assets	44	21.1	56.1	22.8
Volatility	28	Std. Dev. of ROA	32	18.2	47.7	34.1
Tax credits	11	Depreciation/Total assets	56	35.0	50.0	15.0
Dividend policy	11	Dividend-payer dummy	72	17.6	64.7	17.6
Firm stock return	11	One-year stock return	72	6.3	75.0	18.8
Bond rating	9	Bond-rating dummy	79	58.3	8.3	33.3
Age	8	log(Age)	83	8.3	41.7	50.0
Tax rate	6	Marginal tax rate	67	33.3	55.6	11.1

firm size researchers must choose a proxy from among sales, assets, or market value and decide whether to take the log of the chosen size measure. Given the uncertainty in the appropriate proxy, column 3 of Table 2 reports which specific measure is used most frequently for each control, and column 4 reports the usage rate of the specific measure. For example, the most commonly used measure of firm size is the log of total assets, which is used in 54% of the studies that include a size control. Column 4 reveals a general lack of uniformity in the specific measures used for the various control variables. Profitability appears to have the most consistent usage, as return on assets is used as the proxy for profitability in 92% of the studies that use profitability controls. However, in our set of papers researchers employ over a dozen different definitions of return on assets.

Columns 5, 6, and 7 of Table 2 summarize the signs of the coefficients reported on each control variable, among those papers that report the coefficients for the control. For example, firm size has a significant positive coefficient in 64% of the papers, a significant negative coefficient in 14% of the papers, and an ambiguous coefficient in 22% of the papers, with "ambiguous" meaning either that it was not statistically significant, or that the paper reported both positive significance and negative significance in different specifications. Across all control variables, the striking pattern is the lack of consistency in the direction of the relation between each control variable and the debt ratio.

Overall, Table 2 documents a lack of standard practice for control variable usage in leverage regressions in top finance journals. Despite this lack of standardization, we use current practice to guide our regression specifications. In the tests that follow, we use the top six variables from Table 2 as controls, employing the most commonly used measure for each. We label these variables SIZE, PROFITABILITY, GROWTH_OPP, ASSET_TANG, INVESTMENT, and VOLATILITY, respectively. We also include industry median leverage to control for industry effects.

D. Other Methodological Decisions

We also rely on the current literature to make other key methodological decisions. With regard to outlier treatment, we find that 53% of studies with leverage regressions treat outliers in some way. Of those that treat outliers, 72% winsorize outliers and 28% drop outliers, and the most common cutoffs, used 73% of the time, are the 1st and 99th percentiles. So, following the most common methodology, we winsorize all nonindicator variables at the 1st and 99th percentiles. With regard to industry exclusion, we find that 60% of the studies in our sample exclude financial firms from their tests, whereas only 39% exclude utilities. Accordingly, we exclude financial firms (SIC 6000–6999) and retain utilities in our tests.[5] Finally, we find that the most common industry definitions are at the 2-digit SIC level, so we define industry median leverage at the 2-digit SIC level.

IV. Empirical Results

A. Regressions with One Proposed Determinant

Because of the variation in data availability across the different proposed determinants, we first estimate panel regressions which include only one of the 55 proposed determinants at a time. We estimate the following regression equation:

$$\text{LEVERAGE}_{it} = \alpha + \beta \text{CSD}_{it-1} + \mathbf{X}'_{it-1}\boldsymbol{\gamma} + \boldsymbol{\delta}_t + \boldsymbol{\varepsilon}_{it}, \tag{1}$$

where the dependent variable is book or market leverage for firm i in year t, CSD_{it-1} is one of the capital structure determinants, $\mathbf{X}'_{it-1}$ is a vector of firm-level control variables as discussed in Section III.C, and δ_t represents year-fixed effects.[6] The standard errors are adjusted for clustering at the firm level. Due to space considerations, we do not report R^2 for these tests, though we do report them in subsequent tables. As a reference point, the R^2 in the full sample with the standard control variables (including industry median leverage) and year-fixed effects is 0.284, so considerable unexplained variation in debt ratios remains prior to including additional explanatory variables.

Table 3 presents the β coefficients from these regressions. Columns 2–5 report results for book leverage. Column 2 reports the baseline specification as in equation (1). We also report results with other commonly used variations of the baseline specification to better assess the robustness of results. Specifically, column 3 includes firm-fixed effects, column 4 includes lagged leverage as a control variable, and in column 5 the dependent variable is the change in leverage. Columns 6–9 report analogous results for market leverage. Coefficients in bold are statistically significant at the 10% level. Given that 55 potential determinants are tested, the threshold for significance is adjusted for multiple testing using a Bonferroni

[5] In a robustness check, we confirm that our main inferences are not sensitive to whether we also include a dummy for regulated industries (SIC 4900–4939) as an independent variable.

[6] In the equation, the capital structure determinants are subscripted as CSD_{it-1}, but several of the proposed determinants are not firm-level variables. Of the 55 determinants, seven are at the industry level, five are at the state level, and one is at the federal district level.

TABLE 3

Leverage Regressions with One Proposed Determinant

Table 3 reports coefficients from panel regressions of debt ratios on proposed determinants of capital structure. Each coefficient reported is from a separate regression on one proposed determinant along with control variables (the top six listed in Table 2 and industry median leverage) and year-fixed effects. As indicated, some specifications include either firm-fixed effects or lagged leverage. The dependent variable is book leverage or market leverage (in levels or changes), as indicated. All variables are defined in the Appendix. All explanatory variables are standardized. Coefficients in bold indicate statistical significance at a Bonferroni-adjusted 10% level based on standard errors clustered at the firm level (not reported).

Explanatory Variable	Book Leverage			Δ Book Leverage	Market Leverage			Δ Market Leverage	No. of Obs.	No. of Firms	No. of Industries
1	2	3	4	5	6	7	8	9	10	11	12
Taxes											
MARGINAL_TAX_RATE	−1.43	−0.05	−0.65	−0.02	**−2.46**	**−1.52**	**−0.26**	0.00	58,985	8,289	65
STATE_TAX_INCREASES	0.98	0.63	0.13	−0.04	**0.65**	0.68	0.12	0.00	101,113	11,296	66
DEP_TAX_SHIELDS	**4.99**	**2.50**	0.69	0.30	**1.11**	**1.07**	**−0.26**	**−0.01**	132,086	14,765	66
INV_TAX_CREDITS	**−2.75**	**−0.88**	**−0.76**	0.03	**−1.59**	**−0.45**	**−0.27**	0.00	81,982	11,831	66
PENSION_LIABILITIES	−0.64	0.41	−0.40	−0.02	0.10	1.07	**−0.26**	**0.00**	27,996	3,449	61
TAX_SHELTERS	−0.18	−0.28	−0.20	0.00	0.21	−0.24	−0.03	0.00	404	36	18
CORRUPTION	**1.01**	0.04	**0.41**	−0.01	**0.87**	0.03	**0.24**	**0.00**	115,775	12,796	66
CAMPAIGN_CONT	1.66	−0.06	0.32	0.00	0.20	−0.54	0.15	0.00	4,496	407	50
LOBBYING_EXP	**2.31**	0.55	**1.17**	0.10	−0.32	0.29	−0.12	0.00	87,846	11,454	66
Financial distress costs											
IMPORT_PENETRATION	0.39	0.17	−0.01	0.02	0.04	0.20	−0.09	0.00	38,904	5,431	54
IMPORT_TARIFFS	0.41	−2.02	−0.26	−0.07	0.58	−0.97	0.19	0.00	31,513	4,367	50
TRADE_SECRET_PRO	**0.80**	0.71	0.03	0.01	**0.85**	**0.78**	0.09	0.00	80,359	9,552	64
BRAND_PERCEPTION	3.65	−2.99	0.65	0.00	1.37	−3.07	0.80	0.01	532	186	34
PROD_MKT_FLUIDITY	0.20	−0.41	0.27	0.04	0.06	−0.02	**0.29**	**0.00**	68,673	9,020	64
INDUSTRY_CONC	**1.56**	0.21	0.24	0.06	**1.20**	0.12	0.12	0.00	74,249	9,590	64
PROD_SIMILARITY	−0.64	−0.19	0.06	0.01	**−0.57**	−0.06	0.12	**0.00**	74,249	9,590	64
UNEM_INS_GENEROSITY	−0.99	−0.49	−0.51	−0.05	−0.16	0.94	−0.03	0.00	111,150	12,123	66
EMPLOYEE_TREATMENT	**−1.83**	−0.14	**−0.24**	0.00	**−1.34**	0.08	−0.21	0.00	16,228	3,396	62
LABOR_PRO_LAWS	**−1.22**	1.54	−0.14	0.17	**−1.14**	2.02	**−0.19**	0.00	66,642	9,633	66
UNION_COVERAGE	−1.16	−0.50	0.14	0.12	−0.90	−0.95	−0.11	0.00	16,003	2,079	56
CUSTOMER_R&D_INT	−0.87	0.39	−0.27	−0.08	−0.08	0.13	0.03	0.00	71,824	8,552	65
SUPPLIER_R&D_INT	0.61	1.21	−0.24	0.07	0.52	0.43	0.05	0.00	72,248	8,605	65
DED_CUSTOMER_REL	**−2.82**	**−2.02**	**−0.98**	−0.10	**−0.95**	**−0.82**	0.07	**0.00**	103,404	12,758	66
DED_SUPPLIER_REL	0.07	0.03	**0.25**	0.04	**−0.67**	−0.07	**−0.15**	0.00	103,404	12,758	66
CDS_REF_CUSTOMERS	0.42	−0.63	−0.13	0.00	0.56	−0.32	0.10	0.00	24,741	5,589	64
INDUSTRY_CLUSTER	−0.69	0.94	−0.04	0.01	**−0.93**	−0.08	**−0.14**	0.00	132,097	14,766	66
Information asymmetry											
ANALYST_COV	**−2.57**	**−0.72**	0.05	0.00	**−4.68**	**−2.41**	**−0.24**	**0.00**	84,864	10,514	64
ANALYST_DIS	**0.98**	**0.31**	0.07	0.00	**2.08**	**0.83**	0.12	0.00	53,494	8,765	64
STOCK_ILLIQUIDITY	**6.16**	**2.39**	−0.35	−0.06	**11.94**	**5.16**	0.04	**−0.02**	92,957	11,557	65
Agency costs											
CEO_DELTA	**−1.92**	**−1.34**	−0.08	0.00	**−4.29**	**−3.17**	0.12	**0.01**	32,882	2,887	60
CEO_VEGA	−0.23	−0.47	0.15	0.01	**−2.33**	**−1.43**	0.20	**0.01**	32,890	2,887	60
CEO_INSIDE_DEBT	**−6.45**	**−2.50**	−0.03	**0.01**	**−5.50**	**−1.38**	−0.26	**0.01**	7,937	1,149	58
TOURN_INCENTIVES	**0.95**	−0.48	**0.36**	**0.00**	−0.65	**−1.26**	**0.34**	**0.00**	32,742	2,923	60
CEO_COMP_RATIO	**2.40**	**1.74**	0.24	0.01	**4.44**	**3.82**	0.03	**−0.01**	32,070	2,873	60
OPTIONS_TRADED	−0.65	−0.20	0.09	−0.03	**−3.32**	**−0.62**	**−0.29**	**0.00**	53,360	8,273	65
PILOT_CEO	−0.19	0.62	−0.06	0.00	−0.16	0.60	−0.02	0.00	16,576	1,693	59
MALE_CEO	0.30	0.37	0.02	0.00	0.02	−0.09	−0.01	0.00	35,131	2,953	60
MILITARY_CEO	−0.08	−0.12	0.03	0.00	−0.22	−0.18	0.02	0.00	14,078	1,707	58
SHARE_RETAINER	**1.00**	**0.62**	0.16	0.00	0.70	0.45	−0.03	0.00	15,490	1,996	59
CEO_AGE	−0.32	0.07	−0.11	0.01	−0.46	−0.22	−0.16	0.00	35,044	2,946	60
CENTRAL_LOCATION	0.06	0.00	0.03	0.00	0.16	0.00	0.02	0.00	132,097	14,766	66
LARGE_BLOCKHOLDER	**−2.34**	−1.14	**−1.21**	−0.03	**−0.82**	−0.23	−0.05	0.00	99,908	12,699	66
OUTSIDE_DIRECTORS	0.30	−0.23	−0.02	−0.01	0.56	0.10	−0.02	0.00	22,495	2,634	60
BOARD_SIZE	0.24	0.05	−0.11	0.00	−0.19	−0.06	−0.14	0.00	22,495	2,634	60
CEO_TENURE	−0.33	0.00	0.11	0.01	−0.49	−0.25	0.12	**0.00**	35,131	2,953	60
BOARD_CO-OPTION	0.00	−0.11	−0.03	0.00	0.13	−0.02	0.08	0.00	19,078	2,116	59
TAKEOVER_SUSCEPT	0.89	2.51	−0.18	0.05	−0.20	1.18	**−0.68**	**−0.01**	102,335	11,400	65
TAKEOVER_DEFENSES	0.32	−0.14	0.03	0.00	0.27	−0.19	0.10	0.00	29,779	2,946	60
Supply frictions											
BOND_RATING	**8.10**	**4.03**	**1.60**	0.08	**4.31**	**2.62**	**0.34**	**0.00**	132,097	14,766	66
CDS_TRADING	1.25	−0.33	−0.09	0.00	0.13	−0.56	−0.41	0.00	3,691	579	55
COVENANT_STRENGTH	**−3.86**	−0.11	0.16	**0.01**	**−3.86**	1.35	0.37	**0.01**	2,494	448	52
SUPPLY_UNCERTAINTY	**3.73**	−0.61	0.26	0.00	**4.03**	−0.41	**0.74**	0.00	3,794	625	54
RATINGS_CONSERV	**−3.71**	**−4.02**	0.05	0.00	0.49	−0.76	**0.68**	**0.01**	12,979	2,006	62
HISTORICAL_MB	**−5.51**	**−8.17**	1.08	−1.07	**−4.05**	**−1.49**	−0.08	**0.01**	126,960	13,931	66
SIN_STOCK	0.57	0.15	0.14	0.01	0.06	−0.14	−0.01	0.00	132,097	14,766	66
Control variables											
SIZE	**−2.56**	**−13.31**	**−2.70**	−0.23	**1.79**	**8.93**	0.14	**0.00**	132,097	14,766	66
PROFITABILITY	**−24.58**	**−14.50**	**−5.94**	−0.71	**−5.89**	**−3.37**	**−1.01**	0.00	132,097	14,766	66
GROWTH_OPP	**11.43**	**4.84**	−1.63	−0.59	**−4.18**	**−1.52**	**−0.48**	0.00	132,097	14,766	66
ASSET_TANG	**4.82**	**4.23**	**0.57**	−0.10	**3.42**	**3.74**	**0.61**	0.00	132,097	14,766	66
INVESTMENT	**−4.50**	−0.81	−0.68	−0.24	**−3.11**	−0.16	**−0.68**	**0.00**	132,097	14,766	66
VOLATILITY	2.37	1.27	**1.79**	−0.06	−0.16	0.38	0.10	0.00	132,097	14,766	66
Industry median leverage	**6.49**	**4.32**	**0.81**	0.05	**7.43**	**4.89**	**0.94**	**0.00**	132,097	14,766	66
Lagged leverage			**46.76**				**20.99**				
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Firm-fixed effects	No	Yes	No	No	No	Yes	No	No			

