Why Do Firms Hold Less Cash?

A Customer Base Explanation

Daniel Cohen[†]
Naveen Jindal School of Management
University of Texas at Dallas
dcohen@utdallas.edu
(972) 883-4772

Bin Li
Naveen Jindal School of Management
University of Texas at Dallas
bin.li2@utdallas.edu
(972) 883-5836

April 2014

Abstract

Recent empirical and anecdotal evidence suggest that U.S. firms hold a significant amount of cash on their balance sheets. Motivated by this observation, we seek to examine whether the firm's customer base, in particular the amount of sales transactions between a firm and the U.S. government affects the amount of its cash holdings. Building on numerous research streams in the literature to date, we predict and find that firms that have the U.S. government as a major customer hold fewer amounts of cash and have less volatile future earnings. In addition, our evidence suggests that the firm's suppliers take into account the relation between these firms and the U.S. government by providing less trade credit. To address any endogeneity concerns we use the 2000 presidential elections as an exogenous shock and our main findings continue to hold. Our focus on the U.S. government as a determinant of firm's cash holdings has not been addressed before in the literature and therefore advances our understanding why firms might hold less cash rather than more.

JEL Classification: G14; G32; M4; M41

Keywords: Cash holdings; U.S. government; Supply chain; Marginal value of cash; Segment disclosures.

[†] Corresponding author.

* We thank Bill Baber, Allison Koester, Paul Zarowin, Mark Maffett (discussant), Shail Pandit (discussant) and seminar participants at Georgetown University, Southern Methodist University, the 2013 MIT Asia (Shanghai) conference and the 2014 FARS meeting for useful comments.

1. Introduction

The amounts of cash holdings of public U.S. firms are economically significant and have been growing constantly over time. In particular, as of fiscal year 2011, the aggregate cash holdings of firms included in Compustat amounted to $10.8 trillion that consists of 41% of the overall market capitalization of these firms. Moreover, recent evidence in Bates, Kahle, and Stulz (2009) suggests that the average cash-to-assets ratio more than doubles over their sample period, from 10.6% in 1980 to 23.2% in 2006. Seeking to understand why firms hold large amounts of cash has been the focus of academic research for a long time. To date, numerous determinants have been found to affect the level of cash holdings, such as transaction costs, adverse shocks, financial distress, repatriation taxes, and agency problems.

In this paper we investigate and provide a new explanation for the observed level of cash holdings as we examine whether firms' interaction with the U.S. government as a major customer reduces their motives to hold cash. Being a firm's major customer, the U.S. government has several unique features compared to other customers, such as other firms, individuals, and nonprofit organizations. First, firms that engage in transactions with the U.S. government are inevitably affected by changes in government spending that is largely determined by political factors, such as the political environment, political cycles, and election results. Second, the government's objectives are different from other customers, and thus its transactions with firms are often due to considerations about social welfare, for example, reducing unemployment rate, enhancing national security, encouraging technology development, etc. In addition, the process of government procurement is regulated by the Federal Acquisition Regulation (FAR) which is significantly different from the process of transactions between the

firm and other customers.[1] Moreover, firms' transactions with the U.S. government could be potentially affected by their engagement in political activities, such as lobbying or campaign donations (e.g., Goldman, Rocholl, and So 2013). Finally, the U.S. government is expected to have better solvency and lower bankruptcy risk than average customers.

To the extent that engaging in major sales to the U.S. government reduces uncertainty of future operating performance and increases exploitation from suppliers, we predict that these firms have lower cash holdings as compared to other firms. Our research design consists mainly of multiple regressions of cash holdings (defined as the natural logarithm of cash and cash equivalents over noncash assets) on prior determinants of cash holdings identified in the literature and a measure that captures sales made to the U.S. government.[2] We identify whether sales to the U.S. government can be classified as a transaction with a major customer by utilizing the data being disclosed following the new segment reporting requirements in SFAS 14 and 131 which identifies major customer sales greater or equal to 10 percent of total sales.[3]

Our results show that sales to the U.S. government affect firms' future profitability. In particular, we find that the volatility of future profitability measured over a period of three years is lower for firms that engage in substantial transactions with the U.S. government. Based on these findings we claim that these firms require less cash to cope with future potential adverse shocks. The negative relation between sales to the U.S. government and corporate cash holdings

[1] See section 2.4 for details on the U.S. government procurement process.
[2] Following prior literature, we use the terms "cash" and "cash and cash equivalents" interchangeably in this paper.
[3] The FASB issued the Statement of Financial Accounting Standards No. 14 (SFAS 14) that requires disclosure of public firms' major customers in 1976. SFAS 30 amended SFAS 14, and SFAS 131 suspended both SFAS 14 and 30 in 1997. SFAS 14 stipulates that "if 10 percent or more of the revenue of an enterprise is derived from sales to any single customer, that fact and the amount of revenue from each such customer shall be disclosed." SFAS 131 reiterates "if revenues from transactions with a single external customer amount to 10 percent or more of an enterprise's revenues, the enterprise shall disclose that fact, the total amount of revenues from each such customer, and the identity of the segment or segments reporting the revenues." Regulation S-K of the SEC sets similar disclosure requirements.

is also attributable to the exploitation from the firms' suppliers. Specifically, our results suggest that suppliers extend less trade credit to firms with U.S. government sales, and thus reduce the firms' cash holdings, assuming that suppliers are informed about the firms' sales to major customers by having access to their segment disclosures. In addition, we find that firms with U.S. government sales have lower marginal value of cash holdings and they tend to spend more of their operating cash flows. To address any endogeneity concerns related to our analysis, we use the 2000 presidential elections as an exogenous shock. This quasi-natural experiment allows us to draw causal statements on the relation between sales to the U.S. government and the level of cash holdings. Our main findings continue to hold using this specific setting, which increases our confidence in the reported findings.

We make four contributions to the extant literature. First, we add to the literature on corporate cash holdings that identifies the determinants and consequences of cash holdings for U.S. firms. To date, previous research has shown that the main determinants of cash holdings include transaction costs, adverse shocks, financial distress, repatriation tax, and agency problems. Our study is the first to identify another important determinant of cash holdings – the firm's customer base and in particular the relation between the firm and the U.S. government. We utilize this characteristic by first identifying whether the U.S. government indeed engages in business transactions with a particular firm and subsequently measure the amount of sales made to this major customer. In addition, our study expands the literature on customer-supplier relationships along the supply chain. Prior research did not focus on specific major customer characteristics and how this might affect the strategic interaction between the firm and its suppliers. Given that the U.S. government consists of a major customer for numerous firms it is economically important to examine how this might affect both the firm's own business strategy

as well as the strategy employed by the firm's suppliers which are assumed to be aware of the existing relation between the firm and the U.S. government.

Our third contribution relates to the existing literature on political connections attributes. Prior research focused on lobbying and campaign contributions and examined how these activities affect firms' corporate strategies and subsequently the firms' performance and market value. We add to this line of research by identifying an additional attribute of political connections, resulting from the observation that the U.S. government can be identified as a major customer for many firms. Our evidence is important as U.S. firms can be politically connected through the firm-customer channel apart from the existing known channels such as lobbying and campaign contributions. The implications of our findings are important as one can easily identify and classify whether a firm is more likely to be politically connected by simply analyzing its sales to major customers.

Finally, our study expands the existing literature on the consequences of detailed segment disclosures along two streams. The first one relates to the lower value investors assign to cash holdings of firms disclosing the U.S. government as their major customer. In addition, the disclosure of sales to major customers affects the firm's suppliers in their strategic interaction with the firm. To date, most of the literature on segment disclosures focused on the costs and valuation benefits of these specific disclosures without taking into account the specific attributes of the information being actually provided at the segment level. We emphasize that one specific piece of information, which relates to the sales made to major customers, is not only value relevant to the firm's investors but it also affects the behavior of its suppliers. Our study is the first to identify and investigate this important and overlooked attribute. As such, our evidence is also relevant to the ongoing debate on the costs and benefits of increased segment disclosures,

beyond the known arguments advanced so far in the literature relating mainly to competitive costs and capital markets valuation benefits.

The rest of the paper is organized as follows. Section 2 reviews the literatures on corporate cash holdings, supply chain, and political connections. Section 3 discusses our empirical methodology, including our sample construction and estimation equations. Sections 4 and 5 discuss our empirical evidence, and section 6 concludes.

2. Background and hypotheses

Our paper unites three streams of research that have previously been disparate, one on corporate cash holdings, the second on customer-supplier relations and the other on firms' political connections. We first discuss related research in each stream, introduce the procurement process of the U.S. government, and build on the existing body of evidence to develop our hypotheses.

2.1. Corporate Cash Holdings

Since Keynes (1936), numerous papers attempt to explain why firms hold a large amount of cash and cash equivalents as part of their assets even though there are opportunity costs for doing so. Recent studies document that the average cash-to-assets ratio of U.S. industrial firms more than doubled over the past thirty years (e.g., Bates et al., 2009; Duchin, 2010). As summarized by Bates et al. (2009), four different theories have been identified to explain the determinants of firms' cash holdings: the transaction motive, the precautionary motive, the agency motive, and the tax motive.

First, according to the transaction motive, firms incur transaction costs associated with converting a noncash asset into cash, so they can save transaction costs by using cash to make

payments without having to liquidate assets or raise any external capital (e.g., Miller and Orr, 1966; Mulligan, 1997). Thus, larger firms tend to hold lower amounts of cash and cash equivalents, as economies of scale are associated with these transaction costs. The second theory advanced in prior research is the precautionary motive that suggests that firms hold cash to better cope with adverse shocks when access to capital markets is costly (e.g., Han and Qiu, 2007). Consistent with this theory Opler, Pinkowitz, Stulz, and Williamson (1999) document that firms reserve larger amounts of cash and cash equivalents when they have riskier future cash flows and limited access to outside capital. In addition, Opler et al. (1999) provide evidence implying that firms facing a better investment opportunities set have more cash holdings as negative shocks and financial constraints are more costly for them.

The third theory advanced in the literature is referred to as the agency motive. Under this view, entrenched managers would rather retain cash than increase payouts to shareholders when the firm has poor investment opportunities (e.g., Jensen, 1986). In line with the agency motive, prior research has shown that firms hold more cash in countries with greater agency problems (Dittmar, Mahrt-Smith, and Servaes, 2003). In addition, cash holdings are valued less when agency costs are regarded to be higher (e.g., Faulkender and Wang, 2006; Dittmar and Mahrt-Smith, 2007; Pinkowitz, Stulz, and Williamson, 2006). The evidence in the literature to date suggests that firms with larger cash holdings engage in more acquisitions and that these acquisitions are value decreasing (e.g., Harford, 1999). However, in a recent study, Fresard (2010) shows that large cash holdings lead to gains of future product market share at the expense of industry rivals, concluding that industry competition is positively related to corporate cash holdings suggesting a positive consequence for holding excess cash. Finally, Haushalter, Klasa,

and Maxwell (2007) document that if a firm shares a larger proportion of its growth opportunities with rivals, it builds up its cash holdings to manage the predation risk.

The fourth theory relates to the tax motive of corporate cash holdings. Multinational U.S. firms hold more cash and cash equivalents abroad if repatriating foreign earnings would incur negative tax consequences (Foley, Hartzell, Titman, and Twite, 2007). Among these firms, those that are less financially constrained and more technology intensive exhibit a higher sensitivity of affiliate cash holdings to repatriation tax burdens.

In sum, researchers provide numerous explanations for corporate cash holdings. However, the evidence in prior research is not always consistent. For example, Bates et al. (2009) find little support for the agency motive and tax motive, and Pinkowitz, Stulz, and Williamson (2012) also cast doubt on the tax motive by showing that the cash holdings of multinational U.S. firms cannot be explained by the tax treatment of earnings repatriation. Thus, it is important to analyze the impact of each motive under different circumstances carefully.

2.2. Supplier-customer relations

A large body of research has been developed to address how the relation between the firm and its stakeholders affects operating performance and corporate strategies, such as investment policies, capital structure choices, and financial reporting/accounting choices. An important aspect of this relation is the interaction between the firm and its major customers and suppliers.

