Does government spending crowd out R&D investment? Evidence from government-dependent firms and their peers

Phong T. H. Ngo and Jared Stanfield

Internet Appendix

This document provides additional information regarding the US Federal Budget process, our data and sample construction, and further discussion regarding our identification strategy. We also present and discuss the results of supplementary analyses referred to in the main paper.

A1. Government Budget Process and Federal R&D Spending

This section provides a brief discussion of the complicated process through which US federal government funds are spent.[1] The federal budget for the US government is incredibly large; the 2015 Budget for example, was almost $4 trillion.[2] Spending is divided into two broad types. The first component—the focus of this study—is referred to as discretionary spending. This type of spending comprised approximately 30% of the total budget in 2015 and is negotiated annually, requiring Congress to provide spending *authority* (i.e., funding) in appropriations acts each year. When making appropriations, Congress does not vote on the level of spending (i.e., outlays) directly. Rather, Congress votes on the budget authority to incur financial obligations that will result in spending. The distribution of funds is then set through

[1] Interested readers should refer to Analytical Perspectives: Budget of the US government (particularly Chapters 8 and 10) for a very detailed account of the budget concepts and process. The 2015 version can be found here: https://www.gpo.gov/fdsys/pkg/BUDGET-2015-PER/pdf/BUDGET-2015-PER.pdf

[2] The President's Budget proposal totalled $3.9 trillion with $1.19 trillion (30.5%) allocated to discretionary spending (see: https://www.gpo.gov/fdsys/pkg/BUDGET-2015-BUD/pdf/BUDGET-2015-BUD.pdf), whereas the final budget totalled $3.7 trillion with $1.2 trillion (32%) being discretionary (see: https://www.cbo.gov/publication/51110)

subsequent acts of Congress when the authority is appropriated by the Appropriations Committees (and other committees with jurisdiction over spending) of the House.[3] Prior to making appropriations, Congress usually enacts legislation that *authorizes* the appropriations of funds and authorizes agencies to use those funds to carry out federal programs. Authorizing legislation can be permanent or expire after one or more years.[4] Failure to appropriate funds before the end of the fiscal year implies the cessation of funding, which occurred in 2013 and 2018, resulting in the partial shutdown of US government functions. The second category of spending is referred to as mandatory spending, which made up the remaining 70% in 2015. This type of spending is controlled exclusively by authorizing legislation. That is, the authorizing laws provide agencies with the authority or requirement to spend money without first requiring the Appropriations Committees to enact funding. This category of spending includes interest payments on federal debt and spending on major programs such as Social Security, Medicare, Medicaid, and unemployment insurance. Because this type of spending is directed by existing law with indefinite or long-term expiration dates, *expectations* about mandatory spending levels typically *do not* vary year-to-year.[5]

There are several important things to note about how directly funded R&D is treated in the federal budget. First, there is *no* overall R&D budget and no special treatment of R&D

[3] Separate bills must be passed for the following broad categories of funding: agriculture, rural development and food and drug administration; commerce, justice and science; energy and water development; financial services and general government; homeland security; interior and environment; labor, health and human services, and education; legislative branch; military construction and veterans affairs; state and foreign operations; and transportation and housing and urban development.

[4] Note that although it is usually the case the authorizations precede appropriations, it is possible for the Congress to enact appropriations for a program even if there is no specific authorization for it or if its authorization has expired.

[5] This does not imply that *actual* mandatory spending (i.e., outlays) does not vary annually. Further, it is possible for the budget to have a minor impact on short-term expectations about mandatory levels if it contains provisions to change authorizing legislation that is short-term in nature. For example, the President's 2015 budget proposal contained a provision to extend the Emergency Unemployment Compensation program through December 2014, which had expired in December 2013. The Congressional Budget Office estimates that mandatory spending would be $16 billion higher under this provision compared to the status quo in 2014. (see: https://www.cbo.gov/sites/default/files/113th-congress-2013-2014/reports/45230-APB_OneColumn.pdf).

within most agency budgets. Rather, R&D expenditures are folded into regular budget items of more than two dozen federal departments and independent agencies (Hourian, 2015). Therefore, R&D spending is only realized after a complicated and decentralized appropriations process involving hundreds of decisions over individual programs. Second, almost all federal R&D spending comes from the discretionary component of the budget. Third, R&D spending as a percent of the discretionary budget is remarkably stable, especially during our sample period (1990-2013). Fig. A.1 Panel A shows that from the mid-1980s, R&D as a percentage of the discretionary budget hovered between 12 and 13% until the financial crisis. The drop in this ratio was due to large stimulus programs and the TARP expenditures unrelated to R&D. Given the stability of R&D spending as a fraction of the discretionary budget, knowing in advance the size of the discretionary budget is predictive of the ex post R&D spending.

Our discussion above suggests that the proxies for federal R&D used in past studies, such as Government R&D Spending or Value of Government Contracts, are problematic because (1) they contain mandatory long-term spending that is known well in advance (i.e., short term or year-to-year expectations about mandatory spending are relatively stable); (2) actual R&D spending is only realized *after* the Congress approves a budget authority and funds have subsequently been appropriated; thus both the amount and the industrial distribution are likely to be affected by private sector investment behavior (i.e., more likely endogenous); and (3) government spending unrelated to R&D may impact private firm R&D indirectly, as discussed in the introduction and hypothesis development section of the paper, which is not captured by focusing only on federal R&D spending.

Accordingly, our focus in the paper is on the entire discretionary component of federal spending. In particular, we measure expected changes in government spending by examining the

variation in Discretionary Budget *Authority* (DBA) year-to-year. The budget authority sets the maximum available funds for discretionary programs in the following fiscal year. Therefore, it represents *expected* aggregate (discretionary) federal expenditure levels (i.e., outlays) because the distribution and actual level of spending are yet to be determined when Congress approves a certain level of funding.

Therefore, we argue that DBA, relative to traditional measures, suffers less from simultaneity problems and captures both the direct and indirect time varying impacts of government spending on private R&D.

A2. Data

A2.1. Sample and Data

Regulation SFAS No. 131 requires firms to disclose whether they have an economically important customer by industry segment. The guidance suggested to firms is to report customers responsible for at least 10% of total reported firm sales. However, often firms report economically important customers that are responsible for less than 10% of total sales. In addition, although firms need to disclose the existence of an important customer, they need not disclose the identity of the customer. Several papers in the accounting and finance literature have utilized these data, including Hertzel et al. (2008), Ellis et al. (2012), Dhaliwal et al. (2016), and Harford et al. (2019).

To create a database of firms that identify the federal government as a major customer, we collect data from the Compustat segments file from 1990-2013. Customers are classified by type and thus allow an easy differentiation among private customers and foreign government, domestic government, state government, and local government customers. This classification

allows us to obtain a sample of 18,751 firm-federal government customer-year observations (our focus) and 23,459 firm-total government customer-year observations. However, these classifications are often incorrect. We manually check each observation to ensure government, private firm, market, and geographic region customers are correctly identified as such. Although the number of observations incorrectly classified as government customers is relatively small (the number of observations for federal government customers and all government customers declines from 18,751 to 18,685 and 23,459 to 23,307, respectively), we conservatively identify 7,062 firm-customer-year observations that are government customers but incorrectly classified as private firms, geographic regions, or markets. Thus, incorrectly relying on the classification provided by Compustat results in more than a 23% reduction in our sample of firm-customer-years.

We aggregate the data up to the firm-year level, which results in 15,501 firm-year observations (approximately 13% of possible observations) in which firms disclosed the *federal* government as a major customer. Next, we restrict the sample of our panel tests to firms with reported R&D, yielding 55,742 observations, of which 6,044 correspond to government-dependent firm-years (approximately 11% of possible observations).

Being a government-dependent firm is highly persistent. Over our 24-year sample period, approximately 52% of R&D firms that report the government as a major customer also report the relationship for 10 years or more, resulting in firms being government dependent for an average period of approximately 11 years. It follows that there is very little temporal variation in whether a firm is government-dependent of not: for our sample, only 1,881 of 55,742 firm-year observations correspond to a change in whether a firm is dependent or not. Given the lack of variation in the classification of whether a firm is government-dependent or not, it is

necessary for us to focus on the sample of firms reporting actual sales to the government. By focusing on these firms, we rely on within-firm variation in sales to the government (as a fraction of total sales) to identify the impact of government spending on R&D for dependent firms. This additional screen reduces our sample of R&D firms to 47,806 firm-year observations, of which 4,847 correspond to firm-years where we have data on firm level sales to the federal government.

We obtain firm-level accounting and market variables from the Compustat and CRSP databases, which are then matched to our existing sample of government-dependent firms. We define *R&D* as total research and development expenditure scaled by assets. We include (lagged, i.e., year *t*-1) control variables commonly found in the literature: *CASHHOLD* is the stock of cash as a percentage of total assets; *CASHFLOW* is cash flow from operations as a percentage of total assets; *SIZE* is the natural logarithm of market value of equity; *MB* is the market to book ratio; *LEV* is long-term debt plus short term debt as a percentage of market value; *AGE* is firm age in years; *INFLATION* is the annual inflation rate based on the consumer price index; *GROWTH* is the annual growth in real gross domestic product; *10YRTB* is the 10-year constant maturity Treasury bond rate; and *URATE* is the unemployment rate. Macroeconomic data are obtained from the Federal Reserve Bank of St Louis (FRED). Finally, all of the continuous firm level variables are winsorized at their 1st and 99th percentiles.[6]

A2.2. Discretionary Budget Authority

Our main independent variable of interest is the discretionary budget authority. We obtain historical data for the annual discretionary authority from the Office of Management and Budget. We define *DBA* as the total discretionary budget authority (in constant 2009 trillions of dollars). DBA is constructed by taking raw data directly from Table 5.6 (see

[6] Our results are virtually unchanged using unwinsorized data.

https://www.whitehouse.gov/omb/historical-tables/) and then using the composite deflator from Table 1.3 (from the same website) to deflate the numbers to constant 2009 values.

As discussed in the Introduction, the budget calendar and timing of when managers first learn about the size of the Budget Authority for the coming fiscal year is important to our empirical setting. By law, the formal budget process begins when the President transmits his budget proposal to Congress for consideration is done on or after the first Monday in January and no later than the first Monday in February of the prior year. For example, the President was required to transmit his budget proposal for the 2015 fiscal year (beginning October 1, 2014) by February 2014.[7] The President's budget is the first substantial indicator for managers of government spending levels in the following fiscal year.[8] Following the President's budget proposal, Congress completes a congressional budget resolution, and the House begins consideration of annual appropriations bills to approve a discretionary budget authority by June 30.[9] Therefore, in a typical year, the budget authority for year *t* is known to managers in year *t*-1. We therefore examine how the DBA *for* year *t* (established in *t*-1) influences firm R&D decisions in year *t*.

Fig. A.1 Panels B and C show that there is significant variation in DBA over time; DBA both increases and decreases. In fact, for our sample period, there were just as many years when

[7] This deadline is extended if there is a change in the administration to allow sufficient time for the new administration to develop a budget policy. In these years, the timeline for transmitting the President's proposal to Congress is typically extended to April or May; however, there is no specific date that is set by law.

[8] Technically, the first information regarding future spending comes in the form of a budget guidance. Prior to formulating a budget proposal and transmitting the President's budget proposal to Congress, the Whitehouse Office of Budget Management issues a memorandum to federal agencies and departments with guidance on how to approach the development of their budget submission. This can occur up to 18 months prior to the start of the fiscal year in question. For example, the budget guidance for the 2015 fiscal year budget was issued on May 29, 2013 (see: https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2013/m-13-14.pdf). This document is 2-3 pages in length and, in our view, typically does not contain sufficient information for managers to act on.

[9] Note the consideration of appropriations bills by the House can begin even if a budget resolution has not been agreed to. The notional deadline for a Congressional budget resolution is April 15, but this has rarely been adhered to in recent years.

we see decreases as increases in DBA. The figures also show there is no discernable trend in DBA or changes in DBA, with the exception of the period around the crisis.

A2.3. The Industrial Distribution of Government-Dependent Firms

In Table A.1, we present the industrial distribution of (federal) government-dependent firm-customer-year observations. We find that although having some concentration in certain industries (such as over 13% of firm-customer-year observations in health services firms and nearly 13% of observations in electronics firms), government-dependent firms feature in a wide array of industries.

A3. Additional Evidence for the Relative Performance Channel

We present and discuss supplementary analyses conducted to provide further evidence in favor of the relative performance channel.

