Buying on certification: Government procurement and credit ratings

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Abstract

This paper examines how the spending of the public sector is influenced by a certification from the private sector – that is, how the federal government responds to a change in supplier firms' credit ratings in the process of government procurement. Using a triple-difference framework around shifts in supplier firms' rating certification, we find that the government significantly increases the spending on firms that receive positive rating certification, and lowers the spending on firms that receive negative certification. In sharp contrast, firms' non-government customers do not exhibit a similar response. In cross-sectional analyses, we find that the public sector's response is more pronounced when a procurement involves larger stakes of taxpayers, and when a rating certification has a more substantial impact on taxpayers' wealth. These results combined suggest that government agents tend to put particular attention on rating agencies' external certification to ensure, and potentially to signal through this certification, that taxpayers' stake are not put at risk. Our findings highlight a significant effect of credit rating certification on the spending of the public sector through government procurement.

Key words: Government procurement, public spending, rating certification, credit ratings

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1. INTRODUCTION

Federal government procurement plays a central role in the private sector of the United States. The amount of government procurement from private-sector companies has been rising steadily over the past decade. In the fiscal year of 2012, the government spent more than $500 billion, or approximately 14% of the federal budget, on private-sector contractors (Sahadi, 2012).[1] Existing studies has shown that the spending of the public sector influences various aspects of private-sector companies, including their investment, cash holdings, employment, intellectual capitals, and growth prospects (e.g., Cohen, Coval, and Malloy, 2011, 2014; Cohen and Li, 2014; Serrato and Wingender, 2011; Shoag 2011). In this paper, we flip the script, and examine how the spending of public sector is influenced by a certification that comes from the private sector – credit ratings issued by rating agencies. Specifically, we examine how the federal government's procurement decisions respond to changes in supplier firms' credit rating certification.

Credit ratings serve as an influential certification for firms' credit quality in the private sector. For example, they are widely used by corporate management to make capital structure and security issuance decisions, and by equity analysts to make earnings forecasts and trading recommendations (Graham and Harvey 2001; Kisgen, 2006, 2009; Ederington and Goh, 1998). Nonetheless, little is known about how the public sector would use this certification for their spending decisions, particularly in procurement process. Government procurement involves taxpayers' wealth at stake. In the procurement process, government contracting agents aim to minimize any cost and risk associated with supplier firms' failure of fulfilling a contract (see, e.g., the Federal Acquisition Regulation system (FAR), 9.104-1; FAR, 32.403). These government agents therefore have strong incentives to screen out suppliers with inadequate financial resources and week financial conditions to ensure, and also to signal, that taxpayers' stake are not put at risk. Hence, as a crucial certification for firms' financial conditions, credit

[1] In a recent study by Cohen, Coval, and Malloy (2014), the authors document that government procurement contributes to about 23% of the revenues of an average private-sector company that specialize in government sales between 1977 and 2011.

ratings could have a material effect on the government's selection of contractors and determination of contracting terms.[2]

This impact is clearly seen in practice. For example, in January 2001, the Department of Defense issued a request for a contract to establish Wide Area Networking to support the Defense Research Engineering Network. A number of firms responded to this request. After evaluating all candidates, the Department decided to award an indefinite-delivery/indefinite-quantity contract to Global Crossing Telecommunications, Inc. In December 2001, however, this decision was brought into question. The contracting officer became aware of adverse information about the company's financial position, including a drop in the firm's Standard & Poor's (S&P) credit rating to a speculative grade. This observation led the contracting officer to request a review of the award, which in turn set off a series of investigations on the firm's financial conditions. On March 7, 2002 – three months after the investigations were initiated, the Department decided to recommend against making the award to Global Crossing, stating that the company's poor financial conditions could "*expose the Government to significant risks in entering into any contracts.*" Two weeks after this decision, the Department proceeded to award the same contract to another company, MCI Communication. In this award, the contracting officer cited MCI's more favorable rating from S&P (BBB+) as a support for the company's "*adequate capacity to meet its financial commitment.*"[3]

The influence of rating certification on government procurement decisions is apparently recognized by market participants. For example, following Northrop Grumman Corp – a major supplier of military equipment to the federal government – was put on watch for a potential downgrade, analysts immediately expressed concerns that a negative rating revision could "*put Northrop at a competitive disadvantage in bidding for government contracts.*" (Barr, 2002.) We systematically examine whether this influence prevails as suggested by the anecdotal evidence.

Identifying the government's response to rating certification changes is challenging

[2] See, e.g., Holthausen and Leftwich (1986), Hand, Holthausen, and Leftwich (1992), Jorion, Liu and Shi (2005), and Kliger and Sarig (2000), for the information value of credit ratings.

[3] For more detailed information about this case, please see the website of the U.S. Government Accountability Office at http://www.gao.gov/products/402830#mt=e-report.

because these changes are typically confounded by contemporaneous changes in firm fundamentals. For example, a supplier firm's rating downgrade may come as a result of the firm's overall declining financial conditions, which simultaneously causes a shrink in its production supply. Then if we observe a decrease in this firm's government contracts, it might simply reflect the firm's reduced product supply *ex ante*, rather than the government's lowered willingness to contract with this firm due to the rating downgrade. To disentangle this confounding effect, we employ a triple-difference test around a quasi-natural experiment that alters firms' credit rating certification.

On April 26, 1982, Moody's refined its reporting system by introducing modifiers to its previous broad rating categories for all firms with an outstanding Moody's rating. It differentiated firms in each broad category into more refined subclasses based on their relative credit worthiness. Firms with a higher credit quality in a broad category received an "upgrade", or positive certification; firms with a lower credit quality received a "downgrade", or negative certification during the refinement.

As an important feature, Moody's refined ratings were assigned based on the same set of firm information used in the previous coarse rating categories, and merely served as the release of a finer set of rating certification not triggered by changes in firm fundamentals.[4] Hence, a shift in government spending surrounding this rating certification change should not be driven by shifts in the firm's product supply ex ante arising from its contemporaneous fundamental changes. We thus compare government spending on each supplier firm before and after Moody's rating refinement (the first difference), across firms that receive positive and negative certification during the refinement (the second difference). Whereas the first difference could merely reflect time-invariant differences in government spending across firms, the second difference nets them out and allows us to identify changes in government spending that is not associated with firm fundamental changes ex ante.

[4] As Moody's states, "The numerical modifiers are only refinements of the defined categories. The relative positions of all of Moody's corporate bond rating symbols, and their definitions, remain unchanged as do all procedures for bond rating." (Moody's Investors Service, 1982a, 1982b)

It is possible, however, that Moody's rating refinement would affect a firm's product supply *ex post*, through investors' changing perceptions about the firm's credit quality. For instance, after observing Moody's negative certification, investors might increase a firm's cost of borrowing because they realize that the firm was at the bottom of the previous coarse category (Tang, 2009). Increased cost of capital hinders the firm's production, leading to a shrink in its government contracts following the rating refinement. To control for this ex post effect, we further contrast a firm's changes in the spending of its government customers with those in the spending of the firm's non-government (i.e., private-sector) customers (i.e., the third difference). This third difference helps us tease out possible ex-post shifts in the firm's overall product supply, and allows us to further identify the government's responses to changes in rating certification.

We obtain data on firms' customer information from a statutory reporting standard following Regulation SFAS No.131. This regulation requires a firm to disclose whether a customer is a government agent or a non-government (private-sector) company, for all customers representing more than 10% of the firm's total sales. We find that the federal government significantly increases the spending on supplier firms that receive positive rating certification, and lowers the spending on firms that receive negative certification. In three years following Moody's refinement, firms receiving positive rating certification, on average, attract 17% more government procurements (i.e., sales to government agents) than before. On the other hand, firms receiving negative certification experience a 16% drop in their government sales, resulting in a 33% difference in the changes of government procurement across firms that are positively and negatively certified (i.e., the difference-in-difference estimator).

In sharp contrast, the changes in firms' private-sector customers spending surrounding Moody's rating refinement are substantially smaller: firms receiving positive certification do not significantly attract more private-sector customers nor generate more sales from private-sector customers, and firms receiving negative certification do not experience a sharp decline in

private-sector contracts either.[5] The difference-in-difference estimator for non-government customers' spending is only 3%, and is statistically indistinguishable from zero.

Contrasting the two difference-in-difference estimators for government and non-government spending (33% versus 3%) reveals a difference-in-difference-in-difference (the triple difference). It suggests that relative to the private sector, the government increases procurement from firms receiving positive rating certification by approximately 30% more as compared to firms receiving negative rating certification, and vice versa. The contrast between the government and non-government's spending patterns is both statistically and economically significant. It implies that unlike the private sector, government agents – who have taxpayers' wealth at stake and who have strong incentives to ensure, and potentially to signal through rating certification, that taxpayers' stake are not put at risk – put particular attention on rating agencies' external certification during the procurement process.

To further reinforce these government agents' incentives that are linked to taxpayers' stake, we conduct a cross-sectional analysis to explore heterogeneity. We expect that the government's response to rating certification changes should be more pronounced when a procurement involves larger stakes of taxpayers, or when a rating certification has a more substantial impact on taxpayers' stake. This is indeed what we find. The government's response is 33% more pronounced when a procurement occurs in industries that draw the largest amount of government spending. It is 77% stronger when a procurement is from firms whose credit conditions are close to crossing Moody's investment–speculative rating threshold, a cutoff that indicates potential substantial changes in credit risk. Again, in stark contrast, the private sector's spending patterns do not vary with the relevance of taxpayers' stakes like the government does.

We lastly estimate how government's reliance on rating certification feeds into supplier firms' operating performance. We examine a supplier firm's pricing strategy, as reflected in its sales markup, before and after Moody's rating refinement, for firms receiving positive and negative certification, respectively. We find that positive rating certification appears to allow a

[5] This finding is consistent with Hertzel, Li, Officer, and Rodgers (2008), who show that customers in the private sector generally do not experience negative abnormal stock returns when their suppliers announce financial distress.

firm to adopt a more aggressive pricing strategy and to substantially boost its performance. In a back-of-the-envelope calculation, we estimate that on average, a firm receiving positive certification tends to collect a premium of roughly 7 million U.S. dollars annually from the government's incremental procurement (relative to firms receiving negative certification). Put it differently, this amount reflects a premium the government tends to pay for a supplier firm's positive certification during procurement. In comparison, the estimated cost of building a public library is $1.6 million, a nursing home is $2 million, and an elementary school is $2.8 million.[6] The positive certification from the rating agency appears to be expensive.

Overall, these findings highlight a significant impact of rating certification on the spending of the public sector through government procurement. It is worth noting that although government procurement follows various guidelines (e.g., FAR), it is not subject to restrictions that are explicitly based on credit ratings. To this extent, our paper is related to, yet different from, studies examining the regulatory implications of credit ratings (Kisgen and Strahan, 2010; Opp, Opp, and Harris, 2013, Chen, Lookman, Schurhoff, and Seppi, 2014). In these studies, investors face explicit rating-based constraints from financial regulators.[7] These constraints affect investors' holding portfolios and securities' liquidity and pricing, which in turn, generates a regulatory mechanism through which credit rating can affect issuers' cost of capital. Our findings, on the other hand, suggest that even without direct regulatory mechanisms, rating certification still plays an important role in government procurement process.