Prior research documents that the supplier-customer relation influences the firm's operating performance. Gosman, Kelly, and Warfield (2004) find that retail firms that have major customers (those that account for at least 10 percent of total sales) have higher profitability

and more persistent profits, and that investors understand these attributes. Patatoukas (2012) finds that concentrated customer base increases a firm's profitability by reducing its operating expenses and enhancing asset utilization. In addition, the supplier-customer relation affects corporate strategies. For example, Pandit, Wasley, and Zach (2011) document that firms experience an information externality at the time of their major customers' quarterly earnings announcements, because the information conveyed in such announcements can revise investors' expectations about the level of the firms' expected future cash flows and/or the uncertainty associated with future cash flows. Raman and Shahrur (2008) examine the determinants and consequences of earnings management by firms in the context of their relationships with suppliers and customers, and find that earnings management is used opportunistically to influence the perception of suppliers/customers about the firm's future prospects. Hui, Klasa, and Yeung (2012) show that the importance of a firm's economic performance to its suppliers and customers leads to a demand from these stakeholders for the firm to report more conservatively.

In summary, firms' strategies, such as investment policies, capital structure choices, and disclosure decisions, are largely influenced by their relations with their major suppliers and customers.

2.3. Political connections

The third stream of literature that we build upon investigates how firms' political connections relate to their operating performance and value creation. Prior research measures firms' political connections as the amounts of lobbying expenditures, campaign contributions, and/or private access to government officials (e.g., Cooper, Gulen, and Ovtchinnikov, 2010; Ramanna and Roychowdhury, 2010; Duchin and Sosyura, 2012).

Evidence documented in the literature to date suggests that firms with political connections receive favorable treatments and a competitive advantage compared to other firms (e.g., Faccio, 2006 and 2010). For example, politically-connected firms are more likely to have preferential access to capital, obtain government procurement contracts, and receive government investments (e.g., Shleifer and Vishny, 1994; Johnson and Mitton, 2003; Cull and Xu, 2005; Khwaja and Mian, 2005; Faccio, 2010; Goldman et al., 2013). Therefore, a firm's political connections should affect its profitability and firm value. For example, Cooper et al. (2010) find that U.S. firms making donations to political campaigns have better future operating and stock return performances. Goldman, Rocholl, and So (2009) show that political connections of a firm's board of directors members affect firm value. Ramanna and Roychowdhury (2010) study the accrual choices of outsourcing firms with connections to U.S. congressional candidates and find that politically-connected firms with more extensive outsourcing activities have more income-decreasing discretionary accruals if outsourcing is a major campaign issue. Belo, Gala, and Li (2012) document that government spending have different effects on industry-level cash flows and stock returns over different political cycles.

However, it is not costless for firms to invest in or maintain political connections. For example, firms with political connections might be more scrutinized and monitored, especially by outside parties such as the media and opposing political parties (e.g., Faccio, 2006). Therefore, it is noteworthy that the effects of political connections could be under certain circumstances unfavorable to the firm.

2.4. Hypothesis Development

The process of awarding government contracts begins when acquisition personnel working for the U.S. federal government post a solicitation on the Federal Business

Opportunities (FedBizOpps) Website, after determining their agency's requirements (that is, the goods and/or services the specific agency needs). Interested companies submit their offers in response to the solicitation in accordance with applicable provisions of the Federal Acquisition Regulation (FAR). Agency personnel evaluate the offers and make the final decision.[4]

Building on prior research we develop and test three main hypotheses. One of our main innovations compared to the literature to date is the use of firms' sales to the U.S. government to proxy for their political connections. We believe that this measure captures firms' relation with the U.S. government from a new perspective, that is, firms' political connections through the supply chain. In addition, this connection is different from traditional supplier-customer relations, since the customer is no longer an individual or a business organization, but rather a government/federal entity.

As discussed previously, prior research finds that a firm's performance and business strategies are affected by its customer base. However, it is unclear whether having the U.S. government as a major customer will influence the firm's capital structure decisions as reflected in the amount of its cash holdings. On the one hand, firms that have political connections and a concentrated customer base have higher long-term operating and stock performances and better access to external capital (e.g., Goldman et al., 2009; Cooper et al., 2010; Boubakri , Guedhami, Mishra, and Saffar, 2012; Patatoukas, 2012), and thus, firms that have the U.S. government as their major customer should enjoy similar competitive advantages so that they could afford to hold less cash for the transaction and precautionary motives. For instance, the U.S. government is supposed to be less likely to dishonor promised payables compared to individuals and/or

[4] Another type of procurement opportunity for a company is to serve as a subcontractor for a government contractor (Halchin, 2012).

business organizations, so firms that have government major customers should be less financially constrained and their demand for cash to cope with future adverse shocks should be lower. In addition, a concentrated customer base increases operational efficiency and enhances asset utilization (Patatoukas, 2012), suggesting that firms that have the U.S. government as a major customer may reserve lower amounts of cash due to better utilization of their assets. Finally, more sales to the U.S. government may indicate lower foreign sales that have potential tax costs of repatriation, so firms that have government major customers should hold smaller cash balances, due to the tax motive.

However, profitable firms usually face potential competitions from industry rivals (e.g., Fresard, 2010; Haushalter et al., 2007). According to the precautionary motive, it is possible that firms that have government major customers may demand higher cash reserves to deal with any potential adversity in product market competition. Moreover, firms with less competitive product markets are more negatively affected by weak corporate governance (e.g., Giroud and Mueller, 2011). If firms that have government major customers have more problematic corporate governance relative to other firms, their excess cash holdings would be higher than others. Therefore, it is unclear whether having the U.S. government as a major customer would affect corporate cash holdings. The two competing predictions discussed previously lead to the first hypothesis:

H1. *Firms that have the U.S. government as a major customer hold less cash relative to other firms.*

In the next two hypotheses, we propose two channels through which having the U.S. government as a major customer affects corporate cash holdings. The first channel is based on

the relation between a firm's customer base and trade credit obtained from its suppliers. On the one hand, firms that have the U.S. government as a major customer would have less cash available on balance sheets if the suppliers extend less trade credit to them. Prior research shows that suppliers extend less trade credit to less financially-constrained customers (Petersen and Rajan, 1997). If firms that have government major customers are less financially-constrained than other firms, the exploitation of the relationship by their suppliers will leave the firms with less cash. On the other hand, firms will receive more trade credit from the suppliers when they have higher bargaining power or market power (Wilner, 2000; Giannetti et al., 2011). Thus, firms that have government major customers should receive more trade credit, because of their better financial position. If sales to the U.S. government have positive effects on the level and/or persistence of future profits and the suppliers could obtain this information from the firm's segment disclosures, having government major customers will influence the suppliers' decision with regards to the amount of trade credit they extend to the firm. Therefore, our second hypothesis states:

H2. *Firms that have the U.S. government as a major customer receive less trade credit from their suppliers relative to other firms.*

The second channel through which having government major customers would affect corporate cash holdings is related to the precautionary motive for cash holdings. As discussed previously, corporate cash holdings is a function of both expected future profitability and the ability to cope with adverse shocks when access to external capital markets is costly (e.g., Han and Qiu, 2007). Furthermore, prior research suggests that financial performance is a function of corporate political connection and customer base. For example, Cooper et al. (2010) find that firms' donations to political campaigns are positively associated with future operating income

and stock returns. Patatoukas (2012) documents that firms with more concentrated customer bases also have better future operating performance and stock returns. Thus, firms that have government major customers should experience higher and/or more stable streams of future income. On the other hand, government spending is largely determined by political cycles (Belo et al., 2013; Goldman et al., 2013). As a result, firms that are more exposed to government purchases will be more affected by political uncertainty, and thus may experience more volatile incomes. Therefore, it is unclear whether having government major customers would affect the level and volatility of future profitability.[5] We formulate our third hypothesis as follows:

H3. *Firms that have the U.S. government as a major customer have higher levels and/or lower volatilities of future earnings relative to other firms.*

3. Sample selection and research design

3.1. Sample selection

We obtain our sample from the Compustat Segment Files that provide the types and names of major customers of U.S. public firms along with the dollar amount of annual sales generated from each major customer, i.e., those account for at least 10 percent of sales or are otherwise considered important for business (also see footnote 3). The initial sample consists of all major customer observations on the Compustat segment files from 1978 to 2012. Next, we require firm-years with major customer information to have both financial statement data on the Compustat annual database and stock return data on the CRSP monthly file. We remove observations with insufficient information to calculate our primary explanatory variables that

[5] Although Goldman et al. (2013) show that firms with politically connected board of directors affect the allocation of U.S. government procurement contracts, their study is silent on how the government procurement contacts influence the firms' future profitability, such as earnings levels and earnings volatility.

calibrate a firm's sales to different types of major customers (details are provided in Section 3.2). Following prior research on corporate cash holdings (e.g., Bates et al., 2009), we exclude financial firms and utilities (SIC codes 6000-6999 and 4900-4999), because their cash holdings are subject to capital requirements and regulations. We further require all the observations to have information of current and one-year lagged cash holdings, market value of equity, total assets, total debt, and annual stock returns. Our final sample contains 66,015 firm-year observations over the period 1978 – 2012. Some analyses impose additional data requirements that further reduce the sample size.

3.2 Research Design

We use a firm's sales to major customers as a percentage of its total sales ($SaleMC\%$) to gauge the importance of major customer sale to its business and the concentration of its customer base. The Compustat segment file classifies a firm's major customers into seven types (Compustat: CTYPE), including domestic government that represents the U.S. federal government ("GOVDOM"), state government ("GOVSTATE"), local government ("GOVLOC"), company ("COMPANY"), geographic region ("GEOREG"), market ("MARKET"), and foreign government ("GOVFRN"). Based on this classification, we decompose $SaleMC\%$ into three components: percentage sales to government major customers ($SaleGov\%$), percentage sales to corporate major customers ($SaleFirm\%$), and percentage sales to other major customers ($SaleOther\%$).[6] Specifically, $SaleGov\%$ includes sales to the first three major customer classifications, $SaleFirm\%$ represents sales to the fourth major customer classification,[7]

[6] We replace total sales in Compustat annual file with the sum of sales to all major customers in Compustat segment file whenever the former amount is lower than the latter one.

[7] We also measure a firm's sales to the U.S. government as a major customer using an indicator variable. Our (untabulated) results are robust to this alternative measure.

$SaleOther\%$ refers to sales to the last three major customer classifications, and the sum of the three components equals $SaleMC\%$.[8] To test our first hypothesis (H1), we regress corporate cash holdings on $SaleMC\%$ or the three components of $SaleMC\%$ (i.e., SaleGov%, SaleFirm%, and SaleOther%) and a set of control variables.[9]

$$\ln(Cash/NA)_{i,t} = \alpha_0 + \alpha_1 SaleGov\%_{i,t} + \alpha_2 SaleFirm\%_{i,t} + \alpha_3 SaleOther\%_{i,t} + \alpha_4 \ln(NA)_{i,t} + \alpha_5 MVE/NA_{i,t} + \alpha_6 FCF/NA_{i,t} + \alpha_7 NWC/NA_{i,t} + \alpha_8 Capex/NA_{i,t} + \alpha_9 R\&D/NA_{i,t} + \alpha_{10} Acquisition/NA_{i,t} + \alpha_{11} Debt/TA_{i,t} + \alpha_{12} DumDiv_{i,t} + \alpha_{13} indCFRISK_{i,t} + \sum_{j=1}^{49} Industry_j + \sum_{t=1978}^{2012} Year_t + \varepsilon_{i,t} \quad (1)$$

where the subscript *i*, *j*, *t* stands for firm *i*, industry *j*, and year *t*. Following previous research (e.g., Dittmar and Mahrt-Smith, 2007; Bates et al., 2009), $\ln(Cash/NA)$ is defined as the natural logarithm of the ratio of cash and cash equivalents over net assets, where net assets equal total assets minus cash and cash equivalents. $SaleGov\%$, $SaleFirm\%$, and $SaleOther\%$ reflect sales to government major customers, to corporate major customers, and to other major customers, respectively. Our first hypothesis (H1) predicts that firms that have the U.S. government as a major customer would hold less cash relative to other firms, so the coefficient on $SaleGov\%$ should be negative ($\alpha_1 < 0$) in Equation (1).

Control variables are computed per previous studies (e.g., Dittmar and Mahrt-Smith, 2007; Bates et al., 2009; Liu and Mauer, 2011; Gao et al., 2013). We use the natural logarithm of net assets ($\ln(NA)$) to measure firm size, because economy of scale reduces the demand for cash. We measure investment opportunities and growth opportunities using the ratio of market value to

[8] Only 596 firm-year observations have foreign governments as major customers in the entire sample, and the dollar amounts of sales to foreign governments are much smaller than sales to other major customers. Thus, we group sales to foreign governments into "sales to other major customers". Our results remain if we eliminate these observations. Most (over 90% of) firms that have the U.S. government as a major customer sell products to the federal government, not to the state or local government.