correction, which implies a cutoff of $t = 3.12$ for 10% significance. Columns 10–12 report the number of observations, firms, and industries (2-digit SIC) included in each regression.

Table 3 shows that 23 of the 55 proposed determinants are significant at the 10% level in the baseline specification with book leverage (column 2), and 26 are significant with market leverage (column 6). The significant coefficients are spread out across all five categories. When we include firm-fixed effects, 13 variables are statistically significant for book leverage (column 3) and 16 are significant for market leverage (column 7). We expect fewer variables to be significant with firm-fixed effects given the finding of Lemmon et al. (2008) that the explanatory power of traditional capital structure determinants is much smaller when firm-fixed effects are included (in our full sample, the R^2 of firm-fixed effects alone is 0.53). Because firm-fixed effects control for unobserved time-invariant firm characteristics, the loss of significance when firm-fixed effects are added suggests that some variables suffer from omitted variable bias in specifications without firm-fixed effects. However, some variables lack sufficient within-firm variation to detect effects that are more apparent in the variation across firms. In subsequent tables, we focus on tests without firm-fixed effects in order to retain a cross-sectional element to the results. As noted by Lemmon et al. (2008), firm-fixed effects preclude the possibility of identifying factors that explain much of the variation in leverage ratios. Additionally, DeAngelo and Roll (2015), in their critique of the findings of Lemmon et al. (2008), emphasize the importance of understanding both time-varying and cross-sectional determinants of leverage.

Table 3 reports a difference in the significance of variables in book leverage regressions relative to market leverage regressions when lagged leverage is included as a control. In the regressions with lagged leverage, only nine coefficients are significant for book leverage (column 4), whereas 16 coefficients are significant for market leverage (column 8). This disparity arises from the fact that lagged leverage has greater explanatory power for book leverage than for market leverage. Lagged leverage may have greater explanatory power in book leverage regressions because, unlike market leverage, measures of book leverage are not directly impacted by stock price volatility. Table 3 shows an even larger disparity in significance when the dependent variable is the change in leverage. Only three coefficients are significant for book leverage (column 5) whereas 20 are significant for market leverage (column 9).

Turning to the economic significance of results, Table 3 reports a wide variation in the economic significance of the proposed determinants of leverage. In the baseline specification (column 2), the magnitude (in absolute value) of the coefficients ranges from less than 0.001 (BOARD_CO-OPTION) to 8.10 (BOND_RATING). To facilitate interpretation, the explanatory variables are all standardized and the leverage ratios are not. So, for example, the coefficient of 6.16 on stock illiquidity implies that a one-standard-deviation change in stock illiquidity is associated with an increase of 6.16 percentage points in the debt ratio (the leverage ratios are expressed in whole percentages). In assessing economic significance, a key question is always what constitutes a "large" economic effect. One way to assess the magnitude is to compare the size of the effect to the mean or standard deviation of the dependent variable. In the full sample, mean book

leverage is 32% with a standard deviation of 63%.[7] The largest effect in column 2, 8.10 percentage points for BOND_RATING, represents approximately 25% of the mean and 13% of the standard deviation of leverage, which seems fairly substantial.[8] On the other hand, 30 of the 55 determinants have coefficients (column 2) with magnitudes less than 1.0, implying effects less than 3.1% of the mean and 1.6% of the standard deviation, which seems quite small. For market leverage, 36 of 55 determinants have coefficients (column 6) with magnitudes less than 1.0, implying effects less than 4.1% of the mean and 3.9% of the standard deviation of market leverage.

Another way to assess economic significance is to compare the coefficients on the proposed determinants to coefficients on the canonical capital structure covariates that we use as control variables. The bottom of Table 3 reports coefficients for control variables, from separate regressions that include all control variables, but none of the 55 proposed determinants. For book leverage, the magnitude of the coefficients on the control variables (column 2) ranges from 2.4 to 24.6, with four of the six being between 2.4 and 4.8. So as one benchmark we might say that any variable having a coefficient with a magnitude of 2.4 or greater is as economically important as at least one of the canonical control variables. Only 12 of the 55 variables are statistically significant and have coefficients with magnitudes greater than 2.4 in column 2. These include two variables related to taxes (DEP_TAX_SHIELDS, INV_TAX_CREDITS), one related to financial distress costs (DED_CUSTOMER_REL), two related to information asymmetry (ANALYST_COV, STOCK_ILLIQUIDITY), two related to agency costs (CEO_INSIDE_DEBT, CEO_COMP_RATIO), and five related to supply frictions (BOND_RATING, SUPPLY_UNCERTAINTY, COVENANT_STRENGTH, RATINGS_CONSERV, HISTORICAL_MB). The signs on these variables are generally as expected, although the positive sign on DEP_TAX_SHIELDS contradicts the prediction of DeAngelo and Masulis (1980) and the positive sign on SUPPLY_UNCERTAINTY contradicts the prediction of Massa et al. (2013). For market leverage, the magnitudes of the coefficients on the control variables range from 1.8 to 5.9 (with the exception of VOLATILITY, which has a negligible coefficient). Column 6 shows that 13 variables have market leverage coefficients with magnitudes greater than 1.8. In addition to eight that are listed above for book leverage, these include MARGINAL_TAX_RATE, ANALYST_DIS, CEO_DELTA, CEO_VEGA, and OPTIONS_TRADED. The negative signs on MARGINAL_TAX_RATE, CEO_VEGA, and OPTIONS_TRADED are opposite that predicted by key theories (see Section II).

Ultimately, economic significance is a subjective concept, but when we consider the size of the effects relative to the mean and standard deviation of the dependent variable, and relative to the coefficients on canonical control variables, many of the variables proposed in the literature do not appear to be very important economically.

[7]The 25th and 75th percentile book leverage ratios in our sample are 2.9 and 38.6, respectively. Book leverage is calculated as (DLTT+DLC)/(AT), which results in some book leverage ratios above 100%.

[8]In Table 3, each variable is tested in a separate regression, so depending on data availability the mean and standard deviation in a particular sample may not correspond to those in the full sample.

Column 10 of Table 3 shows that the number of observations for the individual proxies varies a great deal, from as low as 404 (for TAX_SHELTERS) to as high as 132,097 (for several variables). These discrepancies in sample size and composition are a by-product of our efforts to test as many potential determinants of leverage as possible with as many observations as possible for each variable. In Section IV.F, we partially address these discrepancies by creating composite variables that aggregate individual variables across each market imperfection. Despite the variability in sample size, columns 11 and 12 show that most of the variables cover a large set of firms from a broad set of industries. Several determinants only include data for smaller sets of firms, and the generalizability of the results is less certain for these variables. TAX_SHELTERS covers only 36 firms from 18 industries because of the specialized nature of the tax shelter data in Graham and Tucker (2006). CAMPAIGN_CONT covers only 407 firms because the data are limited to firms for which political contributions can be identified. BRAND_PERCEPTION covers only 186 firms from 34 industries, because the data are only from firms with prominent brands. CDS_TRADING and SUPPLY_UNCERTAINTY, both of which incorporate Bloomberg data, cover only several hundred firms each. COVENANT_STRENGTH covers only 448 firms because the data are restricted to the private credit agreements of nonfinancial firms studied in Denis and Wang (2014). All other variables cover at least 1,000 firms and at least 50 industries, and thus offer a fairly broad sample composition.

B. Regressions with Multiple Proposed Determinants

We next turn to tests in which we include multiple proposed determinants of capital structure in each regression. Our regressions again take the form of equation (1), including year-fixed effects and the control variables, except that the single explanatory variable is replaced with a vector of explanatory variables taken from our set of proposed determinants. Because of differences in data availability, it is not possible to test all 55 variables in a single regression. Instead, our approach is to estimate a separate regression for each of the variables and to include in each regression as many of the other 54 variables as have sufficient overlap in data availability with the key variable being tested. Our requirement for a variable to have "sufficient overlap" is that it cover at least 80% of the firm-year observations of the key variable. For example, CEO_DELTA has 32,882 observations between 1993 and 2016, and we find that 20 of the other 55 variables have data that cover at least 80% of those 32,882 firm-year observations, so these 20 variables are included as additional explanatory variables in the test for CEO_DELTA. Clearly, it is not ideal to include different sets of explanatory variables in different regressions, but given the data limitations, this approach allows us to test each determinant against a greater number of alternative determinants.

In regressions with many proposed determinants, concerns may arise about the effect of multicollinearity on the estimated coefficients. In order to mitigate these concerns we calculate variance inflation factors for each of the explanatory variables and exclude from the regressions any variable with a variance inflation factor greater than 10. On average, this screen eliminates less than one potential explanatory variable from each regression.

Table 4 presents the results of these regressions. For each book leverage regression, column 2 reports the coefficient on the key variable. To show how much incremental explanatory power is provided by the proposed leverage determinants, column 3 reports the R^2 of the regression when only including year-fixed effects and the standard control variables, and column 4 reports the R^2 after adding the featured leverage determinant and all others that meet the 80% criterion. Columns 5–7 provide the same information for market leverage. Columns 8 and 9 report the number of observations and the number of additional explanatory variables (not including the standard control variables) in the regression.