Firms belonging to industries with higher unionization are incentivized to supply conservative accounting numbers (Leung et al., 2010) and to realize bad news (Bova, 2013) to increase bargaining power relative to unions. Alternatively, unions may prevent cuts to R&D-related unionized labor. Therefore, earnings management is more costly for highly unionized industries and we are less likely to observe a reduction in R&D to boost current earnings in an attempt to match or beat GD firms in our setting. Doing so can result in greater wage demands from unionized labor. In Table A.2, we augment the analysis presented in models 7 and 8 of Table 8 by studying whether other cuts to discretionary spending are concentrated in less-unionized industries. Consistent with the above, we find that cuts to advertising and SG&A are significantly greater in less-unionized industries.

Bushee (1998) assumes that managers use last year's earnings per share as their earnings target and argues that the business press uses this benchmark to analyze current earnings

performance and prior research provides evidence that managers have incentives to avoid missing earnings targets. Extending this logic, most contracting models argue that efficient contracts need to reward effort, but not luck (i.e., an industry wide increase in productivity that is unrelated to effort). In such a setting, relative performance evaluation is important. One can rule out such circumstances by comparing a firm's performance to similar firms in the industry in which it operates. We define a relative benchmark for firm *i* (*RELPERFORM*) to be the difference between the earnings of GD firms and peer firms; this difference is interpreted as deviations from the average performing GD firm in the 4-digit SIC industry.[10] A larger value implies lower relative performance. Because managers and the market use last year's relative performance as a benchmark to assess firm *i*'s performance this year, we calculate the change in the benchmark over time (*ΔRELPERFORM*), where a positive value implies falling relative performance. We argue managers have incentives to avoid missing relative earnings targets.

We study how much of the peer-firm reduction in R&D documented in Table 3 can be explained by a fall in relative performance by including *ΔRELPERFORM* along with interactions with *PEERGOVIND* and *DBA* in model 1 of Table A.3. Consistent with at least some of the effect being explained by a fall in relative performance of peers when DBA is higher, we find that the coefficient on the interaction term *ΔRELPERFORM* × *PEERGOVIND* × *DBA* is negative and significant and that the introduction of this variable reduces the economic and statistical significance of the original result (i.e., in statistical significance of *PEERGOVIND* ×*DBA* the coefficient estimate falls in magnitude from -0.85 to -0.66).

We follow Bushee's (1998) logit specification more closely in models 2 and 3, where the dependent variable is an indicator equal to one if firm *i* cuts R&D spending between year *t*-1 and

[10] We can use the earnings of either the median, mean, or highest performing GD firm in a given 4-digit SIC as the benchmark. We report the results using the median GD firm as the benchmark but the results are qualitatively similar using mean GD firm earnings or the earnings the of best performing GD as the benchmark.

t. Regardless of whether we use the continuous measure *DBA* (model 2) or use an indicator equal to one if DBA increases between year t-1 and year t (model 3), we find that *ΔRELPERFORM* × *PEERGOVIND* × *DBA* is positive and significant and that *PEERGOVIND* × *DBA* is actually insignificant. An increase in DBA is associated with an increase in the likelihood of a cut in R&D only if there is also a deterioration of performance of peer firms relative to GD firms (i.e., an increase in ΔRELPERFORM). Economically, an interquartile increase in ΔRELPERFORM (decline in relative performance) leads to a 9.1% increase in the likelihood of a cut in R&D investment by peer firms. Model 2 also shows that GD firms that underperform relative to the benchmark (i.e., the median GD firm) tend to cut R&D investment (i.e., the coefficient on *ΔRELPERFORM* is positive), but this effect is overwhelmed by the reduction in the likelihood of cutting due an increase in *DBA* (i.e., *ΔRELPERFORM* × *DBA* is negative).

Second, in Table A.4, we document that peer firms (but not GD firms) significantly increase accounting accruals in response to DBA, providing further evidence that peer firms seek to manage earnings through multiple channels in response to increases in government spending.

Third, in Table A.5 we show that the cut in R&D does not last more than two periods. Since the cut in R&D is not permanent, this is more consistent with the cut being associated with earnings management rather than in response to a negative economic shock like losing a government contract.

Fourth, we re-estimate equation (1), replacing the dependent variable with capital expenditure. We do this for government dependent firms as well as peers. The results in Table A.6 show that there is no significant relation between *GOVSALES*×*DBA* nor *PEERINDGOV*×*DBA* and *CAPEX*. It does not appear that discretionary spending significantly

impacts government-dependent firm capital expenditures relative to other firms, nor does it impact the CAPEX of peers relative to other firms. Because, unlike R&D, CAPEX is not expensed, we argue that peers firms are unlikely to vary CAPEX in an attempt to meet performance benchmarks. Therefore, these results are consistent with the earnings management explaining the reduction in peer firm R&D as DBA increases.

Fifth, we perform further tests analyzing whether the peer results found in Table 4, Panel A are centered in firms more likely to cut R&D. As discussed in the main body of the paper, the literatures suggests that firms use real and accrual-based earnings management as substitutes (see for example, Badertscher, 2011; Cohen et al. 2008; Cohen and Zarowin 2010; Zang, 2012). Zang (2012) documents that firms with higher auditor quality and firms in worse financial condition are more likely to manage earnings with real activities (such as cutting R&D expenditures). We document evidence consistent with this finding in Table A.7: our peer firm results are centered in firms with higher auditor quality (i.e. firms using a Big-4 accounting firm as an auditor) and firms closer to financial distress (i.e. lower modified Altman Z-Score (Altman, 1968; 2000)). These results support the predicted relative performance mechanism of Hypothesis 2.

Finally, we follow Kothari et al. (2016) who employ the fixed-effects instrumental variable estimation of Anderson and Hsiao (1982) to study the persistence of R&D expenditures in Table A.8. We expand their specification into our context by including PEERGOVIND and its interactions with lagged R&D and DBA. The variable of interest is the triple interaction term $R\&D_{t-1} \times PEERGOVIND \times DBA_t$ which tells us how persistent peer-firm R&D is, relative to GD firms, when DBA is increasing.[11] Consistent with Hypothesis 2, we find evidence that the

[11] We instrument all variables that have a lagged R&D term with higher order lags.

persistence of R&D expenditures *declines* for peer firms following increases in DBA, suggesting that peer firms reduce R&D spending in response to improved GD firm performance.

A4. Alternative channels

As discussed in Section 4.4 of the paper, we test and rule out several alternative mechanisms. We report the analysis and provide additional discussion below.

First, we examine the nature of peer firms in our sample. As discussed above, government-dependence is highly persistent. This persistence is in part due the how the government awards contracts. An important factor for awarding contracts to suppliers is the ability to make delivery on a contract. Therefore, a key determinant of how contracts are awarded is whether firms have a "track record" of being good supplier to the government. Other factors like solvency matter of the firm also are important. Peer firms thus face an uphill battle to win contracts.

As motivated by this persistence, we study whether peers who are never GD firms behave similarly to those who switch status. Being a peer firm is also highly persistent, about 63% of the observations are for peers that do not switch status. At the firm level, about half of our peer firms (47%) are always peer firms with the remaining occasionally switching. In Table A.9, we decompose our peer firm effect (i.e. PEERGOVIND) into peers that are "always peers" (ALWAYSPEER) and those that are "switching peers" (SWITCHINGPEER). Note that since there is no within-firm variation in ALWAYSPEER, the coefficient is omitted by the inclusion of firm fixed effects. There are two sources of variation SWITCHINGPEER. First, firms can switch between being a GD firm and a peer firm. Second, firms can switch to and from being a non-peer—for example, if previously GD firms become non-dependent or drop out of the

industry; leaving the remaining firms to be classified as non-peers. Presumably, firms that never switch status to GD are less likely to be competing for government contracts. Further, if the reduction in R&D for the average peer is due to firms that reduce R&D spending in response to losing contracts, we would expect our results to be concentrated in the switching peers group. Contrary to this alternative, we find similar effects for ALWAYSPEER and SWITCHINGPEER in response to increases in DBA (i.e., cut R&D), though the magnitude is much larger for "always" peer firms. This is potentially consistent with the fact the non-peers and GD firms have no incentive to cut R&D in response to DBA and thus dilutes the effect.

Second, Kim and Nguyen (2018) find evidence that government spending crowds out private firm investment through a labor-market channel. They report that firms impacted by government spending reduce employment, presumably losing employees to public-sector firms. A related labor market (rather than relative performance) mechanism could be driving our results if the improved performance of GD firms relative to their peers as a result of increases in government spending leads to shifts in employment within the industry. Specifically, peer firms could be faced with a negative employment shock and thus reduce R&D spending. In addition, if the reduction in peer R&D is the result of losing or challenging a bid for a government contract, then we would expect peer employment to decrease (Canayaz, Cornaggia, and Cornaggia, 2019). To determine whether our results are driven by this alternate labor-market channel we test whether changes in DBA differentially impacted employment at GD firms and their peers. As reported in Table A.10, we do not find evidence consistent with this mechanism. In fact, we find that employment declines on average at GD firms and that it increases at their peers in response to increases in government spending, albeit insignificantly. Therefore, it is

unlikely that a labor-market mechanism similar to that documented by Kim and Nguyen (2018) is driving our results.

Second, if negative economic shocks were driving our results with peer firms, we would expect the negative relation between DBA and R&D for peer firms would be most pronounced in firms with less internal slack and more reliant on external finance. In Table A.11 we perform subsample tests split based on median cash holdings. We do not find a significant difference between the R&D investment of peer firms with lower cash holdings. In fact, although not significant, the reduction is economically stronger in firms with more cash. Second, we match firms to the Dealscan database. We do not find that the cost, amount, and covenant strictness of syndicated bank loans for peer firms significantly vary with DBA in Table A.12.

Third, if spillovers between GD firms and their peers were causing the negative peer response to DBA, we would expect our findings to occur in high-innovation states. As reported in Table A.13, our results remain unchanged when we include state fixed-effects, and we do not find a significant difference between high-innovation states (based on a 2013 Bloomberg state innovation ranking) and low-innovation states where spillovers are less likely (Audretsch and Feldman, 1996; Jaffe, 1986). Fourth, if peers, but not non-peers or GD firms, were reducing investment in response to higher political uncertainty, we would expect the inclusion of election indicators or the Baker et al. (2016) political uncertainty index would lead our peer effects to decline in economic and statistical significance. As documented in Table A.14, the inclusion of these controls does not impact our results.

Finally, since political contributions can predict government contracts (Brogaard et al., 2019), we test whether firms whether there is a positive association between political contributions when DBA is high, and R&D. If political contributions were driving our results,

we would expect a significant positive relation between the interaction of political contributions and DBA with firm R&D. In Table A.15, we do not find that political contributions Brogaard et al. (2019) significantly predict R&D expenditures for GD, peer, or non-peer firms, either alone or interacted with DBA.

Taken together, we consider peer firms as those operating in the same industries as GD firms, producing similar products and services however appear to (in the short-term) specialize in providing their products and services to private sector. However, the relative performance between peers and GD firms matters to peers because of industry benchmarking and variation in DBA (i.e. size of government contracts to GD firms) significantly impacts relative performance.

A5. Identification

A5.1. Event Date Selection for Analysis in Section 5.1

In Section 5.1 of the paper, we utilize a quasi-natural experiment to disentangle the potentially endogenous relationship between the value of government-dependent firms and their peers and government spending. We perform short-window event studies around the following four dates.

First, on April 18th, 2011, Standard and Poor's issued a negative outlook on US government debt. The second event date is July 16th, 2011, when Egan-Jones became the first ratings organization to downgrade the US rating (from AAA to AA+). Third, on August 2nd, 2011, US Congress passed the Budget Control Act, which called for as much as $2.4 trillion in reductions in expenditure growth over the next 10 years (through 2021).[12] This act was passed in

[12] These cuts were implemented in two steps: the $917 billion agreed to initially, followed by an additional $1.5 trillion that the newly formed Congressional Joint Select Committee on Deficit Reduction recommended in November 2011. The act further provided that if Congress did not enact the committee's recommendations, cuts of

conjunction with raising the debt ceiling. Finally, on August 5th, 2011, Standard and Poor's downgraded the US rating, citing the political posturing around the debt ceiling increase as a factor in the downgrade.[13] Our analysis shows that government dependent firms experienced positive and significant abnormal returns, whereas peer firms experiences negative returns on these event dates.

We briefly comment on two concerns about the events. First, some argue that these events are somewhat expected by the market, especially the S&P downgrade, given their negative outlook issued earlier in the year. Although we do not claim that the events were a complete surprise, we believe that elements of the timing and nature of the events were surprising. For example, the Budget Control Act, although not a surprise in the sense that the investors were aware of the US government's debt problem, was a surprise in terms of the magnitudes of the changes to spending and taxes. Further, the S&P downgrade was a highly controversial event in the sense that few expected the company to go through with the downgrade. Moreover, the announcement itself was stalled by several hours when Treasury officials found a '$2-trillion' error in S&P's calculations after being notified by S&P about the plan to downgrade US debt and being presented with their analysis. Regardless, S&P pushed ahead with the announcement. Stocks in the US and global markets tumbled on the news, the largest declines in the three years since the Lehman collapse. The fallout for S&P following the downgrade was extremely negative; both the Treasury and the White House launched an

---

$1.2 trillion would be implemented over the same time period. The reductions would mainly affect outlays for civilian discretionary spending, defense, and Medicare.