[9] We focus on contemporaneous sales to major customers in the study, because current sales are the consequences of previous contracts.

net assets (MVE/NA) and the ratio of R&D expenditures to net assets ($R\&D/NA$), respectively. Firms with better investment opportunities and/or growth opportunities would hold more cash, since it would be more costly for these firms to be financially constrained. We also include the ratio of free cash flows to net assets (FCF/NA) and the ratio of working capital to net assets (NWC/NA) in the equation, because firms with more free cash flows accumulate cash reserves faster and firms with more working capital have lower demands for cash. Capital expenditures ($Capex/NA$) may have opposite effects on corporate cash holdings. If capital expenditures create assets that can be used as collaterals, it would increase debt capacity and reduce the demand for cash. However, if capital expenditures represent financial distress costs and/or investment opportunities, they would be positively related to corporate cash holdings. Acquisition activity ($Acquisition/NA$) reflects the cash outflows associated with acquisitions, so it may correlate with cash holdings in the same way as capital expenditures do. Firms that do not pay dividends ($DumDiv$) and firms that have higher industry cash flows risk ($indCFRISK$) should hold more precautionary cash relative to other firms. Moreover, firms would use cash to reduce leverage when debt is sufficiently constraining, so leverage ($Debt/NA$) should be positively correlated with cash holdings. We also include industry (Fama-French 49 industry classifications) and year fixed effects to account for industry and year specific impacts on corporate cash holdings.[10]

Next, we test our second hypothesis (H2) by estimating the following regressions:

$$\ln(TradeCredit)_{i,t} = \beta_0 + \beta_1 SaleGov\%_{i,t} + \beta_2 SaleFirm\%_{i,t} + \beta_3 SaleOther\%_{i,t} + \quad (2)$$

[10] Our main results are insensitive to the control for customer base concentration, measured per Patatoukas (2012) (untabulated). Since our main independent variables (i.e., $SaleGov\%$, $SaleFirm\%$, and $SaleOther\%$) have already gauged customer base concentration of various types of major customers, we do not include the control per Patatoukas (2002) in our main regressions.

$$\beta_4 \ln(TA)_{i,t} + \beta_5 \ln(Age)_{i,t} + \beta_6 \ln(Age)^2_{i,t} + \beta_7 Debt/TA_{i,t} + \beta_8 DumDiv_{i,t} + \beta_9 CR_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} \Delta Sales/TA_{i,t} + \beta_{11} B/M_{i,t} + \beta_{12} Liquidation_{i,t} + \beta_{13} \ln(OperCycle)_{i,t} + \sum_{j=1}^{49} Industry_j + \sum_{t=1976}^{2011} Year_t + \epsilon_{i,t}$$

where the subscript *i, j, t* stands for firm *i*, industry *j*, and year *t*. $\ln(TradeCredit)$ is the trade credit from firm *i*'s suppliers, measured as the natural logarithm of the accounts payable to cost of goods sold ratio (Petersen and Rajan, 1997).[11] Our second hypothesis (H2) predicts that suppliers take advantage of the firms that have government major customers by extending less trade credit to them, so the coefficient on $SaleGov\%$ should be negative ($\beta_1 < 0$) in Equation (2).

We control for the factors that affect corporate trade credit, following prior research (e.g., Petersen and Rajan, 1997; Ma and Martin, 2012). Rajan and Petersen (1997) find that large firms have higher bargaining power for trade credit, so total assets ($\ln(TA)$) should be positively related to trade credit. They also show that mature firms have lower demand for trade credit than immature firms, so we include the natural logarithm of firm age ($\ln(Age)$) and the squared value ($\ln(Age)^2$) to account for the non-linear relationship between firm age and demand for trade credit. Moreover, Petersen and Rajan (1997) argue that suppliers have an advantage over other lenders by repossessing and reselling the inventory, but it would become more costly to do so if their customers have transformed the inputs into products. Thus, we include the liquidation cost of inventory ($Liquidation$) to partially account for the supply of trade credit. In addition, we use debt in total assets ($Debt/TA$), dividends payment ($DumDiv$), current ratio (CR), profitability (ROA), and operating cycle ($\ln(OperCycle)$) to control for the demand of trade credit, and use change in sales ($\Delta Sales/TA$) and the book-to-market ratio (B/M) to account for the supply of

[11] We also use days in payables (DayPay) as the dependent variable of Equation (2). However, DayPay equals trade credit (TradeCredit) multiplied by 365, so we choose not to tabulate the results.

trade credit, following Ma and Martin (2012). We also control for industry and year fixed effects in Equation (2).

Our third hypothesis (H3) relates sales to the U.S. government to the level and volatility of future earnings, and we use the following regression to test this hypothesis.

$$ROA_{i,t+1} \text{ or } \sigma(ROA)_{i,t+1,t+3} = \gamma_0 + \gamma_1 SaleGov\%_{i,t} + \gamma_2 SaleFirm\%_{i,t} + \gamma_3 SaleOther\%_{i,t} + \gamma_4 ROA_{i,t} + \gamma_5 \sigma(ROA)_{i,t-4,t} + \gamma_6 \ln(MVE)_{i,t} + \gamma_7 B/M_{i,t} + \gamma_8 Debt/TA_{i,t} + \gamma_9 \ln(Age)_{i,t} + \sum_{j=1}^{49} Industry_j + \sum_{t=1978}^{2012} Year_t + \omega_{i,t} \quad (3)$$

where the subscript *i*, *j*, *t* stands for firm *i*, industry *j*, and year *t*. The dependent variable is one-year leading return-on-asset ($ROA_{i,t+1}$) or the volatility of return-on-asset in the next three years ($\sigma(ROA)_{i,t+1,t+3}$). Our third hypothesis (H3) predicts that firms that have government major customers will experience higher and more stable streams of future earnings. Thus, the coefficient on $SaleGov\%$ (γ_1) should be positive and negative when the dependent variables are future earnings level and future earnings volatility, respectively. Our control variables in Eq. (3) include current return-on-asset (ROA), historical earnings volatility ($\sigma(ROA)_{t-4,t}$), market capitalization ($\ln(MVE)$), the book-to-market ratio (B/M), firm age (Age), and industry and year fixed effects.

4. Empirical results

4.1. Summary statistics

Table 1 presents summary statistics for our main variables. The government-sales sample includes firm-year observations that have the U.S. government as a major customer, which account for at least 10 percent of sales or are otherwise considered important for business. The non-government-sales sample includes all other firm-years. The number of observations varies

with data availability. Notes that these two samples have very different customer bases: the government-sales sample does not have major customers other than the U.S. government. Table 1 shows that 16.4 percent of firm-years have significant sales to the U.S. government. Sales to major customers ($SaleMC\%$) account for 27.1 percent of total sales for the government-sales sample and only 22.1 percent for the non-government-sales sample. The two samples do not have significant differences in average total sales ($Sales$) and stock returns (Ret). The government-sales sample has lower cash holdings ($Cash$ and $Cash/NA$) and trade credit ($TradeCredit$) relative to the non-government-sales sample (significant at 0.01 level), consistent with our predictions. Compared with the non-government-sales sample, the government-sales sample has smaller firm size (TA), better profitability (ROA), lower future earnings volatility ($\sigma(ROA)_{t+1,t+3}$), and higher operating cash flows (CFO/NA) (significant at 0.01 level). In addition, we find that firms that have government major customers are more likely to pay dividends and repurchase stocks ($Payout$) and less likely to have credit ratings ($Rating$) than other firms. In addition, they tend to have weaker corporate governance ($Gindex$) and less taxable foreign income ($ForeignTax$). On average, days in receivables ($DayRec$) are 7.6 days longer and days in payables ($DayPay$) are 24.1 days shorter when firms have government major customers.

Table 2 reports the Fama and French (1997) 49 industry profile for the government-sales sample and non-government-sales sample separately. Forty-two industries have the U.S. government as their major customer, which account for at least 10 percent of total sales or are otherwise considered important for business. The number of firms that have government major customers varies across industries. More than 67 percent of firm-years in the "Aircraft" and "Defense" industries have substantial sales to the U.S. government, while those in the "Tobacco",

"Precious Metals", and "Mines" industries do not have any significant government sales. On average, firms that have government major customers have lower cash holdings (lower trade credit) in 30 (34) out of 45 industries, suggesting that having government major customers reduce corporate cash holdings and trade credit within industry. Given average cash holdings and trade credit vary across industries, it is crucial to control for industry fixed effects in the multivariate regressions of cash holdings or trade credit.

Figure 1 presents graphically the average cash to total asset ratio for the government-sales sample and non-government-sales sample over the period 1978 – 2012. Firms that have government major customers hold less cash than other firms since early 1980s, and the gap between cash holdings for the two samples becomes wider over time until the late 2000s.

4.2. Government sales and cash holdings (tests of H1)

Our first hypothesis (H1) predicts that firms that have the government as a major customer hold less cash than other firms. As discussed previously, we regress corporate cash holdings on total percentage sales to all major customers combined ($SaleMC\%$) or on the three components of $SaleMC\%$, i.e., percentage of sales to government major customers ($SaleGov\%$), percentage of sales to corporate major customers ($SaleFirm\%$), and percentage of sales to other major customers ($SaleOther\%$). Table 3 reports the results of estimating Equation (1). We first estimate a regression of cash holdings on the sum of $SaleGov\%$, $SaleFirm\%$, and $SaleOther\%$, that is, total sales to major customers ($SaleMC\%$). The coefficient on $SaleMC\%$ is insignificant in column 1 (coeff. = 0.013, t = 0.21), indicating that total sales to all major customers are not associated with corporate cash holdings. This observation could be explained by one of the two following possibilities: (*i*) a firm's customer base is unrelated to its cash holdings, or (*ii*)

different types of major customers have offsetting effects on corporate cash holdings. To examine the two possibilities, we estimate Equation (1) using $SaleGov\%$, $SaleFirm\%$, and $SaleOther\%$ as the main independent variables, and report the estimates in columns 2 – 5. For simplicity, we focus on the results in column 2 where all three components of $SaleMC\%$ are included. Consistent with our first hypothesis (H1), the coefficient on $SaleGov\%$ is significantly negative in column 2 (coeff. = -0.383, t = -3.32), suggesting that firms that have the U.S. government as a major customer hold less cash relative to other firms. If a firm's percentage sales to the U.S. government ($SaleGov\%$) increase from zero to 50 percent, the ratio of cash holdings to net assets ($Cash/NA$) will decrease by 17.4 percent.[12] In contrast to the coefficient on $SaleGov\%$, the coefficients on $SaleFirm\%$ and $SaleOther\%$ are both reliably positive (coeff. = 0.125, t = 1.65; coeff. = 0.191, t = 2.25), implying that cash balances increase with sales to major customers other than the U.S. government. These results support the second explanation of the insignificant coefficient on $SaleMC\%$ in column 1, suggesting that the U.S. government as a major customer affect corporate cash holdings differently. In addition, the F-tests in column 2 show that the coefficient on $SaleGov\%$ is significantly lower than those on $SaleFirm\%$ and $SaleOther\%$, providing further evidence to support the second explanation.

To investigate whether the relation between $SaleGov\%$ and cash balances stays negative for the government-sales sample, we eliminate firm-year observations that have major customers other than the U.S. government, and re-estimate Equation (1). Consistent with the results in Table 1, all $SaleFirm\%$ and $SaleOther\%$ are equal to zero for the government-sales sample, showing that these firms do not have major customers other than the U.S. government. Similar to the results in columns 2 and 3, the coefficient on $SaleGov\%$ is negative and significant (coeff. =

[12] The expected ratio of cash to net assets ($Cash/NA$) is the exponentiation of the predicted value of Equation (1). The change in $Cash/NA$ equals one minus the exponentiation of -0.383 multiplied by 50 percent, or 17.4 percent.

-0.423, t = -2.71), indicating that corporate cash holdings vary with percentage sales to government major customers even within the government-sales sample. Consistent with previous research (e.g., Bates et al., 2009), Table 3 also documents that firms hold more cash when they have smaller size ($ln(NA)$), lower leverage ($Debt/TA$), more growth opportunities (MVE/NA), more free cash flows (FCF/NA), more capital expenditures and R&D expenditures ($Capex/NA$ and $R\&D/NA$), less working capital (NWC/NA), less dividend payments ($DumDiv$). In summary, Table 3 provides evidence to support our first hypothesis (H1).