Table 4 shows that adding the additional explanatory variables changes the statistical significance of several variables relative to the results in Table 3. For book leverage, seven variables lose significance, including four variables related to agency costs (TOURN_INCENTIVES, CEO_COMP_RATIO, SHARE_RETAINER, LARGE_BLOCKHOLDER), two related to financial distress costs (EMPLOYEE_TREATMENT, LABOR_PRO_LAWS), and CORRUPTION. For market leverage, six variables lose significance when additional explanatory variables are added, including three related to agency costs (CEO_VEGA, CEO_COMP_RATIO, LARGE_BLOCKHOLDER), two related to financial distress costs (PROD_SIMILARITY, EMPLOYEE_TREATMENT), and STATE_TAX_INCREASES. Additionally, a few variables gain statistical significance when additional variables are added, including CDS_TRADING for book leverage, and LOBBYING_EXP, CEO_TENURE, TAKEOVER_SUSCEPT, and CDS_TRADING for market leverage. The negative signs on LOBBYING_EXP and TAKEOVER_SUSCEPT, as well as the positive sign on CEO_TENURE, are contrary to prominent theoretical predictions (see Section II).

Regarding economic significance, Table 4 shows that fewer variables have high levels of economic significance after including additional determinants. Without the additional determinants, 12 variables for book leverage and 13 variables for market leverage are statistically significant and exceed the benchmarks of economic significance comparable to canonical control variables (see Table 3). With the additional determinants, Table 4 shows that only 10 variables have coefficients with magnitudes above the 2.4 benchmark in the book leverage results, and only 10 variables are statistically significant and above the 1.8 benchmark in the market leverage results. All of these variables are also above these benchmarks in either the book or market leverage results in Table 3. Only seven variables are statistically significant and exceed these benchmarks in *both* the book and market leverage results, of which two are related to information asymmetry (ANALYST_COV, STOCK_ILLIQUIDITY), two are related to agency costs (CEO_DELTA, CEO_INSIDE_DEBT), and three are related to supply frictions (BOND_RATING, COVENANT_STRENGTH, HISTORICAL_MB). Overall, 36 out of 55 variables in the book leverage results and 36 out of 55 variables in the market leverage results have coefficients with magnitudes less than 1 in Table 4, again suggesting that the most of the proposed determinants are not very important economically.

As a robustness check, we repeat the tests in Table 4 using the requirement that a variable overlap 90% of the observations of another variable in order to be included as a control variable. This typically reduces the number of variables in the regression but increases the number of observations. The results (not reported) are

TABLE 4

Leverage Regressions with Multiple Proposed Determinants

Table 4 reports coefficients from panel regressions of debt ratios on proposed determinants of capital structure. Each row represents a different regression in which the specified proxy is the explanatory variable of interest. Other explanatory variables in the table are included in the regression (coefficients not reported) when a variable's data overlaps at least 80% of the firm-year observations available for the variable of interest. Each regression includes control variables (the top six listed in Table 2 and industry median leverage) and year-fixed effects (coefficients not reported). All variables are defined in the Appendix. All explanatory variables are standardized. Coefficients in bold indicate statistical significance at a Bonferroni-adjusted 10% level based on standard errors clustered at the firm level (not reported).

	Book Leverage			Market Leverage				
Explanatory Variable	Coeff.	R^2 Controls and FE Only	R^2 Full Model	Coeff.	R^2 Controls and FE Only	R^2 Full Model	No. of Obs.	Additional Explanatory Variables
1	2	3	4	5	6	7	8	9
Taxes								
MARGINAL_TAX_RATE	−0.99	0.23	0.26	**−2.53**	0.20	0.26	44,479	10
STATE_TAX_INCREASES	0.86	0.26	0.28	0.60	0.19	0.23	74,221	11
DEP_TAX_SHIELDS	**4.47**	0.29	0.31	**0.85**	0.21	0.24	103,173	7
INV_TAX_CREDITS	**−2.38**	0.32	0.34	**−1.19**	0.18	0.22	53,085	9
PENSION_LIABILITIES	−0.84	0.32	0.34	−0.06	0.20	0.22	22,992	8
TAX_SHELTERS	0.12	0.38	0.61	−0.88	0.40	0.59	243	17
CORRUPTION	0.90	0.29	0.31	**0.79**	0.19	0.23	86,133	9
CAMPAIGN_CONT	1.72	0.17	0.29	0.83	0.38	0.49	2,068	26
LOBBYING_EXP	**1.06**	0.31	0.33	**−1.10**	0.21	0.26	67,918	9
Financial distress costs								
IMPORT_PENETRATION	0.22	0.22	0.25	0.22	0.19	0.24	28,103	13
IMPORT_TARIFFS	0.20	0.21	0.24	0.20	0.22	0.25	19,554	13
TRADE_SECRET_PRO	**0.98**	0.14	0.18	**0.86**	0.25	0.29	61,271	12
BRAND_PERCEPTION	0.88	0.18	0.42	0.12	0.34	0.61	337	25
PROD_MKT_FLUIDITY	0.86	0.16	0.21	0.68	0.26	0.39	44,289	15
INDUSTRY_CONC	**1.53**	0.16	0.21	**1.04**	0.26	0.39	44,289	15
PROD_SIMILARITY	0.47	0.16	0.21	−0.16	0.26	0.39	44,289	15
UNEM_INS_GENEROSITY	−0.74	0.29	0.31	−0.03	0.19	0.23	86,133	9
EMPLOYEE_TREATMENT	−1.16	0.18	0.29	−0.76	0.34	0.45	9,234	21
LABOR_PRO_LAWS	−0.71	0.21	0.24	**−0.75**	0.19	0.23	53,309	12
UNION_COVERAGE	−1.52	0.25	0.27	−1.10	0.23	0.25	11,715	10
CUSTOMER_R&D_INT	−0.25	0.26	0.29	0.12	0.25	0.28	56,667	9
SUPPLIER_R&D_INT	0.50	0.26	0.29	0.25	0.25	0.28	56,667	9
DED_CUSTOMER_REL	**−2.63**	0.26	0.28	**−0.78**	0.19	0.23	74,221	11
DED_SUPPLIER_REL	−0.15	0.26	0.28	**−0.82**	0.19	0.23	74,221	11
CDS_REF_CUSTOMERS	0.11	0.13	0.19	0.20	0.26	0.38	15,679	19
INDUSTRY_CLUSTER	−0.66	0.29	0.31	**−0.86**	0.21	0.24	103,173	7
Information asymmetry								
ANALYST_COV	**−2.62**	0.18	0.24	**−4.03**	0.33	0.42	55,238	9
ANALYST_DIS	**0.86**	0.19	0.26	**1.55**	0.35	0.44	33,859	10
STOCK_ILLIQUIDITY	**8.61**	0.15	0.20	**14.85**	0.27	0.39	49,259	11
Agency costs								
CEO_DELTA	**−2.40**	0.18	0.27	**−4.61**	0.33	0.44	18,063	20
CEO_VEGA	0.77	0.18	0.27	−0.38	0.33	0.44	18,063	20
CEO_INSIDE_DEBT	**−7.21**	0.13	0.35	**−6.50**	0.39	0.54	4,013	25
TOURN_INCENTIVES	0.30	0.18	0.27	0.49	0.33	0.44	18,063	20
CEO_COMP_RATIO	2.07	0.18	0.27	1.83	0.33	0.44	17,930	21
OPTIONS_TRADED	0.60	0.34	0.37	**−3.87**	0.20	0.26	40,923	10
PILOT_CEO	−0.13	0.18	0.28	−0.09	0.32	0.44	7,838	26
MALE_CEO	0.08	0.18	0.27	0.12	0.33	0.44	18,063	20
MILITARY_CEO	0.25	0.17	0.27	0.22	0.34	0.45	7,500	22
SHARE_RETAINER	0.77	0.19	0.29	0.73	0.34	0.44	8,654	24
CEO_AGE	0.11	0.18	0.27	−0.25	0.33	0.44	18,063	20
CENTRAL_LOCATION	0.03	0.29	0.31	0.31	0.21	0.24	103,173	7
LARGE_BLOCKHOLDER	0.28	0.16	0.20	0.16	0.29	0.39	53,716	10
OUTSIDE_DIRECTORS	0.19	0.20	0.30	0.14	0.35	0.45	12,204	24
BOARD_SIZE	0.11	0.20	0.30	−0.31	0.35	0.45	12,204	24
CEO_TENURE	0.56	0.18	0.27	**1.45**	0.33	0.44	18,063	20
BOARD_CO-OPTION	0.26	0.20	0.30	0.65	0.35	0.45	10,356	26
TAKEOVER_SUSCEPT	−0.80	0.26	0.28	**−1.21**	0.19	0.23	74,221	11
TAKEOVER_DEFENSES	−0.13	0.18	0.27	−0.15	0.33	0.42	14,480	18
Supply frictions								
BOND_RATING	**9.00**	0.29	0.31	**4.87**	0.21	0.24	103,173	7
CDS_TRADING	**2.00**	0.14	0.24	**1.77**	0.37	0.49	1,776	31
COVENANT_STRENGTH	**−3.42**	0.16	0.38	**−3.21**	0.29	0.45	1,781	20
SUPPLY_UNCERTAINTY	**1.86**	0.21	0.36	**2.26**	0.40	0.53	2,767	20
RATINGS_CONSERV	**−4.20**	0.19	0.31	0.56	0.36	0.47	8,700	18
HISTORICAL_MB	**−5.48**	0.29	0.31	**−3.90**	0.21	0.24	103,173	7
SIN_STOCK	0.59	0.29	0.31	0.09	0.21	0.24	103,173	7

similar to those reported in Table 4 with a few differences. For book leverage, three variables gain statistical significance relative to the results in Table 4 (PROD_MKT_FLUIDITY, EMPLOYEE_TREATMENT, LARGE_BLOCKHOLDER), and CDS_TRADING loses statistical significance. For market leverage, four variables gain significance relative to the results in Table 4 (PROD_MKT_FLUIDITY, CEO_AGE, LARGE_BLOCKHOLDER, BOARD_CO-OPTION) and two variables lose statistical significance (LABOR_PRO_LAWS, CDS_TRADING).

Overall, the results in Table 4 confirm the pattern observed in Table 3 that relatively few of the proposed determinants of capital structure are robust and economically significant. It is important to note that some of the variables with the strongest results in Table 4 such as STOCK_ILLIQUIDTY and BOND_RATING have a relatively small number of control variables. But overall, variables related to information asymmetry and supply considerations have the greatest economic and statistical significance, on average, in Table 4. Notably, all of the variables related to information asymmetry and all but one of the variables related to supply frictions are statistically significant in at least one of the two specifications in Table 4.

C. Identification Strategies

As is common in empirical corporate finance studies, the results presented thus far suffer from endogeneity concerns, broadly defined. Omitted variable bias is a primary concern, despite the many control variables included in the regressions, and despite the firm-fixed-effects specifications presented in Table 3. Additionally, many of the proposed determinants we study are measured with error, and resolving concerns related to measurement error is difficult, particularly in a setting where multiple independent variables are measured with error (Roberts and Whited (2013)). Although we cannot fully address these endogeneity concerns, we consider identification strategies that have been used in the literature for the proposed determinants of leverage in our data set. Following the classification in Bowen, Frésard, and Taillard (2017), we consider five categories of identification techniques: instrumental variables (IV), difference-in-differences estimates and natural experiments (DD), selection models, regression discontinuity designs (RDD), and randomized experiments. Although we find no instances of RDD or randomized experiments among the 55 determinants, we find IV strategies for 17 variables, DD strategies for five variables, and a selection model for one variable. Additionally, we highlight five other cases in which the proposed determinant is a plausibly exogenous variable (as argued in previous studies). For the remaining 27 proposed determinants, we do not find an identification technique in these categories; in these cases, the results reported in Tables 3 and 4 have comparable identification to existing findings in the literature but are estimated using a standardized approach. For the identification strategies that we find, we perform similar tests using our data set and standardized methodology. We are unable to employ seven of the identification strategies, due to data limitations or to insufficient descriptions of techniques in the prior literature. To report the findings from all available identification strategies, and to facilitate comparison of our results with those reported in the literature, we report results from tests in the literature side-by-side with those estimated using our data and control variables.