[13] http://www.standardandpoors.com/ratings/articles/en/us/?assetID=1245316529563

unprecedented attack on S&P's credibility and integrity[14], which ultimately led S&P to replace its then-President, Deven Sharma.[15]

The second concern is whether the downgrade had any material effect on the US government's ability to borrow. At the time of the event, there was genuine concern regarding the impact of the rating downgrade on the cost of borrowing for the US government. A key worry was whether the downgrade would change the demand for US Treasuries among foreign investors, in particular China, who collectively owned almost half of the outstanding US government debt. This is corroborated in several existing studies. Gallagher et al. (2017) and Gallagher and Collins (2016) find that institutional investors significantly reduced their holdings in government-only money market mutual funds around these events. For example, Fig. 4 from Gallagher and Collins (2016) demonstrates the dramatic outflow around the debt ceiling. A secondary concern was that the downgrade would reduce US banks' risk-based capital ratios and lead banks to sell-off US government debt to manage their regulatory ratios.[16] Some estimates suggested that the downgrade could increase the cost of borrowing for the US government by half a percentage point.[17] For example, JP Morgan estimated that the downgrade would increase the cost of borrowing by $100 billion per year or approximately 10% of the annual discretionary budget.[18]

The combined effect of the four events presented in the paper was an abnormal return of -1.7% (-3.6%) for the average government-dependent firm (highly government-dependent firm). Table A.16, Panels A and B present the results for the individual event dates. As seen in the

[14] http://www.theguardian.com/world/richard-adams-blog/2011/aug/07/standard-poors-treasury-white-house
[15] http://in.reuters.com/article/2011/08/23/idINIndia-58914820110823
[16] The Federal Reserve stepped in and resolved this second concern by saying that US government debt would still be considered riskless for the purposes of regulatory ratios. See, for example, http://problembanklist.com/sp-downgrades-us-debt-feds-tell-banks-us-securities-still-riskless-0386/
[17] http://www.wsj.com/articles/SB10001424053111903366504576490841235575386
[18] http://www.bloomberg.com/news/articles/2011-08-06/u-s-credit-rating-cut-by-s-p-for-first-time-on-deficit-reduction-accord

table, we find that all of the events are associated with negative market reactions for government-dependent firms.

To further document the relation between government spending and peer firm value, Table A.17 repeats the analysis of Table 4 Panel B, models 1-2 on firm value by studying the relation between the interaction of PEERGOVIND and DBA on firm market-to-book. As documented in the table, we observe a significant negative relation between the market-to-book ratios of industry peers of GD firms in response to increases in government spending. In addition, we do not document a reversal of this effect in the following two years in models 3-6.

Finally, to provide additional evidence on the link between government spending and firm R&D, in Table A.18, we present a quasi-difference-in-differences analysis of firm R&D around the introduction of the Budget Control Act (BCA) of 2011. We expect that relative to other firms, government dependent firms will experience a negative shock to sales and profitability with the introduction of this act and reduce R&D in response. We therefore estimate the change in R&D for government-dependent firms after the introduction of the BCA relative to other firms. We restrict the sample to start in 2005 to limit the possibility that we pick up changing time trends in R&D between government-dependent firms and other firms. We include the same controls as in Table 3 as well as firm and year fixed effects and standard errors that are clustered by firm and year. The result shows that government- dependent firms significantly reduced R&D relative to other firms following the passage of the BCA. Taken together with the results discussed in Section 5 as well as Section A5.2 below, these results provide support for a causal relation between government spending and firm investment in R&D.

A5.2. Instrumental Variables Analysis and Discussion

The federal budget process is heavily politicized. The balance of power in Congress is an important determinant of budget outcomes. In the political science literature, institutional features that determine the degree of policy volatility are referred to as veto players (Tsebelis, 1995, 2000). A veto player is a political actor who has the ability to decline a choice being made. Specifically, a veto player is one who can stop a change from the status quo. Thus, the more veto players with diverse opinions, the less likely the status quo will change. A balance of power in Congress (i.e., more veto players) substantially slows the budget process and is usually associated with more compromise on spending levels, and spending changes are less expected. The slowed budget process has been highlighted in recent years with Congress failing to appropriate funds before the end of the fiscal year, resulting in the partial shutdown of governmental functions in 2013 and 2018.

As discussed in Section 5.2, our primary instrument is a continuous variable capturing the degree of the balance of power in Congress.[19] Specifically, *SPLIT CONTINUOUS* is defined as the proportion of Democrats in the Senate (including the Vice President in cases where the ratio is exactly 50%, because the Vice President acts as a tiebreaker) minus 0.5, multiplied by the ratio of Republicans in the House minus 0.5, scaled by the maximum (0.25). This variable generates a higher value when the Senate or House is strongly controlled by Democrats and the other chamber is controlled by Republicans and a smaller positive number when the chambers of Congress are split, but the parties' holds on their respective chambers are weaker (and thus at risk to the extreme wings of each party). It is weakly negative when a party holds both chambers

[19] Cohen et al. (2011) employ an alternative instrument related to politics (rotation of committee chairs) to identify variation in federal expenditure. However, the focus in their paper is identifying the *reallocation* of *state-level* federal expenditures to study its impact on capital investment, whereas we are interested in capturing exogenous variation in the expected *aggregate-level* of discretionary (R&D) expenditure to study the impact on private R&D.

of Congress but their hold is tenuous, and strongly negative when a party has a strong hold on both chambers of Congress.

We must instrument for both *DBA* as well as its interaction with our government-dependence variables; therefore, we require two instruments. However, as discussed in Wooldridge (2002), the linear projection (or fitted value) of an interaction is not the same as the interaction of the linear projection (p. 236). Thus, we cannot estimate the fitted value of *DBA* (*DBAHAT*) and interact it with the government-dependence variables (*GOVSALES* and *HIGOVSALES*) because the *t* statistic from this procedure is generally not valid. To avoid this issue, we follow Wooldridge's recommendation to perform a three-stage procedure described in Section 5.2.

We note that because DBA varies at the annual level, we are unable to include year fixed effects. To ensure that the results of the first stage are not driven by time-varying macroeconomic conditions, we include the macroeconomic controls included in models 1 and 2 of Table 2 as well as a linear time trend. Because the second and third stages are at the firm level, the observations of the first stage are estimated at the firm level. Although cross-sectional correlation among observations will not impact the estimation of *DBAHAT,* it will overstate the power of the first and second stages. Therefore, to ensure that our results are not impacted by this correlation and thus subject to a weak-instrument problem, we cluster by firm and by year in the reported first stage. Additionally, we utilize the Kleibergen and Paap (2006) weak-instrument test (discussed below and reported in Table A.21), which allows for clustering, to account for the reduced power of the first and second stage due to cross-sectional correlation.

Our instrument plausibly impacts the likelihood of changes in government spending but is unlikely to be influenced by expectations of future (and heterogeneous) firm R&D. Therefore,

the instrument should theoretically satisfy both the relevance and exclusion requirements necessary for their inclusion. Notwithstanding, we perform additional tests to ensure the validity of our instruments. To satisfy the exclusion restriction, we rule out the possibility that split control and/or the congressional balance of power between parties is related to expectations of future general and industry business conditions, which, in turn are related to R&D for reasons unrelated to the federal budget.

First, we find that our instruments are not correlated with leading economic indicators as reported in Table A.19. In panel A, we regress *SPLIT CONTINUOUS* and *SPLIT* on the following: (1) volatility indices, VIX and VXO, taken from the Chicago Board Options Exchange; (2) the consumer confidence index, from Thomson Reuters/University of Michigan, and (3) the United States leading index for economic activity, taken from the Federal Reserve Bank of Philadelphia. We find that *SPLIT CONTINUOUS* or *SPLIT* are not significantly related to leading economic indicators, whether we use end of year figures, annual averages, or contemporaneous or lagged indicators. In panel B, we find that higher consumer confidence is related to a lower Democrat share in *both* the House and Senate. This finding is consistent with the idea that aggregate economic conditions may lead voters to prefer one party to another (Pastor and Veronesi, 2019). However, and more important for our study, this is not correlated with a balance of power in Congress. For our instruments to violate the exclusion restriction, we would require, for example, consumer confidence to lead to a fall in the Democrat share in the House but a simultaneous rise in the Democrat share in the Senate. In unreported tests, we also add all four economic indicators as additional controls into our baseline regression without year-effects (inclusive of our other macroeconomic controls) and find that our main result is virtually

unchanged. Further, to control for industry conditions, we include industry-year fixed-effects into our baseline regression. Our results remain unchanged.

Second, we test whether voters are more likely to vote in a split Congress or change the balance of power when the outlook of certain government-dependent industries is unusually good or bad (i.e., whether firms or particular industries can forecast a split Congress or the balance of power in Congress) in Table A.20. Whether our analysis is performed at the firm or industry level, we do not find that the difference in mean (and median) EPS forecasts for firms in the government-dependent Defense and Health industries (taken from Thomson Reuters-IBES) relative to firms in other industries are significantly different in the three months prior to the 2010 election (which elected a split Congress). Specifically, the coefficient on the triple interaction between *HEALTH_DEFENSE*, an indicator for whether the estimate was in the three months prior to an election, and a 2010 indictor is not statistically significant for mean or median firm and industry estimates. Taken together, we find that our instrument is unrelated to underlying general and industry business conditions and that firms cannot accurately forecast the makeup of Congress, and thus our instrument does not violate the exclusion restriction.

In addition, we perform various diagnostic tests reported in Table A.21 column 1 to ensure our instrument is strong enough to identify *DBA*. We perform the following tests: (1) an underidentification test (see Kleibergen and Paap, 2006); (2) a weak-instruments test (see Kleibergen and Paap, 2006; Stock and Yogo, 2005); and (3) a weak-instruments-robust inference test (see Anderson and Rubin, 1949). Importantly, the Kleibergen-Paap weak-instruments test accounts for the cross-sectional correlation present in the first and second stages and allows cross-sectional clustering. We conclude that *SPLIT CONTINUOUS* is valid and sufficiently powerful to identify the impact of DBA on firm R&D.

We also consider three additional instruments related to the balance of power of Congress. The economic intuition for using these variables is similar to that of our primary instrument, *SPLIT CONTINUOUS*. First, we use an indicator variable equal to one if the House and Senate of Congress are controlled by different parties (*SPLIT*) and zero otherwise. Next, we use two continuous variables representing how close each chamber of Congress is to an internal split between parties. *HOUSE SPLIT* (*SENATE SPLIT*) is defined as the ratio of Democrats to Republicans in the House (Senate) when the number of Democrats in the House (Senate) is less than the number of Republicans. It is defined as the ratio of Republicans to Democrats in the House (Senate) when the number of Republicans in the House (Senate) is less than the number of Democrats. Thus, these variables have higher values the closer the parties are (and thus increase the importance of votes of fringe members of the party) to having a balance of power within the respective chamber of Congress.

We employ the three stage least squares approach described above and report the results in Table A.22, Panels A-C, corresponding to the first, second, and third stage regressions respectively. Similar to Table 10, we include time-varying macroeconomic controls and a linear time trend but do not include year fixed effects to avoid misspecification in the third stage. We find that *SPLIT* and *HOUSE SPLIT* are negative and significantly related to *DBA* in Panel A. However, we do not observe that *SENATE SPLIT* is significantly related to *DBA*.[20] Importantly, we observe that the instrumented measure of discretionary budget authority using both *SPLIT* and *SPLIT HOUSE* interacted with the government-dependence measures is positive and significantly related to *R&D* for both of our measures of government-dependent firms (*[GOVSALES×DBA]HAT* and *[HIGOVSALES×DBA]HAT* respectively). These results support

[20] We present the results of diagnostic tests for these alternative instruments in Table A.21 columns 2-4.

the findings of Table 10 and provide further evidence that the observed positive relation between *R&D* and *DBA* for government-dependent firms is not driven by the reverse causality concerns.

A5.3. Selection into Government Dependence

As discussed in Section 5.3, we directly address the possibility that selection bias may explain our findings in the following tests. First, we find that an increase in DBA increases the degree, but not likelihood, of government dependence in Table A.23. Specifically, using logistic regression models, we find that DBA is not significantly related with the likelihood of listing the federal government as a major customer in models 1-2. However, in models 3-5 we document that DBA is positive and significantly related with an increase in sales to the government by GD firms and having above-the-median sales to the government. We also test if cutting R&D is detrimental to the chances of being a GD firm. We find that cutting R&D is uncorrelated with the likelihood of being a GD firm. Further, this finding does change with variation in DBA (i.e., the interaction between whether firms cut R&D and DBA is also insignificant). However, we find some evidence that conditional on being a GD firms, cutting R&D is negatively correlated with sales to the government (especially when DBA is increasing).