4.3. Government sales and trade credit

Our second hypothesis (H2) predicts that suppliers provide less trade credit to firms that have government major customers. We examine the relation between trade credit and sales to major customers by estimating Eq. (2). Table 4 reports the parameter estimates. Similar to the coefficient on $SaleMC\%$ in Table 3, the one in Table 4 is also insignificant (coeff. = -0.026, t = 0.79). Thus, we further examine whether sales to different types of major customers have offsetting effects on trade credit. We focus on the regression results in column 2 that included all three components of $SaleMC\%$. Consistent with our second hypothesis (H2), the coefficient on $SaleGov\%$ is significantly negative (coeff. = -0.235, t = -3.74), whereas the ones on $SaleFirm\%$ and $SaleOther\%$ are reliably positive and insignificant, respectively (coeff. = 0.103, t = 2.56; coeff. = -0.056, t = -1.17). Moreover, the F-tests show that the coefficient on $SaleGov\%$ is significantly lower than the ones on $SaleFirm\%$ and $SaleOther\%$ (at the 0.01 level). These results suggest that firms that have government major customers obtain less trade credit from their suppliers relative to other firms. Because of their better future financial performance (see Section 4.4), the suppliers tend to extend less trade credit to them, reducing their cash reserves. When a firm increases the percentage sales to the U.S. government from zero to 50 percent of

total sales, their trade credit will be 11.8 percent lower than previous (= 1- exp(-0.235 × 50%)). In addition, the coefficient on $SaleGov\%$ is reliably negative in column 6 (coeff. = -0.132, t = -1.73), indicating that having government major customers affects the suppliers' decision of extending trade credit to the firms.

Consistent with prior research (e.g., Petersen and Rajan, 1997; Ma and Martin, 2012), we find that suppliers provide more trade credit to firms that are younger ($ln(Age)$), less profitable (ROA), and non-dividend-paying ($DumDiv$). Firm obtain more trade credit from the suppliers when they are larger ($ln(TA)$) and more leveraged ($Debt/TA$). In addition, trade credit increases with sales growth ($\Delta Sales/TA$), liquidation value ($Liquidation$), and operating cycles ($OperCycle$), and decreases with current ratio (CR) and book-to-market ratio (B/M). In summary, the results in Table 4 support our second hypothesis (H2).

4.4. Government sales and future earnings

Our third hypothesis (H3) predicts that firms that have the government as a major customer will experience better and more stable streams of future income so that they could afford holding less cash to cope with future adverse shocks. We examine the association of percentage sales to major customers with future earnings level (ROA_{t+1}) and future earnings volatility ($\sigma(ROA)_{t+1,t+3}$) by estimating Equation (3). The parameter estimates are reported in Table 5. The coefficients on $SaleMC\%$ are reliably negative in column 1 (coeff. = -0.030, t = -5.65) and reliably positive in column 3 (coeff. = 0.014, t = 3.47), revealing that total sales to major customers are negatively related to future earnings level and positively related to future earnings volatility. Thus, it is important to further investigate whether different types of major customers have different impacts on the stream of future earnings. Consistent with the results in

column 1, the coefficients on $SaleGov\%$, $SaleFirm\%$, and $SaleOther\%$ are all negative in column 2 (coeff. = -0.012, t = -1.81; coeff. = -0.055, t = -7.51; coeff. = -0.006, t = -0.99). However, the F-tests in column 2 show that the coefficient on $SaleGov\%$ is significantly higher than the one on $SaleFirm\%$ but not very different from the one on $SaleOther\%$. This evidence suggests that the negative association of $SaleMC\%$ with future earnings level is mainly driven by sales to corporate major customers ($SaleFirm\%$) rather than sales to other major customers ($SaleGov\%$ and $SaleOther\%$). On the other hand, the results in column 4 show that the coefficient on $SaleGov\%$ is reliably negative (coeff. = -0.008, t = -1.66), while those on $SaleFirm\%$ and $SaleOther\%$ are positive (coeff. = 0.034, t = 6.90; coeff. = 0.006, t = 1.12). The F-tests in column 4 show that the coefficient on $SaleGov\%$ is significantly lower than those on $SaleFirm\%$ and $SaleOther\%$. This evidence implies that having corporate major customers increases future earnings volatility, whereas having government major customers reduces the volatility. Taken together, firms that have government major customers are less likely to have adverse earnings shocks in the future, and thus have a weaker precautionary motive to hold cash.

5. Additional tests

5.1. Customer base and the value of cash

In this section, we explore whether lower cash holdings of firms that have government major customers are attributable to financial constraints. According to Faulkender and Wang (2006), marginal value of cash is higher for financially-constrained firms. If firms that have government major customers are less financially constrained, their marginal value of cash should be lower relative to other firms'. On the contrary, if lower cash holdings of firms that have government major customers is caused by financial constraints, their marginal value of cash

should be higher. To study this issue, we estimate the regression augmented based on prior research (e.g., Faulkender and Wang, 2005; Dittmar and Mahrt-Smith, 2007):

$$ExRet_{i,t} = \theta_0 + \theta_1 SaleGov\%_{i,t} \times \frac{\Delta Cash_{i,t}}{MVE_{i,t-1}} + \theta_2 SaleFirm\%_{i,t} \times \frac{\Delta Cash_{i,t}}{MVE_{i,t-1}} + \theta_3 SaleOther\%_{i,t} \times \frac{\Delta Cash_{i,t}}{MVE_{i,t-1}} + \theta_4 SaleGov\%_{i,t} + \theta_5 SaleFirm\%_{i,t} + \theta_6 SaleOther\%_{i,t} + \theta_7 \frac{\Delta Cash_{i,t}}{MVE_{i,t-1}} + \theta_8 \frac{\Delta Earnings_{i,t}}{MVE_{i,t-1}} + \theta_9 \frac{\Delta NA_{i,t}}{MVE_{i,t-1}} + \theta_{10} \frac{\Delta R\&D_{i,t}}{MVE_{i,t-1}} + \theta_{11} \frac{\Delta Interest_{i,t}}{MVE_{i,t-1}} + \theta_{12} \frac{\Delta Dividend_{i,t}}{MVE_{i,t-1}} + \theta_{13} \frac{Cash_{i,t-1}}{MVE_{i,t-1}} + \theta_{14} Leverage_{it} + \theta_{15} \frac{NewFinance_{i,t}}{MVE_{i,t-1}} + \theta_{16} \frac{Cash_{i,t-1}}{MVE_{i,t-1}} \times \frac{\Delta Cash_{i,t}}{MVE_{i,t-1}} + \theta_{17} Leverage_{it} \times \frac{\Delta Cash_{i,t}}{MVE_{i,t-1}} + \sum_{j=1}^{49} Industry_j + \sum_{t=1978}^{2012} Year_t + \mu_{i,t} , \quad (4)$$

where the subscript *i*, *j*, *t* stands for firm *i*, industry *j*, and year *t*. ΔX indicates a change in X from year *t-1* to *t*. Our dependent variable, $ExRet_{i,t}$, is the size and book-to-market adjusted excess stock return from year *t-1* to *t* per Fama and French (1993). $MVE_{i,t}$ is market value of equity at time *t*. $Cash_{i,t}$ is cash and cash equivalents at time *t*. $Earnings_{i,t}$ is earnings before extraordinary items at time *t*. $NA_{i,t}$ is net assets at time *t*, calculated as total assets minus cash and cash equivalents. $R\&D_{it}$ is research and development expenditures at time *t*. $Interest_{i,t}$ is interest expenses from year *t-1* to *t*. $Dividend_{it}$ is common dividends from year *t-1* to *t*. $Leverage_{it}$ equals long term debt plus short term debt at time *t*. $NewFinance_{it}$ equals net new equity issues plus net new debt issues from year *t-1* to *t*. If firms that have government major customers are less financially-constrained, the coefficient on the interaction of $SaleGov\%_{i,t}$ with change in cash ($\frac{\Delta Cash_{i,t}}{MVE_{i,t-1}}$) should be negative ($\theta_1 < 0$); otherwise, θ_1 should be positive.

Table 6 presents the parameter estimates of Equation (4). The coefficient on the interaction of $SaleMC\%$ with change in cash is statistically insignificant (coeff. = -0.116, *t* = -1.01), so it is crucial to investigate whether marginal value of cash varies across firms that have different types of

major customers. The results in column 2 show that the coefficient on $SaleGov\% \times \Delta Cash/MVE$ is negative and significant (coeff. = -0.858, *t* = -4.46), while those on the interactions with $SaleFirm\%$ and $SaleOther\%$ are insignificant (coeff. = 0.010, *t* = 0.08; coeff. = 0.475, *t* = 1.05). The F-tests indicate that the differences between the coefficients are statistically significant. In addition, the coefficient on $SaleGov\% \times \Delta Cash/MVE$ is marginally significant in column 6 (coeff. = -0.330, t = -1.55), where firms with major customers other than the U.S. government are eliminated. The coefficients on control variables are generally consistent with those in prior research (e.g., Dittmar and Marht-Smith, 2007). Overall, the results in Table 6 indicate that firms that have government major customers are less financially-constrained, and thus have lower marginal value of cash holdings.

5.2. The impact of customer base on the sensitivity of cash holdings to operating cash flows

Next, we explore whether firms that have government major customers save less cash out of operating cash flows, given the lower marginal value of cash holdings. This test will provide further evidence to support our previous findings that firms that sell products to the U.S. government as a major customer have lower cash holdings and lower marginal value of cash. We expect that, relative to other firms, firms that have government major customers would save a smaller portion of their operating cash flows, as measured by the sensitivity of cash holdings to operating cash flows. Specifically, we estimate the following regression adopted from Almeida et al. (2004):

$$\begin{aligned}\left(\frac{\Delta Cash}{NA}\right)_{i,t} = {} & \lambda_0 + \lambda_1 SaleGov\%_{i,t} \times \left(\frac{CFO}{NA}\right)_{i,t} + \lambda_2 SaleFirm\%_{i,t} \times \left(\frac{CFO}{NA}\right)_{i,t} + \lambda_3 SaleOther\%_{i,t} \times \\ & \left(\frac{CFO}{NA}\right)_{i,t} + \lambda_4 SaleGov\%_{i,t} + \lambda_5 SaleFirm\%_{i,t} + \lambda_6 SaleOther\%_{i,t} + \lambda_7 \left(\frac{CFO}{NA}\right)_{i,t} + \\ & \lambda_8 Tobin'sQ_{i,t-1} + \lambda_9 \ln(TA)_{i,t} + \lambda_{10} \left(\frac{Capex}{NA}\right)_{i,t} + \lambda_{11} \left(\frac{Acquisition}{NA}\right)_{i,t} + \lambda_{12} \left(\frac{Payout}{NA}\right)_{i,t} + \\ & \lambda_{13} \left(\frac{TaxPaid}{NA}\right)_{i,t} + \sum_{j=1}^{49} Industry_j + \sum_{t=1978}^{2012} Year_t + \tau_{i,t} \,,\end{aligned} \quad (5)$$

where the subscript *i*, *j*, *t* stands for firm *i*, industry *j*, and year *t*, $\Delta Cash$ is change in change holdings from year *t-1* to *t*, CFO is operating cash flows from the cash flow statement, $Tobin'sQ$ equals market value of assets over book value of assets, $ln(TA)$ is the natural logarithm of total assets, $Capex$ denotes capital expenditures, and $Acquisition$ denotes acquisition expenditures. If firms that have government major customers spend more operating cash flows relative to other firms, we should find a negative coefficient on $SaleGov\% \times CFO/NA$ ($\lambda_1 < 0$); otherwise, λ_1 should be positive.

Table 7 presents the parameter estimates of Equation (5). The sample period starts at year 1988 when the cash flow statement data became available. The coefficient on the interaction of operating cash flows (CFO/NA) with $SaleMC\%$ is reliably negative in column 1 (coeff. = -0.150, *t* = -2.32), indicating that firms that have major customers spend more operating cash flows relative to other firms. Moreover, we find that the interactions of CFO/NA with $SaleGov\%$, $SaleFirm\%$, $SaleOther\%$ are all negative (coeff. = -0.308, *t* = -1.95; coeff. = -0.149, *t* = -2.29; coeff. = -0.071, *t* = -0.59). Suppose a firm generates 50 percent of total sales from its major customers, for every dollar of operating cash flows, it would save 23 cents if its major customer is the U.S. government, would save 31 cents if its major customer are other firms, and would save 35 if it has other major customers.[13] Consistent with prior research (e.g., Almeida et al., 2007), the results show that firms save more operating cash flows when they have more investment opportunities ($Lagged\ Tobin's\ Q$), larger size ($ln(TA)$), less capital expenditures ($Capex/NA$), less acquisition expenditures ($Acquisition/NA$), and less payouts ($Payout/NA$). In summary, the evidence in Table 7 suggests that firms that have the U.S. government as a major customer save less cash out of operating cash flows, corroborating our previous findings.