Table 5 reports the results of the identification strategies. Column 2 briefly describes the identification strategy employed, and column 3 cites the paper from which the strategy was taken. Space considerations prevent us from describing each strategy in detail, so we refer interested readers to the cited papers. Columns 4 (book leverage) and 6 (market leverage) report the key coefficients from the identification strategy as reported in the cited paper.[9] Columns 5 and 7 report the corresponding coefficient from our empirical tests. The results in columns 5 and 7 employ the same instrumental variables and natural experiments as the cited papers, while using our data and the standardized methodological procedures described above. We do not expect the magnitude of the coefficient from our test to match the magnitude of the coefficient reported in the cited paper, because of the differences in sample and methodology (in part because our explanatory variables are standardized), but we do expect the coefficients to be similar in terms of sign and statistical significance. Coefficients in bold are statistically significant at the 10% level, in this case, unadjusted for multiple testing so that our significance levels are comparable with those from the cited papers.

The results in Table 5 are somewhat mixed. Columns 4 and 6 show that the cited papers report statistically significant coefficients for book leverage, market leverage, or both, for all but six of the variables. When we test the identification strategies using our data and methods (columns 5 and 7) we find at least one significant coefficient for 16 of the variables and no significant coefficients for five of the variables (we are unable to test the other seven variables). Only three variables have significant results across all four columns: TRADE_SECRET_PRO, LABOR_PRO_LAWS, and TAKEOVER_SUSCEPT. Overall, the results compiled in Table 5 suggest that more work is required to properly identify the effects of many proposed determinants of capital structure.

D. Robustness Checks

We perform additional tests to evaluate the robustness of the results presented thus far. First, we consider whether there are significant nonlinear relations between any of the proposed determinants and debt ratios. In untabulated tests, we repeat the regressions of Table 3, but add to each regression the squared term of the proposed determinant. Across the book leverage and market leverage value results, we find 13 variables that are not significant in Table 3 that do have significant coefficients on their squared terms (IMPORT_PENETRATION, PROD_SIMILARITY, DED_SUPPLIER_REL, CEO_VEGA, OUTSIDE_DIRECTORS, PENSION_LIABILITIES, IMPORT_TARIFFS, PROD_MKT_FLUIDITY, UNEM_INS_GENEROSITY, CDS_REF_CUSTOMERS, TOURN_INCENTIVES, OUTSIDE_DIRECTORS, BOARD_SIZE). Among these variables, OUTSIDE_DIRECTORS stands out as having strong and consistent nonlinear effects. It is significant for both book leverage and market leverage, and it has a significant positive coefficient on both the level term and the squared term. In accordance

[9]We also note in columns 4 and 6 when a coefficient is not available, either because the results are mentioned but not tabulated in the cited paper, because the instrument is used in a context other than leverage ("Not tested"), or because the cited paper does not report results for book or market leverage ("Not reported").

TABLE 5

Identification Strategies for Proposed Capital Structure Determinants

Table 5 reports identification strategies used in prior literature for proposed capital structure determinants. For the strategies that are found, the table lists the type of strategy (column 2) and a citation for the strategy (column 3). "DD" refers to difference-in-differences or natural experiments; "IV" refers to instrumental variables. Columns 4 and 6 report the coefficient in the cited paper when the strategy is used (explanatory variables are not standardized), and columns 5 and 7 report the analogous coefficient using our data and methodology (including standardized explanatory variables). The dependent variable for CEO_DELTA and CEO_VEGA is the change in leverage from 2001 to 2005, for ANALYST_COVERAGE, it is the change in long-term debt/assets in column 4, and for STOCK_ILLIQUIDITY, it is the change from 2000 to 2002. Regressions reported in columns 5 and 7 include control variables (the top six in Table 2 and industry median leverage) and year-fixed effects. All variables are defined in the Appendix. Coefficients in bold indicate statistical significance at the 10% level.

			Book Leverage		Market Leverage	
Explanatory Variable	Identification Strategy (Among Specified Categories)	Citation for Strategy	Coefficient in Cited Paper	Coefficient with Our Methods	Coefficient in Cited Paper	Coefficient with Our Methods
1	2	3	4	5	6	7
Taxes						
MARGINAL_TAX_RATE	Plausibly exogenous variable	Graham et al. (2004)	Not reported	**−1.43**	**0.23**	**−2.46**
STATE_TAX_INCREASES	Plausibly exogenous variable	Heider and Ljunqvist (2015)	**0.75**	**0.98**	Not reported	**0.65**
PENSION_LIABILITIES	IV: Unionization, plan age	Shivdasani and Stefanescu (2010)	**−0.36**	**−12.90**	Not reported	**−9.90**
TAX_SHELTERS	IV: Implementation unclear	Graham and Tucker (2006)	Not tabulated	Unable to test	Not reported	Unable to test
CORRUPTION	IV: Distance from capital (Campante and Do (2014))	Smith (2016)	**0.17**	**3.47**	Not reported	**2.42**
Financial distress costs						
IMPORT_PENETRATION	IV: Import tariffs, FX rates	Xu (2012)	**−0.85**	−1.71	**−0.70**	−1.83
TRADE_SECRET_PRO	Plausibly exogenous variable	Klasa et al. (2018)	**0.02**	**0.80**	**0.01**	**0.85**
UNEM_INS_GENEROSITY	Plausibly exogenous variable	Agrawal and Matsa (2013)	**0.02**	**−0.99**	**0.05**	−0.17
EMPLOYEE_TREATMENT	IV: Pension expenses, industry wage rates	Bae et al. (2011)	Not reported	**−13.93**	**−8.02**	**−9.15**
LABOR_PRO_LAWS	Plausibly exogenous variable	Serfling (2016)	**−0.02**	**−1.22**	**−0.01**	**−1.14**
UNION_COVERAGE	DD: Repeal of work stoppage provisions	Matsa (2010)	**−0.01**	Unable to test	−0.01	Unable to test
CUSTOMER_R&D_INT	IV: Customer size, 5 others	Kale and Shahrur (2007)	Not reported	Unable to test	**−0.59**	Unable to test
SUPPLIER_R&D_INT	IV: Supplier size, 5 others	Kale and Shahrur (2007)	Not reported	Unable to test	**−0.16**	Unable to test
CDS_REF_CUSTOMERS	IV: FX hedging, loan portfolio concentration	Li and Tang (2016)	**−16.91**	Unable to test	**−9.96**	Unable to test
Information asymmetry						
ANALYST_COV	DD: Broker mergers (Hong and Kacperczyk (2010))	Derrien and Kecskes (2013)	**−0.01**	0.04	Not reported	**−0.59**
STOCK_ILLIQUIDITY	DD: Change to decimalization	Fang et al. (2009)	Not reported	**0.02**	**−0.16**	**0.02**
Agency costs						
CEO_DELTA	DD: 2004 stock option expensing regulation	Chava and Purnanandam (2010)	**−0.001**	**−0.03**	Not reported	**−0.01**
CEO_VEGA	DD: 2004 stock option expensing regulation	Chava and Purnanandam (2010)	**0.001**	0.00	Not reported	0.00
CEO_INSIDE_DEBT	IV: CEO age, 7 others	Cassell et al. (2012)	Not tabulated	**−10.08**	Not reported	**−7.20**
TOURN_INCENTIVES	IV: Number of VPs, 3 others	Kini and Williams (2012)	**0.09**	**−3.22**	Not reported	**−9.96**
MALE_CEO	IV: State gender equality (Sugarman and Straus (1988))	Huang and Kisgen (2013)	Not tabulated	23.05	Not reported	10.10
LARGE_BLOCKHOLDER	IV: Density of high-net-worth individuals	Becker et al. (2011)	−0.03	−14.69	−0.03	−20.61
OUTSIDE_DIRECTORS	IV: Noncompliance with board regulations	Duchin et al. (2010)	Not tested	1.32	Not tested	**1.93**
TAKEOVER_SUSCEPT	Selection model	Wald and Long (2007)	**0.03**	**7.66**	**0.03**	**−2.09**
TAKEOVER_DEFENSES	IV: Defenses of proximate firms	Karpoff et al. (2017)	Not tested	0.98	Not reported	0.23
Supply frictions						
BOND_RATING	IV: S&P 500 inclusion, others	Faulkender and Petersen (2006)	Not reported	**4.13**	**0.06**	1.15
CDS_TRADING	IV: Bank FX derivatives	Saretto and Tookes (2013)	**0.08**	Unable to test	**0.05**	Unable to test
SUPPLY_UNCERTAINTY	IV: Local mutual fund fraction, local turnover	Massa et al. (2013)	**−0.36**	Unable to test	**−0.69**	Unable to test

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with the reasoning of Berger et al. (1997), this suggests that outside directors—and especially larger numbers of outside directors—can discourage entrenched managers from being unnecessarily conservative in debt usage.

In another set of robustness checks, we include a set of macroeconomic controls as independent variables instead of year-fixed effects (results not tabulated). Following Frank and Goyal (2009), the controls we include are the expected inflation rate, the GDP growth rate, the growth rate in aggregate corporate profits, and the term spread, defined as the difference between the 10-year treasury rate and the one-year treasury rate. Including the macroeconomic controls alters the statistical significance for a small number of the leverage determinants. For book leverage, the coefficient on STATE_TAX_INCREASES becomes significant and the coefficient on TOURN_INCENTIVES loses its significance. For market leverage, the coefficients on UNEM_INS_GENEROSITY, TOURN_INCENTIVES, SHARE_ RETAINER, and CEO_TENURE become statistically significant and the coefficient on STATE_TAX_INCREASES loses significance. Aside from these changes, we observe no other notable differences in our results when including macroeconomic controls.

We also repeat our tests excluding zero-leverage firms from the sample (results not tabulated). Again, this does not alter our main inferences. For book leverage, two variables gain statistical significance (MARGINAL_TAX_RATE, TAKEOVER_SUSCEPT) and two lose significance (LABOR_PRO_LAWS, TOURN_INCENTIVES). For market leverage, TOURN_INCENTIVES gains statistical significance, and two variables lose significance (STATE_TAX_INCREASES, PROD_SIMILARITY).

E. Summary of Performance

Because of the large number of explanatory variables we consider in our study, in Table 6 we summarize the performance of the proposed determinants of capital structure as presented in Tables 3–5. This summary makes it easier to observe which variables perform best overall, which theories appear to have the most relevance for the capital structure decision, and which specific frictions have the greatest impact on capital structure. Columns 2–4 of Table 6 provide information on the statistical significance of each variable. Column 2 indicates, for each type of specification tested in Tables 3 and 4, the number of significant coefficients (1 or 2) obtained across book and market leverage regressions. Column 3 reports the sum of these significant coefficients (0 to 10) for each variable, and column 4 reports the average across each market imperfection and across each specific friction. Columns 5–7 of Table 6 provide information on the economic significance of each variable. Column 5 reports the absolute value of the coefficient in our baseline regression, for both book and market leverage regressions. Column 6 reports the average of these two values for each variable, and column 7 reports the average across each market imperfection and across each specific friction.[10] The values in column 6 range from

[10]We average across book and market leverage coefficients in the interest of brevity, but acknowledge that the expected effects of a particular determinant on book or market leverage could be quite different. Additionally, averaging across coefficients from other specifications from Tables 3 and 4 (i.e., with lagged leverage, firm fixed effects, or additional controls) does not alter the relative ordering of economic significance for the different market imperfections.

TABLE 6

Summary of Performance

Table 6 reports the performance of proposed determinants of capital structure based on the results in Tables 3–5. For statistical significance, we report the number of significant coefficients in all specifications from Tables 3 and 4 (out of 10); the numbers for individual specifications (baseline, firm-fixed effects, including lagged leverage, change in leverage, additional controls) indicate how many of two specifications (book leverage, market leverage) are significant. For economic significance, we report the average of the coefficients across book and market leverage regressions in our baseline specification (columns 2 and 6 in Table 3). For identification, we report the number of significant coefficients from Table 5 (out of 4). All variables are defined in the Appendix.

	Statistical Significance (0–10)							Economic Significance (0–9.1)				Identification (0–4)			
Proposed Determinant	Baseline	Firm FE	Lagged	Change	Controls	Sum	Category Average	Baseline (Book)	Baseline (Market)	Average	Category Average	Cited Paper	Our Methods	Sum	Category Average
1	2					3	4	5		6	7	8		9	10
Taxes							**3.7**				**1.3**				**2.4**
Tax rates							*2.5*				*1.4*				*3.0*
MARGINAL_TAX_RATE	1	1	1		1	4		1.4	2.5	1.9		1	2	3	
STATE_TAX_INCREASES	1					1		1.0	0.7	0.8		1	2	3	
Lack of tax shields							*4.5*				*1.4*				*1.5*
DEP_TAX_SHIELDS	2	2	1	1	2	8		5.0	1.1	3.1				N/A	
INV_TAX_CREDITS	2	2	2		2	8		2.8	1.6	2.2				N/A	
PENSION_LIABILITIES			1	1		2		0.6	0.1	0.4		1	2	3	
TAX_SHELTERS						0		0.2	0.2	0.2				0	
Nontax expropriation							*3.3*				*1.1*				*3.0*
CORRUPTION	2		2	1	1	6		1.0	0.9	0.9		1	2	3	
CAMPAIGN_CONT						0		1.7	0.2	0.9				N/A	
LOBBYING_EXP	1		1		2	4		2.3	0.3	1.3				N/A	
Financial Distress Costs							**2.1**				**0.9**				**2.3**
Competitive threats							*1.9*				*0.9*				*3.0*
IMPORT_PENETRATION						0		0.4	0.0	0.2		2		2	
IMPORT_TARIFFS						0		0.4	0.6	0.5				N/A	
TRADE_SECRET_PRO	2	1			2	5		0.8	0.9	0.8		2	2	4	
BRAND_PERCEPTION						0		3.7	1.4	2.5				N/A	
PROD_MKT_FLUIDITY			1	1		2		0.2	0.1	0.1				N/A	
INDUSTRY_CONC	2				2	4		1.6	1.2	1.4				N/A	
PROD_SIMILARITY	1			1		2		0.6	0.6	0.6				N/A	
Labor-related costs							*1.8*				*1.1*				*2.8*
UNEM_INS_GENEROSITY						0		1.0	0.2	0.6		2	1	3	
EMPLOYEE_TREATMENT	2		1			3		1.8	1.3	1.6		1	2	3	
LABOR_PRO_LAWS	2		1		1	4		1.2	1.1	1.2		2	2	4	
UNION_COVERAGE						0		1.2	0.9	1.0		1		1	

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TABLE 6 (continued)

Summary of Performance

	Statistical Significance (0–10)							Economic Significance (0–9.1)				Identification (0–4)			
Proposed Determinant	Baseline	Firm FE	Lagged	Change	Controls	Sum	Category Average	Baseline (Book)	Baseline (Market)	Average	Category Average	Cited Paper	Our Methods	Sum	Category Average
1	2					3	4	5		6	7	8		9	10
Customer/supplier costs							*2.5*				*0.8*				*1.3*
CUSTOMER_R&D_INT						0		0.9	0.1	0.5		1		1	
SUPPLIER_R&D_INT						0		0.6	0.5	0.6		1		1	
DED_CUSTOMER_REL	2	2	1	1	2	8		2.8	1.0	1.9				N/A	
DED_SUPPLIER_REL	1		2		1	4		0.1	0.7	0.4				N/A	
CDS_REF_CUSTOMERS						0		0.4	0.6	0.5		2		2	
M&A-related costs							*3.0*				*0.8*				*N/A*
INDUSTRY_CLUSTER	1		1		1	3		0.7	0.9	0.8				N/A	
Information asymmetry							**7.0**				**4.7**				**2.5**
Equity issuance costs							*7.0*				*4.7*				*2.5*
ANALYST_COV	2	2	1	1	2	8		2.6	4.7	3.6		1	1	2	
ANALYST_DIS	2	2			2	6		1.0	2.1	1.5				N/A	
STOCK_ILLIQUIDITY	2	2		1	2	7		6.2	11.9	9.1		1	2	3	
Agency costs							**2.3**				**1.2**				**1.6**
Managerial risk-taking							*4.9*				*2.4*				*2.3*
CEO_DELTA	2	2		1	2	7		1.9	4.3	3.1		1	2	3	
CEO_VEGA	1	1		1		3		0.2	2.3	1.3		1		1	
CEO_INSIDE_DEBT	2	2		2	2	8		6.5	5.5	6.0			2	2	
TOURN_INCENTIVES	1	1	2	2		6		1.0	0.7	0.8		1	2	3	
CEO_COMP_RATIO	2	2		1		5		2.4	4.4	3.4				N/A	
OPTIONS_TRADED	1	1	1	1	1	5		0.7	3.3	2.0				N/A	
PILOT_CEO						0		0.2	0.2	0.2				N/A	
Behavioral biases							*0.5*				*0.4*				*0.0*
MALE_CEO						0		0.3	0.0	0.2				0	
MILITARY_CEO						0		0.1	0.2	0.2				N/A	
SHARE_RETAINER	1	1				2		1.0	0.7	0.9				N/A	
CEO_AGE						0		0.3	0.5	0.4				N/A	

(continued on next page)

TABLE 6 (continued)

Summary of Performance

	Statistical Significance (0–10)							Economic Significance (0–9.1)				Identification (0–4)			
Proposed Determinant	Baseline	Firm FE	Lagged	Change	Controls	Sum	Category Average	Baseline (Book)	Baseline (Market)	Average	Category Average	Cited Paper	Our Methods	Sum	Category Average
1	2					3	4	5		6	7	8		9	10
Monitoring costs							*0.8*				*0.5*				*0.5*
CENTRAL_LOCATION						0		0.1	0.2	0.1				N/A	
LARGE_BLOCKHOLDER	2		1			3		2.3	0.8	1.6				0	
OUTSIDE_DIRECTORS						0		0.3	0.6	0.4			1	1	
BOARD_SIZE						0		0.2	0.2	0.2				N/A	
CEO_TENURE				1	1	2		0.3	0.5	0.4				N/A	
BOARD_CO-OPTION						0		0.0	0.1	0.1				N/A	
Takeover deterrence							*1.5*				*0.4*				*2.0*
TAKEOVER_SUSCEPT			1	1	1	3		0.9	0.2	0.5		2	2	4	
TAKEOVER_DEFENSES						0		0.3	0.3	0.3				0	
Supply frictions							**4.9**				**3.1**				**2.0**
Poor credit access							*5.4*				*3.3*				*2.0*
BOND_RATING	2	2	2	1	2	9		8.1	4.3	6.2		1	1	2	
CDS_TRADING					2	2		1.3	0.1	0.7		2		2	
COVENANT_STRENGTH	2			2	2	6		3.9	3.9	3.9				N/A	
SUPPLY_UNCERTAINTY	2		1		2	5		3.7	4.0	3.9		2		2	
RATINGS_CONSERV	1	1	1	1	1	5		3.7	0.5	2.1				N/A	
Equity misvaluation							*3.5*				*2.5*				*N/A*
HISTORICAL_MB	2	2		1	2	7		5.5	4.1	4.8				N/A	
SIN_STOCK						0		0.6	0.1	0.3				N/A	

0.1 (for three variables) to 9.1 (for STOCK_ILLIQUIDTY). Columns 8–10 of Table 6 provide information on the identification for each variable. Column 8 indicates, for regressions in each cited paper and from our own tests, the number of significant coefficients (1 or 2) obtained across book and market leverage regressions. Column 9 reports the sum of these significant coefficients (0 to 4) for each variable, and column 10 reports the average across each market imperfection and across each specific friction.

Among the five broad categories of market imperfections, the variables related to information asymmetry have the highest averages for economic significance, statistical significance, and identification, by a large margin in most cases. All three variables in this category perform well, but STOCK_ILLIQUIDTY especially stands out, having the strongest economic significance among all 55 variables, as well as strong statistical significance and identification. Because only three variables are available in the information asymmetry category, it could be that this category appears strongest because its averages are not pulled down by the performance of other ineffective proxies. However, even if we consider only the three strongest variables in each category, the information asymmetry category would still be the strongest category overall.

Next to information asymmetry, the variables related to supply frictions have the second strongest economic significance and statistical significance. Within the supply frictions category, the variables related to credit access are particularly strong, especially BOND_RATING, which has the second highest economic significance and the highest statistical significance among all 55 variables. For the variables related to equity misvaluation, HISTORICAL_MB has notably strong economic and statistical significance.

The superior performance of variables related to asymmetric information and supply frictions suggests that financial claimants have a greater impact on the capital structure decision than do other stakeholders in the firm. As discussed in Section II, variables related to asymmetric information deal with outside investors' perceptions of the value of debt and equity claims, while variables related to supply frictions deal with access to providers of debt and misvaluation of equity claims. By contrast, the other market imperfections are primarily related to other stakeholders such as managers, employees, customers, suppliers, and the government, and these other market imperfections have less impact on our tests. The results indicate that the availability of outside funding is a paramount consideration in the capital structure decision.

In the agency costs category, proxies for one specific friction, managerial risk-taking, perform quite well in all three areas. Among the proxies for managerial risk-taking, CEO_INSIDE_DEBT has particularly strong economic and statistical significance. By contrast, we find very little evidence for the other specific frictions related to agency costs, namely, behavioral biases, monitoring costs, and takeover deterrence.

The evidence for the other two market imperfections is relatively weak. Among the proxies for taxes, the only variables that are particularly strong in terms of economic and statistical significance are DEP_TAX_SHIELDS and INV_TAX_CREDITS, and the sign on DEP_TAX_SHIELDS is usually positive, contrary to the theoretical prediction of DeAngelo and Masulis (1980). The proxies for financial distress costs are mostly weak, with a few exceptions. DED_CUSTOMER_REL has fairly strong economic significance and strong statistical significance.

Additionally, TRADE_SECRET_PRO and LABOR_PRO_LAWS perform well in terms of identification.

Overall, the summary evidence in Table 6 is supportive of pecking order theory. Equity issuance costs driven by information asymmetry appear to have a strong impact on corporate debt ratios. Table 6 also suggests that the more recent emphasis in the literature on supply-side considerations is warranted, as the evidence for the importance of supply frictions on capital structure is quite strong. The results offer some support for agency theory, but only in terms of proxies related to managerial risk-taking. Finally, the evidence in Table 6 offers little support for traditional tradeoff theory, despite the many proxies related to tradeoff theory that have been proposed.

The results summarized in Table 6 have important implications for empirical modeling of the capital structure decision. Despite the first-order importance of variables related to information asymmetry and supply considerations, direct proxies for these factors are not commonly employed as control variables in capital structure tests (see Table 2). With regard to information asymmetry, ANALYST_COV and STOCK_ILLIQUIDITY are highly significant (economically and statistically), can be readily constructed for U.S. firms from commonly used databases, and have excellent data availability. Unless a particular theory dictates otherwise, at least one of these variables should be included as a covariate in capital structure tests. With regard to supply considerations, BOND_RATING and HISTORICAL_MB are highly significant (economically and statistically) and can be constructed from Compustat data. Absent theoretical reasons to exclude them from a particular test, both of these variables should ideally be included as covariates in capital structure tests, given that they represent different supply frictions (poor credit access and equity misvaluation, respectively.)

F. Composite Variables

Thus far the empirical analysis has focused on the effects of each proxy individually. We also create composite variables for the market imperfections listed in Table 1 and test whether these composite variables relate to leverage ratios in a way that is consistent with the motivation in the literature. Creating composite variables is advantageous because individual proxies have data available only in certain time periods or for a subset of firms in the data set. By aggregating the proxies within each group we can test for the relation between leverage and each market imperfection across a consistent sample, and over longer time horizons and larger samples than is possible with individual variables. To ensure that the aggregation process does not affect the value of the composite variable differently in the years when multiple proxies are available, we take the average of all the standardized proxies available in each year. We multiply all proxies that have a negative sign in our baseline specification by –1 before taking averages so that the expected sign on all composite variables is positive.

In Table 7, we report coefficients and *t*-statistics from the estimation of a regression similar to equation (1). This regression includes year-fixed effects, the control variables, industry median leverage, and the five composite variables aggregated from our set of proposed determinants. Only the coefficients on the composite variables are tabulated.