Second, our results remain unchanged when we re-estimate model 2 of Table 3 on a sub-sample of firms who have *ever* listed the government as a major customer in Table A.24. This analysis accounts for latent characteristics that may cause firms to select into selling to the government by only considering firms that have at some stage 'selected' to be GD.

Third, in Table A.25 we rerun our baseline analysis on a propensity-score matched sample. Specifically, we match each GD firm with its five peer and five non-peer nearest-neighbors with common support on all characteristics from Table 3 within year (Rosenbaum and Rubin, 1983). The match between GD firms and their peers performs well with the average

difference in propensity scores between GD firms and their matched peers at 0.015 (compared to 0.129 average propensity score for GD firms). The match between GD firms and non-peers performs even better (which is unsurprising given the lack of restriction on industry) with the average difference in propensity score between GD firms and their matched non-peers at <0.001. As is documented in Table A.25, we continue to find robust support for the positive relation between DBA and R&D investment for GD firms and a negative relation between DBA and R&D investment for their industry peers. Therefore, it does not appear that differences between observable characteristics between GD firms, their peers, and non-peers are driving the observed relation between government spending and R&D for these firms from Table 3.

Fourth, in Table A.26 we do not find evidence that firms with corporate (as opposed to government) customers nor their peers exhibit similar empirical relations between government spending and R&D investment. In fact, we document the opposite relations, with firms with large corporate customers decreasing R&D spending and their peers increasing R&D spending in response to increases in DBA. This reduces the likelihood that the characteristics leading firms to have large customers, rather than our hypothesized mechanisms are driving our results. Finally, to ensure the our result is not being driven by firm size, we define LARGE FIRM as an indicator equal to 1 if a firm is in the top quintile by size. As reported in Table A.27, our results are robust to including LARGE FIRM as well as its interaction with DBA.

A5.4. Additional Robustness Tests

As discussed in Section 5.3, we perform a series of additional robustness tests. First, given the large changes in government spending around the financial crisis, we test to ensure our results are not being driven by the financial crisis. In fact, when we exclude 2007-2009 in our baseline tests in Table A.28, our results significantly increase in magnitude. This not only

demonstrates the robustness of our results, but also highlights the general applicability of these relations, relative to other works that focus solely on the crisis period.

Second, to document the generalizability of our results, we disaggregate government sales by industry in Table A.29. Specifically, we disaggregate DBA by industry and classify each government dependent firm into these industries. As documented in Table A.29, we find that our results hold across most industries. Finally, we find that our results statistically strengthen when we exclude financial firms and utilities in Table A.30.

References

Anderson, T.W. and Hsiao, C., 1982. Formulation and estimation of dynamic models using panel data. Journal of Econometrics 18, 47-82.

Anderson, T.W., Rubin, H., 1949. Estimation of the parameters of a single equation in a complete system of stochastic equations. Annuals of Mathematical Statistics 20, 46–63.

Cohen, D.A., Dey, A., Lys, T.Z. 2008. Real and accrual-based earnings management in the pre- and post Sarbanes-Oxley periods. The Accounting Review, 83, 757-787.

Cohen, D., Zarowin P. 2010. Accrual-based and real earnings management activities around seasoned equity offerings. Journal of Accounting and Economics, 50, 2-19.

Cohen, L., Coval, J., Malloy, C., 2011. Do powerful politicians cause corporate downsizing? Journal of Political Economy 119, 1015–1060.

Dhaliwal, D., Judd, J.S., Serfling, M., Shaikh, S., 2016. Customer concentration risk and the cost of equity capital. Journal of Accounting and Economics 61, 23–48.

Ellis, J.A., Fee, C.E., Thomas, S.E., 2012. Proprietary costs and the disclosure of information about customers. Journal of Accounting Research 50, 685–727.

Gallagher, E., Collins, S., 2016. Money market funds and the prospect of a US treasury default. Quarterly Journal of Finance 6, 1640001.

Gallagher, E., Schmidt, L., Timmermann, A., Wermers, R., 2017. Transparency, Investor Information Acquisition, and Money Market Fund Risk Rebalancing during the 2011-12 Eurozone Crisis. Washington University in St. Louis Working Paper.

Harford, J., Schonlau, J., Stanfield, J., 2019. Trade relationships, indirect economic links, and mergers trade relationships, indirect economic links, and mergers. Management Science 65, 2947-3448.

Hertzel, M., Li, Z., Officer, M., Rodgers, K., 2008. Inter-firm linkages and the wealth effects of financial distress along the supply chain. Journal of Financial Economics 87, 374–387.

Hourian, M., 2015. Federal R&D in the FY 2015 Budget: An Introdcution. American Association for the Advancement of Science Mimeo. American Association for the Advancement of Science, Washington, DC.

Kleibergen, F., Paap, R., 2006. Generalized reduced rank tests using the singular value decomposition. Journal of Econometrics 133, 97–126.

Kothari, S.P., Mizik, N., Roychowdhury, S., 2016. Managing for the moment: The role of earnings management via real activities versus accruals in SEO valuation. The Accounting Review 91, 559-586.

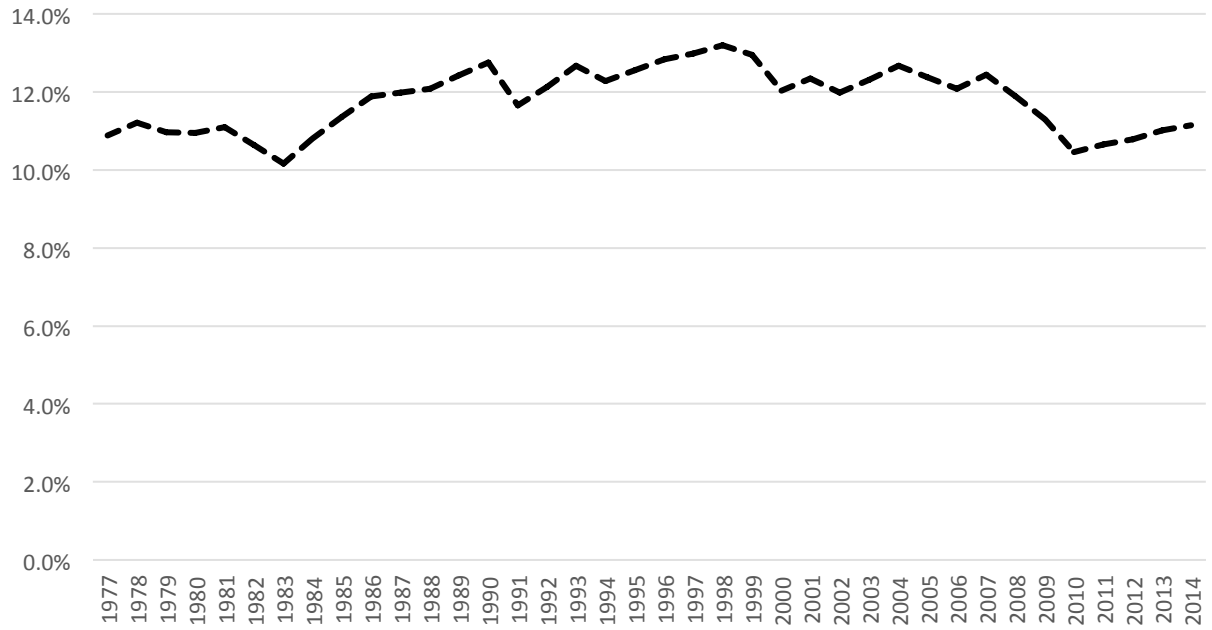
Roychowdhury, S., 2006. Earnings management through real activities manipulation. Journal of Accounting and Economics 42, 335–370.

Stock, J., Yogo, M., 2005. Testing for weak instruments in linear IV regression, in: Andrews, D., Stock, J. (Eds.), Identification and Inference for Econometric Models. Cambridge University Press, Cambridge, MA, pp. 80–108.

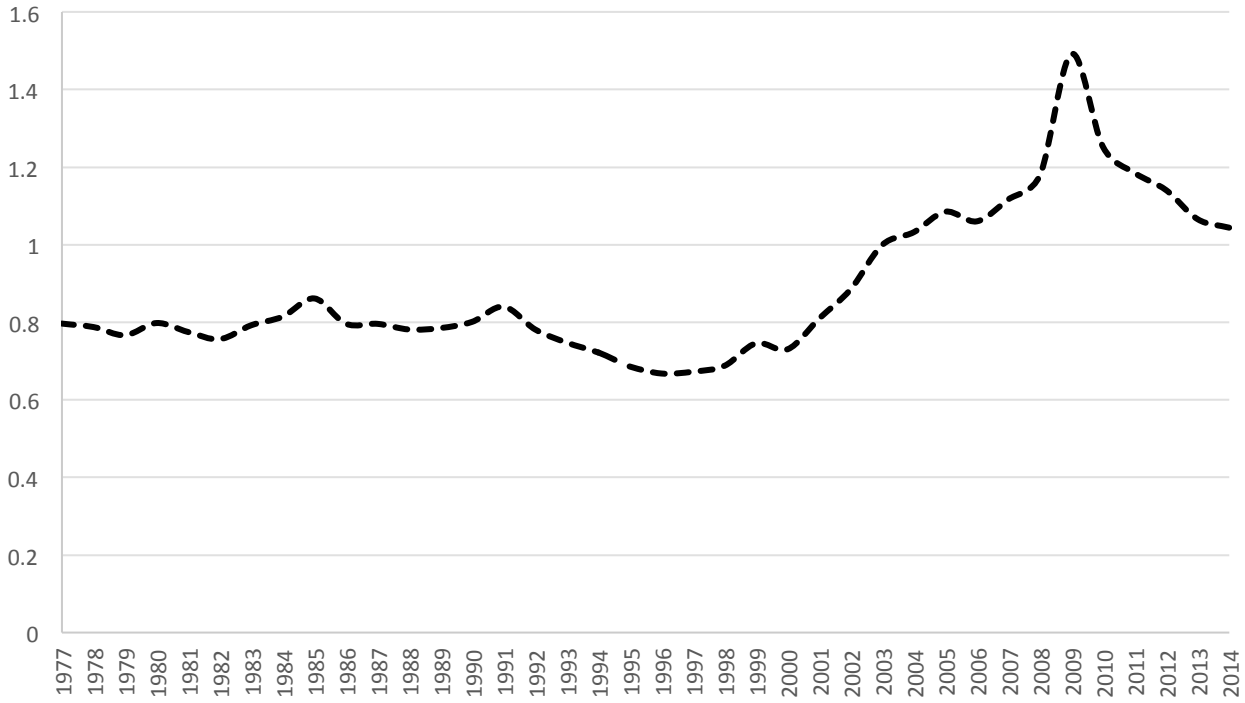
Zang, A. 2012. Evidence on the tradeoff between real activities manipulation and accrual-based earnings management. The Accounting Review, 87, 675-703.

Fig. A.1.
Discretionary budget authority over time.

Panel A. Federal R&D as a percentage of discretionary spending.



Panel B. Discretionary budget authorizations (in $US trillion).



Panel C. Changes in discretionary budget authorizations (in $US trillion).

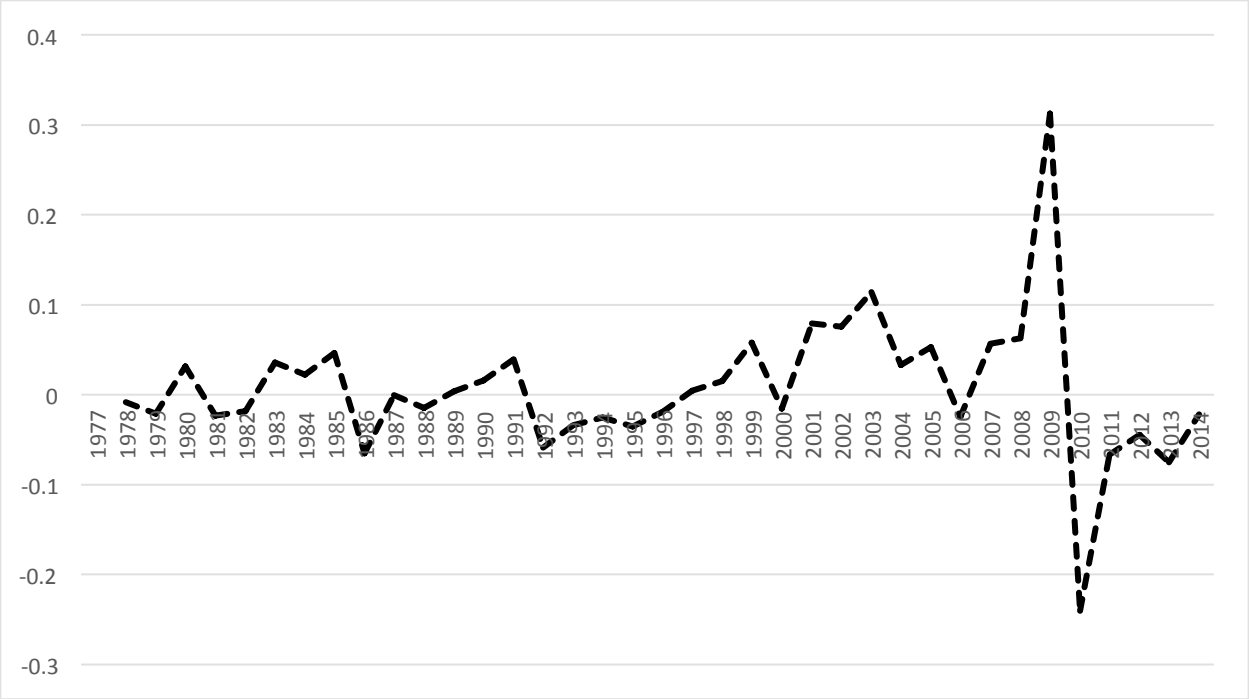


Table A.1.
Industry distribution of firm-customer-years with federal government as a major customer.