[13] This calculation is based on the coefficients on CFO/NA and the interactions in column 2 of Table 7. For example, the firm will save 23 cents out of every dollar of operating cash flows (= 0.385 – 0.308×50%) if its major customer is the U.S. government.

5.3. Change in cash holdings for firms that lost government procurement contracts during George W. Bush's presidency: a quasi-natural experiment

Prior research examining supplier-customer relationships and capital structure choices is plagued by endogeneity concerns, and it has been a challenge for researchers to identify the causality between these two constructs. In this section, we exploit a quasi-natural experiment setting to explore the causal nature of the relation between U.S. government sales and corporate cash holdings. Specifically, we investigate how corporate cash holdings would change for firms that lost government procurement contracts after the U.S. presidential election of 2000. As shown in Figure 2, aggregate sales to the U.S. government as a major customer for public firms declined during Bill Clinton's presidency (January 20, 1993 – January 20, 2001), but this tendency dramatically reversed during George W. Bush's presidency (January 20, 2001 – January 20, 2009). The U-shaped curve suggests that the U.S. government increased government spending aggressively during Bush's presidency.

We identify a subsample that consists of 192 firms that had government procurement contracts during Clinton's presidency but lost the contracts during Bush's presidency, since these firms are more likely to have lost the contracts for exogenous reasons, such as the presidential election of 2000. In particular, we require the firms having at least one sale and no sales to the U.S. government as a major customer before and after January 20, 2001, respectively. We also require the firms having at least four years of relevant data in each presidency regime. To identify the effect of government contracts on cash holdings, we replace the government sales variable ($SaleGov\%$) in Equation (1) with a dummy variable that equals one for Clinton's presidency and zero for Bush's presidency ($Clinton$). All other variables are the same as in Equation (1).

$$\ln\left(\frac{Cash}{NA}\right)_{i,t} = \varphi_0 + \varphi_1 Clinton_{i,t} + \varphi_2 SaleFirm\%_{i,t} + \varphi_3 SaleOther\%_{i,t} + \varphi_4 \ln(NA)_{i,t} + \varphi_5\left(\frac{MVE}{NA}\right)_{i,t} + \varphi_6\left(\frac{FCF}{NA}\right)_{i,t} + \varphi_7\left(\frac{NWC}{NA}\right)_{i,t} + \varphi_8\left(\frac{Capex}{NA}\right)_{i,t} + \varphi_9\left(\frac{R\&D}{NA}\right)_{i,t} + \varphi_{10}\left(\frac{Acquisition}{NA}\right)_{i,t} + \varphi_{11}\left(\frac{Debt}{TA}\right)_{i,t} + \varphi_{12}(Dum\_Div)_{i,t} + \varphi_{13}(indCFRISK)_{i,t} + \sum_{j=1}^{49} Industry_j + \sum_{t=1993}^{2009} Year_t + \varepsilon_{i,t} \quad (6)$$

where the subscript *i*, *j*, *t* stands for firm *i*, industry *j*, and year *t*. As discussed above, losing government procurement contracts will increase firms' demand for cash holdings, so the dummy variable ($Clinton$) should have a negative coefficient ($\varphi_1 < 0$).

Table 8 presents the estimates of Equation (6). Notably, the coefficients on $Clinton$ is negative and significant (coeff. = -0.401, *t* = -3.21), suggesting that firms tend to hold less (more) cash when they won (lost) government procurement contracts during Clinton's (Bush's) presidency. *Ceteris paribus*, the ratio of cash holdings to net assets during Clinton's presidency is 33 percent lower ($= 1 - \exp(-0.401)$) than the one during Bush's presidency. To summarize, this quasi-natural experiment provides evidence to support the causality between corporate cash holdings and having the U.S. government as a major customer.

6. Conclusion

In this paper, we investigate whether firms' relation with the U.S. government as a major customer affects corporate cash holdings through various channels. Prior research has examined how firms' political connections, proxied by lobby contributions, campaign expenditures, or private access to politicians, influence their operating performance and stock value. Our study is the first study to document how firms' relation with the U.S. government as a major customer impacts their corporate finance policies in term of holding liquid assets, specifically, cash and cash equivalents.

First, we document that firms that have the U.S. government as a major customer hold less cash and cash equivalents, compared with other firms. Using the framework proposed by Bates et al. (2009), we attempt to explain why firms with U.S. government sales have lower cash holdings, and find that this phenomenon is attributable to both lower trade credits provided by suppliers and lower volatility of future profitability. Furthermore, we show that firms that have the U.S. government as a major customer have lower value of a marginal dollar of cash holdings. Finally, our evidence suggests that these firms spend more cash out of operating cash flows relative to other firms, consistent with our main prediction.

Our study contributes to the extant literature on the determinants of firm's cash holdings. Specifically, we identify an unexplored important determinant that explains the level of firm's cash holdings by focusing on the characteristics of the firm's customer base, in particular one major customer – the U.S. government. We do so by utilizing specific segment disclosures included in public firms filings. Although much of the evidence to date examines why firms hold more cash, our evidence provides both a statistical and economically plausible explanation for holding less cash.

Appendix: Variable Definitions

Variable	Definition
ΔX	A change in variable *X* from year *t-1* to *t*, and (Compustat codes in parentheses).
SaleGov%	Sales to the U.S. government as a major customer as percentage of total sales (data obtained from Compustat segment files).
SaleFirm%	Sales to corporate major customers as a percentage of total sales (data obtained from Compustat segment files).
SaleOther%	Sales to other major customers as a percentage of total sales (data obtained from Compustat segment files).
SaleMC%	Total percentage sales to all major customers, i.e., the sum of *SaleGov%*, *SaleFirm%*, and *SaleOther%* (data obtained from Compustat segment files).
TA	Book value of total assets (AT).
NA	Net assets, calculated as total assets minus cash ($AT - CHE$). Ln(NA) is the natural logarithm of total assets.
Age	Firm age, calculated as the number of years the firm has Compustat data. Ln(Age) is the natural logarithm of firm age plus one, and Ln(Age)^2 is the squared value of Ln(Age).
Sales	Total sales, if total sales ($Sale_{it}$) is less than aggregate sales from major customers ($\sum_{j=1}^{J} Sale_{ijt}$), then the measure equals the aggregate sales.
Cash	Cash and cash equivalents (CHE).
TradeCredit	Trade credit, calculated as accounts payable to cost of goods sold ($AP/COGS$).
MVE	Market value of equity at the fiscal year end ($PRCC\_F \times CSHO$).
FCF	Free cash flows ($OIBDP - XINT - TXT - DVC$).
NWC	Net working capital ($ACT - LCT - CHE$).
Capex	Capital expenditure ($CAPX$).
R&D	Research and development expenditure (XRD). Missing values are set to zero.
Acquisition	Acquisition expenditure (AQC).
Debt	Total Debt ($DLTT + DLC$).
DumDiv	A dummy variable equals to one if a firm paid common stock dividends (DVC), and zero otherwise.
Dividend	Common dividend (DVC).
ROA	Return on asset ($IB_t/[(AT_t + AT_{t-1})/2]$).
CFO	Operating cash flows ($OANCF$).

Tobin's Q	Tobin's Q that equals market value of assets deflated by book value of assets ($[PRCC\_F \times CSHO + LT]/AT$).
σ *(FCF/NA)*$_{t-4,t}$	Standard deviation of free cash flow to net assets ratio (FCF/NA) over the past five years (from year *t-4* to *t*).
$\sigma(ROA)_{t-4,t}$	Standard deviation of return-on-asset (ROA) over the past five years (from year *t-4* to *t*).
indCFRISK	Industry cash flow risk, calculated as the mean of σ(FCF/NA) for firms in the same industry (Fama and French 49 industry classification).
CR	Current ratio, i.e., the ratio of non-cash current assets to total assets ($(ACT - CHE)/AT$).
B/M	Book-to-market ratio at the fiscal year end ($(CEQ + TXDITC)/(PRCC\_F \times CSHO)$)
Liquidation	Liquidation cost, calculated as the ratio of finished goods to total inventory ($INVFG/INVT$).
OperCycle	Operating cycle, calculated as the natural logarithm of one plus the sum of days in inventory ($365 \times (INVT_t + INVT_{t-1})/(COGS \times 2)$) and days in receivables ($365 \times RECT/SALE$). *ln(OperCycle)* is the natural logarithm of operating cycle. Days in payables (365×AP/COGS)
Ret	Annual stock returns, compounded using monthly returns on CRSP.
ExRet	Excess stock returns, adjusted by Fama and French (1993) size and book-to-market matched portfolio returns from year *t-1* to *t* (e.g., Faulkender and Wang, 2006; Dittmar and Mahrt-Smith, 2007).
Earnings	Earnings before extraordinary items ($IB + XINT + TXDI + ITCI$).
Interest	Interest expense ($XINT$).
Payout	A dummy variable that equals one if a firm has common dividend or stock repurchases (Skinner, 2008), and zero otherwise.
Rating	A dummy variable that equals one if a firm has a debt rating, and zero otherwise (Compustat credit ratings database). The value is set to missing for firms without positive debt.
NewFinance	New finance from year *t-1* to *t* = net new equity issues ($SSTK + PRSTKC$) + net new debt issues ($DLTIS + DLTR$).
Leverage	Leverage ($(DLTT + DLC)/(DLTT + DLC + PRCC\_F \times CSHO)$).
ForeignTax	A dummy variable equals to one if a firm has taxable foreign income ($(PIFO - TXFO) > 0$), and zero otherwise.
$\sigma(ROA)_{t+1,t+3}$	Standard deviation of return-on-asset (ROA) in the following three years (from year *t+1* to *t+3*).
Clinton	A dummy variable that equals one for Bill Clinton's presidency (01/20/1993 – 01/20/2001), and zero for George W. Bush's presidency (01/20/2001 – 01/20/2009).

References

Almeida, H., Campello, M., Weisbach, M.S., 2004. The Cash Flow Sensitivity of Cash. *Journal of Finance* 59, 1777-1804.

Banerjee, S., Dasgupta, S., Kim, Y., 2008. Buyer–Supplier Relationships and the Stakeholder Theory of Capital Structure. *Journal of Finance* 63, 2507-2552.

Bates, T.W., Kahle, K.M., Stulz, R.M., 2009. Why Do U.S. Firms Hold So Much More Cash than They Used To? *Journal of Finance* 64, 1985-2021.

Belo, F., Gala, V.D., Li, J., 2012. Government Spending, Political Cycles, and the Cross Section of Stock Returns. *Journal of Financial Economics* 107: 305-324.

Boubakri, N., Guedhami, O., Mishra, D., Saffar, W., 2012. Political Connections and the Cost of Equity Capital. *Journal of Corporate Finance* 18: 541-559.

Cooper, M.J., Gulen, H., Ovtchinnikov, A.V., 2010. Corporate Political Contributions and Stock Returns. *Journal of Finance* 65, 687-724.

Cull, R., Xu, L.C., 2005. Institutions, ownership, and finance: the determinants of profit reinvestment among Chinese firms. *Journal of Financial Economics* 77, 117-146.

Dittmar, A., Mahrt-Smith, J., 2007. Corporate Governance and the Value of Cash Holdings. *Journal of Financial Economics* 83, 599-634.

Dittmar, A., Mahrt-Smith, J., Servaes, H., 2003. International Corporate Governance and Corporate Cash Holdings. *Journal of Financial and Quantitative Analysis* 38, 111-133.

Duchin, R., 2010. Cash Holdings and Corporate Diversification. *Journal of Finance* 65,955–992.

Duchin, R., Sosyura, D., 2012. The Politics of Government Investment. *Journal of Financial Economics* 106: 24-48.

Faccio, M., 2006. Politically Connected Firms. *The American Economic Review* 96, 369-386.

Faccio, M., 2010. Differences between Politically Connected and Nonconnected Firms: A Cross-Country Analysis. *Financial Management* 39, 905-928.

Fama, E.F., French, K.R., 1993. Common Risk Factors in the Returns on Stocks and Bonds. *Journal of Financial Economics* 33, 3-56.

Fama, E.F., French, K.R., 1997. Industry Costs of Equity. *Journal of Financial Economics* 43, 153-193.