Our paper provides a direct test of Kisgen (2006, 2007), who is among the first to argue that credit ratings can have a material impact on firms' relation with stakeholders, including customers. We document empirical evidence supporting this argument. We differentiate various types of customers, and find that ratings' significant effect on customer procurement largely comes from government customers, instead of private-sector customers.

Our findings also contribute to the literature that documents various benefits of favorable

[6] Source: http://rsmeans.reedconstructiondata.com/.
[7] For example, a number of regulations restrict investors from holding securities from issuers below certain thresholds in the credit rating spectrum (e.g., Kisgen, 2007).

ratings (rating certification) in terms of lowering firms' cost of capital, facilitating debt financing and capital market access, and promoting investments and bank lending (Tang, 2009; Kisgen, 2006, 2009; Faulkender and Petersen 2006; Almeida, Cunha, Ferreira, Restrepo, 2014; Adelino and Ferreira, 2014).[8] We document that favorable ratings allow firms to attract more government procurements, and leverage their improved ratings by adopting a more aggressive pricing strategy. Different from previous studies, we show that such a benefit comes from increased spending of the public sector, and hence, comes from taxpayers' contribution.

This implication is related to Cornaggia, Cornaggia, and Israelsen (2014). These authors examine a large scale of ratings upgrades on municipal bonds resulting from Moody's recalibration of its rating scale in 2010. They estimate that these upgrades result in a reduction of $1.03 billion in the annual interest on municipal bonds, and hence, a cost of $1.03 billion interest expenses paid by taxpayers in Moody's old rating system. In a recent study by Adelino, Cunha, and Ferreira (2015), the authors examine the same setting of Moody's recalibration and show that upgrades of municipal bonds lead to an increase in public- and private-sector employment and the total municipality income, as a result of a lower borrowing cost. Our paper adds another channel to this literature – government procurement – through which credit ratings' impact may go beyond firms and investors to affecting taxpayers' wealth.[9]

Lastly, our paper is related to the literature that explores the economic consequences of firms' connections with governments. For example, this stream of literature shows that firms that

[8] The benefits of favorable ratings also form an implicit assumption in a burgeoning literature that documents rating agencies' conflict of interest to provide favorable (biased) ratings to bond issuers in exchange for higher compensation from these issuers. See, e.g., Bar-Isaac and Shapiro (2013), Bolton, Freixas, and Shapiro (2012), Bruno, Cornaggia, and Cornaggia (2014), Kedia, Rajgopal, and Zhou (2013), Fulghieri, Strobl, and Xia (2014), Mathis, McAndrews, and Rochet (2009), Skreta and Veldkamp (2009) for theoretical analyses of this conflict of interest, and see, e.g., Becker and Milbourn (2011), Bongaerts, Cremers, and Goetzman (2012), Cornaggia and Cornaggia (2013), Griffin, Nickerson, and Tang (2013), Griffin and Tang (2012), He, Qian, and Strahan (2012), Jiang, Stanford, and Xie (2012), and Xia (2014) for supporting empirical evidence.

[9] In a recent study by Begley (2014), the author examines a potential cost of credit ratings. He documents that, in an attempt to obtain a favorable rating for incoming debt issuance, firms aggressively lower R&D and SG&A expenditures to meet the earnings thresholds as specified in rating agencies' guidelines. This finding points to a cost of credit ratings pertaining to firms' innovation outputs. Our paper hints at a cost of credit ratings pertaining to taxpayers' wealth.

have connected politicians in power enjoy a higher valuation (Fisman, 2001; Faccio, 2006; Faccio and Parsley, 2006; Goldman, Rocholl, and So, 2009), are more likely to obtain corporate bailouts and government interventions in times of financial distress (Faccio, Masulis, and McConnell, 2006; Duchin and Sosyura, 2012), and are more likely to capture lucrative procurement contracts (Goldman, Rocholl, and So, 2013). In this paper, we focus on one specific type of firms' connection with governments through government procurement. Instead of examining how this connection affects firms' financial prospects and policies, we document how this connection can be influenced by firms' perceived financial prospects through rating certification.

The rest of the paper is organized as follows. Section 2 provides institutional background of Moody's rating refinement and describes sample selection and summary statistics. Section 3 presents our baseline empirical findings regarding the effect of rating certification change on government procurement. Section 4 provides analyses using alternative approaches to classify firms that receive positive or negative certification during Moody's rating refinement. In Section 5, we perform cross-sectional analyses to examine heterogeneity in our baseline findings depending on taxpayers' stake in government procurement. Section 6 calibrates the economic consequence of the government's reliance on rating certification. Section 7 concludes.

2. INSTITUTIONAL BACKGROUND, SAMPLE SELECTION, AND SUMMARY STATISTICS

2.1 The institutional background of Moody's rating refinement

We employ the setting of Moody's 1982 credit rating refinement to identify the causal effect of rating certification changes on government procurement. Prior to April of 1982, Moody's reported firms' credit ratings using nine broad categories ranging from Aaa (indicating the lowest credit risk) to C (indicating the state of default). On April 26, 1982, Moody's refined its reporting system in a special edition of its monthly *Bond Record* and *Bond Survey* by introducing numerical modifiers to five of its broad rating categories, Aa, A, Baa, Ba, and B, for all firms that had an outstanding Moody's credit rating. In each of these broad categories,

Moody's assigned modifiers "1", "2", and "3" to indicate the best, middle, and the worst subrating, based on firms' relative credit quality within this category. Table 1 Panel A lists Moody's rating categories before and after the refinement.

A few features of Moody's rating refinement are worth noting. First, unlike Standard & Poor's (S&P) and Fitch that began to refine certain firms' coarse ratings gradually since 1973, Moody's refinement was carried out on the same day to all firms with an outstanding Moody's rating. Hence, Moody's does not endogenously decides which firms' ratings should be refined and when this refinement should be carried out. Second, Moody's refinement was not preceded by pre-announcements, and was unlikely anticipated by rated firms or investors. In fact, Moody's only reported this refinement to the general public in the *Wall Street Journal*'s April 27, 1982 issue - one day after Moody's had implemented refinement. Third and importantly, Moody's refinement was based on the same information used in the previous coarse categories as of March 1982. As Moody's emphasized, "the numerical modifiers are only refinements of the defined categories. The relative positions of all Moody's corporate bond rating symbols, and their definitions, remain unchanged as do all procedures for bond rating."

To better illustrate the features of this refinement, consider three firms that Moody's internally evaluated as having high, medium, and low credit quality as of March 1982. Before the refinement, Moody's assigned the same broad rating category of "A" to all the three firms, without differentiating their relative ranks. On April 26, 1982, Moody's carried out the refinement. Based on the same set of internal evaluations, Moody's assigned "A1" to the high-quality firm, "A2" to the medium-quality firm, and "A3" to the low-quality firm.

It is clear from this example that Moody's rating reassignment is not triggered by changes in firm fundamentals. Instead, it serves as the release of more refined information, or certification, on a firm's existing fundamentals as a result of a methodology change. To this extent, Moody's refinement provides a relatively exogenous change in a firm's rating certification that is not confounded by changes in fundamentals ex ante. This refinement therefore provides a foundation for a triple-difference test we employ in the analyses. .

To further ensure that Moody's refinement is not confounded by changes in fundamentals ex ante, we consider the possibility that Moody's internal evaluations prior to the refinement might be correlated with certain events that would predict government procurement in the future. For example, a policy change happened in 1980 could predict an increase in government procurement at the end of 1982. Anticipating which firms could benefit from the incremental government spending, Moody's assigned a high internal evaluation to the firms that would benefit the most, a low evaluation to the firms that would benefit the least, and a medium evaluation to the firms in the middle. That is, Moody's internal evaluations incorporated the anticipated change in future government spending ex ante even before the refinement; they were, however, not released under Moody's broad rating categories. Two years later when Moody's carried out the refinement, these internal evaluations were revealed, and they were followed by the actual change in government spending, as predicted.

First, it is worth pointing out that this argument, although possible, relies on a number of specific assumptions, including the precise timing of the policy's prediction on government spending that would coincide with Moody's refinement in 1982, as well as the existence of differential (as opposed to uniform) effects of this prediction on firms that would lead Moody's to form different internal evaluations prior to the refinement. In addition, this argument implies that Moody's refined ratings are simply a recollection of coincidental public events, and hence should not contain additional information value. This implication is not supported by the findings in Kliger and Sarig (2000) and Tang (2009); these authors find that Moody's 1982 rating refinement triggers significant market reactions and contains additional information value.

Nevertheless, we explicitly account for this possibility in our empirical analyses. We rely on the fact that both S&P and Fitch have begun to introduce a finer rating system since 1970s. If predictable events simultaneously change government spending and agencies' rating evaluations (as in the above example), these events should have had been reflected in S&P or Fitch's existing refined ratings. We therefore benchmark Moody's refined ratings against S&P and Fitch's, and gauge whether Moody's refined ratings come as a surprise relative to these other ratings. Because this surprise contains information beyond predictable events, any responses to this

surprise would point to a causal effect of changes in rating certification. In Section 4, we present analyses following this intuition and confirm our interpretations from the baseline analyses.

2.2 Sample selection

Our initial sample consists of all U.S. public firms whose credit ratings are refined by Moody's on April 26, 1982. We identify these firms using Moody's Default Risk Service (DRS) database. This database contains Moody's monthly updated rating data for over 11,000 corporate and sovereign entities from 1970 to the present. Because our study analyzes the effect of rating certification on customer spending for each firm, we follow Tang (2009) and employ Moody's issuer (i.e., firm-level) credit ratings, instead of bond ratings. These issuer ratings therefore mute the differences in ratings that are attributable to various characteristics of bonds from the same issuer (e.g., spreads, maturity, and seniority).

The initial sample from Moody's DRS includes 1,159 firms with an outstanding rating from Moody's as of April 26, 1982, and hence, whose ratings were refined on that day. We merge this initial sample with Compustat to obtain a set of U.S. public industrial firms for accounting information. We merge these two datasets primarily using firms' CUSIPs. We also manually check firm names to account for potential changes in company names due to mergers, acquisitions, or restructuring. We end up with 367 Compustat industrial firms, comparable with the sample in Tang (2009). They constitute the primary sample for our analyses.

Panel B of Table 1 summarizes our sample distribution over different rating classes. It also presents categorization of firms into upgraded, downgraded, and unchanged firms based on whether the firm's post-refinement ratings come as a positive, negative, or neutral rating certification.[10] Based on this classification, there are 166 upgrades, 100 downgrades, and 101 firms whose rating certification remains unchanged.

[10] In our sample, there are no firms with a "B" rating prior to Moody's refinement. Therefore, the "B" category is omitted in Panel B of Table 1. It is possible that Moody's refined ratings cross the original rating category. For example, if a firm's credit quality ranks at the top of the original broad "A" category and is sufficiently close to the "Aa" category, Moody's could refine this rating to "Aa3" (a cross-category upgrade), instead of "A1" (a within-

To examine how government procurement changes surrounding Moody's rating refinement, we define a pre-refinement period that includes the three years preceding Moody's rating refinement (i.e., 1979 to 1981), and a post-refinement period that includes the year of Moody's rating refinement and the following three years (i.e., 1982 to 1985). Varying these windows to 1-year or 5-year surrounding Moody's refinement does not qualitatively change our results.