Industry	2-Digit SIC	Firm-Years	Percent
Agricultural Production Crops	1	7	0.04
Agricultural Services	7	38	0.2
Metal Mining	10	15	0.08
Oil And Gas Extraction	13	121	0.65
Mining And Quarrying Of Nonmetallic Minerals, Except Fuels	14	25	0.13
Building Construction General Contractors And Operative Builders	15	53	0.29
Heavy Construction Other Than Building Construction Contractors	16	173	0.93
Construction Special Trade Contractors	17	95	0.51
Food And Kindred Products	20	146	0.79
Textile Mill Products	22	35	0.19
Apparel And Other Finished Products Made From Fabrics And Similar Materials	23	25	0.13
Lumber And Wood Products, Except Furniture	24	11	0.06
Furniture And Fixtures	25	88	0.47
Paper And Allied Products	26	31	0.17
Printing, Publishing, And Allied Industries	27	83	0.45
Chemicals And Allied Products	28	769	4.14
Petroleum Refining And Related Industries	29	28	0.15
Rubber And Miscellaneous Plastics Products	30	73	0.39
Leather And Leather Products	31	55	0.3
Stone, Clay, Glass, And Concrete Products	32	65	0.35
Primary Metal Industries	33	201	1.08
Fabricated Metal Products, Except Machinery And Transportation Equipment	34	339	1.83
Industrial And Commercial Machinery And Computer Equipment	35	840	4.53
Electronic And Other Electrical Equipment And Components, Except Computer Equipment	36	2383	12.84
Transportation Equipment	37	1401	7.55
Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks	38	1764	9.51
Miscellaneous Manufacturing Industries	39	23	0.12
Railroad Transportation	40	37	0.2
Local And Suburban Transit And Interurban Highway Passenger Transportation	41	60	0.32
Motor Freight Transportation And Warehousing	42	37	0.2
Water Transportation	44	55	0.3
Transportation By Air	45	79	0.43
Transportation Services	47	17	0.09
Communications	48	128	0.69

Electric, Gas, And Sanitary Services	49	1436	7.74
Wholesale Trade-durable Goods	50	313	1.69
Wholesale Trade-non-durable Goods	51	108	0.58
Building Materials, Hardware, Garden Supply, And Mobile Home Dealers	52	2	0.01
General Merchandise Stores	53	4	0.02
Food Stores	54	7	0.04
Automotive Dealers And Gasoline Service Stations	55	16	0.09
Apparel And Accessory Stores	56	14	0.08
Home Furniture, Furnishings, And Equipment Stores	57	6	0.03
Eating And Drinking Places	58	25	0.13
Miscellaneous Retail	59	253	1.36
Depository Institutions	60	4	0.02
Non-depository Credit Institutions	61	39	0.21
Security And Commodity Brokers, Dealers, Exchanges, And Services	62	18	0.1
Insurance Carriers	63	419	2.26
Insurance Agents, Brokers, And Service	64	32	0.17
Real Estate	65	68	0.37
Holding And Other Investment Offices	67	319	1.72
Hotels, Rooming Houses, Camps, And Other Lodging Places	70	14	0.08
Personal Services	72	10	0.05
Business Services	73	1943	10.47
Automotive Repair, Services, And Parking	75	11	0.06
Miscellaneous Repair Services	76	14	0.08
Motion Pictures	78	12	0.06
Amusement And Recreation Services	79	14	0.08
Health Services	80	2491	13.43
Educational Services	82	195	1.05
Social Services	83	76	0.41
Engineering, Accounting, Research, Management, And Related Services	87	1295	6.98
Nonclassifiable Establishments	99	95	0.51

Table A.2.
Incentives to cut other discretionary expenses by unionization status
This table presents regression results for alternate discretionary expenses used in previous studies on real earnings management (for example, Roychowdhury (2006)). The dependent variable in Columns 1 and 2 is Advertising Expenses (advertising expenses scaled by total assets), and the dependent variable in Columns 3 and 4 is SG&A Expenses (SG&A expenses scaled by total assets). The independent variables of interest include: PEERGOVIND is an indicator equal to 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars). Industry unionization is industry level unionization calculated using data from the *Union Membership and Coverage Database*; high and low refer to above and below median respectively. Control variables (not reported) are similar to models 1-2 of Table 2. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)	(4)
	Advertising		SG&A	
	Industry Unionization		Industry Unionization	
VARIABLES	High	Low	High	Low
PEERGOVIND ×DBA $_t$	0.888	-2.250**	0.762	-15.082***
	(1.71)	(-2.34)	(0.63)	(-4.22)
High-Low	3.14***		15.84***	
test diff H-L	2.87		4.20	
PEERGOVIND	-0.820	2.403**	-0.657	13.495***
	(-1.60)	(2.63)	(-0.57)	(4.44)
Observations	10,828	9,078	36,882	18,715
R-squared	0.862	0.854	0.763	0.851
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A.3.

Budget cycles, peer R&D investment, and relative performance

This table presents regression results that study the impact that relative performance has on earnings management. The dependent variable in model 1 is firm R&D investment in an OLS regression. Models 2 and 3 are logit specifications and follow Bushee (1998) where the dependent variable is an indicator equal to 1 if the firm reduced R&D investment from the previous year and 0 otherwise. In all models, PEERGOVIND is an indicator equal to 1 if the firm does *not* have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise; ΔRELPERFORM is the change in the difference between the earnings of median GD firm and other firms in the same 4-digit SIC industry, interpreted as deviations from the average performing GD firm in the 4-digit SIC industry. DBA is the total discretionary budget authority (in constant 2009 dollars) in models 1 and 2. In model 3, DBA is equal to 1 if the change in DBA from the previous year is positive and 0 otherwise. Control variables (not reported) include: CASHHOLD is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors that are double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
	Continuous DBA		DBA = 1 if ΔDBA > 0
	R&D	Y=1 if ΔR&D<0	Y=1 if ΔR&D<0
PEERGOVIND ×DBA	-0.663*	0.075	-0.069
	(-1.99)	(0.62)	(-1.40)
ΔRELPERFORM × PEERGOVIND × DBA	-0.119***	0.031***	0.009***
	(-5.07)	(7.99)	(5.41)
ΔRELPERFORM × DBA	0.060***	-0.017***	-0.011***
	(3.87)	(-5.73)	(-6.88)
ΔRELPERFORM	-0.040***	0.012***	0.000
	(-3.79)	(5.69)	(0.57)
ΔRELPERFORM × PEERGOVIND	0.107***	-0.027***	-0.000
	(5.00)	(-7.92)	(-0.60)
PEERGOVIND	0.721**	-0.070	0.039
	(2.30)	(-0.60)	(0.95)
Observations	40,976	31,018	31,018
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table A.4.
Accruals evidence of earnings management.
This table presents regression results for firm accounting accruals. The dependent variable is net operating accruals scaled by assets. The independent variables of interest include: PEERGOVIND is an indicator equal to 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise; HIGOVSALES is an indicator equal 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars). Control variables (not reported) are similar to models 1-2 of Table 2. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
$GOVSALES_{t-1} \times DBA_t$	0.017		
	(0.76)		
$GOVSALES_{t-1}$	-0.013		
	(-0.62)		
$HIGOVSALES_{t-1} \times DBA\ t$		0.011	
		(0.71)	
$HIGOVSALES_{t-1}$		-0.004	
		(-0.32)	
$PEERGOVIND \times DBA_t$			0.016**
			(2.56)
PEERGOVIND			-0.014**
			(-2.32)
Observations	44,496	44,496	44,496
R-squared	0.225	0.225	0.225
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table A.5.
Persistence of R&D cuts

This table presents regression results for firm accounting accruals. The dependent variable is net operating accruals scaled by assets. The independent variables of interest include: PEERGOVIND is an indicator equal to 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise; HIGOVSALES is an indicator equal 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars). Control variables (not reported) are similar to models 1-2 of Table 2. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
PEERGOVIND ×DBA $_{t-1}$	-0.695**		
	(-2.03)		
PEERGOVIND ×DBA $_{t-2}$		-0.546	
		(-1.49)	
PEERGOVIND ×DBA $_{t-3}$			-0.700
			(-1.57)
PEERGOVIND	0.685**	0.458	0.606
	(2.25)	(1.42)	(1.57)
Observations	43,091	37,787	33,345
R-squared	0.817	0.814	0.822
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table A.6.
Budget cycles and corporate investment in capital expenditures.
This table presents regression results for firm Capital Expenditures. The independent variables of interest include: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; HIGOVSALES is an indicator equal to 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars) PEERGOVIND is an indicator equal to 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise. Control variables (not reported) are similar to models 1-2 of Table 3. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
		CAPEX	
$GOVSALES_{t-1} \times DBA_t$	0.990		
	(1.10)		
$GOVSALES_{t-1}$	-0.765		
	(-0.82)		
$HIGOVSALES_{t-1} \times DBA_t$		0.925	
		(1.50)	
$HIGOVSALES_{t-1}$		-0.753	
		(-1.24)	
$PEERGOVIND \times DBA_t$			-0.228
			(-0.90)
PEERGOVIND			0.227
			(0.92)
Observations	47,806	47,806	47,806
R-squared	0.623	0.623	0.623
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table A.7.
Analysis by costs of accruals and costs of real earnings management.
This table presents regression results for subsample R&D regressions. The independent variable of interest is PEERGOVIND which is an indicator equal to 1 if the firm does *not* have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars). Auditor Quality is an indicator equal one if a firm uses one of the Big-4 auditors. Following Zang (2012), Financial Health is defined as the modified Altman Z-Score (Altman, 1968; 2000). Firms with Big 4 Auditors and worse financial health have higher costs of accruals earnings management and lower costs of real earnings management and therefore should be more likely to manage earnings by reducing R&D expenditures. Control variables (not reported) include: $CASHHOLD_{t-1}$ is the stock of cash as a percentage of total assets; $CASHFLOW_{t-1}$ is cash flow from operations as a percentage of total assets; $SIZE_{t-1}$ is the natural logarithm of market value of equity; MB_{t-1} is the market to book ratio; LEV_{t-1} is long-term debt plus short-term debt as a percentage of market value; AGE_{t-1} is firm age in years.. Robust t-statistics (with standard errors that are double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)	(4)
	Auditor Quality		Financial Health	
	Not Big 4	Big 4	Low Z-Score	High Z-Score
PEERGOVIND ×DBA_t	-0.365	-1.181***	-0.715*	-1.689**
	(-0.59)	(-3.31)	(-1.78)	(-2.14)
High-Low	-0.816**		-0.974**	
test diff H-L	-2.29		-2.20	
PEERGOVIND	0.410	1.046***	0.594*	1.469**
	(0.68)	(3.27)	(1.67)	(2.14)
Observations	5,881	38,241	15,602	14,802
R-squared	0.844	0.834	0.860	0.823
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No

Table A.8.
R&D persistence of peers of government dependent firms.
This table follows Kothari (2016) and presents dynamic R&D panel regressions. We employ the fixed-effects instrumental variable estimation of Anderson and Hsiao (1982). Model 1 controls only for $SALES_{t-1}$ whereas model 2 includes the following additional controls variables (not reported): $CASHHOLD_{t-1}$ is the stock of cash as a percentage of total assets; $CASHFLOW_{t-1}$ is cash flow from operations as a percentage of total assets; $SIZE_{t-1}$ is the natural logarithm of market value of equity; MB_{t-1} is the market to book ratio; LEV_{t-1} is long-term debt plus short-term debt as a percentage of market value; AGE_{t-1} is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)
$R\&D_{t-1}$	0.224**	0.223**
	(2.54)	(2.57)
$R\&D_{t-1} \times PEERGOVIND \times DBA_t$	-0.132**	-0.128**
	(-2.16)	(-2.11)
$R\&D_{t-1} \times PEERGOVIND$	0.160***	0.160***
	(2.76)	(2.79)
$R\&D_{t-1} \times DBA_t$	0.019	0.009
	(0.20)	(0.10)
PEERGOVIND	-0.609	-0.563
	(-1.43)	(-1.32)
$PEERGOVIND \times DBA_t$	0.419	0.347
	(0.92)	(0.76)
$SALES_{t-1}$	-0.000	-0.000*
	(-0.20)	(-1.82)
Observations	23,299	22,870
Additional Controls	No	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes

Table A.9.