Faulkender, M., Wang, R., 2006. Corporate Financial Policy and the Value of Cash. *Journal of Finance* 61, 1957-1990.

Foley, C.F., Hartzell, J.C., Titman, S., Twite, G., 2007. Why Do Firms Hold So Much Cash? A tax-based explanation. *Journal of Financial Economics* 86, 579-607.

Fresard, L., 2010. Financial Strength and Product Market Behavior: The Real Effects of Corporate Cash Holdings. *Journal of Finance* 65, 1097-1122.

Gao, H., Harford, J., Li, K., 2013. Determinants of Corporate Cash Policy: Insights from Private Firms. *Journal of Financial Economics* 109: 623-639.

Giannetti, M., Burkart, M., Ellingsen, T., 2011. What You Sell Is What You Lend? Explaining Trade Credit Contracts. *Review of Financial Studies* 24, 1261-1298.

Giroud, X., Mueller, H.M., 2011. Corporate Governance, Product Market Competition, and Equity Prices. *Journal of Finance* 66, 563-600.

Goldman, E., Rocholl, J., So, J., 2009. Do Politically Connected Boards Affect Firm Value? *Review of Financial Studies* 22, 2331-2360.

Goldman, E., Rocholl, J., So, J., 2013. Politically Connected Boards of Directors and The Allocation of Procurement Contracts. *Review of Finance* forthcoming.

Gosman, M., Kelly, T., Olsson, P., Warfield, T., 2004. The Profitability and Pricing of Major Customers. *Review of Accounting Studies* 9, 117-139.

Halchin, L. E., 2006. Overview of the Federal Procurement Process and Resources, Congressional Research Service, The Library of Congress, Order Code RS22536.

Han, S., Qiu, J., 2007. Corporate Precautionary Cash Holdings. *Journal of Corporate Finance* 13, 43-57.

Harford, J., 1999. Corporate Cash Reserves and Acquisitions. *Journal of Finance* 54, 1969-1997.

Haushalter, D., Klasa, S., Maxwell, W.F., 2007. The Influence of Product Market Dynamics on a Firm's Cash Holdings and Hedging Behavior. *Journal of Financial Economics* 84, 797-825.

Hui, K.W., Klasa, S., Yeung, P.E., 2012. Corporate Suppliers and Customers and Accounting Conservatism. *Journal of Accounting and Economics* 53, 115-135.

Jensen, M.C., 1986. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *The American Economic Review* 76, 323-329.

Johnson, S., Mitton, T., 2003. Cronyism and Capital Controls: Evidence from Malaysia. *Journal of Financial Economics* 67, 351-382.

Keynes, J., 1936. The General Theory of Employment, Interest and Money (Harcourt Brace, London).

Khwaja, A.I., Mian, A., 2005. Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market. *The Quarterly Journal of Economics* 120, 1371-1411.

Liu, Y., Mauer, D.C., 2011. Corporate Cash Holdings and CEO Compensation Incentives. *Journal of Financial Economics* 102, 183-198.

Ma, T., Martin, X., 2012. The Real Effect of Customer Accounting Quality - Trade Credit and Suppliers' Cash Holdings. Working paper.

Miller, M. H., Orr, D., 1966. A Model of the Demand for Money by Firms. *Quarterly Journal of Economics* 80, 413–435.

Mulligan, C., 1997. Scale Economies, the Value of Time, and the Demand For Money: Longitudinal Evidence from Firms, *Journal of Political Economy* 105, 1061–1079.

Opler, T., Pinkowitz, L., Stulz, R., Williamson, R., 1999. The Determinants and Implications of Corporate Cash Holdings. *Journal of Financial Economics* 52, 3-46.

Pandit, S., Wasley, C.E., Zach, T., 2011. Information Externalities along the Supply Chain: The Economic Determinants of Suppliers' Stock Price Reaction to Their Customers' Earnings Announcements. *Contemporary Accounting Research* 28, 1304-1343.

Patatoukas, P.N., 2012. Customer-Base Concentration: Implications for Firm Performance and Capital Markets. *The Accounting Review* 87, 363-392.

Petersen, M., Rajan, R., 1997. Trade Credit: Theories and Evidence. *Review of Financial Studies* 10, 661-691.

Pinkowitz, L., Stulz, R., Williamson, R., 2006. Does the Contribution of Corporate Cash Holdings and Dividends to Firm Value Depend on Governance? A Cross-country Analysis. *Journal of Finance* 61, 2725-2753.

Pinkowitz, L., Stulz, R., Williamson, R., 2012. Multinationals and the High Cash Holdings Puzzle. National Bureau of Economic Research (NBER).

Raman, K., Shahrur, H., 2008. Relationship-Specific Investments and Earnings Management: Evidence on Corporate Suppliers and Customers. *The Accounting Review* 83, 1041-1081.

Ramanna, K., Roychowdhury, S., 2010. Elections and Discretionary Accruals: Evidence from 2004. *Journal of Accounting Research* 48, 445-475.

Richardson, S., 2006. Over-investment of Free Cash Flows. *Review of Accounting Studies* 11: 159-189.

Shleifer, A., Vishny, R.W., 1994. Politicians and Firms. *Quarterly Journal of Economics* 109, 995-1025.

Skinner, D.J., 2008. The evolving relation between earnings, dividends, and stock repurchases. *Journal of Financial Economics* 87, 582-609.

Titman, S., Wessels, R., 1988. The Determinants of Capital Structure Choice. *Journal of Finance* 43, 1-19.

Wilner, B. S., 2000. The Exploitation of Relationships in Financial Distress: The Case of Trade Credit. *Journal of Finance* 55, 153-178.

Figure 1. Average cash to total assets ratio (Cash/TA) for public firms with and without the U.S. government as a major customer over the period 1978 – 2012

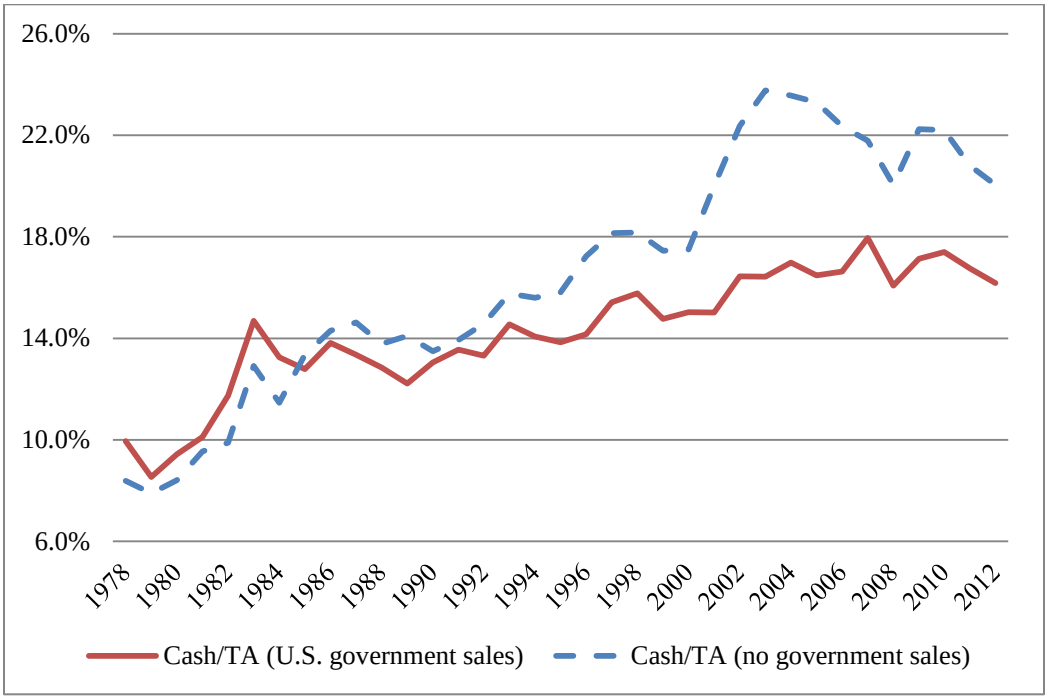

Figure 2. Aggregate sales to the U.S. government as a major customer for all public firms over the period 1978 – 2012 (in millions)

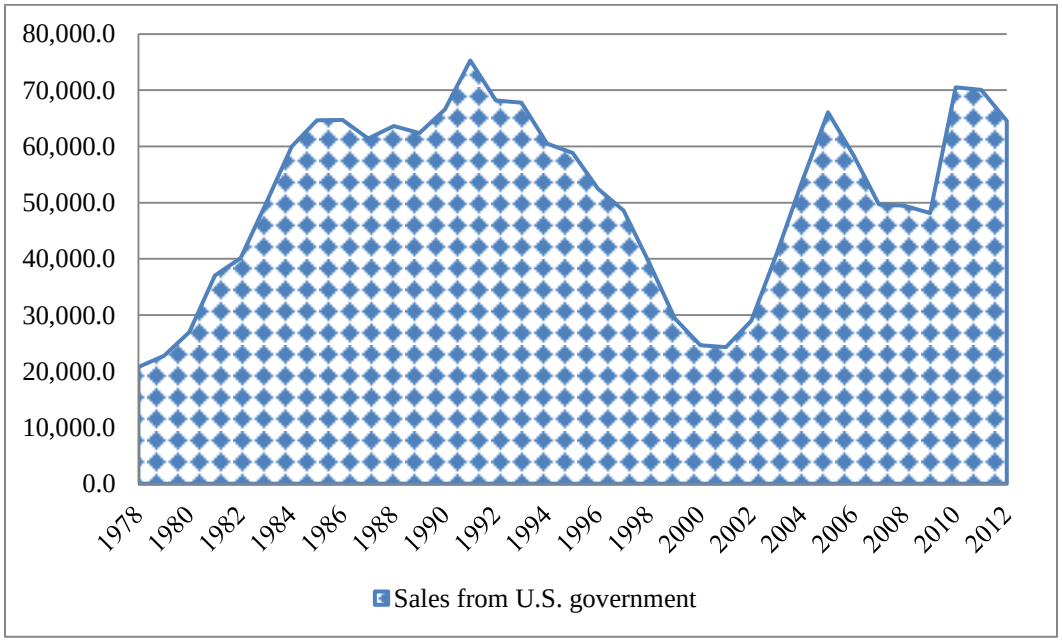

Table 1. Descriptive statistics

This table represents the descriptive statistics of the main variables for the government-sale sample and the non-government-sale sample. The sample includes all firm-years that have major customer data available in the Compustat segment database during the period 1978 – 2012. The sample excludes firm-years with insufficient accounting data and stock return data, and excludes the financial or utility industries. All variable are defined in the Appendix, and all continuous variables are winsorized at the 1st and 99th percentiles. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Variable	Government Sales				Non Government Sales				Mean Difference	
	N	Mean	Median	Std. Dev.	*N*	Mean	Median	Std. Dev.		
SaleMC%	10,831	27.1%	21.0%	21.3%	55,184	22.1%	15.9%	19.4%	5.0%	***
SaleGov%	10,831	27.1%	21.0%	21.3%	55,184	0.0%	0.0%	0.0%	27.1%	***
SaleFirm%	10,831	0.0%	0.0%	0.0%	55,184	17.3%	12.7%	18.5%	-17.3%	***
SaleOther%	10,831	0.0%	0.0%	0.0%	55,184	4.8%	0.0%	14.2%	-4.8%	***
Cash	10,831	95.4	7.4	465.3	55,184	182.4	12.9	773.1	-87.0	***
TA	10,831	1,243.8	83.4	4,572.0	55,184	1,604.8	133.5	6,111.7	-361.0	***
NA	10,831	1,133.5	70.9	4,110.8	55,184	1,400.5	101.6	5,318.7	-267.0	***
Sales	10,831	1,388.9	104.9	4,808.5	55,184	1,468.6	132.8	5,381.6	-79.7	
Age	10,831	18.5	16.0	12.2	55,184	16.6	13.0	12.3	2.0	***
Cash/NA	10,831	0.257	0.081	0.612	55,184	0.413	0.111	0.901	-0.156	***
ROA	10,831	-0.003	0.042	0.174	55,184	-0.030	0.030	0.213	0.027	***
Ret	10,831	0.170	0.064	0.650	55,184	0.163	0.023	0.784	0.007	
Payout	10,831	0.528	1.000	0.499	55,184	0.475	0.000	0.499	0.053	***
Debt/TA	10,831	0.228	0.197	0.190	55,184	0.221	0.184	0.210	0.007	***
$\sigma(ROA)_{t-4,t}$	10,259	0.068	0.038	0.083	51,762	0.096	0.056	0.111	-0.028	***
$\sigma(FCF/NA)_{t-4,t}$	10,259	0.093	0.037	0.211	51,720	0.157	0.054	0.340	-0.064	***
TradeCredit	10,829	0.121	0.096	0.138	55,149	0.191	0.115	0.289	-0.070	***
Rating	9,852	0.199	0.000	0.399	46,774	0.222	0.000	0.416	-0.023	***
Gindex	1,584	9.273	9.000	2.809	9,138	8.948	9.000	2.626	0.325	***
ForeignTax	10,831	0.184	0.000	0.388	55,184	0.255	0.000	0.436	-0.071	***
$\sigma(ROA)_{t+1,t+3}$	8,113	0.060	0.030	0.080	34,605	0.075	0.040	0.095	-0.015	***
CFO/NA	10,784	0.021	0.068	0.317	54,960	-0.001	0.078	0.441	0.022	***
Days in receivables	10,758	74.9	67.2	39.3	54,631	67.2	58.0	45.1	7.6	***
Day in payables	10,742	42.8	33.2	52.8	54,656	66.9	40.3	101.3	-24.1	***

Table 2. Industry profile

This table compares average cash holdings (Cash/NA) or average trade credit (TradeCredit) in each industry (the Fama-French 49 classification) between the government-sale sample and non-government-sale sample. The variables are defined in the Appendix and winsorized at the 1st and 99th percentiles.

Code	Industry Name	Government Sales			Non Government Sales			%Gov. Sales	Mean Difference	
		N	Cash/NA	Trade Credit	*N*	Cash/NA	Trade Credit		Cash/NA	Trade Credit
1	Agriculture	7	0.205	0.084	227	0.230	0.139	3.0%	-0.025	-0.055
2	Food	60	0.065	0.070	1,175	0.110	0.096	4.9%	-0.046	-0.026
3	Candy & Soda	1	0.009	0.114	168	0.168	0.127	0.6%	-0.159	-0.012
4	Beer & Liqor	10	0.201	0.138	193	0.102	0.179	4.9%	0.099	-0.041
5	Tobacco	0	0.000	0.000	82	0.246	0.126	0.0%	-0.246	-0.126
6	Recreation	36	0.065	0.101	803	0.224	0.126	4.3%	-0.159	-0.024
7	Entertainment	24	0.034	0.095	550	0.254	0.275	4.2%	-0.220	-0.179
8	Printing & Publishing	27	0.338	0.189	301	0.145	0.176	8.2%	0.193	0.013
9	Consumer Goods	103	0.125	0.096	1,402	0.205	0.149	6.8%	-0.080	-0.052
10	Apparel	55	0.204	0.084	1,335	0.197	0.103	4.0%	0.007	-0.019
11	Healthcare	944	0.118	0.077	530	0.418	0.102	64.0%	-0.300	-0.025
12	Medical Equipment	253	0.413	0.138	2,109	0.609	0.202	10.7%	-0.196	-0.064
13	Pharmaceutical	219	2.050	0.172	3,732	1.553	0.258	5.5%	0.497	-0.087
14	Chemicals	144	0.392	0.189	1,273	0.220	0.147	10.2%	0.172	0.042
15	Rubber & Plastic	66	0.100	0.126	900	0.132	0.111	6.8%	-0.032	0.015
16	Textiles	41	0.097	0.107	612	0.072	0.083	6.3%	0.025	0.024
17	Building Materials	254	0.116	0.127	1,480	0.147	0.098	14.6%	-0.031	0.030
18	Construction	330	0.185	0.128	595	0.181	0.104	35.7%	0.004	0.024
19	Steel	179	0.131	0.098	1,165	0.098	0.115	13.3%	0.033	-0.017
20	Fabricated	88	0.096	0.099	403	0.119	0.108	17.9%	-0.024	-0.010
21	Machinery	453	0.201	0.130	2,645	0.236	0.138	14.6%	-0.035	-0.008
22	Electrical Equipment	445	0.298	0.126	1,146	0.232	0.150	28.0%	0.067	-0.024
23	Automobiles	193	0.087	0.105	1,201	0.117	0.119	13.8%	-0.030	-0.014
24	Aircraft	506	0.123	0.111	214	0.081	0.111	70.3%	0.042	0.000
25	Shipping and Railroad	99	0.245	0.106	120	0.162	0.116	45.2%	0.083	-0.011
26	Defense	175	0.114	0.103	83	0.276	0.116	67.8%	-0.162	-0.013
27	Precious Metals	0	0.000	0.000	307	0.212	0.181	0.0%	-0.212	-0.181
28	Mines	0	0.000	0.000	345	0.134	0.183	0.0%	-0.134	-0.183
29	Coal	4	0.124	0.109	189	0.106	0.120	2.1%	0.018	-0.012
30	Petroleum & Natural Gas	81	0.120	0.225	4,163	0.135	0.546	1.9%	-0.015	-0.321
32	Communication	93	0.158	0.209	1,198	0.276	0.201	7.2%	-0.118	0.009
33	Personal Services	166	0.319	0.106	352	0.338	0.161	32.0%	-0.019	-0.055
34	Business Service	1,269	0.247	0.113	3,324	0.420	0.174	27.6%	-0.173	-0.061
35	Hardware	656	0.317	0.160	2,359	0.590	0.188	21.8%	-0.273	-0.028
36	Software	678	0.395	0.130	4,215	0.869	0.225	13.9%	-0.474	-0.095
37	Chips	1,696	0.238	0.123	5,387	0.553	0.169	23.9%	-0.315	-0.045
38	Lab Equipment	705	0.254	0.113	1,600	0.505	0.149	30.6%	-0.251	-0.036
39	Business Supplies	89	0.104	0.116	877	0.095	0.140	9.2%	0.008	-0.025
40	Shipping Containers	50	0.029	0.095	242	0.060	0.104	17.1%	-0.031	-0.009
41	Transportation	209	0.164	0.070	1,765	0.100	0.111	10.6%	0.065	-0.042
42	Wholesale	259	0.069	0.127	2,871	0.126	0.137	8.3%	-0.058	-0.011
43	Retail	105	0.145	0.110	914	0.177	0.129	10.3%	-0.032	-0.019
44	Restaurant & Hotels	6	0.054	0.105	218	0.178	0.080	2.7%	-0.124	0.025
49	Other	53	0.200	0.324	414	0.237	0.270	11.3%	-0.037	0.054

Table 3. The impact of government major customers on corporate cash holdings

This table presents parameter estimations of Equation (1). The dependent variable is the natural logarithm of cash holdings scaled by net assets (ln(Cash/NA)). The variables of interest are percentage sales from major customers (SaleMC%), percentage sales from government major customers (SaleGov%), percentage sales from corporate major customers (SaleFirm%), and percentage sales from other major customers (SaleOther%). Standard errors are clustered at both firm and year levels (Petersen, 2009). Industry fixed effect is based on Fama-French 49 industries. *t-statistics* are in parentheses below parameter estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All variable are defined in the Appendix, and all continuous variables are winsorized at the 1st and 99th percentiles.

Variable	Predicted sign	All firm-years					Gov. sales
		(1)	(2)	(3)	(4)	(5)	(6)
SaleMC%		0.013					
		(0.21)					
SaleGov%			-0.383***	-0.434***			-0.423***
			(-3.32)	(-3.78)			(-2.71)
SaleFirm%			0.125*		0.163**		
			(1.65)		(2.23)		
SaleOther%			0.191**			0.169*	
			(2.25)			(1.93)	
ln(NA)	-	-0.093***	-0.091***	-0.092***	-0.090***	-0.094***	-0.126***
		(-11.29)	(-11.02)	(-11.30)	(-10.91)	(-11.47)	(-7.07)
MVE/NA	+	0.018**	0.018**	0.018**	0.017**	0.018**	0.020***
		(2.17)	(2.16)	(2.17)	(2.16)	(2.17)	(3.06)
FCF/NA	+	0.145***	0.140***	0.139***	0.146***	0.144***	0.071
		(3.70)	(3.57)	(3.55)	(3.73)	(3.66)	(0.76)
NWC/NA	-	-0.958***	-0.940***	-0.947***	-0.950***	-0.958***	-0.905***
		(-16.93)	(-16.69)	(-16.68)	(-16.92)	(-16.86)	(-6.59)
Capex/NA	+	1.342***	1.325***	1.335***	1.322***	1.349***	1.810***
		(7.01)	(6.96)	(7.03)	(6.90)	(7.04)	(5.34)
R&D/NA	+	0.967***	0.961***	0.963***	0.962***	0.968***	0.855***
		(7.69)	(7.64)	(7.69)	(7.63)	(7.70)	(5.45)
Acquisition/NA	-	-0.370**	-0.364**	-0.369**	-0.368**	-0.367**	-0.650*
		(-2.44)	(-2.42)	(-2.45)	(-2.42)	(-2.41)	(-1.84)
Debt/TA	+	-3.106***	-3.096***	-3.100***	-3.104***	-3.103***	-3.189***
		(-29.57)	(-29.53)	(-29.63)	(-29.72)	(-29.47)	(-18.69)
DumDiv	-	-0.050	-0.047	-0.048	-0.048	-0.050	-0.003
		(-1.55)	(-1.46)	(-1.49)	(-1.49)	(-1.56)	(-0.04)
indCFRISK	+	-0.005	-0.004	-0.004	-0.005	-0.005	0.001
		(-0.75)	(-0.67)	(-0.68)	(-0.71)	(-0.76)	(0.04)
Industry effect		Included	Included	Included	Included	Included	Included
Year effect		Included	Included	Included	Included	Included	Included
N		62,096	62,096	62,096	62,096	62,096	10,208
Adj. R^2		41.1%	41.2%	41.2%	41.1%	41.1%	32.4%
F-test							
SaleGov% = SaleFirm%			F = 90.41				
SaleGov% = SaleOther%			F = 76.45				

Table 4. The impacts of government major customers on trade credit

This table presents parameter estimations of Equation (2). The dependent variables are the natural logarithm of trade credit (ln(TradeCredit)). The variables of interest are percentage sales from major customers (SaleMC%), percentage sales from government major customers (SaleGov%), percentage sales from corporate major customers (SaleFirm%), and percentage sales from other major customers (SaleOther%). Standard errors are clustered at both firm and year levels (Petersen, 2009). Industry fixed effect is based on Fama-French 49 industries. *t-statistics* are in parentheses below parameter estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All variable are defined in the Appendix, and all continuous variables are winsorized at the 1st and 99th percentiles.

Variable	Predicted Sign	All firm-years					Gov. sales
		(1)	(2)	(3)	(4)	(5)	(6)
SaleMC%		-0.026					
		(-0.79)					
SaleGov%			-0.235***	-0.271***			-0.132*
			(-3.74)	(-4.34)			(-1.73)
SaleFirm%			0.103**		0.160***		
			(2.56)		(4.04)		
SaleOther%			-0.056			-0.084*	
			(-1.17)			(-1.77)	
ln(TA)	+	0.042***	0.044***	0.042***	0.044***	0.042***	0.040***
		(6.87)	(7.18)	(7.02)	(7.31)	(6.93)	(3.73)
ln(Age)	-	-0.144**	-0.130**	-0.134**	-0.133**	-0.144**	-0.210
		(-2.17)	(-1.97)	(-2.04)	(-2.01)	(-2.18)	(-1.23)
$ln(Age)^2$	?	0.013	0.012	0.012	0.012	0.014	0.012
		(1.09)	(0.96)	(1.01)	(0.97)	(1.10)	(0.36)
Debt/TA	+	0.104***	0.106***	0.106***	0.107***	0.103***	0.198**
		(2.93)	(3.00)	(3.00)	(3.01)	(2.90)	(2.39)
DumDiv	-	-0.095***	-0.092***	-0.094***	-0.092***	-0.094***	-0.111***
		(-5.38)	(-5.25)	(-5.38)	(-5.21)	(-5.34)	(-3.45)
CR	-	-0.373***	-0.354***	-0.364***	-0.356***	-0.370***	-0.140
		(-8.68)	(-8.35)	(-8.51)	(-8.33)	(-8.59)	(-1.57)
ROA	-	-0.636***	-0.631***	-0.636***	-0.629***	-0.634***	-0.863***
		(-14.18)	(-14.15)	(-14.16)	(-14.15)	(-14.20)	(-8.21)
ΔSales/TA	+	0.285***	0.283***	0.283***	0.284***	0.284***	0.277***
		(15.50)	(15.20)	(15.28)	(15.41)	(15.44)	(7.18)
B/M	-	-0.109***	-0.109***	-0.109***	-0.109***	-0.109***	-0.115***
		(-8.72)	(-8.75)	(-8.79)	(-8.71)	(-8.70)	(-5.96)
Liquidation	+	0.151***	0.136***	0.132***	0.154***	0.154***	0.126*
		(4.35)	(3.78)	(3.68)	(4.46)	(4.48)	(1.81)
ln(OperCycle)	+	0.536***	0.540***	0.538***	0.539***	0.537***	0.457***
		(29.09)	(29.48)	(29.49)	(29.35)	(29.07)	(10.73)
Industry effect		Included	Included	Included	Included	Included	Included
Year effect		Included	Included	Included	Included	Included	Included
N		38,208	38,208	38,208	38,208	38,208	6,110
Adj. R^2		27.9%	28.2%	28.1%	28.0%	27.9%	28.3%
F-test							
SaleGov% = SaleFirm%			F = 128.31				
SaleGov% = SaleOther%			F = 24.44				

Table 5. The impacts of government major customers on future earnings level and future earnings volatility

This table reports parameter estimations of Equation (3). The dependent variable is earnings level in the following year (ROA_{t+1}) or earnings volatility in the following three years (σ $(ROA)_{t+1,t+3}$). The variables of interest are percentage sales from major customers (SaleMC%), percentage sales from government major customers (SaleGov%), percentage sales from corporate major customers (SaleFirm%), and percentage sales from other major customers (SaleOther%). Standard errors are clustered at both firm and year levels (Petersen, 2009). Industry fixed effect is based on Fama-French 49 industries. *t-statistics* are in parentheses below parameter estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All variable are defined in the Appendix, and all continuous variables are winsorized at the 1st and 99th percentiles.