2.3 Government procurement

Following the existing literature, we obtain data on firms' customer information from a statutory reporting following Regulation SFAS No.131 (e.g., Cohen, Coval, and Malloy, 2014; Mertzel et al., 2008). This regulation states that "if revenues from transactions with a single external customer amount to 10 percent or more of an enterprise's revenues, the enterprise shall disclose that fact, the total amount of revenues from each such customer, and the identity of the segment or segments reporting the revenues." Information from this reporting is compiled in Compustat segment files. We collect a firm's number of customers, the type of each customer (i.e., a federal government agent or a private-sector company), and the sales to each customer for all of our sample firms.

Note that one data limitation for our analyses is that Regulation SFAS No.131 only requires firms to disclose customer information when a customer's sales accounts for at least 10% of the firm's total sales. Disclosure for customers with sales below this threshold is voluntary. This limitation could potentially bias our estimates. In Section 3.2, we discuss this concern in more detail, and explicitly address this concern to confirm our findings in the baseline analyses.

Table 2 provides summary statistics on government procurement spending across industries and firms. Panel A reports top 10 industries in our sample that have the largest average amount of government spending (i.e., total sales, in millions of U.S. dollars) during the pre-refinement period (i.e., from 1979 to 1981). We employ Moody's classifications, as reported in

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category upgrade). Like all others, these cross-category refinements follow Moody's general principal and are based on the same set of information as used prior to the refinement.

Moody's credit rating reports, to classify a firm's industry because Moody's typically provides a finer industry classification than the conventional two-digit SIC codes. The one with top government spending is the defense industry. It bears total sales of over $17 billion to government customers during the pre-refinement period. It is followed by the manufacturing and chemicals industry, with a government spending of about $3 billion and $1.2 billion, respectively. Other industries with large government spending include energy, telecommunications, and aircraft and aerospace, consistent with Cohen, Coval, and Malloy (2014).

Column (3) of Panel A reports the average proportion of government spending to the total sales of firms with government customers in each industry. It shows that overall, government spending contributes a significant proportion of firms' sales, amounting to 30% or more in industries including defense, telecommunications, aircraft and aerospace, and healthcare. In certain industries (e.g., chemicals and energy), the proportion of government spending accounts for less than 10% of total sales, which appears below the threshold required by Regulation SFAS 131 to disclose customer information. This observation is consistent with the fact that firms often voluntarily disclose information about customers that they view as important to their business, regardless of their sales proportion to revenues (see, e.g., Patatoukas, 2011, and Ellis, Fee, and Thomas, 2009).

Panel B of Table 2 tabulates 20 sample firms with the largest average government spending during the pre-refinement period, as well as the proportion of government spending to each firm's total sales. Consistent with Panel A, most of these firms are in the defense industry, with government spending taking up to 60% of their total sales.

We construct three variables to measure the procurement spending of government customers for each supplier firm. First, we define *Gov. Customers* as a dummy variable to indicate whether the firm has a government customer in a given year. Second, we define *Ln*(*Sales to Gov. Customers*) as the natural logarithm of the total sales to a firm's government customers in a given year.[11] While this measure captures the amount of revenues contributed by

[11] To avoid losing firm-year observations without government customers and government spending, we add one to the dollar value of sales when taking natural logarithm.

government customers, it does not speak to the importance of government procurement to a firm's overall business. Therefore, we define a third measure, *Proportion of Sales to Gov. Customers*, as the sales to government customers proportional to the firm's contemporaneous total sales (in percentage).

2.4 Non-government procurement and other variables

We generate three variables to capture the procurement spending of non-government customers (i.e., private-sector customers): *non-Gov. Customers*, *Ln*(*Sales to non-Gov. Customers*) and *Proportion of Sales to non-Gov.* They are defined analogously as those for government spending. We also construct various firm characteristics that may be correlated with a firm's sales to customers. *Ln(assets)* is the natural logarithm of total assets; *Leverage* is the ratio of total debt from the balance sheet to total assets; *Tangibility* is the ratio of property, plant, and equipment to total assets; *Capex-to-assets* is the ratio of capital expenditures to total assets. *R&D-to-sales* is the ratio of research and development expenses to total sales.

Table 3 reports descriptive statistics of these firm characteristics in our sample. In the top section, we report statistics at the firm-year level, which includes the 7-year period (i.e., both the pre- and post-refinement periods) for each firm. It shows that an average firm has book value assets of $2.76 billion, total sales of $2.51 billion, leverage of 31%, capital expenditure of 10% of total assets, asset tangibility of 59%, and R&D-to-sales ratio of 0.8%. These ratios suggest that our sample firms appear to be large and well profitable; they moderately rely on external financing and spend on research and development. These observations are consistent with the fact that our sample consists of firms that are rated by credit rating agencies and hence, have well access to the credit market. Therefore, they represent a set of large and well-established firms (Faulkender and Petersen, 2006). The bottom section of Table 3 reports the changes of each variable from the pre- to the post-refinement period, i.e., the difference between the mean of each variable during the post- and pre-refinement period. We include these change variables as controls in our difference-in-differences test framework.

3. GOVERNMENT PROCUREMENT AND RATING CERTIFICATION

3.1 Baseline analyses

Our primary approach to study how government spending through procurement responds to rating certification changes is a triple-difference framework. Specifically, we compare the government spending of upgraded firms from Moody's rating refinement to that of downgraded as well as unchanged firms (the first difference) during the pre- and post-refinement periods (the second difference), and contrast these patterns to those of non-government spending (the third difference) In this section, we present analyses on each of these three differences, respectively, leading to the triple-difference test.

We start with a graphical analysis in Figure 1 and plot the three government spending variables surrounding Moody's rating refinement. We demean each variable by subtracting the mean of this variable for all sample firms in the same year to take out potential calendar time trend in firms' government spending that may be correlated with Moody's rating refinement. Because we are interested in the changes in, rather than the levels of, government spending, we re-center each plot at the year end of 1982 (i.e., the year of Moody's rating refinement). For expositional ease, we omit the plot for unchanged firms because government spending in this group does not show apparent changes surrounding Moody's rating refinement (which we further confirm in unreported statistic tests). Following Kliger and Sarig (2000) and Tang (2009), we focus on the comparison between the downgraded and upgraded groups, as it provides more powerful tests of the influence of rating certification changes.

In Figure 1, the x-axis denotes calendar year ends, and the y-axis denotes the magnitude of each government spending measure. Panel A plots *Gov. Customers*; Panel B plots *Ln*(*Sales to Gov. Customers*); Panel C plots *Proportion of Sales to Gov. Customers*. The vertical line in each panel indicates the date of Moody's ratings refinement on April 26, 1982. A few observations are worth noting. First, all three panels consistently show that during the pre-refinement period, government spending trends closely for upgraded and downgraded firms – there is no systematic difference in the patterns of government spending variables across firms before the refinement.

This observation ensures the satisfaction of a key identifying assumption in our analyses, the parallel trends assumption. This assumption does not require the level of government spending to be identical across two groups of firms during the pre-refinement periods because these distinctions are differenced out in the estimation. Instead, it requires that government spending shows a similar trend during the pre-refinement period for both groups. In unreported results, we further confirm that the one-year change of these government spending variables during the pre-refinement period are not statistically significant between the two groups.[12]

Second, the parallel pattern drastically changes during the post-refinement period. Downgraded firms experience a sharp decline in government spending, while upgraded firms experience a dramatic increase. These changes start from the year end of Moody's refinement (i.e., the end of 1982). This prompt response appears to be consistent with the great flexibility government contracting offers to government agents in practice, which allows them to modify or terminate a contract in a timely manner in the government's interest (see, e.g., FAR 43.101, 43.201, 49.101, 49.201).[13] Third, the response in government spending appears to have a long-term effect. It affects the level of government spending for the two groups throughout the three years following Moody's rating refinement.

To formalize this graphical analyses, we present a univaraite DiD analysis in Panel A of Table 4. Specifically, for each upgraded and downgraded firm, we compute the difference in the mean of each government spending variable in the post-refinement and the pre-refinement periods. We then report the averaged difference for upgraded and downgraded firms, respectively, in columns (1) and (2).[14] These two columns suggest an economically significant

[12] We note that downgraded firms appear to have a higher level of government spending than upgraded firms during the pre-refinement period. This finding is consistent with Cohen, Coval, and Malloy (2014), who document that firms relying on government spending have lower sales growth, capital expenditures, and research and development expenses; these firms are therefore more likely to receive negative certification during Moody's rating refinement to reflect their relatively lower growth prospects.

[13] For example, the government may unilaterally modify all or part of a contract. The contractor is obliged to perform the contract unilaterally changed by the contracting officer. For termination, the government may make a settlement to compensate the contractor fairly for the work that has been done.

[14] To be consistent with Figure 1, we employ year-demeaned measures of government spending. All results are robust to using the raw measures.

change in government spending in response to rating certification changes. For example, the amount of government spending for a downgraded firm is lowered by 17.4% from the pre- to post-refinement period (as denoted by changes in *Ln(Sales to Gov. Customers)*), while it is increased by 16% for an upgraded firm. The difference of these two changes - the DiD estimator - amounts to 33.4%, as reported in column (3). It is statistically significant at the 1% level, and suggests that relative to downgraded (upgraded) firms, upgraded (downgraded) firms attract (lose) over 33% more government spending following Moody's refinement. This magnitude becomes even larger when we examine the proportion of government sales to a firm's total sales. Government procurements account for 59% more in an upgraded firm's total sales, relative to downgraded firms.

We next contrast the DiD pattern of government spending with that of non-government (i.e., private sector) customers to generate the triple-difference estimator. In Panel B of Table 4, we conduct a similar set of univariate analyses as that in Panel A for firms' non-government customers. Interestingly, the spending of non-government customers exhibits a much smaller change surrounding Moody's rating refinement. For example, based on the second row of Panel B, neither the upgraded group nor the downgraded group experiences a significant change in total sales to non-government customers following Moody's rating refinement. The DiD estimator amounts to only 2.8%. It is neither statistically nor economically significant.

Contrasting the two DiD estimators for government and non-government spending reveals a difference-in-difference-in-differences (the triple difference), as reported at the bottom of Table 4. For example, based on *Ln(Sales to Gov. Customers)*, the triple-difference estimator amounts to 30.6% (=33.4%-2.8%). It suggests that relative to the private sector, the government increases (reduces) procurement from firms receiving positive (negative) rating certification by approximately 31% as compared to firms receiving negative (positive) rating certification. This triple-difference estimator is both statistically and economically significant. We draw a similar interpretation using other government spending variables.

The sharp contrast between the government and non-government's spending patterns around rating certification change implies that unlike the private sector, government agents –

who have taxpayers' wealth at stake, and who have strong incentives to ensure, and potentially to signal through rating certification, that taxpayers' stake are not put at risk – put particular attention on rating agencies' external certification during the procurement process.[15] In Section 5, we reinforce these government agents' incentives that are linked to taxpayers' stake by conducting cross-sectional analyses on our baseline results.

We next perform the triple-difference analyses in a multivariate regression framework, and control for various firm characteristics. As before, we first estimate the DiD estimators for government and non-government spending, separately. When contrast these two DiD estimators to generate a triple-difference estimator. We follow the regression model in Tang (2009) to obtain the DiD estimators:

$$\Delta Government\ (non-Government)\ Spending_i = \alpha + \beta_1 Upgrade_i + \beta_2 Unchange_i + \gamma' \Delta X_i + Rating\ Fixed\ Effects + \epsilon_i. \quad (1)$$

The dependent variable, *ΔGovernment (non-Government) Spending*, is the change in government (non-government) spending for each firm from the pre- to post-refinement period (i.e., the difference in the means of government spending between the post-refinement and the pre-refinement period). *ΔGovernment Spending* is either *ΔGov. Customers, ΔLn(Sales to Gov. Customers)*, or *ΔSales to Gov. Customers*. *Δnon-Government Spending* is defined in a similar way.[16] The right-hand side variables include an *Upgrade* dummy and an *Unchange* dummy, which are indicators for whether this firm is upgraded or unchanged from Moody's rating refinement, respectively. The downgraded group is omitted as the benchmark group. *ΔX* is the vector of changes in firm characteristics as discussed in Section 2.4. *Rating Fixed Effects* are indicators for Moody's rating category prior to the refinement. This model is estimated using a firm-level data consisting of all the 367 upgraded, downgraded, and unchanged firms. In this model, the coefficient β_1 is the DiD estimator. It captures the differential changes of government

[15] Non-government customers' weaker response to rating certification change is consistent with Hertzel, Li, Officer, and Rodgers (2008), who document that in private-sector customers generally do not experience negative abnormal stock returns when the suppliers announce financial distress.

[16] Because we use the means of *Gov. Customers* during the pre- and post-refinement period to calculate *ΔGov. Customers*, *ΔGov. Customers* is a "continuous" variable that takes more values than -1, 0, and 1. Hence, we use the OLS, instead of an ordered probit model, to estimate equations with *ΔGov. Customers* as the dependent variable.

(non-government) spending surrounding Moody's refinement between upgraded and downgraded firms.[17]

Table 5 reports the regression results. Panel A reports the results for government customers. Consistent with Panel A of Table 4, the DiD estimators for all three government spending measures are positive and significant, suggesting that firms receiving positive (negative) certification experience an increase (decrease) in their likelihood of having government customers, the amount of government spending, and the proportion of government spending to total sales, relative to downgraded (upgraded) firms. The economic effects are sizable. For example, based on column (3), the amount of government procurements for upgraded firms rises by 29.1% more following Moody's refinement relative to that of downgraded firms. This magnitude is event larger when we control for firm characteristics in column (4). As for unchanged firms, the rating refinement does not elicit changes in government spending that are statistically different from a downgrade. This observation is consistent with the findings in Tang (2009) in the context of bond yields. Most of other control variables show expected signs, although they are insignificantly different zero at the 10% level. For example, larger firms and firms with lower leverage are associated with higher levels of government spending. Firms' capital expenditures are negatively associated with government spending, consistent with Cohen, Coval, and Malloy (2014).

In Panel B, we repeat the same set of analyses for firms' non-government spending. Consistent with Panel B of Table 4, we do not find significant responses of non-government spending, neither statistically nor economically. Accordingly, contrasting the two DiD estimators between government and non-government spending yields significant triple-difference estimators, as shown at the bottom of Table 5, with magnitudes similar to those in Table 4.

[17] This firm-level estimation is similar to estimating a firm fixed-effects regression in a firm-year panel. This regression would use the level of government spending as the dependent variable, and *Post*Upgrade* and *Post*Downgrade* as the main independent variables to capture the DiD estimator (where *Post* is a dummy variable indicating the post-refinement period). In unreported results, we confirm that this firm-year panel estimation generates the same interpretation. To conserve space, we only present the firm-level estimation in our following analyses.

3.2 Addressing mis-estimation concerns

As discussed before, Regulation SFAS No.131 only requires the disclosure of customer information if a customer accounts for at least 10% of the firm's total sales. Because disclosure is voluntary when customer sales are below the threshold, this data limitation could potentially bias our estimates.

We first consider an overestimation bias. If the government's sales fall from 20% of the firm's total sales to 5% after Moody's refinement, and the firm does not voluntarily disclose the latter sales information, we would observe a change in sales from 20% to zero, resulting in a 5% overestimation on the government's response to rating certification. Similarly, an overestimation may occur if the government sales increase from below the 10% threshold to above the threshold.

We first note that the same data limitation applies for both our analyses on government spending and non-government spending. To the extent that the same set of bias is present for both analyses, our interpretation based on triple-difference tests (which contrasts government and non-government spending) should still provide reasonable inferences.

In addition, we provide empirical tests to further address this overestimation concern. Specifically, we estimate a lower bound of customers' response to rating certification as follows. If we observe that a firm's customer spending accounts for at least 10% of the firm's total sales prior to Moody's refinement, and observe no sales from this customer after Moody's refinement, we assign this customer's spending after the refinement as equal to 10% of the firm's contemporaneous sales. Similarly, if we observe that a customer's sales are zero prior to Moody's refinement, but emerge to above 10% of the supplier firm's total sales after Moody's refinement, we assign this customer's spending before the refinement as equal to 10% of the firm's contemporaneous sales. We repeat our previous analyses using these lower-bound changes in customer sales.

Table 6 reports the results from estimating Equation (1). Panel A reports the DiD estimator for government spending. We find similar evidence as before: Changes in rating certification elicit a significant change in government spending. The economic significance is smaller than that in Table 5, by definition, but is still sizable. For example, based on column (3),

government customers account for 52.9% more in a firm's total sales following positive certification from Moody's rating refinement, relative to firms receiving negative certification. (The corresponding coefficient estimate in Table 6 is 69.7%.) We find similar results in other columns. Panel B reports the DiD estimator for government spending. We again see a much weaker change in customer spending surrounding Moody's rating refinement, either statistically or economically. The triple difference estimator is now weaker, but remain economically sizable.

In principal, this data limitation could also result in an underestimation bias. For example, if a customer's sales change from 9% of the firm's total sales to 5% (or the other way around), and the firm does not disclose either sales information, then we would observe no change in the sales to this customer (i.e., both zeros before and after the refinement). Because this underestimation bias would only mute customers' response to rating certification, it will not cause misinterpretation in our results regarding the government's significant responses to rating certification. It might, however, lead us to under-estimate non-government customers' responses, leading to a bias in our triple-difference estimator. To address this concern, we follow a similar intuition as above, and estimate an upper-bound effect of rating certification for non-government customers' spending. We confirm our interpretation.[18]

4. ALTERNATIVE BENCHMARKS TO CLASSIFY FIRMS

Our classifications of upgraded, unchanged, and downgraded firms so far are based on the subcategories of Moody's refined rating within each broad rating category. As discussed in Section 2.1, it is possible that certain events that predict government spending were incorporated into Moody's internal evaluations even before the rating refinement, which got disclosed during the refinement. In this case, our findings could simply capture simultaneity, instead of causality.

To address this concern, we employ two alternative benchmarks to categorize firms. We first benchmark Moody's refined ratings against other rating agencies' ratings at the time of

[18] More specifically, if we observe that a customer's sales are zero both before and after Moody's refinement, we then assume this customer's spending has changed (either increased or decreased) by 10% of the firm's contemporaneous sales.

Moody's rating refinement. S&P and Fitch have begun to introduce a finer rating system since 1970s. Any events that predict government spending and simultaneously affect rating evaluations would have had been absorbed in these existing refined ratings. Therefore, by classifying firms based on whether Moody's refined ratings come as a surprise relative to these other ratings, we can identify the additional information in Moody's refinement that is beyond these events. Following this intuition, we use S&P's ratings as a benchmark to re-classify our sample firms. Similar to Moody's, S&P' rating refinement introduces modifiers to the previous broad rating categories. A "+" modifier indicates the best relative credit quality in each broad category, a "-" modifier indicates the worst, and no modifiers indicate the middle. As such, we re-classify firms as follows:

i) If a firm's S&P's rating at the time of Moody's refinement has a "+" modifier, and
   if Moody's assigns a modifier 1, then we classify this firm as an unchanged firm (that is, Moody's refinement does not come as a positive surprise relative to S&P's existing rating);
   if Moody's assigns a modifier 2 or 3, then we classify this firm as a downgraded firm (that is, Moody's refinement comes as a negative surprise relative to S&P's existing rating).
ii) If a firm's S&P's rating at the time of Moody's refinement does not have a modifier, and
   if Moody's assigns a modifier 1, then we classify this firm as an upgraded firm;
   if Moody's assigns a modifier 2, then we classify this firm as an unchanged firm;
   if Moody's assigns a modifier 3, then we classify this firm as a downgraded firm.
iii) If a firm's S&P's rating at the time of Moody's refinement has a "-" modifier, and
   if Moody's assigns a modifier 1 or 2, then we classify this firm as an upgraded firm;
   if Moody's assigns a modifier 3, then we classify this firm as an unchanged firm.

In this classification, we note that S&P's rating refinement was carried out gradually over time. Therefore, a potential concern arises: If we do not observe a firm's S&P rating has a modifier (i.e., in case (ii)), we cannot determine whether this is because the firm's rating has not been refined, or because the firm's rating has been refined but falls into the middle subrating

category. Hence, S&P's ratings in case (ii) might not serve as an adequate benchmark to control for the predictable events incorporated in rating agencies' internal evaluations.

For this reason, we consider not only S&P's existing ratings as the benchmark, but also non-rating information, that is, observable firm characteristics. The intuition is that if there are predictive events that affect government procurement and coincide with Moody's rating refinement, they would have had been reflected in certain firm characteristics by the time of Moody's refinement. By benchmarking Moody's refined ratings against these characteristics, we can again identify Moody's information that comes as a surprise relative to these characteristics, and hence, that is beyond these existing predictable events.

To implement this second alternative benchmark, we follow three steps. First, we compute a credit score for each firm based on firms' characteristics. We follow Kisgen (2006) and estimate a parsimonious regression model for the determinants of a firm's credit ratings:

$$Rating_{i,t} = \alpha + \beta_1 Ln(assets_{i,t}) + \beta_2 ROA_{i,t} + \beta_3 \frac{Debt}{Cap} Ratio_{i,t} + S\&P\ Rating\ Dummies + \epsilon_{i,t}. \quad (2)$$

The dependent variable, *Rating*, equals 1 for a Moody's rating of Aaa, 2 for a rating of Aa, and up to a value of 9 for a rating of C. *Ln(assets)* is the natural logarithm of firm total assets; *ROA* is the ratio of operating income before depreciation to total assets, and *Debt/Cap Ratio* is the ratio of total debt from the balance sheet to total capitalization. Kisgen (2006) shows that these three variables have the most explanatory power in determining a firm's credit ratings. In addition, we include dummies for each S&P's rating category (from AAA to C) to account for S&P's existing ratings at the time of Moody's refinement. This model is estimated in a firm-year panel for all sample firms during the pre-refinement period.[19] The estimation has an R-squared of 77.1%, consistent with Kisgan (2006). The coefficient estimates on each variable have expected signs as follows and are all significant at the 1% level.

[19] In unreported results, we also estimate this model during one year preceding Moody's rating refinement (i.e., in 1981), or five years preceding Moody's rating refinement (i.e., from 1977 to 1981). We get qualitatively similar results.

$$Rating_{i,t} = \alpha - 0.205\, Ln(assets_{i,t}) - 1.645\, ROA_{i,t} + 1.182\, \frac{Debt}{Cap} Ratio_{i,t} + S\&P\ Rating\ Dummies + \epsilon_{i,t}. \quad (3)$$

We then use the estimated coefficients to generate a predicted value for $Rating_{i,t}$, which we define as a firm's credit score in a given year.

Second, we take each firm's credit score in the year before Moody's rating refinement (i.e., 1981), and rank firms' credit scores within each of Moody's broad rating categories from the smallest to the largest. In each category, firms with credit scores in the smallest tercile are the ones that are most likely to have an AAA rating (which is assigned a numerical value of 1 in the regression), and are therefore assigned as the top tercile firms. The rest firms are assigned as the middle, and the bottom tercile, respectively.

Finally, we re-classify upgraded, unchanged, and downgraded firms based on the following three cases.

i) If a firm's credit score is in the top tercile of a Moody's coarse category, and
   if Moody's assigns a modifier 1, then we classify this firm as an unchanged firm;
   if Moody's assigns a modifier 2 or 3, then we classify this firm as a downgraded firm.
ii) If a firm's credit score is in the middle tercile of a Moody's coarse category, and
   if Moody's assigns a modifier 1, then we classify this firm as an upgraded firm;
   if Moody's assigns a modifier 2, then we classify this firm as an unchanged firm;
   if Moody's assigns a modifier 3, then we classify this firm as a downgraded firm.
iii) If a firm's credit score is in the bottom tercile of a Moody's coarse category, and
   if Moody's assigns a modifier 1 or 2, then we classify this firm as an upgraded firm;
   if Moody's assigns a modifier 3, then we classify this firm as an unchanged firm.

Table 7 presents the DiD estimators using the two alternative classifications. For government spending, all DiD estimators are negative and statistically significant. For example, the DiD estimator for *Ln(Sales to Gov. Customers)* is -0.484 using the classification incorporating S&P's existing ratings, as reported in Panel A column (3), and is -0.255 using the credit-score classification, as reported in Panel B column (3). Both DiD estimators are

economically sizable given the magnitude of the change in firms' *Ln(Sales to Gov. Customers)* from pre- to post-refinement period, as reported in columns (1) and (2). We obtain similar findings using all other government spending measures. In untabulated tests, we again confirm that the DiD estimators for non-government spending is neither statistically nor economically significant. This contract between the government-spending and non-government spending patterns are further confirmed in a multivariate regression setting.

5. GOVERNMENT RESPONSE TO RATING CERTIFICATION CHANGES AND TAXPAYERS' STAKE

Our results so far imply that unlike the private sector, government agents – whose decisions involve taxpayers' wealth at stake – appear to have strong incentives to follow rating agencies' external certification to ensure, and potentially to signal that taxpayers' stake are not put at risk. To further reinforce these government agents' incentives that are linked to taxpayers' stake, we conduct a cross-sectional analysis. We expect that the government's response to rating certification changes should be more pronounced when a procurement involves larger stakes of taxpayers, or when a rating certification has a more substantial impact on taxpayers' stake.

To examine this intuition, we first consider firms in industries draw the largest amount of government spending. Given the government's large stakes in these industries, we expect them to pay particular attention and hence, are especially sensitive to supplier firms' rating certification. Next, we consider firms whose credit ratings prior to Moody's rating refinement are surrounding the investment-speculative threshold; that is, firms with an original rating of "Baa" or "Ba". The investment-speculative threshold is viewed as an important boundary on the credit rating spectrum. It separates out issuers and securities with substantially higher credit risk (Moody's Investor Service, 2010), and is commonly referred to in regulations and contractual guidelines regarding investors' portfolio holdings. We expect government customers to be especially sensitive to changes in credit signals when a firm is on the verge of this threshold.

To test these conjectures, we employ the following regression model:

$$\Delta Government\ Spending_i = \alpha + \beta_1 Upgrade_i * Indicator + \beta_2 Unchange_i * Indicator + \beta_3 Indicator + \beta_4 Upgrade_i + \beta_5 Unchange_i + \gamma' \Delta X_i + Rating\ Fixed\ Effects + \epsilon_i. \quad (4)$$

In Equation (4), *Indicator* is a dummy variable indicating one of the above two cases. In the first case, it equals one if a firm is in one of top 15 government spending industries as ranked by the average government spending during the pre-refinement period (*TopInd*), and zero otherwise. In the second case, it equals one if a firm's original rating prior to Moody's refinement is either "Baa" or "Ba" (*Threshold*), and zero otherwise. The coefficient of interest is β_1, which indicates whether the response of government spending to rating certification changes (i.e., the DiD estimators from Equation (1)) varies along these two dimensions.

Table 8 reports the results. We first use Δ*Gov. Customer* as the dependent variable. In column (1), the positive coefficient estimate of *Upgrade*TopInd* suggests that upgraded firms in the top government-spending industries experience a significantly larger increase (i.e., 10%) in the likelihood of having a government customer (relative to downgraded firms) than firms in other industries. This magnitude is economically sizable given that the overall effect of rating certification on government spending is 10.4% (column (1) of Table 6). The insignificant coefficient of *Upgrade* suggest that government spending of upgraded firms (relative to downgraded firms) in non-top industries does not seem to be affected by the change in rating certification. Column (2) includes the same set of control variables as in Table 6. The coefficient of *Upgrade*TopInd* becomes slightly larger, and is both statistically and economically significant.

In columns (3) and (4), we test how the government's responses to rating certification interact with a firm's original ratings surrounding the investment-speculative threshold.[20] The coefficient estimate of β_1 are positive and significant at the 1% level in both columns, suggesting that firms near the investment-speculative threshold exhibit a larger change in government spending in response to the rating certification change, relative to firms that are distant from the threshold.

[20] In these columns, the *Threshold* indicator is omitted from Equation (3) because it is absorbed by the *Initial rating fixed effects* we include in the regression.

In columns (5) to (8), we use the other two measures of government spending as the dependent variables. We draw similar conclusions as before. Taken together, our findings suggest that the spending of government customers is particularly sensitive to rating certification when taxpayers' stakes are mostly involved or affected in government procurement.

Not surprisingly, as shown in Panel B of Table 8, the spending patterns of the private sector do not vary with the relevance of taxpayers' stakes like the government does. These patterns can be seen using all three measures of government spending. This observation reinforces the government agents' incentives to respond to external rating certification that are linked to taxpayers' stake.

6. DOES POSITIVE RATING CERTIFICATIONFEEDS INTO FIRMS' OPERATING PERFORMANCE?

We document so far that government procurement responds significantly to changes in rating certification. While firms receiving negative certification experience a decline in government procurement, firms receiving positive certification attract more. What would this effect feed into firms' operating performance? Does positive certification allow a firm to adopt a more aggressive pricing strategy, and charge a higher price for government procurement? If yes, what is the premium firms tends to collect from the government for this positive certification? On the other hand, does negative certification put firms at a disadvantage and lead them to discount their pricing for government customers? We shed light on these questions by conducting a back-of-the-envelope calculation.

We first examine a firm's pricing strategy as reflected in sales markup. Sales markup is defined as $\frac{Total\ sales}{Cost\ of\ goods\ sold} - 1$. It measures the profit the firm collects over each \$1 of total costs that generates the sales, and therefore reflects a firm's pricing strategy (e.g., Pashigian, 1988; Campello, 2003; Edmond, Midrigan, and Xu, 2012). Table 9 Panel A reports the sales markup for upgraded and downgraded firms during the pre- and post-refinement period, respectively. The first row shows that during the pre-refinement period, a subsequently-downgraded firm has

an average markup of $0.416 per $1 of cost of goods sold, while a subsequently-upgraded firm has an average markup of $0.457. The difference in the markups equals -0.041 and is not statistically significant. It suggests that prior to Moody's rating refinement, there does not seem to be a substantial difference between these firms' pricing strategies.

During the post-refinement period (reported in the second row of Panel A), the sales markup for downgraded firms slightly declines by 0.009 (statistically insignificant) to $0.407, while the sales markup for upgraded firms significantly increases by 0.037 to $0.495. As a result, the post-refinement markup between downgraded and upgraded firms (0.407 versus 0.495) differs by $-0.088 and is significant at the 5% level. The DiD estimator on the changes in markup equals to approximately $0.05 and is statistically significant at the 1% level. This observation suggests that changes in rating certification significantly affect the sales markup and hence, the relative pricing strategy of upgraded firms.

How does this $0.05 change in markup translate into the premium collected by the firm from the government? As we previously show, rating certification appears to only affect the spending of government customers, but not that of non-government customers. To the extent that the increase in upgraded firms' markup is largely driven by its more aggressive pricing strategies to government customers (as opposed to non-government customers), this amount of $0.05 provides an estimate of the premium an upgraded firm collects from the government for each $1 of cost of goods sold.

Next, we calculate (but do not tabulate) that the cost of goods sold of an average upgraded firm increases (relatively to downgraded firms) by approximately $141 million from the pre- to post-refinement period. Hence the amount of $0.05 per dollar of cost of goods sold translates into a total amount of $7 million (=$141 * 0.05). In other words, $7 million is an estimated premium the firm collects from government for its incremental spending due to Moody's positive certification. Put it differently, this $ 7 million also reflects an estimated premium the government tends to pay for an average firm receiving positive rating certification. For context, the average cost of building a public library is $1.3 million, a senior house is $1.4 million, and an elementary school is $2.8 million (all in 1982 dollars). Hence, the rating agency's

positive certification appears to be expensive, from taxpayers' perspective.

In Panel B of Table 9, we undertake a multivariate regression analysis on the effect of rating certification on firms' markup and pricing strategies. Specifically, we run a similar model as in Equation (1), where we replace the dependent variable with a firm's sales markup. Columns (1) and (2) show that after controlling for the changes in various firm characteristics during the pre- and post-refinement period, we find a DiD estimator (i.e., the coefficient of *Upgrade*) with a similar statistical and economic significance as in Panel A.

In columns (3) to (6), we examine two additional variables: net profit margin and return on assets (ROA). These two variables measure a firm's profitability and hence are similar indicators of a firm's pricing strategy as sales markup, although they tend to be less accurate. For example, the net income used in the calculations of these two measures embeds expenses such as interest expenses and tax expenses, which may not relate to the direct cost incurred for generating sales.[21] With this caveat in mind, we report results using these alternative measures for qualitative inferences. Columns (3) to (6) present regression analyses of profit margin and return on assets, respectively. We find similar interpretations for these measures as for sales markup. Taken together, we find suggestive evidence that positive rating certification enables firms to use a more aggressive pricing strategies, in particular, for government customers, and to boost their operating performance.