Firms that are always peers vs. those that switch status

This table presents regression results for peer firm R&D. We decompose our main independent variable PEERGOVIND into two independent variables of interest: ALWAYSPEER which is an indicator equal 1 for firms that are always peer firms during our sample; and SWITCHINGPEER which is an indicator equal 1 in years when a firm switches to being a peer firm. DBA is the total discretionary budget authority (in constant 2009 dollars). Control variables (not reported) are similar to models 1-2 of Table 2. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)
SWITCHINGPEER $\times$DBA$_t$	-0.904*	-0.689**
	(-1.66)	(-2.02)
ALWAYSPEER $\times$DBA$_t$	-1.691*	-1.759*
	(-1.70)	(-1.79)
SWITCHINGPEER	2.089***	0.686**
	(4.09)	(2.23)
ALWAYSPEER	4.353***	
	(5.01)	
Observations	47,962	47,816
R-squared	0.379	0.809
Controls	Yes	Yes
Industry FE	Yes	No
Firm FE	No	Yes
Year FE	Yes	Yes

Table A.10.
Budget cycles and corporate employment.
This table presents regression results for firm Employment, defined as the number of employees reported in Compustat scaled by total assets. The independent variables of interest include: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; HIGOVSALES is an indicator equal to 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars) PEERGOVIND is an indicator equal to 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise. Control variables (not reported) are similar to models 1-2 of Table 3. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
		Employment	
$GOVSALES_{t-1} \times DBA_t$	-0.001		
	(-0.42)		
$GOVSALES_{t-1}$	-0.000		
	(-0.05)		
$HIGOVSALES_{t-1} \times DBA_t$		-0.001	
		(-0.64)	
$HIGOVSALES_{t-1}$		0.000	
		(0.05)	
$PEERGOVIND \times DBA_t$			0.001
			(1.45)
PEERGOVIND			-0.001
			(-1.28)
Observations	46,590	46,590	46,590
R-squared	0.438	0.438	0.438
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table A.11.
Budget cycles and peer-firm R&D: The role of internal flexibility
This table presents regression results for firm R&D. The independent variables of interest include: DBA which is the total discretionary budget authority (in constant 2009 dollars) and PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise. Separate regressions are run for above and below median cash holdings. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1) Low Cash	(2) High Cash
PEERGOVIND ×DBA $_t$	-0.114	-0.478
	(-0.41)	(-0.74)
Diff	0.364	
Z-stat	0.497	
PEERGOVIND	0.086	0.601
	(0.34)	(0.90)
Observations	22,881	19,892
R-squared	0.873	0.807
Controls	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes

Table A.12.
Budget cycles and peer-firm access to external credit

This table presents regression results for firm financing. The dependent variables are ln(Spread) which is the natural log of the all-in-spread, ln(Amt.) which is the natural log of the loan amount (either spot or rollover), ln(Rollover amt.) which is the natural log of the rollover loan amount and Covenant which is an indicator equal 1 if the loan has at least one covenant attached to it. The independent variables of interest include: DBA which is the total discretionary budget authority (in constant 2009 dollars) and PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise. Control variables are defined as follows: SIZE is the natural logarithm of total assets; MB is the market to book ratio; PROFITABILITY is return on assets; LEVERAGE is the ratio of debt to assets; TANGIBILITY is the ratio of plant, property and equipment to assets; CASH FLOW VOL is the volatility of cash flows; DEAL AMOUNT is the natural logarithm of the loan amount; COVENANT is an indicator equal one if the loan has at least one covenant; SECURED is an indicator equal one of the loan is secured; SOLE is an indicator equal one if the loan is made by a sole lender; PRIME is an indicator is the loan price base is the prime rate; RELATIONSHIP is an indicator if the lead bank has a past lending relationship with the firm (i.e. in the past five years); PERFORMANCE is an indicator is the loan has performance pricing provisions attached; REFINANCE is an indicator equal one if the loan is a refinancing. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

VARIABLES	(1) ln(Spread)	(2) ln(Amt.)	(3) ln(Rollover amt.)	(4) Covenant (Yes/No)
PEERGOVIND ×DBA $_{t-1}$	-0.103	0.057	-0.025	0.061
	(-0.94)	(0.43)	(-0.17)	(0.88)
PEERGOVIND	0.089	-0.038	0.021	-0.062
	(0.99)	(-0.32)	(0.15)	(-0.99)
SIZE	-0.120***	0.610***	0.617***	-0.032***
	(-11.04)	(52.13)	(49.22)	(-4.13)
MB	-0.049***	0.015	0.011	-0.002
	(-6.03)	(1.38)	(0.87)	(-0.40)
PROFITABILITY	-0.638***	0.326***	0.089	0.490***
	(-9.13)	(2.72)	(0.71)	(9.20)
LEVERAGE	0.617***	0.433***	0.223***	0.022
	(13.83)	(6.17)	(2.65)	(0.67)
TANGIBILITY	-0.191***	-0.162*	-0.170*	-0.009
	(-3.42)	(-1.90)	(-1.69)	(-0.23)
CASH FLOW VOL	0.078	-0.037	-0.078	0.005
	(0.86)	(-0.34)	(-0.59)	(0.08)
DEAL AMOUNT	-0.076***			0.008
	(-6.00)			(0.95)
COVENANT	-0.021	0.033	0.049	
	(-0.89)	(1.01)	(1.28)	
SECURED	0.546***	-0.081***	-0.118***	-0.033**
	(26.33)	(-2.98)	(-4.09)	(-2.48)
SOLE	-0.021	-0.757***	-0.735***	-0.027*
	(-0.83)	(-22.73)	(-19.32)	(-1.65)
PRIME	0.094***	0.125***	0.016	0.208***
	(2.81)	(3.19)	(0.35)	(11.03)
RELATIONSHIP	0.005	0.031	0.014	0.021*
	(0.31)	(1.26)	(0.51)	(1.85)
PERFORMANCE	-0.116***	0.170***	0.256***	0.169***
	(-5.96)	(5.73)	(7.63)	(11.35)
REFINANCE	0.041*	0.186***	0.161***	0.090***
	(1.96)	(6.22)	(4.78)	(5.76)
Observations	4,842	5,217	3,695	5,346
R-squared	0.693	0.858	0.877	0.468
Industry FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Senior debt rating FE	Yes	Yes	Yes	Yes
Type of loan FE	Yes	Yes	No	Yes
Purpose of loan FE	Yes	Yes	Yes	Yes

Table A.13.
Budget cycles and peer-firm R&D: The role technological spillovers

This table presents regression results for firm R&D. The independent variables of interest include: DBA which is the total discretionary budget authority (in constant 2009 dollars) and PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise. Model 1 includes state fixed-effects to our baseline regression. Models 2 and 3 run separate regressions for high and low innovation states. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1) State Fixed-effects	(2) High Innovation State	(3) Low Innovation State
PEERGOVIND ×DBA $_t$	-1.392*** (-2.74)	-1.393** (-2.43)	-1.408 (-1.61)
Diff		0.015	
Z-stat		0.014	
PEERGOVIND	2.936*** (6.25)	3.234*** (6.12)	2.446*** (2.98)
Observations	41,948	36,976	12,143
R-squared	0.4251	0.4024	0.4111
Controls	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table A.14.
Budget cycles and peer-firm R&D: The role political uncertainty

This table presents regression results for firm R&D. The independent variables of interest include: DBA which is the total discretionary budget authority (in constant 2009 dollars), PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise, PRESIDENTIAL ELECTION is an indicator equal 1 in presidential election years, and BBD Political Uncertainty Index is the Baker, Bloom and Davis political uncertainty index. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)
PEERGOVIND $\times$DBA $_t$	-1.876***	-1.578***
	(-5.34)	(-5.06)
PEERGOVIND	1.774***	1.504***
	(5.69)	(5.29)
PRESIDENTIAL ELECTION	0.020	
	(0.30)	
BBD Political Uncertainty Index		-0.002
		(-1.34)
Observations	47,816	44,496
R-squared	0.806	0.824
Controls	Yes	Yes
Firm FE	Yes	Yes
Year FE	No	No

Table A.15.
Budget cycles and firm R&D: The role political contributions
This table presents regression results for firm R&D. The independent variables of interest include: DBA which is the total discretionary budget authority (in constant 2009 dollars), CONRIBUTIONS AMOUNT is the total amount of political contributions made by a firm in a given year scaled by total assets, CONTRIBUTIONS INDICATOR is an indicator equal 1 if a firm makes political contributions in a given year. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)	(4)	(5)	(6)
	All firms		GD firms		Peers	
CONTRIBUTIONS AMOUNT $\times$DBA $_t$	2.663		18.623		-3.606	
	(0.42)		(1.42)		(-0.36)	
CONTRIBUTIONS AMOUNT	-3.078		-15.636		5.713	
	(-0.40)		(-0.90)		(0.47)	
CONTRIBUTIONS INDICATOR $\times$DBA $_t$		-0.326		1.565		-0.640
		(-0.49)		(1.13)		(-0.52)
CONTRIBUTIONS INDICATOR		-0.030		-0.890		0.541
		(-0.04)		(-0.43)		(0.44)
Observations	20,077	20,077	1,163	1,163	9,187	9,187
R-squared	0.872	0.872	0.922	0.922	0.858	0.858
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table A.16.
Market reaction to expected budget tightening.
This table presents empirical results from models examining the relationship between firms with the US government as a significant customer on key event dates and firm values. Panel A presents results from estimation of ordinary least squares (OLS) models; Panel B presents result from estimation of Sefcik and Thompson (1986) models. The dependent variable in the OLS models is Cumulative Abnormal Return (CAR) over the 3-day window surrounding each event day. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. The dependent variable in the Sefcik-Thompson models is the factor portfolio's daily return with coefficient estimates computed as per the procedure described in Section 4. All other variables are as defined in Table 1. Columns 1 and 6 report estimated coefficients for April 18th, 2011, the day that S&P issued a negative outlook on the US government's credit rating. Columns 2 and 7 report estimated coefficients for July 18th, 2011, the day Egan-Jones downgraded US government debt. Columns 3 and 8 report estimated coefficients for August 2nd, 2011, the day an agreement on the increase of the US debt ceiling was reached by congress. Columns 4 and 9 report estimated coefficients for August 5th, 2011, the day S&P downgraded US government debt. Columns 5 and 10 report estimated coefficients for a combined analysis of all event days. Panel C presents abnormal returns regression results to the combined events tested in Panel A, Column 10. Column 1 restricts the sample to firms where PEERGOVIND is 1 and where R&D is non-missing. Column 2 restricts the sample to firms that do not have the federal government as a major customer and where R&D is non-missing. HIRD is an indicator equal to 1 if the firm has above the median in R&D. Control variables (not reported) are the same as those in Panel A. OLS standard errors that are robust to heteroskedasticity and within-firm correlation. Sefcik-Thompson standard errors that are robust to heteroskedasticity and cross-sectional correlation between firms with shared event days. Industry fixed effects (FE) are defined at the 2-digit SIC level. Adjusted R-Squared is suppressed for the Sefcik-Thompson multiple equation models. Observations denotes the number of firm-event observations for OLS models and the number of trading days used in estimation for Sefcik-Thompson models. Robust t-statistics in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

Panel A: OLS estimates

	(1) April 18th	(2) July 18th	(3) August 2nd	(4) August 5th	(5) Combined	(6) April 18th	(7) July 18th	(8) August 2nd	(9) August 5th	(10) Combined
$GOVSALES_{t-1}$	-0.016***	-0.016**	-0.010	-0.004	-0.046**					
	(-2.75)	(-2.44)	(-1.28)	(-0.34)	(-2.36)					
$HIGOVSALES_{t-1}$						-0.006**	-0.008***	-0.007*	-0.004	-0.025***
						(-2.06)	(-2.76)	(-1.95)	(-0.64)	(-2.97)
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3737	3678	3673	3673	3737	3744	3685	3680	3680	3744
R-squared	0.055	0.138	0.140	0.192	0.147	0.054	0.138	0.14	0.192	0.147

Panel B: Sefcik-Thompson estimates

	(1) April 18th	(2) July 18th	(3) August 2nd	(4) August 5th	(5) Combined	(6) April 18th	(7) July 18th	(8) August 2nd	(9) August 5th	(10) Combined
$GOVSALES_{t-1}$	-0.005*	-0.005*	-0.005**	-0.012***	-0.006***					
	(-1.90)	(-1.80)	(-1.99)	(-4.18)	(-4.53)					
$HIGOVSALES_{t-1}$						-0.002	-0.003**	-0.004***	-0.005***	-0.003***
						(-1.33)	(-2.25)	(-3.23)	(-4.15)	(-5.06)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	210	210	210	210	210	210	210	210	210

Table A.17.