TABLE 7

Regressions with Composite Variables

Table 7 reports the results of panel regressions of debt ratios on composite variables related to proposed determinants of capital structure. The composite variables for each market imperfection are constructed from all proxies associated with the market imperfection with available data for each firm-year observation. The composite variables are aggregated by averaging all available proxies after standardizing each variable and reversing the sign on all variables with a negative relation with leverage in our baseline specification. Large (small) firms are defined as those with above (below) median total assets; high- (low-) growth firms are defined as those with above (below) median 1-year total asset growth. All regressions include control variables (the top six listed in Table 2 and industry median leverage) and year-fixed effects (coefficients not reported). Below coefficients in parentheses are *t*-statistics based on robust standard errors clustered at the firm level. Coefficients in bold indicate statistical significance at the 10% level.

	Book Leverage							Market Leverage						
	All Firms	Large Firms	Small Firms	Low-Growth Firms	High-Growth Firms	Dividend Payers	Nondividend Payers	All Firms	Large Firms	Small Firms	Low-Growth Firms	High-Growth Firms	Dividend Payers	Nondividend Payers
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Taxes	**3.91**	**3.76**	**4.53**	**3.21**	**4.31**	**1.82**	**4.48**	**2.17**	**1.57**	**2.77**	**2.58**	**2.28**	0.06	**2.46**
	(9.61)	(7.82)	(7.40)	(7.82)	(7.25)	(2.36)	(9.91)	(7.85)	(3.90)	(8.83)	(6.22)	(9.33)	(0.11)	(8.43)
Financial distress costs	**1.53**	**1.87**	**1.51**	**1.53**	**1.18**	0.25	**2.52**	**1.72**	0.52	**2.51**	**2.50**	**1.60**	−0.95	**2.84**
	(3.28)	(3.50)	(2.09)	(3.22)	(1.70)	(0.33)	(4.64)	(4.63)	(0.96)	(5.58)	(4.30)	(5.24)	-(1.28)	(7.18)
Information asymmetry	**5.92**	**5.12**	**8.12**	**6.66**	**6.46**	**2.97**	**7.03**	**11.06**	**8.99**	**12.92**	**9.47**	**6.74**	**6.99**	**12.40**
	(19.59)	(15.35)	(15.70)	(22.09)	(12.96)	(5.65)	(20.78)	(40.98)	(26.92)	(35.74)	(27.48)	(23.62)	(13.29)	(42.95)
Agency costs	**−0.78**	**−1.45**	0.30	**−1.74**	0.13	−0.74	−0.54	**0.62**	0.64	0.41	**0.82**	**0.71**	**1.31**	**0.48**
	(−2.44)	(−3.50)	(0.69)	(−5.33)	(0.26)	(−1.19)	(−1.52)	(2.32)	(1.60)	(1.31)	(2.21)	(2.88)	(2.16)	(1.72)
Supply frictions	**8.01**	**9.12**	**6.33**	**6.42**	**9.34**	**6.27**	**8.77**	**5.38**	**6.05**	**4.11**	**6.06**	**4.84**	**3.32**	**6.14**
	(13.02)	(14.26)	(5.48)	(10.56)	(10.53)	(5.85)	(12.64)	(11.44)	(11.21)	(5.76)	(9.94)	(10.85)	(4.05)	(12.33)
R^2	0.18	0.22	0.15	0.23	0.17	0.21	0.18	0.35	0.38	0.28	0.29	0.24	0.36	0.37
No. of Obs.	107,365	53,689	53,676	53,676	53,689	23,683	83,682	107,365	53,689	53,676	53,676	53,689	23,683	83,682

Columns 2 and 9 of Table 7 report the baseline results for the composite variables. The results support inferences from earlier tables in that the variables related to asymmetric information and supply frictions have the strongest effect on debt ratios. The coefficients on these two composite variables are positive (as expected), statistically significant, and large in magnitude.[11] In addition, the composite variables for proxies related to taxes and financial distress costs have coefficients that are positive and statistically significant, lending support to traditional tradeoff theory. However, the magnitude of the coefficients related to tradeoff theory is smaller than those related to asymmetric information and supply frictions. Finally, the coefficient on the composite variable for agency costs is negative for book leverage, and positive and small in magnitude for market leverage, offering little support for theories related to agency costs.

In the remaining columns of Table 7, we test for heterogeneity in effects across different types of firms. Our focus is on whether results are different for firms that are more financially constrained relative to firms that are less financially constrained. Following Frank and Goyal (2009), we employ three different measures of financial constraints: firm size, firm growth, and dividend-payer status. Firms that are larger, that have lower growth rates, and that are dividend payers would be expected to be less financially constrained. We designate large firms as those with above-median total assets and low-growth firms as those with below-median 1-year growth rates in total assets. Columns 3–8 (for book leverage) and columns 10–15 (for market leverage) report regression results for each of these subsets of firms.

In the subsample results for taxes and financial distress costs, there is some evidence that traditional tradeoff theory has greater relevance among financially constrained firms. The coefficients on taxes are of greater magnitude among the financially constrained subsamples; that is, among smaller firms, high-growth firms, and nondividend payers. The one exception is the growth-based subsamples in the market leverage results. The results are less consistent for the financial distress cost coefficients, but strong results are observed in dividend-payer subsamples. In the results for information asymmetry, there is some evidence that pecking order theory has more relevance among financially constrained firms. With the exception of the growth subsamples, the coefficient on information asymmetry is of greater magnitude in the financially constrained subsamples. Regarding the variable representing agency theory, some of the coefficients are statistically insignificant, and there is no consistent pattern among the subsamples. Finally, in the results for supply frictions, the results are mixed, although the results are consistently stronger among nondividend payers as compared to dividend payers. Taken as a whole, the subsample results in Table 7 provide moderate evidence that capital structure theories, especially traditional tradeoff theory and pecking order theory, have greater relevance among firms that are financially constrained.

[11] We also perform regressions in which we include only one representative explanatory variable from each of the five categories. Although data availability limits the number of observations in these regressions, the results confirm that the strongest proxies are those related to asymmetric information and supply frictions.

V. Conclusion

The question of what determines corporate debt ratios remains a very active topic for research, but perceptions about what variables are important determinants of capital structure are sometimes based on seminal papers published multiple decades ago. Our study provides an updated perspective on the key predictors of debt ratios, using a greatly expanded set of proposed determinants of capital structure. One of our key findings is that relatively few of the variables proposed in the literature emerge as robust and economically important determinants of capital structure. Our results suggest that as empirical capital structure research moves forward, new proposed determinants of leverage should be stringently tested to ensure that they are economically important and that they explain variation in debt ratios beyond what is explained by the multitude of leverage determinants already documented in the literature.

Despite the lack of importance of many variables, when we consider the evidence as a whole, we are able to draw conclusions about which capital structure theories have the greatest support in the data. Corporate leverage appears to be most strongly influenced, first, by information asymmetry—confirming the importance of pecking order theory—and, second, by supply frictions, including lack of credit access and misvaluation of equity. The primacy of information asymmetry and supply frictions in our tests suggests that financial claimants are the parties that have the greatest influence on capital structure. Additionally, the results suggest that direct proxies for information asymmetry (e.g., analyst coverage and stock liquidity) and for supply frictions (e.g., a bond rating dummy and the historical market-to-book ratio) should take their place among firm size, profitability, growth opportunities, and asset tangibility as common covariates in capital structure tests.

As discussed at various points above, the design of our study carries certain limitations. Applying a standardized methodology when testing all 55 proposed determinants enhances comparability, but it necessitates the sacrifice of nuances in methodology that could be important when testing individual theories. Additionally, differences in data availability across the many variables tested preclude the possibility of testing all determinants in the same regression or of employing a comprehensive set of controls in every regression. Also, because we find identification strategies for only half of the proposed determinants in our study, we are unable to fully address the endogeneity concerns that cloud the interpretation of leverage regressions. Certainly, developing better strategies for identification should remain one of the primary goals of empirical capital structure research in the future.

Finally, our study highlights the complexity of the capital structure decision. In addition to variables related to information asymmetry and supply frictions, we find other variables related to agency theory and traditional tradeoff theory that have some impact (albeit smaller) on leverage. The parties related to shareholders that influence capital structure thus extend from financial claimants to managers, employees, customers, suppliers, competitors, acquirers, targets, and the government. Ultimately, even with all the theories and variables that we consider, most of our regression models explain less than half of the variation in debt ratios in the U.S. Despite decades of research, more work is required to fully understand corporate capital structure.

Appendix. Variable Definitions and Sources

This Appendix presents definitions and sources of the variables used in the study. All nonindicator variables are winsorized at the 1st/99th percentiles. All explanatory variables are standardized. Compustat mnemonics are noted where applicable.

BOOK_LEVERAGE: Long-term debt (DLTT) plus debt in current liabilities (DLC) all divided by the book value of assets (AT). Source: Compustat.

MARKET_LEVERAGE: Long-term debt (DLTT) plus debt in current liabilities (DLC) all divided by the market value of assets (DLTT + DLC + PRCC_C × CSHO). Source: Compustat.

MARGINAL_TAX_RATE: The firm's marginal tax rate for the year indicated, adjusted for option grants and before interest expense. Source: Graham et al. (2004).

STATE_TAX_INCREASES: The cumulative number of corporate income tax rate increases enacted from 1989 to 2012 in the firm's state through the year indicated. Source: Heider and Ljunqvist (2015) from various sources.

DEP_TAX_SHIELDS: Depreciation and amortization (DP) divided by total assets (AT) in the year indicated. Source: Compustat.

INV_TAX_CREDITS: Investment tax credits (ITCI) divided by total assets (AT) in the year indicated; multiplied by 100 for presentation purposes. Source: Compustat.

PENSION_LIABILITIES: Accumulated pension benefit obligation (PBACO) divided by total assets (AT) in the year indicated. Source: Compustat.

TAX_SHELTERS: A dummy variable equal to 1 if the firm had an active tax shelter in the year indicated. Source: Graham and Tucker (2006) from various sources.

CORRUPTION: The number of corruption convictions in the firm's federal district in the year indicated, scaled by population in 100,000s. Source: Smith (2016) from U.S. Department of Justice.

CAMPAIGN_CONT: The log of the total amount of campaign contributions made by officers and directors in the firm in the most recent election cycle. Source: Bonica (2016) from DIME 2.0.

LOBBYING_EXP: The log of 1 plus the value of lobbying expenditures (in $10,000s) made by the firm in the year indicated. Source: Center for Responsive Politics.

IMPORT_PENETRATION: The ratio of imports to the sum of imports and domestic production in the firm's 3-digit NAICS industry in the year indicated (expressed in whole percentages). Source: Xu (2012) from TradeStats Express, BEA.

IMPORT_TARIFFS: The ratio of duties collected to product value in the firm's 4-digit SIC industry in the year indicated. Source: Frésard and Valta (2016) from U.S. Census Bureau.

TRADE_SECRET_PRO: A dummy variable equal to 1 if the firm is headquartered in a state which recognizes the inevitable disclosure doctrine in the year indicated. Source: Klasa et al. (2018).

BRAND_PERCEPTION: An index measuring brand loyalty and quality perception of the firm's products in the year indicated; averaged across quarters and then averaged across multiple products per firm (where applicable). Source: Lovett, Peres, and Shachar (2014) from Y&R Brand Asset Valuator.

PROD_MKT_FLUIDITY: A text-based measure of product market competition measuring the degree to which rival firms' products change relative to the firm's products. Source: Hoberg, Phillips, and Prabhala (2014) from SEC filings.

INDUSTRY_CONC: A sales-based Herfindahl index of the firm's industry, with the industry uniquely defined at the firm level based on textual analysis. Source: Hoberg and Phillips (2016) from SEC filings.

PROD_SIMILARITY: The product similarity of the firm relative to its industry, with the industry uniquely defined at the firm level based on textual analysis. Source: Hoberg and Phillips (2016) from SEC filings.

UNEM_INS_GENEROSITY: The log of the product of the maximum weekly unemployment benefit and the maximum number of benefit weeks in the firm's state in the year indicated. Source: U.S. Department of Labor.

EMPLOYEE_TREATMENT: An index ranging from 0 to 4 with a higher value indicating better employee treatment in the areas of union relations, profit sharing, employee involvement, and health and safety. Source: MSCI ESG database.

LABOR_PRO_LAWS: A dummy variable equal to 1 if the state adopted wrongful discharge laws (specifically the "good faith exception") by the year indicated. Source: Serfling (2016).

UNION_COVERAGE: The percentage of employees (expressed in whole percentages) in the firm's NAICS industry that are covered by a collective bargaining agreement in the year indicated. Source: Hirsch and Macpherson (2003) from Current Population Survey.

CUSTOMER_R&D_INT: Weighted average of the R&D intensities of the firm's set of customer industries as in Kale and Shahrur (2007); multiplied by 100 for presentation purposes. Source: Compustat, BEA summary use tables.

SUPPLIER_R&D_INT: Weighted average of the R&D intensities of a firm's set of supplier industries as in Kale and Shahrur (2007); multiplied by 100 for presentation purposes. Source: Compustat, BEA summary use tables.

DED_CUSTOMER_REL: Proportion of a firm's sales to all customers reported as major customers. Source: Compustat.

DED_SUPPLIER_REL: Total purchases from all manufacturing suppliers that record a given firm as a principal customer divided by cost of goods sold as in Banerjee et al. (2008); multiplied by 10 for presentation purposes. Source: Harford, Schonlau, and Stanfield (2019), Compustat.

CDS_REF_CUSTOMERS: A ratio from 0 to 1 representing the percentage of the firm's sales that are to CDS-referenced customers in the year indicated. Source: Li and Tang (2016) from CreditTrade, GFI.

INDUSTRY_CLUSTER: A dummy variable equal to 1 if there are 10 or more firms in the same 3-digit SIC industry within 100 miles that collectively account for at least 3% of the total market value of that industry (as in Almazan et al. (2010)). Source: Compustat.

ANALYST_COV: The number of analysts covering the firm in the year indicated. Source: IBES.

ANALYST_DIS: The standard deviation of earnings forecasts by analysts covering the firm in the year indicated, scaled by the absolute value of the mean forecast. Source: IBES.

STOCK_ILLIQUIDITY: Logarithm of the relative effective spread of the firm's stock, measured over the year indicated, where the relative effective spread is the absolute difference between the execution price and the midpoint of the prevailing bid–ask quote, divided by the midpoint of the quote. Source: TAQ database.

CEO_DELTA: The value change in the CEO's stock and option portfolio per dollar change in the firm's stock price (see Core and Guay (2002), Knopf, Nam, and Thornton (2002)), multiplied by the value of stocks and options that the firm's CEO owns. Source: ExecuComp.

CEO_VEGA: The value change in the CEO's stock and option portfolio per 1% change in the implied volatility of the firm's stock (as in Core and Guay (2002)), multiplied by the total value of options that the firm's CEO owns. Source: ExecuComp.

CEO_INSIDE_DEBT: The log of the ratio of the CEO's debt-to-equity ratio to the firm's debt-to-equity ratio, where CEO debt is calculated as sum of the present value of accumulated pension benefits and deferred compensation, and CEO equity includes the value of both stock and stock options (as in Cassell et al. (2012)). Source: ExecuComp.

TOURN_INCENTIVES: The log of the difference between the CEO's total compensation and the total compensation of the median non-CEO executive. Source: ExecuComp.

CEO_COMP_RATIO: The log of the ratio of CEO salary to the product of the effective fractional stock holding and market capitalization. Source: ExecuComp.

OPTIONS_TRADED: A dummy variable equal to 1 if options traded on the firm's stock in the year indicated. Source: CBOE Livevol.

PILOT_CEO: A dummy variable equal to 1 if the firm had a CEO with a private pilot license in the year indicated. Source: Cain and McKeon (2016) from Federal Aviation Administration.

MALE_CEO: A dummy variable equal to 1 if the firm's CEO was male in the year indicated. Source: ExecuComp.

MILITARY_CEO: A dummy variable equal to 1 if the firm had a CEO with military experience in the year indicated. Source: Benmelech and Frydman (2015) from various sources.

SHARE_RETAINER: A dummy variable equal to 1 if the CEO retained greater than 1% of the shares received from option exercise in the year indicated. Source: Sen and Tamarkin (2015) from Execucomp, Thomson Reuters.

CEO_AGE: The age of the CEO in the year indicated. Source: ExecuComp.

CENTRAL_LOCATION: A dummy variable equal to 1 if the firm's headquarters are in the Boston, Chicago, Dallas, Detroit, Houston, Los Angeles, New York, Philadelphia, San Francisco, or Washington metro areas. Source: Compustat, U.S. Census Bureau.

LARGE_BLOCKHOLDER: A dummy variable equal to 1 if the firm has a shareholder owning 5% or more of firm stock in the year indicated. Source: Volkova (2018) from SEC filings.

OUTSIDE_DIRECTORS: The ratio of outside directors to total directors on the firm's board in the year indicated. Source: Institutional Shareholder Services.

BOARD_SIZE: The number of directors on the firm's board in the year indicated. Source: Institutional Shareholder Services.

CEO_TENURE: The cumulative number of years for which the CEO has held the title of CEO as of the year indicated. Source: ExecuComp.

BOARD_CO-OPTION: The percentage of the board that was elected subsequent to appointment of the current CEO. Source: Coles, Daniel, and Naveen (2014) from RiskMetrics.

TAKEOVER_SUSCEPT: An index representing the susceptibility of the firm to a hostile takeover, based on an assessment of 17 takeover laws enacted from 1964 to 2014. Source: Cain, McKeon, and Solomon (2017) from various sources.

TAKEOVER_DEFENSES: The E-index as described in Bebchuk, Cohen, and Ferrell (2009). Source: IRRC and Riskmetrics.

BOND_RATING: A dummy variable equal to 1 if the firm had a credit rating in the year indicated, as indicated by codes SPLTICRM, SPSDRM, or SPSTICRM. Source: Compustat.

CDS_TRADING: A dummy variable equal to 1 if there were quoted CDS contracts on the firm's debt in the year indicated. Source: Saretto and Tookes (2013) from Bloomberg.

COVENANT_STRENGTH: An index of the relative strength of the debt covenants (specifically the debt/EBITDA restriction) for the firm in the year indicated. Source: Denis and Wang (2014) from Dealscan, SEC filings.

SUPPLY_UNCERTAINTY: The weighted average of portfolio churn rates for investors in the firm's bonds in the year prior. Source: Massa et al. (2013) from Lipper eMAXX, Bloomberg.

RATINGS_CONSERV: The conservativeness of bond ratings in the firm's industry in the year indicated, based on the difference between actual Standard and Poor's ratings and predicted ratings from a regression model. Source: Baghai et al. (2014) from Compustat, CRSP.

HISTORICAL_MB: Weighted average of historical firm valuations as measured by market-to-book ratios using the procedure described in Baker and Wurgler (2002). Source: Compustat.

SIN_STOCK: A dummy variable equal to 1 if the firm's primary SIC code is within 2100–2199 (tobacco) or 2080–2085 (liquor) or if its primary NAICS code is equal to 7132, 71312, 713210, 71329, 713290, 72112, 721120 (gaming). Source: Compustat.

SIZE: The natural logarithm of total assets (AT). Source: Compustat.

PROFITABILITY: Return on assets measured as EBITDA/AT. Source: Compustat.

GROWTH_OPP: Market value of assets (AT − CEQ + PRCC_C × CSHO) divided by book value of assets (AT). Source: Compustat.

ASSET_TANG: Net property, plant, and equipment (PPENT) divided by total assets (AT); gross PPE (PPEGT) is used when PPENT is missing. Source: Compustat.

INVESTMENT: Research and development expense (XRD) divided by total assets (AT), with missing observations of XRD treated as 0. Source: Compustat.

VOLATILITY: The standard deviation of return on assets for 5 years prior to the year indicated. Source: Compustat.

TABLE A1
Summary Statistics

Table A1 reports summary statistics of variables used in the empirical analysis. All explanatory variables are standardized in the empirical analysis, but are presented in unstandardized form here. All nonindicator variables are winsorized at the 1st/99th percentiles. All variables are defined in the Appendix.

Category	Variable	Mean	Median	Std. Dev.	No. of Obs.	Years Available
1	2	3	4	5	6	7
Dependent variables	BOOK_LEVERAGE	32.48	20.69	62.57	132,097	1990–2016
	MARKET_LEVERAGE	24.29	15.96	25.68	132,097	1990–2016
Taxes						
	MARGINAL_TAX_RATE	0.27	0.34	0.13	58,985	1990–2016
	STATE_TAX_INCREASES	0.36	0.00	0.64	101,113	1990–2013
	DEP_TAX_SHIELDS	0.05	0.04	0.04	132,086	1990–2016
	INV_TAX_CREDITS	0.07	0.00	0.25	81,982	1990–2016
	PENSION_LIABILITIES	0.11	0.06	0.15	27,996	1990–2016
	TAX_SHELTERS	0.18	0.00	0.38	404	1990–2001
	CORRUPTION	0.32	0.25	0.28	115,775	1990–2016
	CAMPAIGN_CONT	11.53	11.58	1.26	4,496	2003–2014
	LOBBYING_EXP	0.51	0.00	1.33	87,846	1999–2016
Financial distress costs						
	IMPORT_PENETRATION	0.20	0.20	0.11	38,904	1990–2004
	IMPORT_TARIFFS	1.59	0.87	1.91	31,513	1990–2006
	TRADE_SECRET_PRO	0.49	0.00	0.50	80,359	1990–2012
	BRAND_PERCEPTION	2.63	2.44	1.49	532	2009–2011
	PROD_MKT_FLUIDITY	6.83	6.19	3.42	68,673	1998–2016
	INDUSTRY_CONC	0.25	0.17	0.23	74,249	1997–2016
	PROD_SIMILARITY	4.11	1.90	5.46	74,249	1997–2016
	UNEM_INS_GENEROSITY	9.09	9.06	0.36	111,150	1990–2016
	EMPLOYEE_TREATMENT	0.22	0.00	0.49	16,228	2004–2016
	LABOR_PRO_LAWS	0.29	0.00	0.45	66,642	1990–2004
	UNION_COVERAGE	18.29	16.00	14.78	16,003	1990–2016
	CUSTOMER_R&D_INT	0.53	0.45	0.45	71,824	1990–2016
	SUPPLIER_R&D_INT	0.33	0.25	0.23	72,248	1990–2016
	DED_CUSTOMER_REL	0.14	0.00	0.24	103,404	1991–2010
	DED_SUPPLIER_REL	0.02	0.00	0.10	103,404	1991–2010
	CDS_REF_CUSTOMERS	0.06	0.00	0.14	24,741	1998–2009
	INDUSTRY_CLUSTER	0.17	0.00	0.37	132,097	1990–2016
Information asymmetry						
	ANALYST_COV	8.94	6.00	8.47	84,864	1990–2016
	ANALYST_DIS	0.20	0.04	0.55	53,494	1990–2016
	STOCK_ILLIQUIDITY	−5.24	−5.19	1.32	92,957	1994–2015
Agency costs	CEO_DELTA	5.13	5.20	1.74	32,882	1993–2016
	CEO_VEGA	3.46	3.68	1.82	32,890	1993–2016
	CEO_INSIDE_DEBT	-0.41	-0.24	2.04	7,937	2007–2016
	TOURN_INCENTIVES	7.32	7.40	1.30	32,742	1993–2016
	CEO_COMP_RATIO	-3.44	-3.42	1.53	32,070	1993–2016
	OPTIONS_TRADED	0.52	1.00	0.50	53,360	2005–2016
	PILOT_CEO	0.06	0.00	0.25	16,576	1993–2016
	MALE_CEO	0.98	1.00	0.14	35,131	1993–2016
	MILITARY_CEO	0.15	0.00	0.36	14,078	1990–2007
	SHARE_RETAINER	0.63	1.00	0.48	15,490	1995–2016
	CEO_AGE	55.46	55.00	7.37	35,044	1993–2016
	CENTRAL_LOCATION	0.37	0.00	0.48	132,097	1990–2016
	LARGE_BLOCKHOLDER	0.72	1.00	0.45	99,908	1997–2016
	OUTSIDE_DIRECTORS	0.71	0.75	0.17	22,495	1997–2016
	BOARD_SIZE	2.18	2.20	0.26	22,495	1997–2016
	CEO_TENURE	1.28	1.39	0.80	35,131	1993–2016
	BOARD_CO-OPTION	0.47	0.43	0.32	19,078	1997–2015
	TAKEOVER_SUSCEPT	0.12	0.10	0.08	102,335	1990–2015
	TAKEOVER_DEFENSES	2.84	3.00	1.24	29,779	1991–2014
Supply frictions	BOND_RATING	0.23	0.00	0.42	132,097	1990–2016
	CDS_TRADING	0.43	0.00	0.50	3,691	2002–2011
	COVENANT_STRENGTH	-0.40	0.00	0.80	2,494	1997–2012
	SUPPLY_UNCERTAINTY	0.30	0.25	0.14	3,794	2000–2006
	RATINGS_CONSERV	1.69	1.65	2.10	12,979	1998–2010
	HISTORICAL_MB	2.98	1.70	4.76	126,960	1990–2016
	SIN_STOCK	0.01	0.00	0.12	132,097	1990–2016
Control variables	SIZE	5.04	5.02	2.63	132,097	1990–2016
	PROFITABILITY	-0.10	0.10	0.87	132,097	1990–2016
	GROWTH_OPP	3.32	1.51	8.41	132,097	1990–2016
	ASSET_TANG	0.28	0.20	0.25	132,097	1990–2016
	INVESTMENT	0.07	0.00	0.16	132,097	1990–2016
	VOLATILITY	0.30	0.06	1.16	132,097	1990–2016

TABLE A2

Correlations of proposed leverage determinants

The table reports correlations (multiplied by 100) of explanatory variables used in the empirical analysis. Green (red) shading indicates increasingly positive (negative) values. Blank cells are those for which the variables have no overlapping data. All non-indicator variables are winsorized at the 1st and 99th percentiles. All variables are defined in Table A1.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
1 MARGINAL_TAX_RATE																																																								
2 STATE_TAX_INCREASES	3																																																						
3 DEP_TAX_SHIELDS	−13	−5																																																					
4 INV_TAX_CREDITS	−5	4	−4																																																				
5 PENSION_LIABILITIES	0	10	−3	6																																																			
6 TAX_SHELTERS	0	12	−10	5	−11																																																		
7 CORRUPTION	3	3	−2	−6	0	7																																																	
8 CAMPAIGN_CONT	7	−4	2	7	8		−1																																																
9 LOBBYING_EXP	17	5	−6	1	22	−3	2	37																																															
10 IMPORT_PENETRATION	−5	−4	1	6	−1	−28	−7	−9	−9																																														
11 IMPORT_TARIFFS	9	−9	−4	−6	−9	15	3	−3	−1	−15																																													
12 TRADE_SECRET_PRO	1	13	−5	−4	7	10	17	−1	2	−3	−4																																											
13 BRAND_PERCEPTION	17	−9	−21	5	29		16	4	34			3																																										
14 PROD_MKT_FLUIDITY	−26	−3	6	18	−20	−11	−3	11	4	6	−31	−9	−23																																									
15 INDUSTRY_CONC	−2	2	−3	−8	9	5	3	−4	−6	−10	7	6	19	−32																																								
16 PROD_SIMILARITY	−29	0	−5	32	−20	−15	−4	5	−4	−9	−24	−6	−18	63	−35																																								
17 UNEM_INS_GENEROSITY	−5	29	−7	10	19	2	−6	4	6	11	−26	37	−1	3	0	10																																							
18 EMPLOYEE_TREATMENT	5	3	−2	6	19		−4	16	33	−2	4	0	28	−3	−4	−2	6																																						
19 LABOR_PRO_LAWS	−11	−12	3	9	−6	−21	−19	0	−5	16	−7	−38		19	−6	18	0	2																																						
20 UNION_COVERAGE	19	4	−24	10	19	25	6	15	29	−40	68	7	−2	−10	−11	−29	−13	28	−2																																					
21 CUSTOMER_R&D_INT	−7	3	−3	5	4	1	−2	−3	3	−15	8	2	−5	10	−5	20	9	12	−8	−20																																		
22 SUPPLIER_R&D_INT	−2	−1	−4	5	14	5	−1	−6	−2	2	6	5	8	−10	13	0	1	0	−1	−17	14																																		
23 DED_CUSTOMER_REL	−13	−1	1	8	−4	11	−3	−14	−8	10	−2	−3	11	8	0	12	2	−1	8	−22	5	0																																	
24 DED_SUPPLIER_REL	7	1	−2	1	5	−2	−1	17	26	0	−4	0	20	0	−4	0	3	15	−1	8	−1	−4	−4																																
25 CDS_REF_CUSTOMERS	0	5	−1	7	9	8	−1	6	4	12	−4	−4	25	2	−4	8	9	4	1	−9	−4	−7	33	0																																
26 INDUSTRY_CLUSTER	−12	6	3	11	−6	−21	−4	10	−1	18	−13	2	−5	26	−14	27	16	5	17	−40	1	−1	10	2	1																																
27 ANALYST_COV	18	3	1	1	3	−8	0	32	42	−7	−8	−2	3	5	−16	2	6	30	−4	5	−2	−11	−11	27	9	10																														
28 ANALYST_DIS	−17	−1	6	−1	−3	−2	−1	1	−6	1	1	−2	−8	8	0	5	2	−2	2	−11	4	−1	4	−3	0	3	−8																														
29 STOCK_ILLIQUIDITY	−32	−13	13	−3	−17	12	1	−31	−43	7	15	3	−34	−2	19	−2	−23	−29	3	−15	−1	9	13	−20	−11	−2	−61	11																														
30 CEO_DELTA	19	3	−10	−1	−2	−24	2	24	25	3	−10	2	7	5	−4	4	7	12	0	−19	−6	3	−7	14	3	9	37	−11	−41																														
31 CEO_VEGA	11	8	−7	2	8	−17	1	19	34	1	−20	3	27	3	−3	2	19	19	2	−10	−3	2	−6	16	11	8	41	−6	−49	55																														
32 CEO_INSIDE_DEBT	6	4	−9	11	12		2	1	4			−2	10	−13	3	−4	2	12		12	9	8	4	−1	6	−4	0	−10	−5	−16	−3																														
33 TOURN_INCENTIVES	9	7	−8	−3	14	−23	2	24	39	2	−18	3	21	4	−5	1	17	22	−1	−8	1	1	−9	18	8	5	43	−4	−53	45	62	−1																												
34 CEO_COMP_RATIO	−17	2	8	−2	8	22	1	−17	−13	−9	8	3	1	−10	5	−8	2	−6	−7	21	8	−5	3	−9	1	−13	−26	11	24	−94	−35	18	−25																												
35 OPTIONS_TRADED	26	1	−4	8	2		−1	5	31		−6	−3	12	8	−20	6	5	15		9	4	−4	8	18	6	6	45	−4	−69	26	28	−2	31	−19																												

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
36 PILOT_CEO	0	−5	1	4	1	−17	−4	−2	6	−4	0	−2	2	3	−2	2	−3	1	1	4	−3	1	2	3	−2	−1	4	0	0	2	2	−1	2	−2	3																			
37 MALE_CEO	0	0	1	0	−6		0	−3	−1	−6	2	−1	10	2	0	0	−4	−2	−1	4	1	1	0	0	0	1	1	−1	2	2	0	−4	−2	−4	1	4																			
38 MILITARY_CEO	4	−3	1	−2	−4	3	7	4	−1	−13	9	0		0	−2	0	−13	−1	−6	9	−1	−4	−4	−2	−4	−7	0	−1	6	−7	−9	7	−8	7	−2	5	4																		
39 SHARE_RETAINER	−2	−4	3	−4	1	−6	3	0	−6	−14	5	7	4	−3	4	0	−10	−6	−7	−2	1	7	−3	−3	−4	−5	−14	2	18	−1	−8	−11	−15	−4	−10	3	3	3																
40 CEO_AGE	7	0	−4	−5	4	−6	4	7	7	−13	4	3	2	−7	0	−7	0	2	−10	2	5	4	−6	1	−3	−6	2	−3	−9	12	2	10	5	−6	−2	2	5	24	4															
41 CENTRAL_LOCATION	−5	2	−2	0	−2	−14	14	−4	0	1	−1	17	−7	8	−1	9	19	−3	4	−15	−3	−2	3	1	4	28	4	0	0	6	6	2	8	−3	2	−1	−2	−1	−4	1														
42 LARGE_BLOCKHOLDER	13	4	−5	6	11	1	−2	−13	6	2	−1	0	−21	−1	−5	2	8	−2	2	−3	0	1	10	0	6	6	6	−1	−16	0	−1	−3	−1	0	29	0	−3	−3	−2	−1	6													
43 OUTSIDE_DIRECTORS	1	10	−7	9	15	−2	−4	5	23	−2	−12	−2	26	−2	2	−2	25	18	0	6	10	0	1	7	9	1	13	0	−35	−3	22	10	28	15	15	1	−4	0	−13	−2	−2	2											
44 BOARD_SIZE	11	3	−8	−10	10	13	8	33	41	−27	8	13	38	−6	1	−10	2	20	−22	27	2	−7	−16	18	3	−13	25	−4	−31	11	25	2	30	3	6	2	2	5	−2	9	0	−14	15									
45 CEO_TENURE	3	6	−5	2	1	−16	0	5	5	9	−18	2	−4	−4	−1	−1	18	4	−2	−10	−1	−1	−1	2	3	0	8	−3	−22	35	25	4	17	−24	6	1	2	−1	−2	30	0	4	5	−4								
46 BOARD_CO-OPTION	0	−2	−1	0	−9	−6	0	−1	−6	9	0	−4	−11	10	−4	8	1	−4	5	−9	−5	3	7	−5	2	6	0	1	4	23	−1	−6	−1	−27	0	−2	3	5	3	22	3	4	−5	−15	48							
47 TAKEOVER_SUSCEPT	17	8	−7	−5	26	4	4	7	30	−12	1	7	37	−29	5	−18	6	22	−9	14	4	5	−11	13	2	−8	28	−6	−29	6	20	9	20	8	16	3	1	7	4	22	3	6	16	36	8	−18						
48 TAKEOVER_DEFENSES	3	7	−4	0	6	8	−1	−2	5	−9	3	3	11	−5	2	−4	18	0	−9	−8	2	1	3	−3	7	−7	−2	1	−16	−3	12	3	11	9	10	0	0	2	−6	−3	−5	1	27	13	5	−4	−1						
49 BOND_RATING	23	5	−2	−6	17	−11	5	13	43	−13	−3	3	35	−4	−12	−9	2	20	−9	23	2	−8	−13	18	5	−6	42	−4	−49	16	29	−14	37	0	36	2	2	3	−4	10	−3	6	15	42	6	−8	32	9					
50 CDS_TRADING	4	8	−6	−2	10		6	21	33	−10	11	−2	30	−5	2	−8	8	18	−8	7	−5	−5	−4	16	7	−4	10	2	−28	7	14	−3	21	2	9	6	−9	−2	−1	4	4	−6	25	26	5	−1	25	14	24				
51 COVENANT_STRENGTH	3	0	−2	5	−2		−5	23	1	3	−25	3	−2	6	−4	5	−1	6	6	1	−8	−7	4	5	−10	7	6	−7	−5	20	10	13	1	−24	2	2	1	9	−3	−3	10	−3	−9	1	4	8	−3	−6	−1	−3			
52 SUPPLY_UNCERTAINTY	−17	−4	9	1	−11	7	5	2	−11	15	−12	−13		33	−2	21	2	−8	15	−23	0	−7	15	−2	8	18	2	6	10	−2	−7		−2	−5	10	10	−10	−6	−4	−4	5	0	−13	−23	0	7	−28	−9	16	−7	5			
53 RATINGS_CONSERV	−3	2	−5	5	2	0	−3	5	7	7	−16	−10	−7	12	−4	9	13	0	5	8	−4	−13	2	7	8	4	6	5	−19	7	5	−9	11	−4	10	5	−6	−7	−14	−7	4	3	6	−2	1	2	−6	7	−2	9	−4	25	
54 HISTORICAL_MB	−25	1	5	4	−10	−8	−3	12	−8	7	−12	−2	−5	22	−3	22	8	0	10	−14	1	3	−2	−2	−1	7	5	−2	2	18	3	12	−1	−30	−20	−2	−1	−9	−1	−17	2	−15	−8	−22	1	10	−19	−10	−16	−18	16	15	0	
55 SIN_STOCK	3	−2	−1	−3	−1	−8	0	11	3	−14	4	−3	−11	2	1	−3	−3	0	3	1	−4	−6	−4	2	−3	1	2	−1	−1	6	4	−6	5	−5	0	0	0	6	1	1	−5	−1	−6	3	−2	−3	1	−1	6	−1	2	12	−2	−2

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