7. CONCLUSION

In this paper, we study how the spending of public sector can be influenced by a certification that comes from the private sector – credit ratings issued by rating agencies. Specifically, we examine how the federal government's procurement decisions respond to a change supplier firms' credit rating certification.

Using a triple-difference test around shifts in supplier firms' rating certification, we find that the government significantly increases their spending on firms receiving positive rating

[21] These expenses are likely affected by the firms' debt issue activities, which are in turn affected by changes of firms' credit ratings, making net income less relevant to firm's pricing strategies.

certification, and lowers their spending on firms receiving negative certification. In stark contrast, we do not find a similar response from a firm's non-government customers. In cross-sectional analyses, we show that the government's response to rating certification is more pronounced when the financial conditions of a supplier firm is most relevant for taxpayers' stakes – that is, when a procurement involves larger stakes of taxpayers, and when a rating certification has a more substantial impact on taxpayers' wealth. These results suggest that the government, who have taxpayers' wealth at stake, tends to put particular attention on rating agencies' external certification to ensure, and potentially to signal through this certification, that taxpayers' stake are not put at risk.

We show that the rating agency's positive certification leads a firm to adopt more aggressive pricing strategies. As a result, we estimate that a positively certified firm appears to collect a premium of roughly $7 million from government customers, even though this certification is not accompanied by changes in fundamentals. These findings highlight a significant impact of credit rating certification on government spending, and potentially, on taxpayers' wealth.

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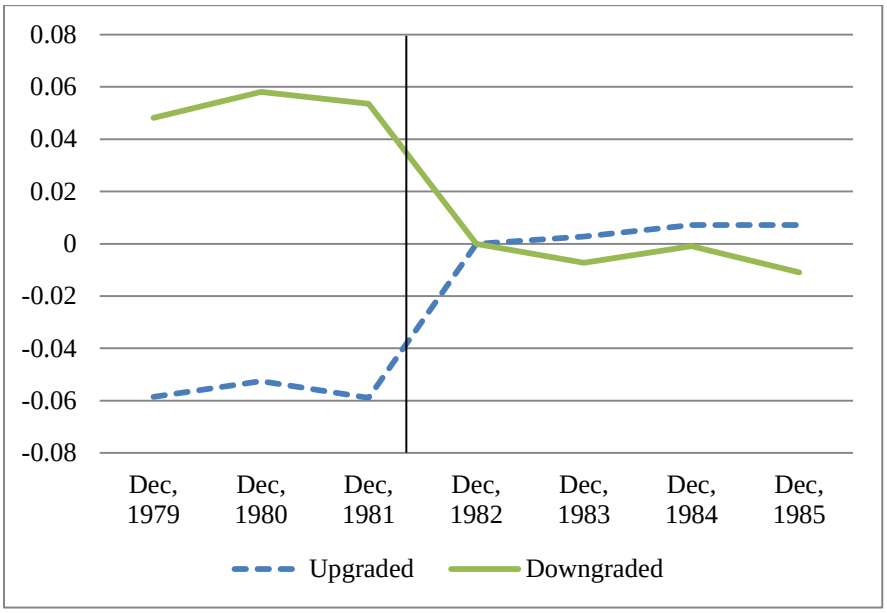
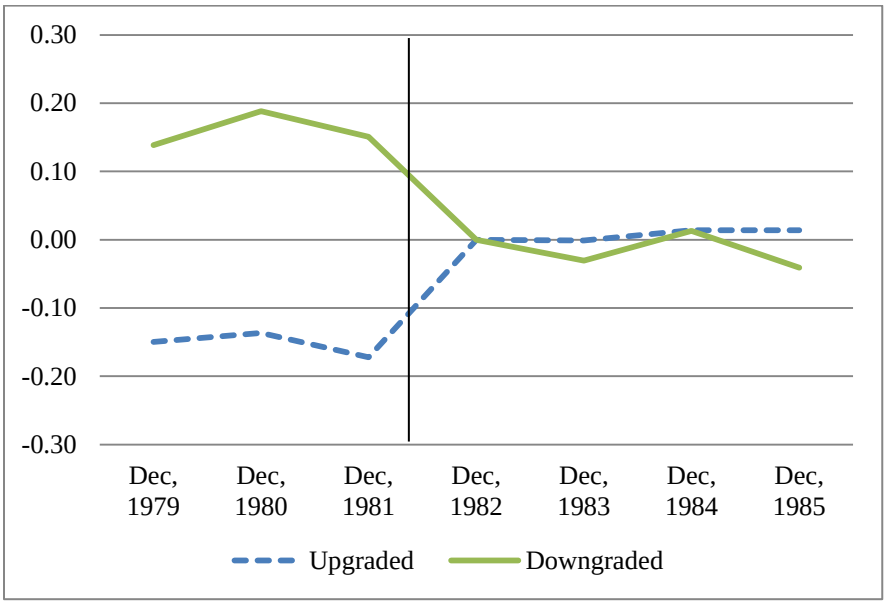
Figure 1. This figure plots the procurement spending of firms' government customers during the pre-refinement and post-refinement periods of Moody's credit rating refinement on April 26, 1982, for upgraded and downgraded firms, respectively. Government procurement spending is measured by *Gov. Customers*, *Ln (Sales to Gov. Customers)*, and *Proportion of Sales to Gov. Customers*, in Panels A to C, respectively. *Gov. Customers* is an indicator for whether a firm has a government customer in a given year. *Ln(Sales to Gov. Customers)* is the natural logarithm of one plus a firm's total sales to government customers in a given year. *Proportion of Sales to Gov. Customers* is the sales to government customers divided by the firm's contemporaneous total sales (denoted in percentage). Each variable is demeaned by the mean of the variable for all sample firms during the same calendar year. The pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985). All variables are measured at year ends. Upgraded and downgraded firms are firms whose Moody's credit ratings are affected by Moody's ratings refinement, as categorized in Table 1. In each panel, the x-axis denotes calendar year end, and the y-axis denotes the magnitude of the government spending variable. The vertical line indicates the date of Moody's rating refinement.

Panel A: Gov. Customers



Panel B: Ln (Sales to Gov. Customers)



Panel C: Proportion of Sales to Gov. Customers

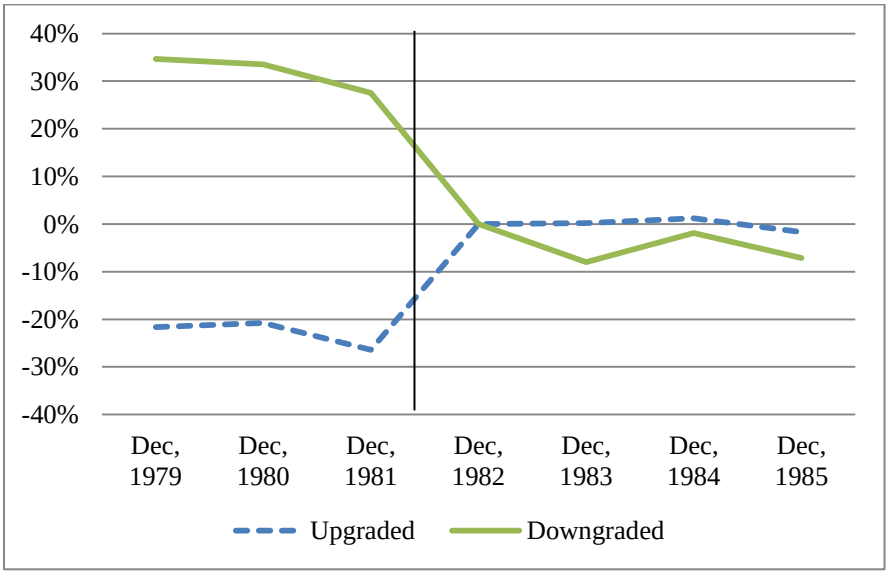


Table 1. Summary statistics of Moody's credit rating refinement

This table presents summary statistics of Moody's credit rating refinement on April 26, 1982. Panel A lists Moody's rating categories before and after the refinement. Panel B reports categorization of upgraded, unchanged, and downgraded firms in the rating refinement, and the number of firms in each category.

Panel A

Pre-refinement rating	Post-refinement rating
Aaa	Aaa
Aa	Aa1
	Aa2
	Aa3
A	A1
	A2
	A3
Baa	Baa1
	Baa2
	Baa3
Ba	Ba1
	Ba2
	Ba3
B	B1
	B2
	B3
Caa	Caa
Ca	Ca
C	C

Panel B

Pre-refinement ratings	Post-refinement rating	Categorization	Number of sample firms
Aa	Aa1 or higher	Upgrade	11
	Aa2	Unchange	23
	Aa3 or lower	Downgrade	24
A	A1 or higher	Upgrade	58
	A2	Unchange	54
	A3 or lower	Downgrade	32
Baa	Baa1 or higher	Upgrade	66
	Baa2	Unchange	18
	Baa3 or lower	Downgrade	34
Ba	Ba1 or higher	Upgrade	28
	Ba2	Unchange	6
	Ba3 or lower	Downgrade	9
Total		Upgrade	166
		Unchange	101
		Downgrade	100

Table 2. Summary statistics of government procurement

This table provides descriptive statistics on government spending through procurement spending across industries and firms. In Panel A, column (1) lists ten industries in our sample with the largest average amount of government procurement during the pre-refinement period (i.e., from 1979 to 1981), ranked by the average amount of government spending. We employ Moody's industry classification, as reported in Moody's credit rating reports, to classify a firm's industry. Column (2) reports the average of the total government spending (i.e., total sales to government customers) in millions of U.S. dollars in each industry during the pre-refinement period. Column (3) reports the average proportion of government spending to the total sales of firms with government customers in each industry during the pre-refinement period. Panel B lists the twenty firms in our sample with the largest average amount of government spending during the pre-refinement period (column (1)), the industry each firm belongs to following Moody's industry classification (column (2)), the average government spending in millions of U.S. dollars during the pre-refinement period (column (3)), and the average proportion of government spending to a firm's contemporaneous total sales during the pre-refinement period (column (4)).

Panel A: Top industries of government procurement spending

Industry (1)	Average government spending ($Mil) (2)	Average proportion of government spending to total sales (3)
Defense	17,479.44	28.94%
Manufacturing	2,728.36	14.70%
Chemicals	1,174.66	6.00%
Energy	1,125.23	5.46%
Technology	940.27	17.73%
Telecommunications	449.04	13.94%
Aircraft & Aerospace	374.44	26.54%
Media	306.60	11.33%
Healthcare	290.13	47.23%
Automotive	244.07	8.00%

Panel B: Top firms of government procurement spending

Firm (1)	Industry (2)	Average gov. spending ($Mil) (3)	Average proportion of gov. spending to total sales (4)
Mcdonnell Douglas Corp.	Defense	3,591.43	56.83%
United Technologies Corp.	Defense	2,819.48	23.94%
ITT Corp.	Manufacturing	2,672.33	15.11%
Rockwell Automation	Defense	2,390.00	35.56%
Raytheon Co.	Defense	1,763.00	37.64%
Boeing Co.	Defense	1,752.33	19.11%
Northrop Grumman Corp.	Defense	1,275.90	62.92%
TRW Inc.	Defense	1,154.90	23.18%
Litton Industries Inc.	Defense	1,077.11	24.32%
Honeywell Inc.	Defense	817.53	16.86%
Textron Inc.	Defense	493.41	14.67%
Texas Instruments Inc	Technology	480.45	12.45%
Ashland Inc.	Chemicals	436.40	5.70%
FMC Corp.	Chemicals	407.26	12.01%
Gencorp Inc.	Defense	344.33	15.53%
Computer Sciences Corp.	Technology	343.15	75.23%
Motorola Solutions Inc.	Telecommunication	331.67	10.86%
Harris Corp.	Aircraft & Aerospace	331.35	24.37%
Ceridian Corp.	Media	306.60	11.33%
Perkinelmer Inc.	Healthcare	290.13	47.23%

Table 3. Summary statistics of firm characteristics

This table presents summary statistics for firm characteristics and changes in firm characteristics during the pre-refinement and post-refinement periods. The pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985). Total asset and total sales are in millions of U.S. dollars; Leverage is the ratio of total debt from the balance sheet to total assets; Tangibility is the ratio of property, plant, and equipment to total assets; Capex-to-assets is the ratio of capital expenditures to total assets; R&D-to-sales is the ratio of research and development expenses to total sales; ROA is the ratio of operating income before depreciation to total assets. Changes in each firm characteristic, denoted as Δ firm characteristic, are calculated as the mean of this characteristic during the post-refinement period minus the mean of this variable during the pre-refinement period.

				Percentile		
	N	Mean	S.D	10th	50th	90th
Total assets ($ Mil)	2,161	2,760	3,204	293	1,607	6,838
Total sales ($ Mil)	2,160	2,515	3,110	254	1,249	6,405
Leverage	2,161	0.310	0.113	0.152	0.322	0.455
Tangibility	2,154	0.592	0.242	0.257	0.606	0.899
Capex-to-assets	2,106	0.099	0.048	0.039	0.093	0.173
R&D-to-sales	2,160	0.008	0.015	0.000	0.000	0.032
ROA	2,158	0.146	0.047	0.085	0.142	0.218
Δ Total assets ($ Mil)	304	629	909	0	340	1,611
Δ Total sales ($ Mil)	304	405	687	-26	212	1,157
Δ Leverage	304	-0.023	0.055	-0.083	-0.029	0.043
Δ Tangibility	303	0.000	0.058	-0.056	0.000	0.069
Δ Capex-to-assets	298	-0.025	0.036	-0.077	-0.023	0.016
Δ R&D-to-sales	304	0.001	0.003	0.000	0.000	0.005
Δ ROA	304	-0.002	0.035	-0.053	0.001	0.039

Table 4. Univariate triple-difference analyses of government spending

This table presents univariate triple-difference analyses of the effect of credit rating information the spending of firms' government customers. Panel A presents a difference-in-differences analysis on government spending. Government spending is measured by Gov. Customers, Ln (Sales to Gov. Customers), and Proportion of Sales to Gov. Customers, respectively. Gov. Customers is an indicator for whether a firm has major government spending in a given year. Ln(Sales to Gov. Customers) is the natural logarithm of one plus the total sales from a firm's major government customers in a given year. Proportion of Sales to Gov. Customers equals the sales to major government customers divided by the firm's contemporaneous total sales (denoted in percentage). Columns (1) and (2) report the mean differences of the government spending variables between the post- and pre-refinement periods, for upgraded and downgraded firms, respectively. Upgraded and downgraded firms are firms whose Moody's credit ratings are affected by Moody's ratings refinement on April 26, 1982, and are categorized as in Table 1. The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985), and the pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). Column (3) reports the mean difference-in-difference between upgraded firms and downgraded firms. Panel B presents a difference-in-differences analysis on non-government spending. Non-government spending is measured similarly as government spending. Panel C reports triple-difference estimators by taking the difference of difference-in-differences estimators between government spending (in Panel A) and non-government spending (in Panel B). Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10 % levels, respectively.

Panel A: Government Spending

	Mean Difference for Downgraded (1)	Mean Difference for Upgraded (2)	Mean Diff-in-Diffs (4)
	(Post - Pre)	(Post - Pre)	(1) -(2)
Gov. Customers	-0.058***	0.061**	-0.119***
	(0.019)	(0.027)	(0.038)
Ln (Sales to Gov. Customers)	-0.167**	0.174*	-0.340**
	(0.072)	(0.089)	(0.127)
Proportion of Sales to Gov. Customers (%)	-0.391***	0.276	-0.667**
	(0.141)	(0.185)	(0.262)

Panel B: Non-Government Spending

	Mean Difference for Downgraded (1)	Mean Difference for Upgraded (2)	Mean Diff-in-Diffs (4)
	(Post - Pre)	(Post - Pre)	(1) -(2)
Ln (non-Gov. Customers)	-0.018	0.001	-0.020
	(0.019)	(0.016)	(0.025)
Ln (Sales to non-Gov. Customers)	-0.051	-0.017	-0.034
	(0.083)	(0.068)	(0.109)
Proportion of Sales to non-Gov. Customers (%)	-0.058	0.010	-0.068
	(0.250)	(0.206)	(0.329)
Panel C: Triple Diff-in-Diff			
Gov. Customers - non-Gov. Customers			-0.100***
			(0.037)
Ln (Sales to Gov. Customers) - Ln (Sales to non-Gov. Customers)			-0.306**
			(0.146)
Proportion of Sales to Gov. Customers - Proportion of Sales to non-Gov. Customers (%)			-0.600*
			(0.376)

Table 5. Multivariate triple-difference analyses on government spending

This table presents multivariate triple-difference analyses of the effect of credit rating information the spending of firms' government customers. Panel A presents a difference-in-differences analysis on government spending. The dependent variables are the changes in government spending, defined as the mean of government spending during the post-refinement period minus the mean of government spending during the pre-refinement period for each firm. Panel B presents a difference-in-differences analysis on non-government spending. The dependent variables are the changes in non-government spending, defined similarly as in those of Panel A. Government and non-government spending is measured by the variables as in Table 4. Panel C reports triple-difference estimators by taking the difference of difference-in-differences estimators between government spending (in Panel A) and non-government spending (in Panel B). The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985), and the pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). Upgrade and Unchange are indicators variables for upgraded firms and unchanged firms. Downgraded firms are omitted as the benchmark group. Upgraded, unchanged, and downgraded firms are firms whose Moody's credit ratings are affected by Moody's ratings refinement on April 26, 1982, and are categorized as in Table 1. Changes in each firm characteristic, denoted as Δ firm characteristic, is calculated as the mean of this characteristic, during the post-refinement period minus the mean of this variable during the pre-refinement period. Ln (asset) is the natural logarithm of total assets; Leverage is the ratio of total debt from the balance sheet to total assets; Tangibility is the ratio of property, plant, and equipment to total assets; Capex-to-assets is the ratio of capital expenditures to total assets; R&D-to-sales is the ratio of research and development expenses to total sales. Initial rating fixed effects are indicator variables for Moody's credit ratings before the ratings refinement. In Panel A and Panel B, robust standard errors are in parentheses. In Panel C, Chi-squared statistics are reported below coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10 % levels, respectively.

Panel A: Government spending						
	Gov. Customers		Ln(Sales to Gov. Customers)		Proportion of Sales to Gov. Customers (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Upgrade	0.104***	0.125***	0.302***	0.374**	0.599**	0.779**
	(0.033)	(0.042)	(0.116)	(0.154)	(0.233)	(0.327)
Unchange	0.032	0.048	0.086	0.125	0.403	0.509
	(0.031)	(0.039)	(0.115)	(0.140)	(0.254)	(0.312)
Δ Ln(assets)		0.082		0.287		0.363
		(0.074)		(0.243)		(0.683)
Δ Leverage		-0.518		-1.459		-2.225
		(0.369)		(1.251)		(3.199)
Δ Tangibility		-0.269		-0.464		0.723
		(0.429)		(1.524)		(4.124)
Δ Capex-to-assets		-0.999*		-3.296**		-6.822*
		(0.515)		(1.596)		(3.851)
Δ R&D-to-sales		-1.282		-2.036		13.118
		(4.028)		(16.824)		(43.993)
Initial rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	367	297	367	297	367	297
R-squared	0.069	0.112	0.043	0.074	0.034	0.054

Panel B: Non-Government spending						
	Non-Gov. Customers		Ln(Sales to non-Gov. Customers)		Proportion of Sales to non-Gov. Customers (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Upgrade	0.008	0.012	-0.001	0.013	-0.030	-0.082
	(0.018)	(0.023)	(0.114)	(0.147)	(0.336)	(0.438)
Unchange	0.027	0.043	0.151	0.252	0.201	0.473
	(0.022)	(0.027)	(0.138)	(0.166)	(0.420)	(0.483)
Δ Ln(assets)		-0.009		-0.000		0.287
		(0.052)		(0.315)		(0.947)
Δ Leverage		-0.132		-0.925		-4.115
		(0.197)		(1.206)		(3.461)
Δ Tangibility		-0.160		-0.998		-4.860
		(0.258)		(1.681)		(5.245)
Δ Capex-to-assets		-0.284		-1.969		-6.965
		(0.272)		(1.838)		(5.810)
Δ R&D-to-sales		-2.036		-10.033		-46.866
		(2.951)		(18.602)		(65.492)
Initial rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	367	297	367	297	367	297
R-squared	0.019	0.037	0.025	0.044	0.025	0.054

Panel C: Triple Diff-in-Diff						
	Gov. Customers - non-Gov. Customers		Ln(Sales to Gov. Customers) - Ln(Sales to non-Gov. Customers)		Proportion of Sales to Gov. Customers - Proportion of Sales to non-Gov. Customers (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Upgrade	0.012**	0.107**	0.303**	0.361*	0.629	0.861*
	5.926	4.769	4.141	3.510	2.632	2.810

Table 6. Robustness analyses regarding over-estimation

This table presents multivariate triple-difference analyses of the effect of credit rating information the spending of firms' government customers. Panel A presents a difference-in-differences analysis on government spending. The dependent variables are the changes in government spending, defined as the mean of government spending during the post-refinement period minus the mean of government spending during the pre-refinement period for each firm. Panel B presents a difference-in-differences analysis on non-government spending. The dependent variables are the changes in non-government spending, defined similarly as in those of Panel A. Panel C reports triple-difference estimators by taking the difference of difference-in-differences estimators between government spending (in Panel A) and non-government spending (in Panel B). We assume a firm's average sales to a customer in the post-refinement period to equal 10% of the firm's average sales in the post-refinement period if the firm's average sales to this customer in the pre-refinement period is more than 10% of the firm's average sales in the pre-refinement period and the observed sales to this customer are 0 in the post-refinement period. The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985), and the pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). Upgrade and Unchange are indicators variables for upgraded firms and unchanged firms. Downgraded firms are omitted as the benchmark group. Upgraded, unchanged, and downgraded firms are firms whose Moody's credit ratings are affected by Moody's ratings refinement on April 26, 1982, and are categorized as in Table 1. Changes in each firm characteristic, denoted as Δ firm characteristic, is calculated as the mean of this characteristic, during the post-refinement period minus the mean of this variable during the pre-refinement period. Ln (asset) is the natural logarithm of total assets; Leverage is the ratio of total debt from the balance sheet to total assets; Tangibility is the ratio of property, plant, and equipment to total assets; Capex-to-assets is the ratio of capital expenditures to total assets; R&D-to-sales is the ratio of research and development expenses to total sales. Initial rating fixed effects are indicator variables for Moody's credit ratings before the ratings refinement. In Panel A and Panel B, robust standard errors are in parentheses. In Panel C, Chi-squared statistics are reported below coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10 % levels, respectively.

	Panel A: Government spending			Panel B: Non-Government spending			Panel C: Triple Diff-in-Diff		
	Gov. Cust.	Ln(Sales to Gov. Cust.)	Proportion of Sales to Gov. Cust. (%)	Ln (Non-Gov. Cust.)	Ln(Sales to non-Gov. Cust.)	Prop. of Sales to non-Gov. Cust. (%)	(1)- (4)	(2)- (5)	(3)- (6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Upgrade	0.108***	0.316**	0.612**	0.018	0.013	-0.082	0.090*	0.303	0.693
	(0.041)	(0.147)	(0.285)	(0.034)	(0.147)	(0.438)	3.289	2.434	1.973
Unchange	0.038	0.081	0.407	0.063	0.252	0.473			
	(0.037)	(0.134)	(0.290)	(0.040)	(0.166)	(0.483)			
Firm char. controls	Yes	Yes	Yes	Yes	Yes	Yes			
Initial rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes			
Observations	297	294	297	297	297	297			
R-squared	0.108	0.073	0.051	0.037	0.044	0.054			

Table 7: Univariate difference-in-difference analyses using alternative classifications

This table presents robustness analyses of the effect of credit rating information on government spending using alternative categories for upgraded, unchanged, and downgraded firms. Panel A uses S&P's existing ratings to define an upgraded (downgraded) firms if the firm's Moody's refined ratings exceeds (falls short of) S&P's existing rating, as described in Section 3.2. Panel B uses predicted credit scores to define an upgraded (downgrade) firms if the firm's Moody's refined ratings exceeds (falls short of) the predicted credit scores based on firm observable characteristics, as described in Section 3.2. Government spending is measured by the variables as in Table 4. The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985), and the pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). Columns (1) and (2) report the mean differences of the government spending variables between the post- and pre-refinement periods, for upgraded and downgraded firms, respectively. Column (3) reports the mean difference-in-difference between upgraded firms and downgraded firms. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10 % levels, respectively.

Panel A: S&P ratings benchmark

Government spending

	Mean Difference for Downgraded (1)	Mean Difference for Upgraded (2)	Mean Diff-in-Diffs (3)
	(Post - Pre)	(Post - Pre)	(1) -(2)
Gov. Customers	-0.053***	0.051	-0.104***
	(0.020)	(0.046)	(0.043)
Ln (Sales to Gov. Customers)	-0.186***	0.238	-0.424***
	(0.061)	(0.176)	(0.154)
Proportion of Sales to Gov. Customers (%)	-0.362***	0.472	-0.834***
	(0.134)	(0.384)	(0.337)

Panel B: Credit score benchmark			
Government spending			
	Mean Difference for Downgraded (1)	Mean Difference for Upgraded (2)	Mean Diff-in-Diffs (4)
	(Post - Pre)	(Post - Pre)	(1) -(2)
Gov. Customers	-0.067***	0.046*	-0.113***
	(0.015)	(0.027)	(0.036)
Ln (Sales to Gov. Customers)	-0.182***	0.100	-0.281***
	(0.066)	(0.080)	(0.115)
Proportion of Sales to Gov. Customers (%)	-0.361**	0.142	-0.503**
	(0.161)	(0.174)	(0.255)

Table 8. Cross-sectional analyses on government and non-government procurement spending

This table presents analyses of cross-sectional variations in the responses of government and non-government procurement spending to changes in rating certification. Panel A presents results on government spending. Panel B presents results on non-government spending. The dependent variables are the changes in the three measures of government (non-government) spending, respectively, which are defined as the mean of a government (non-government) spending variable during the post-refinement period minus the mean of the variable during the pre-refinement period for each firm. Government (non-government) spending is measured the same as in Table 4. The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985), and the pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). Upgrade and Unchange are indicators variables for upgraded firms and unchanged firms. Downgraded firms are omitted as the benchmark group. Upgraded, unchanged, and downgraded firms are firms whose Moody's credit ratings are refined by Moody's ratings refinement on April 26, 1982, and are categorized as in Table 1. TopInd is an indicator variable for whether a firm is in the top 15 industries with the largest average government spending during the pre-refinement period, where a firm's industry is classified following Moody's industry classification; Threshold is an indicator variable for whether a firm's original rating prior to Moody's refinement is either "Baa" or "Ba". Changes in firm characteristics as those in Table 5 are included but not reported. Initial rating fixed effects are indicator variables for Moody's credit ratings before the ratings refinement. Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10 % levels, respectively.

Panel A: Gov. Customers								
	Gov. Customers				Sales to Gov. Customers		Proportion of Sales to Gov. Customers (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Upgrade*TopInd	0.093**	0.103*			0.345*		0.760*	
	(0.041)	(0.056)			(0.197)		(0.410)	
Unchange*TopInd	0.009	-0.009			-0.036		0.223	
	(0.047)	(0.060)			(0.215)		(0.451)	
Upgrade*Threshold			0.206***	0.226***		0.727**		1.600***
			(0.063)	(0.079)		(0.294)		(0.587)
Unchange*Threshold			0.030	0.026		-0.007		-0.439
			(0.073)	(0.093)		(0.280)		(0.604)
TopInd	0.043	0.063			0.235		0.292	
	(0.032)	(0.044)			(0.168)		(0.327)	
Threshold			NA	NA		NA		NA
			NA	NA		NA		NA
Upgrade	0.011	0.021	-0.001	0.008	0.023	-0.006	0.054	-0.075
	(0.017)	(0.032)	(0.039)	(0.052)	(0.102)	(0.217)	(0.180)	(0.349)
Unchange	0.021	0.052*	0.004	0.017	0.142	0.052	0.340*	0.464
	(0.016)	(0.029)	(0.035)	(0.045)	(0.097)	(0.190)	(0.178)	(0.398)
Firm characteristics controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Initial rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	367	297	367	297	297	297	297	297
R-squared	0.081	0.126	0.095	0.137	0.089	0.099	0.065	0.088

Panel B: Non-Gov. Customers								
	Non-Gov. Customers				Sales to non-Gov. Customers		Proportion of Sales to non-Gov. Customers (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Upgrade*TopInd	0.011	-0.004			-0.133		-0.647	
	(0.038)	(0.048)			(0.214)		(0.696)	
Unchange*TopInd	0.015	0.012			0.035		-0.379	
	(0.050)	(0.057)			(0.259)		(0.806)	
Upgrade*Threshold			0.061	0.047		0.047		-0.457
			(0.052)	(0.069)		(0.314)		(0.930)
Unchange*Threshold			0.058	0.054		0.253		0.614
			(0.087)	(0.104)		(0.438)		(1.436)
TopInd	0.057**	0.077**			0.377**		0.946*	
	(0.029)	(0.035)			(0.157)		(0.493)	
Threshold			NA	NA		NA		NA
			NA	NA		NA		NA
Upgrade	-0.010	0.007	-0.018	-0.005	0.063	-0.002	0.309	0.182
	(0.017)	(0.027)	(0.032)	(0.042)	(0.110)	(0.192)	(0.382)	(0.477)
Unchange	0.024	0.054**	0.017	0.043	0.231*	0.177	0.745	0.349
	(0.018)	(0.026)	(0.030)	(0.040)	(0.135)	(0.164)	(0.461)	(0.363)
Firm characteristics controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Initial rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	367	297	367	297	297	297	297	297
R-squared	0.034	0.054	0.023	0.039	0.062	0.046	0.065	0.088

Table 9. Analyses of firms' sales markup and profitability

This table presents analyses of the effect of rating certification on firms' sales markup and profitability. Panel A reports sales markup for downgraded and upgraded firms, respectively, during the pre-refinement and post-refinement periods. Markup is defined as (Total sales/Cost of goods sold)-1. Upgraded, unchanged, and downgraded firms are firms whose Moody's credit ratings are refined by Moody's ratings refinement on April 26, 1982, and are categorized as in Table 1. The post-refinement period includes the year of Moody's ratings refinement and the following three years (i.e., 1982 to 1985), and the pre-refinement period includes the three years preceding Moody's ratings refinement (i.e., 1979 to 1981). Panel B reports regression analyses for markup, profit margin and ROA. The dependent variables are the changes in each variable, defined as the mean of each variable during the post-refinement period minus the mean of this variable during the pre-refinement period for each firm. Profit margin is defined as net income divided by total sales; ROA is defined as operating income before depreciation to total assets. Upgrade and Unchange are indicators variables for upgraded firms and unchanged firms. Changes in firm characteristics as those in Table 6 are included but not reported. Initial rating fixed effects are indicator variables for Moody's credit ratings before the ratings refinement. Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10 % levels, respectively.

Panel A: Sales Markup for downgraded and upgraded firms

	Mean for Downgraded	Mean for Upgraded		Difference
Pre-refinement	0.416	0.457		-0.041
				(0.038)
Post-refinement	0.407	0.495		-0.088**
				(0.039)
Difference	-0.009	0.038***	**DiD:**	0.047***
	(0.012)	(0.008)		(0.012)

Panel B: Regressions on markup and profitability

	Markup		Profit Margin		ROA	
	(1)	(2)	(3)	(4)	(5)	(6)
Upgrade	0.042***	0.040***	0.015***	0.016***	0.021***	0.017***
	(0.012)	(0.013)	(0.004)	(0.004)	(0.004)	(0.004)
Unchange	0.015	0.025**	0.001	0.005	-0.003	0.004
	(0.012)	(0.012)	(0.004)	(0.004)	(0.005)	(0.004)
Δ Ln(assets)		-0.023		0.015*		-0.011
		(0.027)		(0.008)		(0.007)
Δ Leverage		-0.150		-0.159***		-0.261***
		(0.115)		(0.034)		(0.039)
Δ Tangibility		-0.010		0.102***		0.039
		(0.119)		(0.033)		(0.036)
Δ Capex-to-assets		0.190		-0.195***		0.126***
		(0.131)		(0.043)		(0.046)
Δ R&D-to-sales		-1.535		-0.545		-1.458***
		(1.491)		(0.439)		(0.530)
Initial rating fixed effects	No	Yes	No	Yes	No	Yes
Observations	304	297	303	297	304	297
R-squared	0.045	0.085	0.061	0.193	0.124	0.346