Variable	ROA_{t+1}		$\sigma(ROA)_{t+1, t+3}$	
	(1)	(2)	(3)	(4)
SaleMC%	-0.030***		0.014***	
	(-5.65)		(3.47)	
SaleGov%		-0.012*		-0.008*
		(-1.81)		(-1.66)
SaleFirm%		-0.055***		0.034***
		(-7.51)		(6.90)
SaleOther%		-0.006		0.006
		(-0.99)		(1.12)
ROA	0.617***	0.616***	-0.139***	-0.139***
	(37.71)	(37.57)	(-21.57)	(-21.40)
$\sigma(ROA)_{t-4,t}$	-0.124***	-0.117***	0.184***	0.178***
	(-7.48)	(-7.25)	(10.28)	(10.14)
ln(MVE)	0.004***	0.004***	-0.005***	-0.005***
	(6.63)	(6.11)	(-9.92)	(-9.67)
B/M	-0.012***	-0.012***	-0.008***	-0.008***
	(-6.95)	(-7.24)	(-6.61)	(-6.54)
Debt/TA	0.003	0.002	-0.016***	-0.014***
	(0.61)	(0.37)	(-3.67)	(-3.42)
ln(Age)	0.010***	0.009***	-0.008***	-0.007***
	(7.76)	(7.46)	(-5.75)	(-5.26)
Industry effect	Included	Included	Included	Included
Year effect	Included	Included	Included	Included
N	53,766	53,766	40,212	40,212
Adj. R^2	47.7%	47.8%	28.5%	28.8%
F-test				
SaleGov% = SaleFirm%		F = 59.89		F = 147.59
SaleGov% = SaleOther%		F = 0.77		F = 9.77

Table 6. The impact of government major customers on marginal value of cash

This table presents the parameter estimations of Equation (4). The dependent variable is excess stock returns (ExRet). The variables of interest are interactions of change in cash (Δ Cash/MVE) with SaleMC%, SaleGov%, SaleFirm%, and SaleOther%. Standard errors are clustered at both firm and year levels (Petersen, 2009). Industry fixed effect is based on Fama-French 49 industries. *t-statistics* are in parentheses below parameter estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All variable are defined in the Appendix, and all continuous variables are winsorized at the 1st and 99th percentiles.

Variable	Predicted Sign	All firm-years					Gov. sales
		(1)	(2)	(3)	(4)	(5)	(6)
SaleMC% × ΔCash/MVE		-0.116					
		(-1.01)					
SaleMC%		-0.043**					
		(-2.09)					
SaleGov% × ΔCash/MVE			-0.858***	-0.897***			-0.330
			(-4.46)	(-4.58)			(-1.55)
SaleFirm% × ΔCash/MVE			0.010		0.122		
			(0.08)		(0.98)		
SaleOther% × ΔCash/MVE			0.475			0.561	
			(1.05)			(1.24)	
SaleGov%			0.017	0.044			0.055
			(0.45)	(1.19)			(1.47)
SaleFirm%			-0.069***		-0.064***		
			(-3.30)		(-3.31)		
SaleOther%			-0.045			-0.023	
			(-1.52)			(-0.84)	
ΔCash/MVE	+	1.843***	1.841***	1.857***	1.787***	1.797***	1.310***
		(11.22)	(11.33)	(11.36)	(11.27)	(11.30)	(12.45)
ΔEarnings/MVE	+	0.414***	0.414***	0.414***	0.414***	0.414***	0.442***
		(9.79)	(9.79)	(9.82)	(9.82)	(9.77)	(11.82)
ΔNA/MVE	+	0.224***	0.222***	0.223***	0.223***	0.224***	0.216***
		(13.07)	(13.26)	(13.04)	(13.05)	(13.25)	(10.80)
ΔR&D/MVE	+	0.242	0.234	0.236	0.234	0.240	0.599***
		(0.48)	(0.47)	(0.48)	(0.47)	(0.48)	(2.62)
ΔInterest/MVE	-	-1.504***	-1.505***	-1.503***	-1.504***	-1.505***	-1.251***
		(-7.09)	(-7.18)	(-7.16)	(-7.08)	(-7.08)	(-3.00)
ΔDividend/MVE	+	1.780***	1.802***	1.806***	1.782***	1.792***	1.677**
		(3.22)	(3.21)	(3.23)	(3.20)	(3.18)	(1.99)
lagged Cash/MVE	+	0.411***	0.414***	0.412***	0.413***	0.409***	0.323***
		(5.46)	(5.53)	(5.46)	(5.52)	(5.47)	(5.39)
Leverage	-	-0.577***	-0.579***	-0.575***	-0.578***	-0.575***	-0.557***
		(-11.50)	(-11.62)	(-11.56)	(-11.60)	(-11.51)	(-10.82)
New Finance/MVE	+	0.030	0.031	0.029	0.031	0.028	-0.049
		(0.81)	(0.85)	(0.78)	(0.85)	(0.77)	(-1.30)
Lagged Cash/MVE × ΔCash/MVE	-	-0.535***	-0.551***	-0.546***	-0.538***	-0.541***	-0.392***
		(-4.74)	(-5.10)	(-4.96)	(-4.81)	(-4.95)	(-3.58)
Leverage × ΔCash/MVE	-	-1.455***	-1.428***	-1.429***	-1.430***	-1.442***	-0.809***
		(-7.43)	(-7.45)	(-7.40)	(-7.33)	(-7.40)	(-5.10)
Industry effect		Included	Included	Included	Included	Included	Included
Year effect		Included	Included	Included	Included	Included	Included
N		66,015	66,015	66,015	66,015	66,015	10,831
Adj. R^2		22.3%	22.4%	22.4%	22.3%	22.3%	21.3%

F-test

SaleGov% ×ΔCash/MVE = SaleFirm% × ΔCash/MVE	F = 55.03
SaleGov% × ΔCash/MVE = SaleOther% × ΔCash/MVE	F = 65.82

Table 7. The impact of government major customers on the sensitivity of cash holdings to operating cash flows (year >= 1988)

This table reports the parameter estimation of Equation (5). The dependent variable is change in cash holdings scaled by net assets (Δ Cash/NA). The variables of interest are interactions of operating cash flows (CFO/NA) with SaleMC%, SaleGov%, SaleFirm%, and SaleOther%. The data of operating cash flows are obtained from cash flow statements since year 1988. Standard errors are clustered at both firm and year levels (Petersen, 2009). Industry fixed effect is based on Fama-French 49 industries. *t-statistics* are in parentheses below parameter estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All variable are defined in the Appendix, and all continuous variables are winsorized at the 1st and 99th percentiles.

Variable	Predicted sign	All firm-years					Gov. sales
		(1)	(2)	(3)	(4)	(5)	(6)
SaleMC% × CFO/NA		-0.150**					
		(-2.32)					
SaleMC%		0.037***					
		(3.48)					
SaleGov% × CFO/NA			-0.308*	-0.196			-0.039
			(-1.95)	(-1.28)			(-0.12)
SaleFirm% × CFO/NA			-0.149**		-0.119**		
			(-2.29)		(-2.10)		
SaleOther% × CFO/NA			-0.071			0.032	
			(-0.59)			(0.33)	
SaleGov%			0.053***	0.033**			0.023
			(3.28)	(2.36)			(0.93)
SaleFirm%			0.046***		0.036***		
			(3.37)		(2.96)		
SaleOther%			0.015			-0.006	
			(0.91)			(-0.39)	
CFO/NA	+	0.385***	0.385***	0.333***	0.367***	0.328***	0.285*
		(7.76)	(7.68)	(7.79)	(8.61)	(7.53)	(1.81)
lagged Tobin's Q	+	0.034***	0.034***	0.034***	0.034***	0.034***	0.044***
		(10.08)	(9.89)	(9.84)	(10.08)	(9.90)	(5.72)
ln(AT)	+	0.001	0.001	0.001	0.001	0.001	0.004***
		(0.92)	(1.14)	(0.99)	(1.13)	(1.00)	(2.83)
Capex/NA	-	-0.164***	-0.168***	-0.153***	-0.166***	-0.154***	-0.083
		(-4.18)	(-4.43)	(-3.96)	(-4.28)	(-3.94)	(-0.58)
Aquisition/NA	-	-0.403***	-0.403***	-0.404***	-0.403***	-0.405***	-0.340***
		(-12.39)	(-12.39)	(-12.42)	(-12.42)	(-12.43)	(-9.93)
Payout/NA	-	-0.217***	-0.217***	-0.216***	-0.218***	-0.217***	-0.565***
		(-3.68)	(-3.70)	(-3.75)	(-3.71)	(-3.78)	(-5.26)
TaxPaid/NA	-	0.172	0.173	0.184	0.173	0.183	0.541***
		(1.46)	(1.48)	(1.56)	(1.48)	(1.55)	(3.01)
Industry effect		Included	Included	Included	Included	Included	Included
Year effect		Included	Included	Included	Included	Included	Included
N		45,308	45,308	45,308	45,308	45,308	6,035
Adj. R^2		17.9%	18.0%	17.7%	17.9%	17.7%	15.4%

F-test

SaleGov% × CFO/NA = SaleFirm% × CFO/NA	F = 15.49
SaleGov% × CFO/NA = SaleOther% × CFO/NA	F = 23.63

Table 8. The impact of losing government procurement contracts on corporate cash holdings: a quasi-natural experiment

This table presents the parameter estimation of Equation (6) for a subsample of firms that had at least one government sales during Bill Clinton's presidency but lost their government procurement contracts during George W. Bush's presidency. The dependent variable is the natural logarithm of cash holdings ($Cash$) scaled by net assets (NA). The independent variable is an indicator of Bill Clinton's presidency (January 20, 1993 – January 20, 2001). Standard errors are clustered at both firm and year levels (Petersen, 2009). Industry fixed effect is based on Fama-French 49 industries. *t-statistics* are in parentheses below parameter estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All variable are defined in the Appendix, and all continuous variables are winsorized at the 1st and 99th percentiles.

Variable	Predicted sign	ln(Cash/NA)
Clinton	-	-0.401***
		(-3.21)
SaleFirm%	?	0.003
		(0.01)
SaleOther%	?	-0.417
		(-1.50)
ln(NA)	-	-0.140***
		(-3.80)
MVE/NA	+	0.020***
		(3.47)
FCF/NA	+	-0.050
		(-0.39)
NWC/NA	-	-0.933***
		(-3.36)
Capex/NA	+	2.406***
		(4.18)
R&D/NA	+	0.368
		(1.44)
Acquisition/NA	+	-1.227***
		(-2.94)
Debt/TA	+	-3.066***
		(-6.34)
DumDiv	-	0.161
		(0.99)
indCFRISK	+	-0.001
		(-0.03)
Industry effect		Included
Year effect		Included
N		1,933
Adj. R^2		54.4%