Budget cycles and market-to-book ratios for peer firms

This table presents regression results for firm market-to-book ratios. The independent variables of interest include the following: PEERGOVIND is an indicator equal to 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm that has the federal government as a major customer and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars). Control variables include: CASHHOLD is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)	(4)	(5)	(6)
	DBA @ t		DBA @ t-1		DBA @ t-2	
	Full Sample	Non-government dependent firms	Full Sample	Non-government dependent firms	Full Sample	Non-government dependent firms
PEERGOVIND ×DBA $_t$	-0.829***	-0.891***	-0.402***	-0.363	-0.547***	-0.503**
	(-5.99)	(-6.22)	(-3.17)	(-1.42)	(-3.46)	(-2.61)
PEERGOVIND	0.778***	0.855***	0.387***	0.367	0.507***	0.437**
	(6.01)	(6.52)	(3.24)	(1.69)	(3.55)	(2.69)
Observations	44,496	40,310	40,442	36,562	35,405	30,716
R-squared	0.547	0.556	0.598	0.617	0.562	0.622
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table A.18.
Corporate investment in response to the Budget Control Act of 2011.
This table presents regression results for firm R&D in response to the Budget Control Act of 2011. Model 1 includes observations from 2005 to 2013. The independent variables of interest include: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; BCA is an indicator variable equal to 1 for observations following 2011 and 0 otherwise. Control variables include: CASHHOLD is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Both models include firm and year fixed effects. The coefficient on BCA is not included because it is spanned by the year fixed effects. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1) 2005-2013
$GOVSALES_{t-1} \times BCA$	-1.751*
	(-2.30)
$GOVSALES_{t-1}$	-0.515
	(-0.45)
Observations	13,873
R-squared	0.877
Controls	Yes
Firm FE	Yes
Year FE	Yes

Table A.19.
Instrument validation

This table presents regression results of univariate regressions of SPLIT CONTINUOUS and SPLIT in panel A and the proportion of democrats in the house and senate in panel B on various leading indicators of economic performance. These include volatility indices, VIX and VXO, taken from the Chicago Board Options Exchange; the consumer sentiment (confidence) index, from Thomson Reuters/University of Michigan, and the United States leading index for economic activity (growth indicator), taken from the Federal Reserve Bank of Philadelphia. SPLIT CONTINUOUS is defined as the proportion of Democrats in the Senate (including the Vice President in cases where the ratio is exactly 50%, because the Vice President acts as a tiebreaker) minus 0.5, multiplied by the ratio of Republicans in the House minus 0.5, scaled by the maximum (0.25). SPLIT is defined as 1 if the House and Senate are controlled by different parties and 0 otherwise.

Panel A: Instruments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SPLIT CONTINUOUS				SPLIT			
end of year VIX	0.001				0.015			
	(1.37)				(1.16)			
end of year VXO		0.000				0.005		
		(0.84)				(0.44)		
end of year consumer sentiment			0.001				-0.008	
			(1.02)				(-1.39)	
US leading growth indicator				0.003				0.031
				(1.02)				(0.30)
Constant	-0.018**	-0.014*	-0.062***	-0.010**	-0.061	0.142	1.025*	0.293*
	(-2.34)	(-2.05)	(-2.99)	(-2.13)	(-0.22)	(0.59)	(2.01)	(1.85)
Observations	25	29	37	33	25	29	37	33
R-squared	0.031	0.037	0.000	0.047	0.055	0.007	0.052	0.003

Panel B: Ratio of democrats to republicans in congress

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	house = house dems/house reps				senate=senate dems/senate reps			
end of year VIX	-0.00231				-0.00594			
	(-0.270)				(-0.988)			
end of year VXO		0.000254				-0.00451		
		(0.035)				(-0.934)		
end of year consumer sentiment			-0.0107**				-0.00894***	
			(-2.668)				(-3.604)	
US leading growth indicator				0.0295				-0.0260
				(0.465)				(-0.628)
Constant	1.131***	1.129***	2.135***	1.137***	1.174***	1.159***	1.826***	1.076***
	(6.278)	(7.101)	(6.243)	(11.543)	(9.244)	(10.934)	(8.613)	(16.734)
Observations	25	29	37	33	25	29	37	33
R-squared	0.003	0.000	0.169	0.007	0.041	0.031	0.270	0.013

Table A.20.
Analyst estimates of government-dependent industries

This table presents regression results for the mean and median monthly analyst ratings for firms in the health and defense industries and government-dependent industries. Mean (Median) Estimate is the average (median) winsorized analyst earnings estimate in a given month for a firm in model 1 (2). Mean (Median) Estimate is the average (median) winsorized analyst earnings estimate in a given industry for the average (median) firm in that industry in model 3 (4). The independent variables include: HEALTH_DEFENSE is an indicator variable equal to 1 if the firm is in the health sector or defense industry and 0 otherwise. PREELECTION is an indicator variable equal to 1 if the estimate is in the three months prior to an election (August-October) in a congressional election year and 0 otherwise. 2010 is an indicator variable equal to 1 if the estimate is in the year 2010, when a split congress was elected in U.S. and 0 otherwise. All interactions and standalone variables not reported in these models are subsumed by firm/industry and year-month fixed effects. Robust t-statistics (with standard errors double clustered by firm/industry and year-month) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)	(4)
	Mean Estimate	Median Estimate	Mean Estimate	Median Estimate
HEALTH_DEFENSE ×	-0.024	-0.023	0.023	0.036
PREELECTION × 2010	(-0.44)	(-0.42)	(0.46)	(1.38)
HEALTH_DEFENSE ×	-0.042	-0.039	-0.069	-0.092**
PREELECTION	(-0.77)	(-0.70)	(-1.22)	(-2.61)
HEALTH_DEFENSE × 2010	0.508***	0.506***	0.058	0.031
	(7.15)	(7.12)	(0.39)	(-0.25)
Unit of Analysis	Firm-Month	Firm-Month	Industry-Month	Industry-Month
Observations	1,421,613	1,421,613	34,992	34,992
R-squared	0.605	0.605	0.576	0.599
Firm FE	Yes	Yes	No	No
Industry FE	No	No	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes

Table A.21.
Testing the validity of instrumental variables.
This table presents statistics from several tests of the validity of the instrumental variables used in the paper and Internet Appendix. Panel A reports statistics for regressions using GOVSALES, whereas Panel B reports statistics for regressions using HIGOVSALES. GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; HIGOVSALES is an indicator equal to 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; Column 1 presents various test statistics for SPLIT CONTINUOUS as defined in Table 9 and used in Model 1 of Table 9. Column 2-4 present test statistics for SPLIT, HOUSE SPLIT, and HOUSE SPLIT and SENATE SPLIT as used in Models 1-3 of Table A.19, Panel A, respectively. Test statistics include the Kleibergen-Paap rk LM statistic, the Cragg-Donald Wald F statistic, the Kleibergen-Paap rk Wald F statistic, the Stock-Yogo weak ID test, and the Hansen J statistic.

Panel A. GOVSALES.

	SPLIT CONTINUOUS	SPLIT	HOUSE SPLIT	HOUSE SPLIT and SENATE SPLIT
	(1)	(2)	(3)	(4)
Underidentification test. H0: equation is underidentified (Kleibergen-Paap rk LM statistic [p-value])	7.74 [0.005]	7.13 [0.008]	5.26 [0.022]	5.35 [0.067]
Weak identification test. H0: equation is weakly identified				
Cragg-Donald Wald F statistic	8256.58	13019.74	4380.23	3382.35
Kleibergen-Paap rk Wald F statistic	8.07	6.66	5.21	4.43
Stock-Yogo weak ID test critical values	3.36-7.03	3.63-7.03	3.36-7.03	5.45-13.43
Hansen J statistic [p-value]. H0: instruments are jointly valid	n/a	n/a	n/a	0.412 [0.521]

Panel B. HIGOVSALES.

	SPLIT CONTINUOUS	SPLIT	HOUSE SPLIT	HOUSE SPLIT and SENATE SPLIT
Panel B: HIGOVSALES	(1)	(2)	(3)	(4)
Underidentification test. H0: equation is underidentified (Kleibergen-Paap rk LM statistic [p-value])	7.74 [0.005]	7.13 [0.008]	5.25 [0.022]	5.34 [0.069]
Weak identification test. H0: equation is weakly identified				
Cragg-Donald Wald F statistic	8255.9	13018.84	4377.21	3380.4
Kleibergen-Paap rk Wald F statistic	8.07	6.66	5.2	4.42
Stock-Yogo weak ID test critical values	3.63-7.03	3.63-7.03	3.63-7.03	5.45-13.43
Hansen J statistic [p-value]. H0: instruments are jointly valid	n/a	n/a	n/a	0.406 [0.524]

Table A.22.

Budget cycles and corporate R&D investment: alternative instrumental variable results.

This table presents regression from a three-stage procedure following Wooldridge (2002) in estimating results for firm R&D and as described in Table 10, Section 5.2, and Section A5.2. The alternative instruments are the following: SPLIT is defined as 1 if the House and Senate are controlled by different parties and 0 otherwise; HOUSE SPLIT is defined as the ratio of Democrats to Republicans in the House when the number of Democrats in the House is less than the number of Republicans. It is defined as the ratio of Republicans to Democrats in the House when the number of Republicans in the House is less than the number of Democrats. SENATE SPLIT is defined similar to HOUSE SPLIT but for the Senate. Panel A reports the first stage results for the alternative instruments, Panel B reports the second stage results for the alternative instruments, and Panel C reports the third stage results for the alternative instruments. Control variables (not reported) include: CASHHOLD is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years, firm fixed-effects, macroeconomic controls (as defined in Table 3) and a linear time trend due to the lack of year fixed effects (which cannot be included because DBA varies by year). Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

Panel A. First stage

	(1)	(2)	(3)
		DBA_t	
$SPLIT_t$	-0.130***		
	(-3.65)		
$HOUSE\ SPLIT_t$		-0.551***	-0.440*
		(-3.23)	(-1.83)
$SENATE\ SPLIT_t$			-0.164
			(-0.65)
$GOVSALES_{t-1}$	0.001	-0.015	-0.014
	(0.09)	(-1.69)	(-1.62)
Observations	47,806	47,806	47,806
R-squared	0.940	0.922	0.924
Controls	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	No	No	No

Panel B. Second stage

	(1) DBA_t	(2) $GOVSALES_{t-1} \times DBA_t$	(3) DBA_t	(4) $GOVSALES_{t-1} \times DBA_t$	(5) DBA_t	(6) $GOVSALES_{t-1} \times DBA_t$
$SPLIT_t$	-0.130***	0.000				
	(-3.65)	(0.06)				
$HOUSE\ SPLIT_t$			-0.551***	0.002	-0.440*	0.004
			(-3.23)	(0.43)	(-1.83)	(0.71)
$SENATE\ SPLIT_t$					-0.164	-0.003
					(-0.65)	(-0.71)
$GOVSALES_{t-1} \times DBAHAT_t$	-0.034	0.989***	0.004	0.993***	0.001	0.993***
	(-1.58)	(22.05)	(0.17)	(12.88)	(0.04)	(13.98)
$GOVSALES_{t-1}$	0.026	0.172***	-0.016	0.755***	-0.014	0.840***
	(1.23)	(4.94)	(-1.52)	(62.85)	(-1.54)	(79.12)
Observations	47,806	47,806	47,806	47,806	47,806	47,806
R-squared	0.940	0.997	0.922	0.995	0.924	0.995
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No

Panel C. Third stage

Panel C: Third Stage	(1)	(2) R&D	(3)
$[GOVSALES_{t-1} \times DBA_t]$ HAT	5.461**	6.316*	6.087*
	(2.01)	(1.95)	(1.91)
$DBAHAT2_t$	-5.624**	3.314	2.491
	(-2.63)	(1.08)	(0.87)
$GOVSALES_{t-1}$	-5.050**	-5.822**	-5.615**
	(-2.34)	(-2.24)	(-2.21)
Observations	47,806	47,806	47,806
R-squared	0.808	0.807	0.807
Controls	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	No	No	No

Table A.23
Budget cycles and government dependence
This table presents regression results for the determinants of government dependence. The dependent variables are: (1) GOV is an indicator equal 1 if the federal government is a major customer and 0 otherwise; (2) GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; and (3) HIGOVSALES is an indicator equal 1 if GOVSAES is above median and 0 otherwise; The independent variable of interest is DBA. DBA is the total discretionary budget authority (in constant 2009 dollars). Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. INFLATION is the annual inflation rate based on the consumer price index; GROWTH is the annual growth in real gross domestic product; 10YRTB is the 10-year constant maturity treasury bond rate; URATE is the unemployment rate. Models 1 and 3 are logistic regressions whereas Model 2 is a least squares regression. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)	(4)	(5)	(6)
	GOV		GOVSALES		HIGOVSALES	
DBA_t	-0.002	-0.002	0.007***	0.008***	0.018***	0.018***
	(-0.36)	(-0.24)	(2.84)	(3.19)	(3.99)	(3.99)
R&D CUT		0.003		0.004		0.001
		(0.39)		(1.47)		(0.27)
R&D CUT $\times DBA_t$		-0.004		-0.006**		-0.003
		(-0.54)		(-1.98)		(-0.52)
Observations	98,243	98,243	96,412	96,412	98,243	98,243
R-squared	0.656	0.656	0.592	0.592	0.617	0.617
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No

Table A.24.
Budget cycles and corporate R&D investment: Selection effects
This table presents regression results for firm R&D for the subsample of government dependent firms. The independent variables of interest include: HIGOVSALES is an indicator equal 1 for firms with above median value of total firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars). PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
$HIGOVSALES_{t-1} \times DBA_t$	4.182***	4.085***	2.472**
	(3.06)	(3.00)	(2.30)
$HIGOVSALES_{t-1}$	-4.028***	-3.923***	-2.760***
	(-3.48)	(-3.42)	(-2.63)
DBA_t	-2.529***		
	(-4.80)		
Observations	14,566	14,566	13,364
R-squared	0.786	0.788	0.808
Firm FE	Yes	Yes	Yes
Year FE	No	Yes	No
Industry-Year FE	No	No	Yes

Table A.25.
Budget cycles and corporate investment using a propensity score matched sample
This table presents regression results for firm R&D. The independent variables of interest include the following: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; HIGOVSALES is an indicator equal to 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars); PEERGOVIND is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise. Control variables include the following: CASHHOLD is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years; Government dependent firms (firms with GOVSALES > 0 in specification 1 and where HIGOVSALES = 1 in specification 2) are matched to their 5 peer and 5 non-peer nearest neighbors with common support and matched within year on all control characteristics listed above (Rosenbaum and Rubin, 1983). Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
$GOVSALES_{t-1} \times DBA_t$	4.597*		
	(2.03)		
$GOVSALES_{t-1}$	-4.201**		
	(-2.26)		
$HIGOVSALES_{t-1} \times DBA_t$		1.016*	
		(1.76)	
$HIGOVSALES_{t-1}$		-1.492**	
		(-2.38)	
$PEERGOVIND \times DBA_t$			-1.088*
			(-1.80)
PEERGOVIND			0.952*
			(1.81)
Observations	16,304	16,221	16,872
R-squared	0.787	0.781	0.785
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Table A.26.
Budget cycles and corporate R&D investment: The influence of large non-government customers
This table presents regression results for firm R&D investment. The independent variables of interest include: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; HIGOVSALES is an indicator equal 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars), PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise, LARGE CUSTOMER is an indicator equal 1 if a firm reports having a large non-government customer in a given year and zero otherwise, and LARGE CUSTOMER PEER is an indicator equal 1 if the firm does not a large corporate customer but operates in an industry (4-digit sic) with at least one firm who reports having a large corporate customer and 0 otherwise. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)	(4)	(5)
$GOVSALES_{t-1} \times DBA_t$	4.849***				
	(2.64)				
$GOVSALES_{t-1}$	-5.008***				
	(-3.01)				
$HIGOVSALES_{t-1} \times DBA_t$		3.683***			
		(2.72)			
$HIGOVSALES_{t-1}$		-3.679***			
		(-3.24)			
$PEERGOVIND \times DBA_t$			-0.869**		
			(-2.45)		
PEERGOVIND			0.847***		
			(2.68)		
$LARGE\ CUSTOMER_{t-1} \times DBA_t$				-1.098**	
				(-2.56)	
$LARGE\ CUSTOMER_{t-1}$	-0.258*	-0.249*	-0.261**	0.745*	
	(-1.93)	(-1.87)	(-1.96)	(1.86)	
$LARGE\ CUSTOMER\ PEER_{t-1} \times DBA_t$					1.065**
					(2.47)
$LARGE\ CUSTOMER\ PEER_{t-1}$					-0.714*
					(-1.78)
Observations	47,816	47,816	47,816	47,816	47,816
R-squared	0.808	0.808	0.808	0.808	0.808
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table A.27.
Is Table 3 the result of a large firm effect?
This table presents regression results for firm R&D. The independent variables of interest include the following: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; LARGEFIRM is an indicator equal to 1 if SIZE is in the top quintile for the sample and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars). Control variables include the following: CASHHOLD is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years; Government dependent firms (firms with GOVSALES > 0 in specification 1 and where HIGOVSALES = 1 in specification 2) are matched to their 5 peer and 5 non-peer nearest neighbors with common support and matched within year on all control characteristics listed above (Rosenbaum and Rubin, 1983). Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)
$LARGE\ FIRM_{t-1} \times DBA_t$	-0.145	-0.138
	(-0.33)	(-0.32)
$LARGE\ FIRM_{t-1}$	0.488	0.484
	(0.79)	(0.78)
$GOVSALES_{t-1} \times DBA_t$		5.263**
		(2.17)
$GOVSALES_{t-1}$		-5.055***
		(-2.63)
Observations	16,304	16,221
R-squared	0.787	0.781
Controls	Yes	Yes
Year FE	Yes	Yes
Firm FE	Yes	Yes

Table A.28.
Budget cycles and corporate R&D investment excluding the crisis

This table presents regression results for firm R&D investment, excluding the financial crisis. The table replicates the analysis of Table 2, Panel A, columns 3 and 4 and Table 3, column 1, excluding the years 2007-2009. The independent variables of interest include: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; HIGOVSALES is an indicator equal 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars); PEERGOVIND is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
		R&D	
$GOVSALES_{t-1} \times DBA_{t-1}$	6.664**		
	(2.27)		
$GOVSALES_{t-1}$	-6.099**		
	(-2.52)		
$HIGOVSALES_{t-1} \times DBA_{t-1}$		5.205**	
		(2.35)	
$HIGOVSALES_{t-1}$		-4.669**	
		(-2.68)	
$PEERGOVIND \times DBA_{t-1}$			-1.113**
			(-2.09)
PEERGOVIND			0.973*
			(2.09)
Observations	42,276	42,276	42,276
R-squared	0.810	0.810	0.810
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Table A.29.

Budget cycles and corporate R&D investment: Disaggregated budget authorities by industry

This table presents regression results for firm R&D investment. The independent variables of interest include: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise (Panel A); HIGOVSALES is an indicator equal 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise (Panel B); PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise (Panel C); DBA is the total discretionary budget authority (in constant 2009 dollars) disaggregated at the industry level, each column represents the DBA for a different industry. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

Panel A. Government Sales

	(1) National Defense	(2) Medicare	(3) Health	(4) Energy	(5) Transport	(6) General Science	(7) Agriculture	(8) Other
$GOVSALES_{t-1} \times DBA_t$	0.841***							
	(2.64)							
$GOVSALES_{t-1} \times DBA_t$		138.677**						
		(2.32)						
$GOVSALES_{t-1} \times DBA_t$			8.060***					
			(3.23)					
$GOVSALES_{t-1} \times DBA_t$				-2.397				
				(-1.08)				
$GOVSALES_{t-1} \times DBA_t$					5.829**			
					(2.49)			
$GOVSALES_{t-1} \times DBA_t$						29.035***		
						(2.65)		
$GOVSALES_{t-1} \times DBA_t$							55.884**	
							(2.47)	
$GOVSALES_{t-1} \times DBA_t$								1.420**
								(2.54)
$GOVSALES_{t-1}$	-4.597***	-6.752***	-3.908***	-0.310	-2.037***	-7.903***	-3.816**	-3.935***
	(-2.93)	(-2.62)	(-3.33)	(-0.49)	(-2.71)	(-2.82)	(-2.33)	(-2.88)
Observations	47,816	47,816	47,816	47,816	47,816	47,816	47,816	47,816
R-squared	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B. High Government Sales Indicator

	(1) National Defense	(2) Medicare	(3) Health	(4) Energy	(5) Transport	(6) General Science	(7) Agriculture	(8) Other
$HIGOVSALES_{t-1}$×DBA t	0.621***							
	(2.64)							
$HIGOVSALES_{t-1}$×DBA t		115.197**						
		(2.44)						
$HIGOVSALES_{t-1}$×DBA t			6.323***					
			(3.51)					
$HIGOVSALES_{t-1}$×DBA t				-1.507				
				(-0.89)				
$HIGOVSALES_{t-1}$×DBA t					4.587***			
					(2.68)			
$HIGOVSALES_{t-1}$×DBA t						22.080***		
						(2.85)		
$HIGOVSALES_{t-1}$×DBA t							45.584**	
							(2.49)	
$HIGOVSALES_{t-1}$×DBA t								1.133***
								(2.67)
$HIGOVSALES_{t-1}$	-3.309***	-5.471***	-2.976***	-0.190	-1.508***	-5.917***	-3.004**	-3.033***
	(-3.12)	(-2.82)	(-3.68)	(-0.38)	(-2.98)	(-3.10)	(-2.28)	(-3.18)
Observations	47,816	47,816	47,816	47,816	47,816	47,816	47,816	47,816
R-squared	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel C. Peers

	(1) National Defense	(2) Medicare	(3) Health	(4) Energy	(5) Transport	(6) General Science	(7) Agriculture	(8) Other
PEERGOVIND ×DBA $_{t-1}$	-0.165***							
	(-2.62)							
PEERGOVIND ×DBA $_{t-1}$		-7.214						
		(-0.74)						
PEERGOVIND ×DBA $_{t-1}$			-1.244**					
			(-2.32)					
PEERGOVIND ×DBA $_{t-1}$				-0.676				
				(-1.10)				
PEERGOVIND ×DBA $_{t-1}$					-1.005*			
					(-1.94)			
PEERGOVIND ×DBA $_{t-1}$						-6.344**		
						(-2.40)		
PEERGOVIND ×DBA $_{t-1}$							-17.340**	
							(-2.56)	
PEERGOVIND ×DBA $_{t-1}$								-0.165
								(-1.55)
PEERGOVIND ×DBA $_{t-1}$	0.835***	0.361	0.597**	0.081	0.301**	1.656**	1.088**	0.448*
	(2.77)	(0.85)	(2.45)	(0.84)	(2.06)	(2.47)	(2.56)	(1.72)
Observations	47,816	47,816	47,816	47,816	47,816	47,816	47,816	47,816
R-squared	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.30.
Budget cycles and corporate R&D investment excluding financials and utilities
This table presents regression results for firm R&D investment, excluding the financial and utilities firms. The independent variables of interest include: GOVSALES is the ratio of firm sales sold to the federal government as a fraction of total sales (for firms with the federal government as a major customer) and 0 otherwise; HIGOVSALES is an indicator equal 1 if GOVSALES is above median (for firms with the federal government as a major customer) and 0 otherwise; DBA is the total discretionary budget authority (in constant 2009 dollars) PEERGOVIND which is an indicator equal 1 if the firm does not have the federal government as a major customer but operates in an industry (4-digit sic) with at least one firm who has the federal government as a major customer and 0 otherwise. Control variables include: CASHHOLD which is the stock of cash as a percentage of total assets; CASHFLOW is cash flow from operations as a percentage of total assets; SIZE is the natural logarithm of market value of equity; MB is the market to book ratio; LEV is long-term debt plus short term debt as a percentage of market value; AGE is firm age in years. Robust t-statistics (with standard errors double clustered by firm and year) in parentheses. Significance levels of 10, 5, and 1 percent are represented by *, **, and ***.

	(1)	(2)	(3)
$GOVSALES_{t-1} \times DBA_t$	5.375***		
	(2.76)		
$GOVSALES_{t-1}$	-5.382***		
	(-3.09)		
$HIGOVSALES_{t-1} \times DBA\ t$		4.061***	
		(2.86)	
$HIGOVSALES_{t-1}$		-3.954***	
		(-3.34)	
$PEERGOVIND \times DBA_t$			-1.070***
			(-2.77)
PEERGOVIND			0.940***
			(2.72)
Observations	44,276	44,276	44,276
R-squared	0.805	0.805	0.805
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes