

# Choose Your Battles Wisely: The Consequences of Protesting Government Procurement Contracts

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## Abstract

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JEL classification: G38, H57, P16.

Keywords: Bid protests, government procurement, competition.

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# **Choose Your Battles Wisely: The Consequences of Protesting Government Procurement Contracts**

## **Abstract**

Firms that successfully protest a government agency's conduct or terms of a procurement contract lose future business opportunities with the government. Their chance of receiving procurement contracts from the contested government agencies during the following four years drops by 68%, and they experience significant reductions in sales growth and employee growth. They receive fewer contracts also from other, non-contested, government agencies. Despite widespread belief, successful bid protestors do not delay the government procurement process due to lengthy dispute resolutions. Overall, we provide the first analysis of how firms interact with the government bid-protest system in the United States. Our results demonstrate the consequences of legitimate bid protests on firms and raise questions about the efficacy of the government bid-protest system.

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## I. INTRODUCTION

Competition in public contracting benefits society by lowering prices, encouraging innovation, and promoting integrity in the procurement process.<sup>1</sup> To protect competition, most public procurement systems offer complaint and audit mechanisms.<sup>2</sup> Procurement is otherwise vulnerable to fraud and corruption, and firms are discouraged from participating in public contracting. In the United States, the Government Accountability Office (GAO) is the main statutory authority to hear complaints and correct errors in public contracting. Since 1926, if a government agency's contracting decision violates procurement law to the detriment of a firm, the firm can raise a complaint by submitting a bid protest to the GAO. The GAO has authority to issue a corrective action decision that leads to the termination and complete resolicitation of the protested contract, along with the reimbursement of the successful protesting firm by the protested government agency for the costs of pursuing the bid protest.

To the best of our knowledge, there is no direct academic evidence on how the GAO's corrective action decisions impact protesting firms. A corrective action decision may help a protesting firm secure a previously unattainable government contract at no cost, and therefore boost that firm's sales and growth. On the other hand, if procurement officers resent production delays and the additional work required to terminate the existing contract and solicit another round of bids, their bias may negatively affect the protesting firm's future contracting.<sup>3</sup> Such distortions would undermine GAO's efforts to provide objective, independent, and impartial resolutions for procurement-related disputes, and have detrimental effects on the protesting firm. In short, whether a corrective action decision has a positive or a negative effect on a protesting firm is an important but currently unanswered empirical question. The answer to this question is

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<sup>1</sup> See, for example, Agapos and Dunlap (1970), Attanasi and Johnson (1975), Lichtenberg (1988), Schleifer and Vishny (1993).

<sup>2</sup> See Gordon (2013) and Knack, Biletska, and Kacker (2017) for an overview of bid protest mechanisms around the world.

<sup>3</sup> A 2018 RAND paper surveys Department of Defense (DoD) personnel and reports their general dissatisfaction with bid protests; see Arena, et al (2018). DoD personnel argue that bid protesters impede procurement awards by making weak allegations.

important to firms bidding for government contracts and their shareholders. It is also important for taxpayers, because they ultimately pay for inefficient and ineffective management of public resources.

The contributions of this paper are twofold. First, we identify the causal impact of the GAO's corrective action decisions on subsequent government contract allocations to protesting firms. Next, we analyze whether the GAO's corrective action decisions influence corporate outcomes such as sales and employee growth. To the best of our knowledge, this paper provides the first systematic analysis in the financial economics literature of how the bid protest system affects firms participating in the public procurement process. Throughout the paper, we refer to firms that protest and receive corrective actions as having "successfully protested" the government.

To conduct our analyses, we gather detailed data on bid protests and government contracts. Only a fraction of the data on bid protests is publicly accessible through the official GAO website. We therefore file a series of Freedom of Information Act (FOIA) requests with the GAO to obtain a comprehensive dataset for all bid protests filed between 2005 and 2016. We manually merge this data with publicly available government procurement data. The merged dataset allows us to compare future government contract allocations to all firms filing bid protests for any particular government contract. For example, if firms A and B file bid protests against the Department of Agriculture's contract "AG123", and the GAO decides only firm A was wrongly eliminated from this contract, then we would compare future government contracts allocated by the Department of Agriculture to firms A and B during the four-year period following the GAO's decision.

We begin by conducting OLS regressions to examine the relation between successful government protests and future government contract allocations. We find a positive association, indicating firms that successfully protest receive more future government contracts. However, this approach may fail to identify the causal effect of successfully protesting. For example, omitted and unobservable time-varying firm quality may be correlated with the possibility of obtaining corrective actions from the GAO and future

government contracts from agencies. We offer a novel empirical approach to overcome this challenge and shed light on the impact of corrective action decisions on corporate outcomes.

A well-known feature of the bid protest system in the United States is the tight bid protest window.<sup>4</sup> As explained in detail in Section II below, firms are only allowed to file comprehensive and meritorious bid protests within 10 calendar days of being notified that they were eliminated from competition. In order to compel a stay of execution, the protest deadline is within five days. This deadline is strictly enforced by the GAO. Our key innovation is to use the intensity of power outages in the geography of protesting firms' headquarters on bid protest deadlines to identify exogenous variation in corrective action decisions in a two-stage least squares (2SLS) procedure. Such power outages potentially disrupt firms' ability to file effective bid protests on time and obtain corrective actions. They coincide with bid protest deadlines frequently, are spread widely over time and geography, and vary considerably in terms of magnitude. In first stage regressions, we find that major power outages that occur as the protest window closes indeed reduce bid protesters' chances of filing successful protests. Therefore, these events satisfy the strength requirement for an acceptable instrument.

Power outages also likely satisfy the exclusion restriction for an acceptable instrument, because they are temporary and have little long-term impact on a firm's physical productive capacity. In other words, power outages should only affect a firm's ability to receive future government contracts through their impact on whether firms effectively file successful protests. We conduct two tests to support this claim. If power outages do not satisfy the exclusion restriction, then they should still predict corrective actions when they occur outside the bid protest window. We find no evidence to this effect. In fact, the instrument only predicts corrective actions from [-3,0] days relative to the protest date.<sup>5</sup> It has no predictive power on the days immediately before this four-day window, or immediately after the bid protest date.

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<sup>4</sup> See, for example, GAO's descriptive guide for bid protests at <https://www.gao.gov/products/GAO-18-510SP>.

<sup>5</sup> A representative power outage in our sample takes about two days.

One might argue that natural disasters may simultaneously cause power outages and disrupt firms' productive capacities. To reaffirm that the exclusion restriction is not violated due to natural disasters, we use daily satellite images of firms' surroundings around bid protest days. More specifically, we use innovative computer vision techniques to examine how firms' surroundings change in the event time of bid protests and power outages, and confirm that firms' productive capacities are indeed unaffected by natural disasters. Collectively, these two tests provide strong evidence that our instrument pins down the exogenous impact of corrective actions on future government contract allocation and firm growth.

Our approach draws inferences based on the comparison of firms that protest the same government contract. We show that the GAO's corrective action decisions result in large and persistent reductions in future government contracts for successfully protesting firms. The probability of a successful protesting firm receiving a government contract from the protested agency decreases by 68% during the four-year period after the GAO's corrective action decision, after which the effect abates. This result contradicts the positive association found in the preliminary OLS regressions and underscores the importance of identifying the causal impact of successful protests. We confirm the robustness of this result by using a rich array of controls and interactive fixed effect structures that absorb geographic, economic, and political shocks at the state-year level along with budgetary restrictions and bid protest activity at the agency-year level. To explore the impact of corrective action decisions on other corporate outcomes, we study sales growth and employee growth. We find that corrective action decisions result in a statistically and economically significant reduction of 51% in the next year's employee growth and 67% in the next year's sales growth for successfully protesting firms. Our results overall support the hypothesis that corrective action decisions have detrimental effects on firms' government-related cash flows and growth.

A common concern regarding corrective action decisions is that they delay the government procurement process due to lengthy dispute resolutions.<sup>6</sup> To provide empirical evidence on this debate, we

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<sup>6</sup> See, for example, Hawkins, Yoder, and Gravier (2016) and Khoury, Walsh, and Ward (2017), which have different findings on the bid protest resolution times. See also <https://bit.ly/2Q1NeTC>.

study the GAO's bid-protest resolution period, i.e., the number of days it takes the GAO to finalize its decision on a protest. Contrary to widespread concerns, we find that corrective action decisions have shorter bid-protest resolution periods than unsuccessful protests. We conclude the legitimate protests generally do not delay procurement unduly. This result is statistically and economically significant and robust to an array of controls and interactive fixed effect structures.

We contribute to a large and growing literature examining factors that influence the allocation of government resources. These factors include lobbying (Blanes i Vidal, Draca, and Fons-Rosen (2012), and Acemoglu, Kermani, Kwak, and Mitton (2015)), revolving doors, senior politicians and political networks (Roberts (1990), and Faccio and Parsley (2009), Faccio (2006), Goldman, Rocholl, and So (2009, 2013), Fisman (2001), Cohen, Coval, and Malloy (2011), Fisman, Fisman, Galef, and Khurana (2012), Kim, Pantzalis and Park (2012), Belo, Gala and Li (2013), Schoenherr (2016) and Canayaz (2018)), political campaign donations and investment decisions of political representatives (Cooper, Gulen, and Ovtchinnikov (2010), and Tahoun (2014)), and legislation (Cohen, Diether, and Malloy (2013)). To the best of our knowledge, we provide a first exploration of the effect of the GAO's corrective action decisions on future government contracts and corporate outcomes.

The closest paper to ours is by Cohen and Malloy (2016), who study the effects of government sales on future firm outcomes. The authors compare activities of government-contract winners with the activities of government-contract losers that challenge these contracting decisions at the U.S. Court of Federal Claims (CFC). The authors conclude that government-contract winners invest less and exhibit lower future sales growth. Our paper compliments Cohen and Malloy (2016) in the following ways. First, our research question is about the consequences of successful protesting, not the consequences of winning contracts. A corrective action (successful protest) does not guarantee that a protesting firm will receive any contract. A corrective action guarantees only re-solicitation (a second round of bidding) and reimbursement of legal fees and other protest costs. Rather than benchmark government-contract winners with government-contract losers, we compare government-contract losers that protest the outcome. Our identification strategy

relies on unexpected power outages on bid protest deadlines that create a source of exogenous variation in corrective action decisions. We focus on the consequences of legitimate protests rather than how government contracts affect corporate activities.

Second, we study GAO bid protests rather than CFC cases. Because pursuing a case at the CFC is costly, it is difficult to disentangle the effect of winning a case from the effect of litigation costs on corporate outcomes.<sup>7</sup> In contrast to CFC cases, filing a GAO bid protest is easy, fast, and for successful protestors direct costs are reimbursed by the protested agency.<sup>8</sup> Our results are thus arguably immune to confounding effects of litigation costs on corporate outcomes.

Related legal literature argues that the benefits of the bid protest system outweigh its costs. Gordon (2013) lists costs associated with bid protests as attorney costs and costs due to holding up the protested acquisition, and benefits associated with bid protests as a low-cost system of accountability, and higher participation and competition in public contracting. In this paper, we study private-sector implications of the GAO's corrective action decisions. In so doing, we identify an indirect cost previously undocumented. Firms that successfully protest government contract awards are deprived of future business opportunities with the government. This effect potentially deters competition in public contracting and therefore the effective and efficient use of government resources.

The remainder of the paper is organized as follows. Section II provides institutional background on the bid protest system. Section III presents our data and summary statistics. Section IV describes our empirical strategy and provides our main results. Section V presents robustness tests and Section VI concludes. We present additional findings and details on bid protesting in the Appendix.

## **II. INSTITUTIONAL BACKGROUND**

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<sup>7</sup> See, for example, Thaler (1988) on the winner's curse.

<sup>8</sup> We randomly select a handful of bid protests and submit FOIA requests to the protested agencies in order to learn how much a bid protest may cost a protesting firm. We learn that the cost of the average bid protest via the GAO is less than \$50,000, which is a marginal amount relative to the average government vendor's sales.



A bid protest is a challenge to the award or proposed award of a contract by a government agency for the procurement of goods and services.<sup>9</sup> As shown in Figure I, it can be filed by government vendors before or after a contract award decision. A pre-award protest is submitted by a potential government contract bidder after a proposed contract solicitation is announced but before the contract is allocated.<sup>10</sup> A post-award protest is submitted by an unsuccessful bidder after the contract is allocated. In pre-award protests, protesters generally challenge their elimination from competition for a proposed award, or a proposed award being vague or conflicting. Post-award protesters raise issues with evaluation, procedural errors, or organizational conflicts of interest.

[Figure I about here]

A key consideration in both pre- and post-award protests is the timing of events. To submit a credible protest, a potential protester needs to understand why it was excluded from an award or a proposed award. Toward this end, the excluded firm must submit a request for a debrief within three calendar days of being notified that it was eliminated from competition. We provide sample debrief application letters in Appendix Figure A.I. Contracting agencies are known to time notifications on Fridays (which require a debrief request by Monday) in order to reduce the number of such requests.<sup>11</sup> For eliminated firms who make this deadline, the contracting agency must provide the debrief within five days of this request. After this debrief, the potential protester has 10 calendar days to file a protest.<sup>12</sup>

Importantly, a post-award protest must be complete by Day 5 following the contract award date in order to force a stay of execution, which halts production until the resolution of the protest. These deadlines are strictly enforced and the contracting agencies further time award notifications strategically on Fridays

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<sup>10</sup> In pre-award protests, protesters can be notified that they have been eliminated from competition after the request for quotation process with an e-mail and/or letter.

<sup>11</sup> In response to our FOIA request regarding debrief dates, the GAO indicates that they do not keep this data.

<sup>12</sup> We opened a bid protester account at the GAO in order to study the bid protest applications closely. We show GAO's online bid-protest framework in Appendix Figure A.II.

or near a holiday in order to minimize the number of post-award protests.<sup>13,14</sup> Given this limited time frame to process legally relevant information, disturbances to a potential protester (such as contemporaneous power outages) potentially diminish its chances of filing a successful protest in time.

As shown in Figure II, the deadline for the GAO to issue a decision on a given protest is 100 calendar days and most protests are resolved within this time frame. The GAO generally dismisses any bid protests that are untimely (e.g., too late) or legally insufficient by Day 30. If the GAO decides that a protest has merit, then the contracting government agency is asked to write a responsive report by Day 30 and the protesting firm is then asked to respond to this agency report by Day 40. Protesters' failure to respond by this deadline yields a dismissal. After Day 40, the GAO may request additional filings by the parties, conduct alternative dispute resolutions, and hold hearings.

[Figure II about here]

A protest is concluded when it is "withdrawn" by the protester, "dismissed" by the GAO due to a technical or procedural flaw such as lack of timeliness or jurisdiction, "denied" by the GAO due to lack of protest merit, or "sustained" by the GAO as timely and meritorious. Additionally, the protested government agency may take a corrective action before the GAO concludes its investigation. Such corrective action may involve a re-evaluation of proposals, a new award decision, an amendment to a solicitation, and/or providing financial relief to the protester. Such actions on the part of the contracting agency result in a withdrawal by the protestor or a dismissal by the GAO.

In addition to protesting government contracts via GAO, firms may also protest via government agencies (FAR 33.103) and US Court of Federal Claims (FAR 33.108). The average number (1,679.67) of bid protests submitted to the GAO in a given year between 2005 and 2016 is much larger than the average

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<sup>13</sup> An announcement can for example be made on the day before Thanksgiving, in which case Day 5 is the Monday following Thanksgiving.

<sup>14</sup> For more information, see Bid Protest Regulations (4 C.F.R. § 21.2) and Bid Protests at GAO: A Descriptive Guide.

number (provided by Thomson Reuters) of direct government agency protests (average is 28 per year between 1999 and 2004) or protests via the CFC (average is 91 per year between 2006 and 2015). We collect data on CFC cases from the West Law dataset to confirm this average provided by Thomson Reuters. We conclude that the GAO is the main venue for bid protests in the U.S., likely due to relative costs. For a comparison of bid protest venues, please see Schaengold, Guiffre, and Gill (2009), and Kovacic (1995). To compare bid protest outcomes at GAO and CFC, please refer to Saunders and Butler (2010), who find that vast majority of bid protests brought both to the GAO and CFC result in identical outcomes.

### **III. DATA AND SUMMARY STATISTICS**

The GAO obtains detailed data from bid protests but shares only a limited portion of this data online.<sup>15</sup> To conduct our empirical analyses, we therefore file a series of FOIA requests to the GAO to obtain comprehensive data on all bid protests that were filed between 2005 and 2016. The GAO groups related protests in the same docket and assigns an index number to each. Each bid protest is assigned a unique 8-digit number referred to as button numbers or “B-numbers” (e.g., B-123456.01). The first six digits of each B-number refers to the docket (e.g., B-123456) and the last two digits refer to the index number (e.g., 01). The first protest in docket B-123456 would thus be assigned a B-number of B-123456.01.

The protesting firm’s attorneys are then privy to the protested agency’s sensitive procurement documents which often give rise to additional grounds for protest. To increase the likelihood of a sustained protest, protesting firms are incentivized to file protests on multiple legal bases. A subsequent protest filed for the same docket (either by the incumbent protestor or by a new protestor) is then assigned B-number B-123456.02, and so forth. Each B-number is linked with a protesting firm name, protest filing date, GAO decision date, name of the protested government agency, related solicitation or request for quotation (RFQ) number, the GAO’s final decision on the protest, and the GAO’s explanation for its decision.

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<sup>15</sup> The GAO actively deletes publicly available bid protest information from their website. Relying on data from the GAO website, we gather a total of 1,931 protests over the period January 2014 - November 2018. However, our FOIA request reveals that there were 2,172 bid protests in 2014 alone. We thus believe that we have compiled the most inclusive dataset available.

Since the GAO groups protests against the same solicitation in the same 6-digit docket number, we can easily identify firms that protest the same contract or proposed contract award. Button number B-295663.01, for example, maps to a bid protest filed by ELR Consultants, LLC on January 12<sup>th</sup>, 2005 for solicitation number DE-RP24-04OH20179, which was solicited by Department of Energy. On January 25<sup>th</sup>, 2005, GAO's decision on B-295663.01 was finalized and ELR Consultants, LLC was informed that their protest was dismissed because the firm was not an interested party. There were 11 subsequent bid protests filed on the same docket number. Four of these (B-295663.03, B-295663.05, B-295663.08, and B-295663.10) yielded corrective actions; others were dismissed or withdrawn before yielding corrective actions.

[Table I about here]

As shown in Panel A of Table I, the GAO dataset contains 20,156 bid protests filed between 2005 and 2016. In the average year 865 firms filed 1,679.67 bid protests challenging 33.75 government agencies. 11,885 of these 20,156 bid protests were dismissed, 3,935 were denied, 3,444 were withdrawn and 831 were sustained. The sustain rate between 2005 and 2016 was therefore approximately 4.1%. However, this rate underestimates the total corrective action rate. During our sampling period, the GAO issued 8,562 corrective-action decisions. As shown in Panel B of Table I, 6,821 cases were dismissed by the GAO and 819 cases were withdrawn by protesters, because contracting government agencies took corrective actions. As shown in Panel C of Table I, the Department of Defense is the most protested government agency, subject to 11,523 bid protests during our sampling period. The Department of Veterans Affairs was subject to 1,857 bid protests, Homeland Security was subject to 1,136, and Health and Human services was subject to 836.

We merge GAO data with government procurement data from USAspending.gov, which is the official source for data on spending by the U.S. Government. Government contract award data is pulled daily into this USAspending dataset from the Federal Procurement Data System Next Generation (FPDS-NG), the system of record for federal procurement data. To merge these data, we first perform string

matching between protesting firm names from the GAO dataset with vendor names in the USAspending dataset. As a second step, we manually confirm the merged firm and vendor name matches. As a third and final step, we identify the unmatched GAO firm names and manually match them with USAspending vendor names. This process provides us with a linking table between these datasets.

To measure government procurement activity at the firm-agency-year level, we then manually match government agency names in the GAO dataset with government agency names in the USAspending.gov dataset. With these data, we observe government contracts allocated to each protesting firm before and after the bid protest and we identify important firm-level information including revenues, number of employees, geographic location, and whether the protesting firm is classified as a small, women-owned, veteran-owned, or minority-owned business eligible for certain set asides.

The third dataset we utilize is on power outage events in the U.S. We collect power outage data between 2005 and 2016 from the U.S. Energy Information Administration (EIA)'s Electric Power Monthly reports. The EIA lists major electric disturbances and unusual occurrences in Appendix B1 and Appendix B2 of each Electric Power Monthly report. The EIA data includes information on event time, restoration time, areas affected, disturbance type, demand loss, and number of customers affected. To identify protesting firms that are affected by power outages, we use headquarter locations from the USAspending dataset.

[Table II about here]

The empirical identification strategy of this paper exploits unexpected power outages in the U.S. on bid protest filing dates, which likely complicate communication, file transfer, and work product between protesting firms and their attorneys. For example, Team Wendy, LLC submitted bid protest B-406954.02 on July 2, 2012, while being exposed to a severe weather event in Ohio. This event caused a demand loss of 2,946 megawatts and affected 4,645,572 customers. Similarly, OPFOR Group LLC and The MayaTech Corporation were exposed to unexpected power outages on bid protest filing dates for B-405639.02 and B-

407397.02 due to unexpected transmission/distribution interruption and load shedding, and equipment failure. None of these bid protests yielded corrective actions. Table II presents the number of power outages along with affected states, bid protests and customers. In total, we identify 232 power outages effecting 125 states and 81.5 million customers. These power outages were on the same dates as 439 bid protest filings with the GAO. In the average year, there were 19.33 power outages affecting 36.58 bid protests.

[Table III about here]

Table III presents summary statistics on the merged GAO-USAspending-EIA universe. To compare government contract allocation to firms that do and do not receive corrective actions, we keep dockets with more than one bid protest; (e.g., we keep B-123456 only if we identify at least B-123456.01 and B-123456.02). This allows us to compare firms that protest the same procurement award or proposed procurement award (and therefore the same government agency). These firms bidding on the same contracts are arguably similar in terms of production capabilities. Our final dataset encompasses 9,681 bid protests, 46% of which generate corrective actions.<sup>16</sup> 65% of these protesting firms receive government contracts from the protested government agencies and 50% receive government contracts from other (undisputed) government agencies during the four-year period after their bid protests.

Figure III maps the geographic concentration of protesting firms in our final sample. Perhaps it is not surprising to find the highest concentration of these firms in Virginia. Figure IV maps the geographic concentration of power outages. Here we find the highest concentration in California. Figure V maps the geographic dispersion of power outages affecting the protesting firms in our sample. Here, we find significant and helpful geographic dispersion.

[Figures III to V about here]

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<sup>16</sup> This is close to the average corrective action rate in our broader sample (43%).

The average government contract from protested government agencies amounts to \$158.61 million in the year before the protest; the median contract amount is \$2.07 million. Total government contracts allocated to the average protesting firm amounts to \$281.04 million in the year before the bid protest; the median total amount is \$8.87 million. As part of their procurement applications, most government contractors report their revenues and employee headcount. The median reported revenue is \$13.87 million and number of employees is 104. Therefore, government contracts represent a significant 64.0% of the median protesting firm's revenues. In years preceding bid protests, the average sales growth among protesting firms is 13% and employee growth is 7%. Of our sample of protesting firms, 31% are small, 19% are women-owned, 23% are veteran-owned and 31% are minority-owned businesses potentially eligible for set asides.

#### **IV. EMPIRICAL STRATEGY**

##### ***A. CONVENTIONAL REGRESSION FRAMEWORK***

In this section, we study the relation between corrective action decisions and future government contract allocation to protesting firms by the respective protested government agencies. As a first step, we use a conventional OLS regression framework to estimate correlation between these variables. In particular, we estimate a linear probability model using the following specification:

$$y_{pd} = \alpha + \beta \times \text{Corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd}, \quad (1)$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $y_{pd}$  is the dependent variable of interest, equal to one if the firm that submitted bid protest  $p$  within GAO docket  $d$  received government contracts from the protested government agency during the four-year period after the bid protest, and equal to zero otherwise. The estimated coefficient of interest is on the variable *Corrective action* <sub>$pd$</sub> , which is a dummy variable denoting whether GAO assigns a corrective action decision or sustainment to bid protest  $p$  within docket  $d$ .  $X$  contains firm-level indicator variables that denote whether

the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business.

We use a rich set of fixed effect structures including GAO docket, year, state  $\times$  year and government-agency  $\times$  year fixed effects. Docket fixed effects allow us to compare bid protests for the same contract award or proposed contract award. State  $\times$  year fixed effects absorb geographic, economic and political shocks at the state-year level, and government-agency  $\times$  year fixed effects allow us to control for agency-year shocks such as budgetary restrictions and bid protest activity the agency is exposed to in a given year. We cluster the standard errors in two dimensions (at docket and year levels) to account for the presence of correlation within dockets and years.

If corrective action is positively related to future government procurement contracts, we would expect  $\beta$  to exhibit a positive and statistically significant coefficient. Nonetheless, equation (1) could suffer from endogeneity problems due to “better” firms being more likely to get corrective actions and more valuable government contracts in the future. In an alternative hypothesis, firms that are not performing well may be granted relief by the GAO and more government contracts by government agencies, similar to the corporate welfare documented by Cohen and Malloy (2016). A priori,  $\beta$  may therefore be biased in either direction and is unlikely to reveal any causal effect of corrective action on future government contracts. Results from Equation (1) are tabulated in Table IV and discussed in context below.

### ***B. INSTRUMENTAL VARIABLE STRATEGY***

To overcome potential endogeneity concerns related to the *Corrective action*<sub>pd</sub> dummy, we exploit unexpected power outages on bid-protest application days. Given the very short bid-protest window (i.e., five or 10 calendar days), protesting firms are likely to be impacted by power outages, especially if they occur right before bid protest filing deadlines. Arguably, the difficulty imposed on the potential protestor to file a comprehensive, meritorious, and timely protest increases in the magnitude of the power outage.



With this premise, we run a two-stage least squares framework. In the first stage, we instrument corrective action decisions with the number of customers (in millions) from the protesting firm’s headquarter state that experienced a major and unexpected power outage on the bid protest date. More specifically, we estimate:

$$Corrective\ action_{pd} = \alpha + \varphi \times Number\ of\ affected\ customers_{pd} + \gamma' X + Fixed\ effects + \varepsilon_{pd}, \quad (2)$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $Corrective\ action_{pd}$  is once again the dependent variable, equal to one if the bid protest  $p$  within GAO docket  $d$  resulted in a corrective action decision by the GAO, and zero otherwise.  $Number\ of\ affected\ customers_{pd}$  denotes the number of customers (in millions) in the protesting firm’s HQ state that experience a major and unexpected power outage on the day when protest  $p$  within docket  $d$  is filed.  $X$  contains firm-level indicator variables that denote protest  $p$  was submitted by a small business, veteran-owned business, women-owned business, or minority-owned business. We also include docket, year, state  $\times$  year and government-agency  $\times$  year fixed effects.

The instrumented  $Corrective\ action_{pd}$  variable is then used in the second stage to predict whether the bid protester receives contracts from the protested government agency during the four-year period following the bid protest. In particular, we estimate:

$$y_{pd} = \alpha + \delta \times Instrumented\ corrective\ action_{pd} + \gamma' X + Fixed\ effects + \varepsilon_{pd}, \quad (3)$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $y_{pd}$  is the dependent variable of interest, equal to one if the firm that submitted bid protest  $p$  within GAO docket  $d$  receives contracts from the protested government agency during the four-year period after the bid protest, and equal to zero otherwise. The estimated coefficient of interest is now on  $Instrumented\ corrective\ action_{pd}$ , which is the variation in  $Corrective\ action_{pd}$  that is explained by  $Number\ of\ affected\ customers_{pd}$ . Across all specifications, we include the same fixed effects and control variables as the first stage regressions.

[Table IV about here]

We present our findings in Table IV. As shown in Panel A, OLS regressions specified in Eq. (1) yield a positive coefficient of 0.02 on *Corrective action<sub>pd</sub>*. This coefficient is statistically significant across different specifications but potentially suffers from the endogeneity problems discussed above. In Panel B, we present results from the first stage of our two-stage framework, specified in Eq. (2). In columns (1) through (4), we use different sets of fixed effects, explained above, in order to compare bid protests within the same GAO docket while controlling for state-year and agency-year shocks. Across all specifications, the estimated coefficients of interest on *Number of affected customers<sub>pd</sub>* remain statistically significant and negative, with estimates ranging from  $-0.09$  to  $-0.11$ . Using our main specification with docket, state  $\times$  year, and government-agency  $\times$  year fixed effects, we find that the probability of getting a corrective action decision decreases by 11% for every one million customers from the protesting firm's HQ state that are exposed to power outages on the bid protest date.<sup>17</sup>

Panel C of Table IV presents results from our second-stage regressions specified in Eq. (3). Results in columns (1) through (4) are computed using corresponding first stage regressions presented in Panel B.<sup>18</sup> Across all specifications, the estimated coefficients of interest on *Instrumented corrective action<sub>pd</sub>* remain statistically significant and negative, with estimates ranging from  $-0.79$  to  $-0.68$ . Using our main specification with docket, state  $\times$  year, and government-agency  $\times$  year fixed effects, we find that the probability of receiving a government contract from the protested agency during the four-year period after the bid protest decreases by 68% after a obtaining a corrective action decision from the GAO. This result indicates that receiving a corrective action from the GAO against a government agency drives economically and statistically significant, and long-lasting distortions in subsequent government contracts from the protested agency.

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<sup>17</sup> The F-statistic is above 10.

<sup>18</sup> Column (1)'s first stage, for example, is shown in Panel B column (1).

### C. EVENT TIME ANALYSIS AND ADDITIONAL TESTS ON SATELLITE IMAGES

Results from the previous section indicate that our instrument is powerful in decreasing the likelihood of receiving corrective actions and explaining the distortionary effects of corrective actions on future government contracts. In this section, we study whether distortionary effects of corrective actions fade away over time. As a placebo test, we also examine whether power outages on days other than the protest filing dates influence corrective action decisions.

To show the impact of corrective actions in the event time, we estimate the following model:

$$y_{pdT} = \alpha + \delta \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd}, \quad (4)$$

where  $y_{pdT}$  is equal to one if the firm that submitted protest  $p$  within docket  $d$  receives government contracts from the protested agency in year  $T \in \{0, 1, 2, 3, 4, 5\}$  relative to the bid protest year. We use docket, state  $\times$  year and government-agency  $\times$  year fixed effects, and include indicator variables that denote whether protest  $p$  was filed by a small, veteran-owned, women-owned, or minority-owned business. First stage regressions for *Instrumented corrective action*<sub>pd</sub> are reported in column (4) of Table IV, Panel B.

We present our second stage results in Panel A of Table V. A corrective action decision decreases the probability of receiving government contracts from the protested agency in the protest year by 66%. This result is persistent over a four-year period. In the year after the bid protest, for example, the protesting firm's likelihood of receiving government contracts from the protested agency drops by 64%. For years 2 and 3 after the bid protest, the coefficient is 66% and 63% respectively. In year 4, the effect fades away statistically but is still an economically large 49% decrease. Any significant effect from the corrective action dissipates by year 5. In untabulated results, we find that the effect remains insignificant in years subsequent to year 5. These findings demonstrate a persistent negative influence of corrective action decisions on government contract allocation to protesters by protested government agencies. This influence is particularly strong between years 0 and 4 relative to the bid protest year.

[Table V about here]

Next, we study whether power outages on days other than the protest filing dates influence corrective action decisions. Toward that end, Panels B and C of Table V compare the probability of receiving corrective actions when a power outage is experienced between days -5 to 5 relative to the bid protest dates. As shown in Panel B of Table 5, the impact of power outage on the probability of obtaining a corrective action is only significant in days -3, -2, -1, and 0 relative to actual bid protest filing date. These results support the hypothesis that power outages leading up to bid protest deadlines disturb the probability of obtaining a corrective action from the GAO. As shown in Panel C, the impact of power outages on corrective actions immediately disappears one day after the bid protest filing date, and remains insignificant. These results support the hypothesis that GAO's decision is not driven by potential concerns about production efficiencies or related factors.

[Figure VI about here]

To further validate that power outages do not disrupt bid protester firms through channels other than bid protests, we analyze satellite images of firms' surroundings around bid protest days. To that end, we concentrate on bid protesters that experience significant power outages close to bid protest filing days. A potential driver of power outages is natural disasters, which may disturb bid protester firms' productive capacities and economic activities around them. To motivate, Figure VI shows satellite images of a tornado aftermath around a randomly chosen firm that is at the center of all images. We provide images of the region before and after the event, and we highlight the visual differences between the two. Panel C underlines the path of the tornado along with the establishments it disturbs (circled in bold). Understandably, if a power outage in our sample was caused by such a tornado, the exclusion restriction would be violated. To confirm that our exclusion restriction is not violated due to natural disasters, we borrow a computer vision technique from Wang, Bovik, Sheikh and Simoncelli (2004), which can successfully detect stark visual differences from satellite images.

We first generate satellite images from Planet.com for a randomly chosen 135 bid protests.<sup>19</sup> We use daily images from all available satellites: RapidEye, PlanetScope, Landsat 8, SkySat and Sentinel-2. We filter these satellite images so that the minimum area coverage is 100%, cloud cover is 0%, off-nadir angle is -60 to 60, ground sample distance (i.e., radius around the bid protester firm) is 10 km, sun azimuth is 0 to 360, and sun elevation is -90 to 90. Planet website allows us to download videos of up to 120 randomly chosen images, and we examine the -180 days to +180 days event window between bid protests.

For each bid protest, we first create a video of corresponding satellite images. These videos (named “stories” by the data vendor) contain satellite images of firms’ surroundings with the above filters along with the dates of these satellite images. We first use computational techniques to split these videos into different frames, i.e., photographs of firms’ surroundings with dates on the upper right corner. We then use machine learning and natural language processing techniques to determine which photograph corresponds to which date.

Once we have all satellite images in hand, we compare satellite images taken on bid protest days with satellite images taken from -180 days to +180 days relative to bid protest filing days. To do so, we use a simple and easy-to-compute statistical measure. We first convert images into vector form. In other words, we compute  $\mathbf{x} = \{x_i \mid i = 1, 2, \dots, N\}$  and  $\mathbf{y} = \{y_i \mid i = 1, 2, \dots, N\}$ , where each item in vectors  $\mathbf{x}$  and  $\mathbf{y}$  shows the intensity of color in each pixel of the corresponding images and  $N$  denotes the number of pixels. Similar to Wang, Bovik, Sheikh and Simoncelli (2004), our visual similarity measure is calculated as

$$\text{Visual Similarity} = l(x, y) \cdot c(x, y) \cdot s(x, y) = \left( \frac{2\mu_x\mu_y}{\mu_x^2 + \mu_y^2} \right) \cdot \left( \frac{2\sigma_x\sigma_y}{\sigma_x^2 + \sigma_y^2} \right) \cdot \left( \frac{\sigma_{xy}}{\sigma_x\sigma_y} \right)$$

where  $\mu_x$  and  $\mu_y$  are the local sample means of  $\mathbf{x}$  and  $\mathbf{y}$ ,  $\sigma_x$  and  $\sigma_y$  are the local sample standard deviations of  $\mathbf{x}$  and  $\mathbf{y}$ , and  $\sigma_{xy}$  is the sample cross correlation of  $\mathbf{x}$  and  $\mathbf{y}$  after removing the means. This

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<sup>19</sup> Our Planet account allows us to download a limited amount of data. We will include satellite images for all other protests over time. We thank Planet.com for sharing their data.

measure is also known as structural visual similarity.<sup>20</sup> We compare images taken on the bid protest filing days with images taken within the -180 days to +180 days event window.

The visual similarity index measures the similarities of three elements: the similarity of brightness (luminance), i.e.,  $l(\mathbf{x}, \mathbf{y})$ , the similarity of contrasts, i.e.,  $c(\mathbf{x}, \mathbf{y})$ , and the similarity of structures, i.e.,  $s(\mathbf{x}, \mathbf{y})$ . The first component equals 1 if and only if  $\mu_x = \mu_y$ . This holds when the average brightness of image  $\mathbf{x}$  and  $\mathbf{y}$  are equal. Since  $\sigma_x$  and  $\sigma_y$  can be viewed as estimates of contrast, the second component measures how similar the contrasts in  $\mathbf{x}$  and  $\mathbf{y}$  are. The range of values is  $[0,1]$ , where the highest value of 1 is achieved if and only if  $\sigma_x = \sigma_y$ . Lastly, the third component denotes the correlation between  $\mathbf{x}$  and  $\mathbf{y}$ , and its range is  $[-1,1]$ . The maximum is attained when  $y_i = ax_i + b$  for  $i=1,2,\dots,N$ , where  $a>0$ .

[Figure VII about here]

Figure VII shows how surroundings of bid protester firms visually change in the event time of bid protests. We concentrate on bid protester firms that experience significant power outages on bid protest filing days. In Panel A, we show visual similarities between satellite images taken on the bid protest days<sup>21</sup> and satellite images taken within the -180 days to +180 days event window. As shown in the figure, the visual similarities between day  $-t$  and  $+t$  are within each other's confidence intervals, which suggests that there is no significant disruption in near geographies. In other words, a day after the bid protest looks like a day before the bid protest. In untabulated results, we confirm this in a systematic manner. Our findings are robust to controlling for bid protest and year-month interactive fixed effects that control for fixed firm and protest docket characteristics along with seasonality.

Panel B of Figure VII shows a placebo test, in which we examine how surroundings of bid protester firms visually change one year before bid protest filing dates. More specifically, if a bid protest was filed

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<sup>20</sup> In untabulated analyses, we confirm that our findings are similar when we use a simple mean squared error (MSE) measure for visual similarity.

<sup>21</sup> If we cannot find satellite images for bid protest filing dates, we use satellite images from the closest date available.

on 01/01/2016 and if there was a power outage on that day, we study the surroundings of the bid protester firm between 180 days before 01/01/2015 and 180 days after 01/01/2015. As seen in the figure, changes in visual similarities from a year ago are very similar to changes in visual similarities before and after today's bid protests.

Finally, we also show how surroundings of four randomly chosen establishments visually change in the event time of four natural disasters.<sup>22</sup> The purpose of this exercise is to prove that our visual similarity measure can quickly detect large visual changes that are driven by natural disasters. As shown in Panel B of Figure VII, there is a large and immediate decline in visual similarities on first days after the natural disasters. This indicates that our computer vision approach yields convincing results. Collectively, these tests collectively suggest that our exclusion restriction assumption is not violated due to natural disasters and our instrument allows us to pin down the exogenous impact of corrective actions on future government contract allocation and firm growth.

Results from this section demonstrate a large and persistent effect of corrective actions on subsequent government contracts from the protested government agencies. The effects of corrective actions on government procurement survive until year 4 after the bid protest. It is unlikely that the power outages impact GAO's corrective action decisions through a channel other than protester's ability to write meritorious bid protests, because when a protester experiences a power outage one day after the bid protest we find no impact on the possibility of getting a corrective action. We reaffirm that our exclusion restriction assumption is not violated due to natural disasters by using satellite images of firms' surroundings around bid protest days.

#### ***D. CORPORATE OUTCOMES***

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<sup>22</sup> These disasters include the tornado in Texas from Figure VI; a hurricane in Port Arthur, FL; a fire in Paradise, CA; and a hurricane in El Reno, OK. The locations are 10725 Villager Rd, Dallas, TX 75230; 221 Houston Ave, Port Arthur, TX 77640; 6286 Mountain Meadow Ct, Paradise, CA; 1644 OK-66, El Reno, OK 73036, and the disaster dates are 10/21/2019; 8/30/2017; 11/5/2018; and 5/23/2019.

Our findings in the previous section demonstrate the negative impacts of corrective action decisions on an important cash flow channel for government vendors: government contracts. In this section, we study whether corrective actions also impact other corporate outcomes. In particular, we regress:

$$z_{pd} = \alpha + \delta \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd}, \quad (5)$$

where  $z_{pd}$  is the dependent variable of interest equal to next year's (relative to bid protest date) employee growth or sales growth exhibited by the firm submitting bid protest  $p$  within docket  $d$ . *Instrumented corrective action* $_{pd}$  is once again the variation in *Corrective action* $_{pd}$  that is explained by *Number of affected customers* $_{pd}$ . Fixed effects include docket, state  $\times$  year and government-agency  $\times$  year fixed effects, and  $X$  contains firm-level indicator variables that denote whether protest  $p$  within docket  $d$  was filed by a small business, veteran-owned business, women-owned business, or minority-owned business. As additional controls, we include firm revenue and the number of employees from the previous year (both logged). Standard errors are once again two-way clustered at the docket and year levels.

[Table VI about here]

We present our results in Table VI. Since data on revenue and employee growth are not available for a small portion of protesting firms, we rerun our first and second stage regressions in columns (1) and (2) for the subsample with complete data and confirm the deterioration in future government contracts after corrective action decisions. As shown in these columns, we obtain very similar results to our previous findings: we observe a decrease of 10% in corrective action probability and a decrease of 69% in the probability of receiving government contracts from the protested government agency. In columns (3) and (4), we present our findings on employee growth. The estimated coefficient of interest, on *Instrumented corrective action* $_{pd}$ , is once again statistically significant and negative, with an estimate of  $-0.51$ . This result implies that corrective actions decrease employee growth by 51% the year after bid protests. In columns (5) and (6) we present our findings on sales growth. The estimated coefficient of interest, on *Instrumented*



*corrective action*<sub>pd</sub>, is statistically significant and negative, with an estimate of  $-0.67$ . This result implies that corrective actions decrease revenue growth by 67% the year after bid protests.

Results from this section highlight the substantial impact of corrective actions on corporate growth. We find economically and statistically significant negative effects on employee and sales growth. These results demonstrate that corrective action decisions not only diminish a vital cashflow channel for government vendors but also hurt their growth opportunities. In the following section, we perform three additional tests. First, we analyze whether corrective action decisions impact government contract allocations from other (undisputed) government agencies. Second, we study whether corrective action decisions delay government procurement processes due to lengthy dispute resolutions. Third, we test whether corrective action decisions impact initial protesters of government contracts more than bid protest followers.

## **V. ROBUSTNESS**

In addition to the potential to win the protested contract award itself, an additional potential motivation for government vendors to protest denied contracts is the possibility of winning future government contracts from other agencies by signaling litigation power. On the other hand, to the extent that procurement officers network across agencies, any negative reputation effects associated with successfully disrupting procurement at one agency could spread across other agencies as well. To test whether corrective actions impact government contract allocation by other agencies, we rerun equation (4) using government contracts from other, non-disputed agencies as the dependent variable. The null hypothesis predicts that successful protests of Agency A's procurement should have no impact on future contracts awarded to the protesting firm by Agency B.

As shown in Panel A of Table VII, we find no evidence that that corrective action decisions against the protested agency positively impact government contract allocation from the other agencies. (We find no evidence that winning bid protests signals litigation power to other agencies.) Rather, in columns (1) to

(3), we observe a statistically and economically significant negative effect on the probability of getting government contracts from the other, non-disputed agencies during the four-year period subsequent to the bid protest. This result is more consistent with a negative reputation effects spreading across agencies.

[Table VII about here]

A common argument made by protested government agencies against protesting firms seeking corrective actions is that they delay the government procurement processes due to lengthy dispute resolutions. However, we could find no large-sample empirical analysis to support such concern. To provide relevant empirical evidence, we test whether sustained protests take longer to resolve than those dismissed by the GAO for lack of merit. Specifically, we rerun equation (4) using the GAO's bid protest resolution time (the number of days it takes the GAO to finalize its decision on a bid protest) as the dependent variable. As shown in Panel B of Table VII, we do not find a positive effect on resolution time. In fact, in column (4), we show that a corrective action decision has a statistically and economically significant negative effect on the number of days it takes GAO to finalize its decision on a bid protest. In contrast to anecdotal evidence provided by protested agencies, our results do not indicate that corrective actions delay the procurement process generally.

Finally, we test whether corrective action decisions impact all protesting firms equally. To the extent that our results above reflect bias against protesting firms that create additional work for procurement officers, and to the extent that subsequent protests follow from initial protests (as explained in Section III above), we predict that any negative reputation effects should accrue primarily to the earliest protesting firms. To test this prediction, we group bid protesters into two subsamples: protest starters and protest followers. We characterize the firms filing the first three protests in each GAO docket as protest starters. We characterize firms filing all subsequent protests in each docket as protest followers. We rerun specifications (2) and (3) for these subsamples.

[Table VIII about here]

We present our results in Table VIII. As shown in column (1), for bid protest starters, we find that the probability of winning a corrective action decision decreases by 7% for every-one million customers from the protesting firm's HQ state that are exposed to power outages on the bid protest date. In columns (2) and (3), we show that the probability of receiving a government contract from the protested agency during the four-year period following the bid protest decreases by 70% and the probability of receiving a government contract from the other government agencies during the four-year period following the bid protest decreases by 57%. Columns (4) to (6) show our results for protest followers; here, we find no significant effect. From these results, we conclude that *starting* a bid protest and receiving a corrective action from the GAO against a government agency causes economically and statistically significant distortions on future government contracts.

## VI. CONCLUSION

We provide a first analysis of the relation between successful bid protests and government contract allocations. We find that government contractors who challenge government procurement contracts by submitting successful bid protests to the GAO receive significantly fewer future government contracts from the respective protested agencies. Based on our instrumental variable approach, we conclude that this result reflects a negative reputation effect rather than an endogenous effect by which deteriorating firm quality simultaneously results in less business and more protesting. The observed negative effect of corrective action decisions persists four years after the successful bid protests. Protesting firms further lose future government contracts allocated by other, non-disputed agencies suggesting that any negative reputation effects spreads across procurement officers, and thus experience significant deteriorations in sales growth and employee growth over subsequent periods. Despite conventional wisdom, we find no evidence that corrective actions significantly delay government procurement due to lengthy dispute resolutions. Overall, our results demonstrate undesirable effects of meritorious bid protests on the protesting government vendors.

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**Table I**

**Bid protest characteristics**

This table presents key information on bid protests using data from the merged GAO and USASpending universe, spanning the period 2005–2016. **Panel A** reports yearly data on bid protests, **Panel B** reports detailed information on GAO’s decisions on bid protests, and **Panel C** reports detailed information on protested government agencies. In **Panel A**, the first seven columns report the number of bid protests submitted to GAO for each year in our sampling period along with GAO’s final decisions, and the last three columns report numbers of corrective action decisions, protester firms and protested agencies in each given year. In **Panel B**, we report justifications for GAO’s final decisions. We list up to five most popular justifications. In **Panel C**, we report 20 government agencies that received the highest number of bid protests during our sampling period.

<b>Panel A: Bid protests submitted to the GAO</b>										
<b>Year</b>	<b>Protests</b>	<b>Dismissed</b>	<b>Denied</b>	<b>Withdrawn</b>	<b>Sustained</b>	<b>No Decision</b>	<b>Other</b>	<b>Corrective actions</b>	<b>Protester firms</b>	<b>Protested agencies</b>
2005	997	531	184	225	56	0	1	354	557	28
2006	1,099	622	200	211	65	1	0	426	602	27
2007	1,135	642	217	210	63	2	1	444	626	33
2008	1,369	889	234	154	58	34	0	570	741	33
2009	1,704	1,039	260	324	77	4	0	763	894	35
2010	1,793	1,073	361	296	59	4	0	729	949	36
2011	1,997	1,141	401	380	71	4	0	792	1,006	33
2012	2,042	1,230	394	342	69	7	0	848	1,078	35
2013	1,995	1,163	404	359	68	1	0	918	1,006	38
2014	2,172	1,285	494	330	63	0	0	891	1,099	34
2015	2,131	1,227	451	354	98	1	0	1007	1,016	36
2016	1,722	1,043	335	259	85	0	0	820	798	29
<b>Total</b>	<b>20,156</b>	<b>11,885</b>	<b>3,935</b>	<b>3,444</b>	<b>832</b>	<b>58</b>	<b>2</b>	<b>8,562</b>	<b>10372</b>	<b>397</b>
<b>Mean</b>	<b>1,679.67</b>	<b>990.42</b>	<b>327.92</b>	<b>287.00</b>	<b>69.33</b>	<b>4.83</b>	<b>0.17</b>	<b>713.50</b>	<b>864.33</b>	<b>33.08</b>

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**Panel B: Bid protest results**

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<b>Dismissed (Total number =11,885)</b>	<b>N</b>
Academic: Agency Took Corrective Action	6,821
Untimely	1,176
Legally Insufficient	1,045
Interested Party	497
Failure to Comment	420
<b>Denied (Total number=3,935)</b>	<b>N</b>
No reason given	3,935
<b>Withdrawn (Total number=3,444)</b>	<b>N</b>
Withdrawn: Reason Not Known	1,903
Withdrawn: Agency Took Corrective Action	819
Withdrawn: Agency Not A Factor	691
Academic: Agency Took Corrective Action	16
Withdrawn: Agency Not A Factor & Reason Not Known	6
<b>Sustained (Total number=832)</b>	<b>N</b>
No reason given	832
<b>No Decision (Total number=58)</b>	<b>N</b>
No reason given	58
<b>Other (Total number=2)</b>	<b>N</b>
No reason given	2

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**Panel C: Protested government agencies**

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<b>Top</b>	<b>Agency name</b>	<b>N</b>
1	Department of Defense	11,523
2	Department of Veterans Affairs	1,857
3	Department of Homeland Security	1,136
4	Department of Health and Human Services	836
5	General Services Administration	803
6	Department of Justice	505
7	Department of State	448
8	Department of the Interior	415
9	Department of Agriculture	402
10	National Aeronautics and Space Administration	252
11	Department of Energy	249
12	Department of Labor	219
13	Department of Housing and Urban Development	206
14	Department of Commerce	179
15	Department of the Treasury	171
16	Department of Transportation	151
17	Agency for International Development	145
18	Environmental Protection Agency	124
19	Social Security Administration	68
20	Department of Education	64

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**Table II**

**Power Outages on Bid Protest Filing Dates**

This table presents key information on power outages on protest filing dates using data from the merged GAO-USASpending-EIA universe, spanning the period 2005–2016. Power outages data come from Appendix B1 and Appendix B2 of U.S. Energy Information Administration (EIA)'s Electric Power Monthly reports. To identify the bid protesters that are affected by power outages, we use headquarter locations of protester firms from USASpending dataset. Affected states denotes the number states that experienced power outages. Affected protests denotes the number of bid protests that were filed by bid protesters that experienced power outages on protest filing dates. Affected customers denotes the number customers (in millions) that experienced power outages.

<b>Year</b>	<b>Power outages</b>	<b>Affected states</b>	<b>Affected protests</b>	<b>Affected customers</b>
2005	4	4	4	0.40
2006	9	5	17	5.51
2007	7	6	9	1.66
2008	20	13	36	7.10
2009	15	9	21	3.58
2010	30	12	47	11.20
2011	49	19	81	12.70
2012	34	19	82	25.40
2013	18	8	36	3.47
2014	18	12	43	6.72
2015	11	8	15	1.28
2016	17	10	48	2.42
<b>Total</b>	<b>232</b>	<b>125</b>	<b>439</b>	<b>81.45</b>
<b>Mean</b>	<b>19.33</b>	<b>10.42</b>	<b>36.58</b>	<b>6.79</b>

**Table III**  
**Summary Statistics**

This table reports summary statistics on bid-protester firms such as number of observations, mean, median, standard deviation, minimum and maximum values. Our sample is the merged GAO and USASpending universe, spanning the period 2005–2016. Corrective action is one if GAO sustained a bid protest or assigned a corrective action decision, or zero otherwise. Government contracts from protested agency to protesters is one if a bid-protester firm received government contracts from the agency that it protested during the four-year period following the bid protest, or zero otherwise. Government contracts to protesters from agencies they did not protest is one if a bid-protester firm received government contracts from all agencies that it didn't protest during the four-year period following a bid protest, or zero otherwise. Agency contract denotes government contracts (in \$M) allocated to a bid protester from the agency that it protests during the year. Total contract denotes total government contracts (in \$M) allocated to a bid protester. Lagged total revenue denotes bid-protester firm's last year revenues (in \$M). Lagged number of employees denotes bid-protester firm's number of employees from the previous year. Sales growth denotes the percent change in a bid-protester firm's revenues. Employee growth denotes the percent change in a bid-protester firm's number of employees. Small, Women-owned, Veteran-owned, and Minority-owned business note whether the bid-protester firm is a small business and owned by a woman, veteran or a minority.

	<b>N</b>	<b>Mean</b>	<b>Median</b>	<b>Stdev</b>	<b>Min</b>	<b>Max</b>
Corrective action	9,681	0.46	0.00	0.50	0.00	1.00
Government contracts from protested agency to protesters	9,681	0.65	1.00	0.48	0.00	1.00
Government contracts to protesters from agencies they did not protest	9,681	0.50	0.00	0.50	0.00	1.00
Agency contract	9,681	158.61	2.07	949.40	0.00	17,920.50
Total contract	8,485	281.04	8.87	1,307.52	0.00	20,557.82
Lagged total revenue	6,806	1,509.72	13.87	4,581.59	0.05	24,000.00
Lagged number of employees	6,806	6,605.77	104.00	18,258.08	2.00	86,340.81
Sales growth	6,806	0.13	0.00	0.37	-0.50	1.67
Employee growth	6,806	0.07	0.00	0.23	-0.33	1.03
Small business	6,806	0.31	0.00	0.46	0.00	1.00
Women owned business	6,806	0.19	0.00	0.39	0.00	1.00
Veteran owned business	6,806	0.23	0.00	0.42	0.00	1.00
Minority owned business	6,806	0.31	0.00	0.46	0.00	1.00

**Table IV**

**Effects of Corrective Action Decisions on Future Government Contracts**

This table reports the relation between GAO’s corrective action decisions for bid protests and future government contracts allocated to bid-protester firms by the government agencies they protest. Panel A reports our results from using ordinary least squares estimations, whereas Panel B and C report our results from using two-stage least squares. \*\*\*, \*\*, and \* indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

- In **Panel A**, we estimate a linear probability model using the following specification:

$$y_{pd} = \alpha + \beta \times \text{Corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $y_{pd}$  is the dependent variable of interest, and it’s equal to one if the firm that submitted bid protest  $p$  within GAO docket  $d$  received government contracts from the protested government agency during the four-year period after the bid protest, and it’s equal to zero otherwise.  $\text{Corrective action}_{pd}$ , which is a dummy variable that denotes whether GAO assigned a corrective action decision or sustainment to bid protest  $p$  within docket  $d$ .  $X$  contains firm-level indicator variables that denote whether the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business.

- In **Panel B**, we run regressions on:

$$\text{Corrective action}_{pd} = \alpha + \varphi \times \text{Number of affected customers}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $\text{Corrective action}_{pd}$  is once again the dependent variable of interest and it’s equal to one if the bid protest  $p$  within GAO docket  $d$  resulted in a corrective action decision by the GAO, and it’s zero otherwise.  $\text{Number of affected customers}_{pd}$  denotes the number of customers (in millions) in bid protester firm’s state that experienced a major and unexpected power outage on the day when protest  $p$  within docket  $d$  was filed.  $X$  contains the same firm-level controls as **Panel A**.

- In **Panel C**, we estimate:

$$y_{pd} = \alpha + \pi \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $y_{pd}$  is the dependent variable of interest, and it’s equal to one if the firm that submitted bid protest  $p$  within GAO docket  $d$  received government contracts from the protested government agency during the four-year period after the bid protest, and it’s equal to zero otherwise.  $\text{Instrumented corrective action}_{pd}$  is the variation in  $\text{Corrective action}_{pd}$  that is explained by  $\text{Number of affected customers}_{pd}$ .  $X$  contains the same firm-level controls as **Panel A**, and across all specifications, we include the same fixed effects and control variables as the first stage regressions.

*(The table is on the following page)*

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**Panel A: OLS regressions predicting agency contracting to protesters**

	(1)	(2)	(3)	(4)
Corrective action	0.02** (0.01)	0.02** (0.01)	0.02** (0.01)	0.02** (0.01)
Firm-level controls	Yes	Yes	Yes	Yes
Docket FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Agency x Year FE	No	No	Yes	Yes
State x Year FE	No	No	No	Yes
Observations	9,648	9,567	9,614	9,529
R-squared	0.835	0.871	0.847	0.884

**Panel B: First stage regressions predicting GAO corrective actions**

	(1)	(2)	(3)	(4)
Number of affected customers	-0.09** (0.03)	-0.11*** (0.03)	-0.09** (0.03)	-0.11*** (0.03)
Firm-level controls	Yes	Yes	Yes	Yes
Docket FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Agency x Year FE	No	No	Yes	Yes
State x Year FE	No	No	No	Yes
Observations	9,648	9,567	9,614	9,529
R-squared	0.671	0.714	0.685	0.725

**Panel C: Second stage results predicting government contracts from protested agency to protesters**

	(1)	(2)	(3)	(4)
Instrumented corrective action	-0.79** (0.29)	-0.71** (0.25)	-0.91** (0.37)	-0.68** (0.30)
Firm-level controls	Yes	Yes	Yes	Yes
Docket FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Agency x Year FE	No	No	Yes	Yes
State x Year FE	No	No	No	Yes
Observations	9,648	9,567	9,614	9,529
R-squared	0.600	0.705	0.551	0.737

---

**Table V**

**Government Contracts in the Event Time of Bid Protests**

This table reports the impact of corrective actions on government contracts in the event time of bid protests and the impact of power outages on days before and after the bid protest filing dates. \*\*\*, \*\*, and \* indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

- In **Panel A**, we report the impact of GAO’s corrective action decisions on future government contracts to bid-protester firms in the event time of bid protests. We run regressions on:

$$y_{pdT} = \alpha + \delta \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $y_{pdT}$  is equal to one if the firm that submitted protest  $p$  within docket  $d$  received government contracts from the protested agency in year  $T \in \{0, 1, 2, 3, 4, 5\}$  relative to the bid protest year. Instrumented corrective action $_{pd}$  is the variation in Corrective action $_{pd}$  that is explained by Number of affected customers $_{pd}$ . The first stage is reported in Table 4, Panel B, Column 4.  $X$  contains firm-level indicator variables that denote whether the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business.

- In **Panels B** and **C**, we run regressions on:

$$\text{Corrective action}_{pd} = \alpha + \phi \times \text{Number of affected customers}_{pdT} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number. Corrective action $_{pd}$  is once again the dependent variable of interest and it’s equal to one if the bid protest  $p$  within GAO docket  $d$  resulted in a corrective action decision by the GAO, and it’s zero otherwise. Number of affected customers $_{pdT}$  denotes the number of customers (in millions) in bid protester firm’s state that experienced a major and unexpected power outage on day  $t \in \{-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}$  relative to the date when protest  $p$  within docket  $d$  was filed.  $X$  contains firm-level indicator variables that denote whether the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business.

*(The table is on the following page)*

<b>Panel A: Government contracts from protested agencies to protesters after bid protests</b>						
	<b>Protest year</b>	<b>1 year after</b>	<b>2 years after</b>	<b>3 years after</b>	<b>4 years after</b>	<b>5 years after</b>
	(1)	(2)	(3)	(4)	(5)	(6)
Instrumented corrective action	-0.66** (0.29)	-0.64** (0.28)	-0.66** (0.30)	-0.63* (0.30)	-0.49 (0.30)	-0.09 (0.17)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Docket FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Agency x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,529	9,529	9,529	9,529	9,529	9,529
R-squared	0.679	0.751	0.768	0.797	0.849	0.923
<b>Panel B: Explaining corrective actions with power outages before the bid protest date</b>						
	<b>5 days before</b>	<b>4 days before</b>	<b>3 days before</b>	<b>2 days before</b>	<b>1 day before</b>	<b>On the same day</b>
Number of affected customers	-0.06 (0.15)	-0.10 (0.09)	-0.07** (0.03)	-0.11*** (0.04)	-0.09** (0.03)	-0.10*** (0.03)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Docket FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Agency x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,529	9,529	9,529	9,529	9,529	9,529
R-squared	0.724	0.724	0.724	0.724	0.724	0.724
<b>Panel C: Explaining corrective actions with power outages after the bid protest date</b>						
	<b>1 day after</b>	<b>2 days after</b>	<b>3 days after</b>	<b>4 days after</b>	<b>5 days after</b>	
Number of affected customers	0.10 (0.10)	0.15 (0.09)	0.08 (0.12)	-0.01 (0.11)	0.03 (0.10)	
Firm-level controls	Yes	Yes	Yes	Yes	Yes	
Docket FE	Yes	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	Yes	
Agency x Year FE	Yes	Yes	Yes	Yes	Yes	
State x Year FE	Yes	Yes	Yes	Yes	Yes	
Observations	9,529	9,529	9,529	9,529	9,529	
R-squared	0.724	0.724	0.724	0.724	0.724	

**Table VI****Corrective Actions and Firm Growth**

This table reruns our two-stage least squares regressions (first two columns) and reports the effects of corrective actions on firm growth (last four columns). We regress:

$$z_{pd} = \alpha + \delta \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $z_{pd}$  is the dependent variable of interest and it's equal to next year's (relative to bid protest) employee growth or sales growth of the firm that submitted bid protest  $p$  within docket  $d$ . Instrumented corrective action $_{pd}$  is once again the variation in Corrective action $_{pd}$  that is explained by Number of affected customers $_{pd}$ . The first stage is reported in Table 4, Panel B, Column 4.  $X$  contains firm-level indicator variables that denote whether the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business. \*\*\*, \*\*, and \* indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	<b>Corrective Action</b>	<b>Agency Contracts?</b>	<b>Employee growth</b>		<b>Sales growth</b>	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of affected customers	-0.10** (0.03)					
Predicted corrective action		-0.69** (0.26)	-0.51** (0.21)	-0.51** (0.21)	-0.69** (0.25)	-0.67** (0.25)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional firm-level controls	No	No	No	Yes	No	Yes
Docket FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Agency x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,475	6,475	6,475	6,475	6,475	6,475
R-squared	0.734	0.654	0.440	0.440	0.518	0.533



**Table VII**

**Contracts from Unprotested Agencies and Delays Related to Corrective Actions**

This table studies government contracts allocated to bid-protester firms by the government agencies they did not protest and the number of days procurement contract is delayed due to bid protest resolutions. \*\*\*, \*\*, and \* indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

- In **Panel A**, we estimate:

$$y_{pd} = \alpha + \delta \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $y_{pd}$  is the dependent variable of interest, and it's equal to one if the firm that submitted bid protest  $p$  within GAO docket  $d$  received government contracts from all unprotested government agencies during the four-year period after the bid protest, and it's equal to zero otherwise. Instrumented corrective action $_{pd}$  is the variation in Corrective action $_{pd}$  that is explained by Number of affected customers $_{pd}$ . The first stage is reported in Table 4, Panel B, Column 4.  $X$  contains firm-level indicator variables that denote whether the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business.

- In **Panel B**, we estimate:

$$d_{pd} = \alpha + \pi \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $d_{pd}$  is the dependent variable of interest, and it's equal to the number of days it takes GAO to finalize its decision on a bid protest  $p$  within GAO docket  $d$ . Instrumented corrective action $_{pd}$  is the variation in Corrective action $_{pd}$  that is explained by Number of affected customers $_{pd}$ . The first stage is reported in Table 4, Panel B, Column 4.  $X$  contains firm-level indicator variables that denote whether the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business.

*(The table is on the following page)*

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<b>Panel A: Government contracts to protesters from agencies they did not protest</b>				
	(1)	(2)	(3)	(4)
Predicted corrective action	-0.72* (0.36)	-0.54** (0.23)	-0.79* (0.44)	-0.49 (0.30)
Firm-level controls	Yes	Yes	Yes	Yes
Docket FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Agency x Year FE	No	No	Yes	Yes
State x Year FE	No	No	No	Yes
Observations	9,648	9,567	9,614	9,529
R-squared	0.644	0.776	0.628	0.804
<b>Panel B: The number of days procurement contract is delayed</b>				
	(1)	(2)	(3)	(4)
Predicted corrective action	-75.26 (50.35)	-74.65* (37.96)	-104.03* (51.93)	-105.02** (43.57)
Firm-level controls	Yes	Yes	Yes	Yes
Docket FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Agency x Year FE	No	No	Yes	Yes
State x Year FE	No	No	No	Yes
Observations	9,648	9,567	9,614	9,529
R-squared	0.295	0.385	0.009	0.122

---

**Table VIII**

**Protest Starter and Protest Follower Firms**

This table studies government contracts allocated to bid-protester firms by the government agencies protest. First three columns study the first three bid protests within each GAO docket and the last three columns study the remaining bid protests. We estimate:

$$y_{pd} = \alpha + \delta \times \text{Instrumented corrective action}_{pd} + \gamma' X + \text{Fixed effects} + \varepsilon_{pd},$$

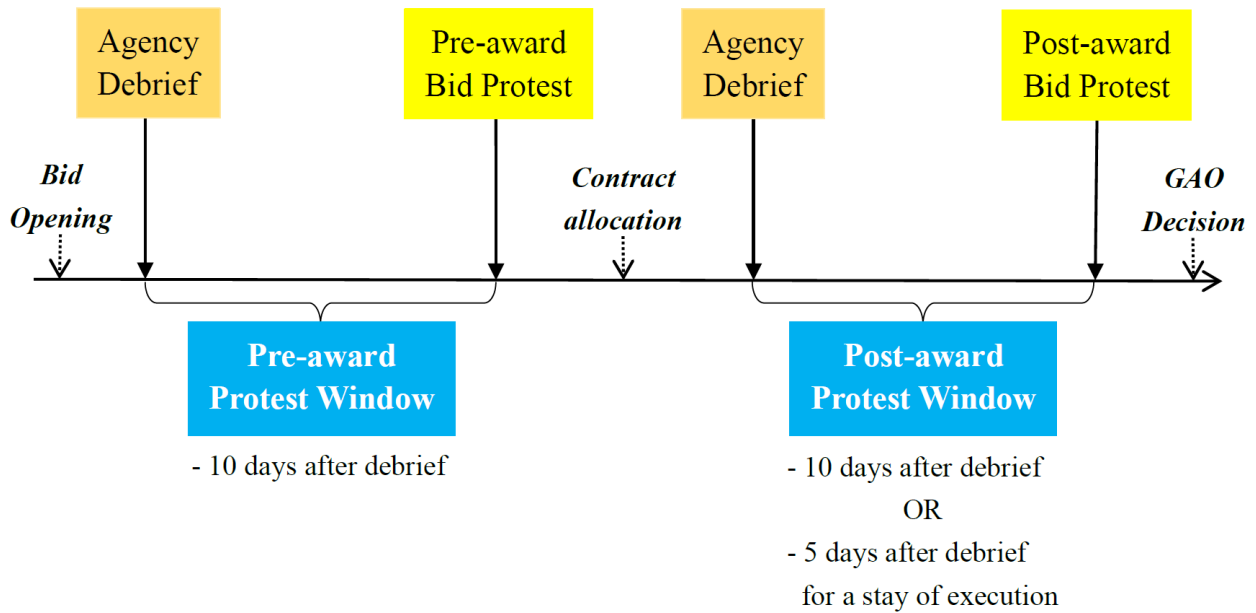
where  $p$  indexes the bid protest number, and  $d$  indexes the GAO docket number.  $y_{pd}$  is the dependent variable of interest, and it's equal to one if the firm that submitted bid protest  $p$  within GAO docket  $d$  received government contracts from the protested government agency during the four-year period after the bid protest, and it's equal to zero otherwise. Instrumented corrective action $_{pd}$  is the variation in Corrective action $_{pd}$  that is explained by Number of affected customers $_{pd}$ . The first stage is reported in Table 4, Panel B, Column 4.  $X$  contains firm-level indicator variables that denote whether the firm that submitted bid protest  $p$  is identified by the government as a small business, veteran-owned business, women-owned business, or a minority-owned business. \*\*\*, \*\*, and \* indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	<i>Protest Starters</i>			<i>Protest Followers</i>		
	<b>Corrective Action</b>	<b>Agency Contract?</b>	<b>Other Agency Contract?</b>	<b>Corrective Action</b>	<b>Agency Contract?</b>	<b>Other Agency Contract?</b>
	(1)	(2)	(3)	(4)	(5)	(6)
Number of affected customers	-0.07*** (0.02)			0.37 (0.58)		
Predicted corrective action		-0.70** (0.30)	-0.57* (0.27)		0.83 (1.29)	-0.33 (1.18)
Docket FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Agency x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,497	6,497	6,497	1,539	1,539	1,539
R-squared	0.777	0.789	0.837	0.737	0.660	0.822

**Figure I**

**Bid protest window**

This figure shows bid protest windows set by Government Accountability Office (GAO). Bid protests can be filed to GAO before or after a contract award decision. A pre-award protest is submitted by a potential government contract bidder after a proposed contract solicitation is announced, bid opening is initiated, and before the contract is allocated. A post-award protest, on the other hand, is submitted by an unsuccessful bidder after a contract is allocated. Both pre- and post-award protests must be submitted after agency debriefs that explain why a firm cannot complete for a contract or was not awarded a contract. In both cases, bid protester has 10 calendar days after the agency debrief to submit a bid protest to GAO. Post-award protests submitted within 5 calendar days after a debrief initiate a stay of execution on the allocated contract. For simplification purposes, we do not plot bid protests after request for quotes. The protest window for those is up to 10 calendar days after a request for proposal is rejected by the government agency.



**Figure II**

**Bid protest outcomes**

This figure presents GAO’s decision timeline for bid protests. Day 1 denotes the day the bid protest is filed. Between day 1 to day 30, GAO will dismiss protests that are untimely (e.g., late) or outside its jurisdiction. For those protests that are not dismissed, GAO requests a report from the government agency on the protested government contract, and day 30 is agency’s deadline to file this report. Day 40 is protester’s deadline to file its comments on the agency report. Failure to file comments will result in dismissal of the protest. After receiving these, GAO will make a final decision between days 40 and 100. Most protests are resolved within 100 days.

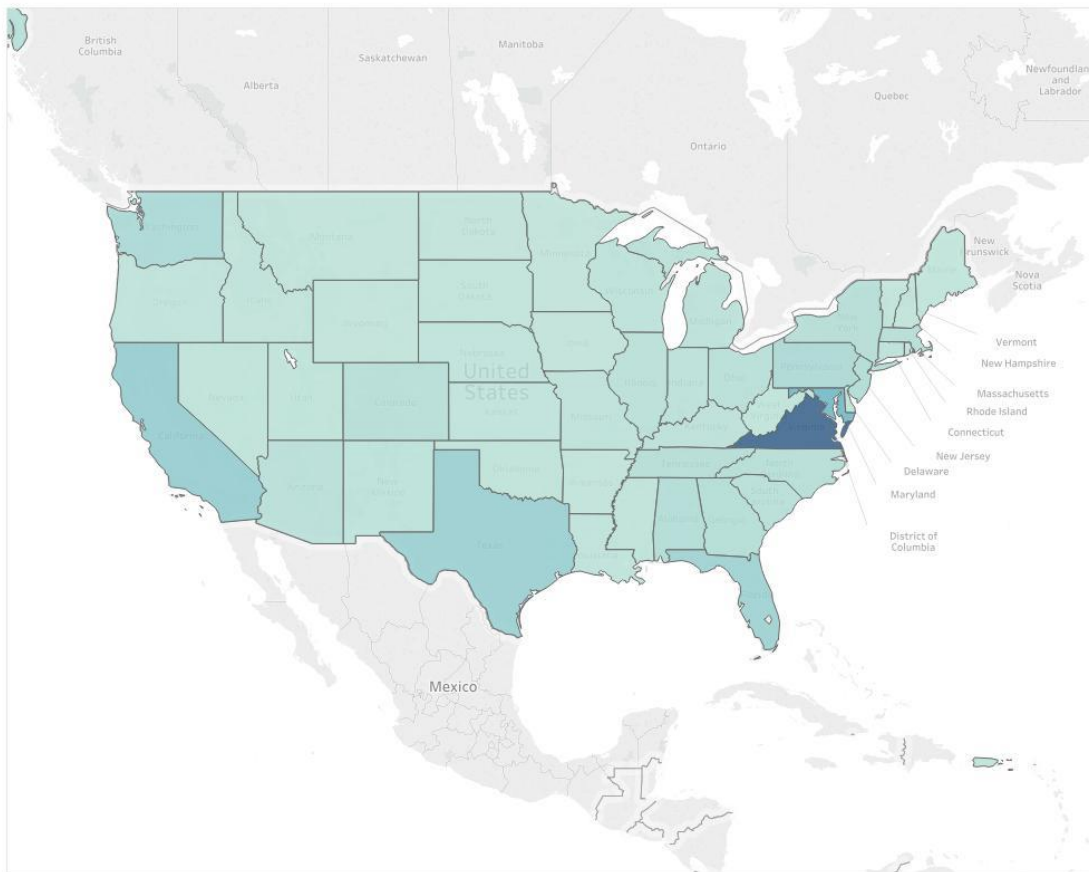


Source: <https://www.gao.gov/legal/bid-protests> and <https://www.gao.gov/timelinegraphic.htm>

### Figure III

#### Bid protests

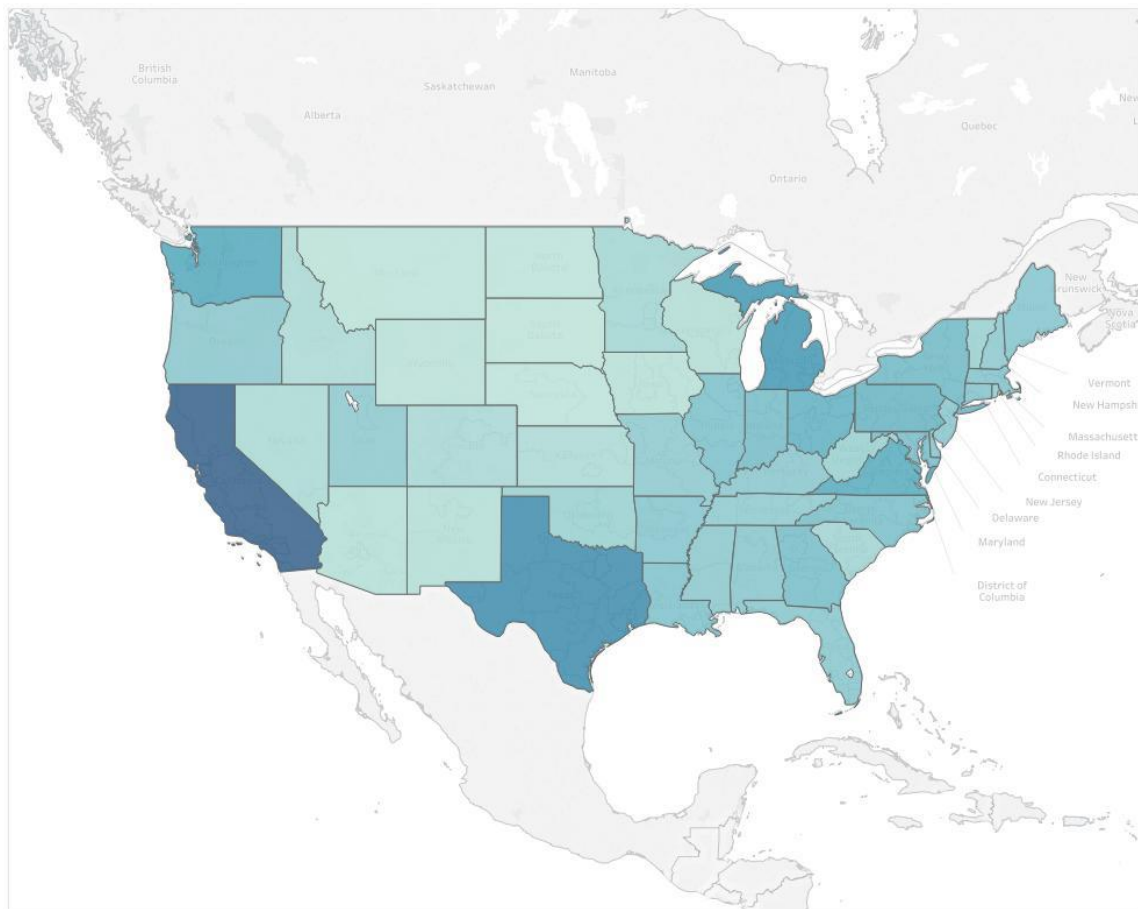
The map shows geographic distribution of bid protesters. We use data from the merged GAO and USASpending universe, spanning the period 2005–2016. In order to identify the location of bid-protester firms, we manually merge firm names in GAO bid protest dataset and USASpending dataset. Using the merged sample, we count the number of bid protests submitted from firms in each state during our sampling period. States with higher numbers of bid protests are reported in darker green.



## Figure IV

### All power outages

The map shows geographic distribution of power outages in the U.S. between 2005 and 2016. We collect power outage data from U.S. Energy Information Administration (EIA)'s Electric Power Monthly reports. EIA lists major electric disturbances and unusual occurrences in Appendix B1 and Appendix B2 of each Electric Power Monthly report. We count the number of power outages experienced in each state during our sampling period. States with higher numbers of power outages are reported in darker green.







## Figure VI

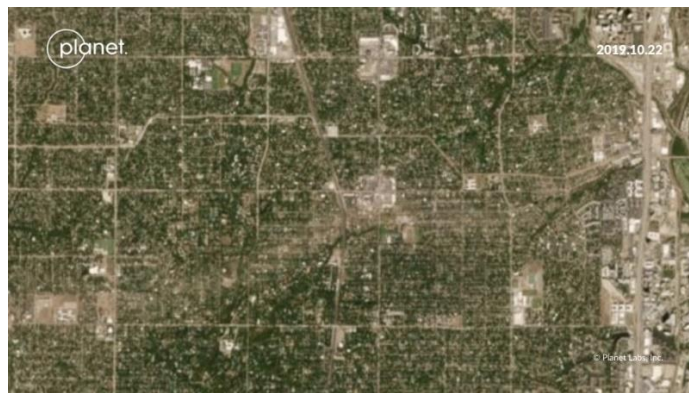
### Detecting the effects of natural disasters using satellite images and computer vision

The satellite images show how a tornado disrupted local businesses on Villager Rd, Dallas, TX 75230. The first image in Panel A is from 10/19/2019, the second image in Panel B is from 10/22/2019, and the third image in Panel C shows the visual difference between these two satellite images, highlighting the route of the tornado and the affected establishments (circled with bold colors).

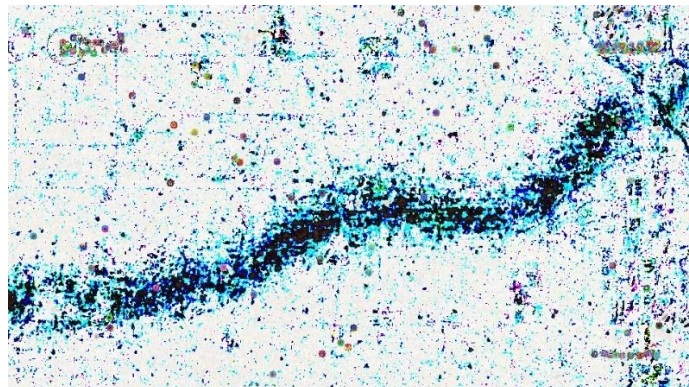
#### Panel A. Before the tornado



#### Panel B. After the tornado



#### Panel C. Detecting differences between Panel A and Panel B using computer vision

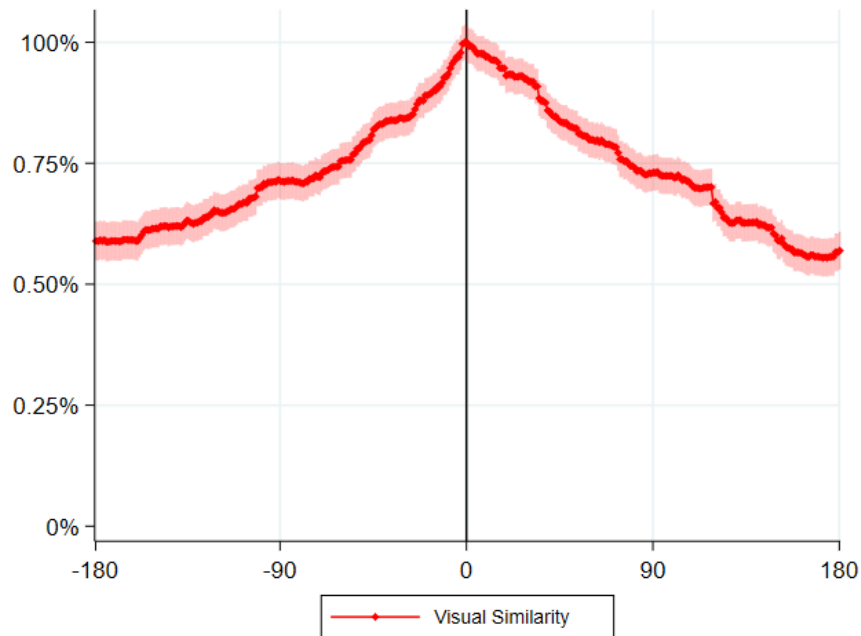


## Figure VII

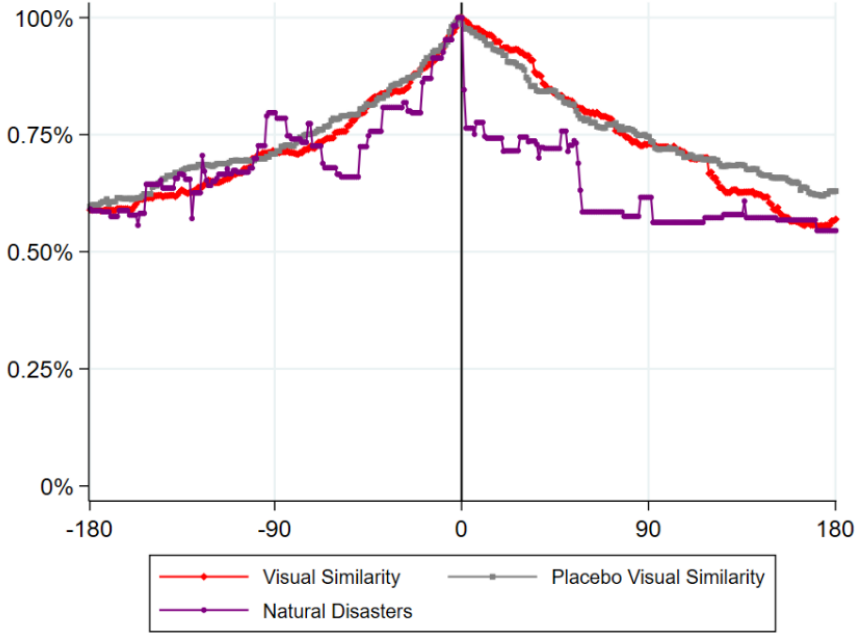
### Using computer vision to analyze bid protester firms' surroundings

Panel A presents our results from comparing satellite images of bid protester firms' surroundings in the event time of bid protests. These bid protesters experience significant power outages on bid protest filing days. The event window contains 180 days before and after bid protest filing dates. The confidence intervals indicate significance at the 5% level. Our methodology and data collection procedure are explained in detail in Part C of Section IV. Panel B compares our results from Part A with a placebo test that examines visual changes from a year ago (relative to bid protest filing dates). Panel B also shows visual changes after four natural disasters. The placebo test and the selected natural disasters are explained in detail in Part C of Section IV.

#### Panel A. Comparing satellite images taken on the bid protest filing days with satellite images taken within the -180 days to +180 days event window.



**Panel B. Placebo test on visual changes from a year ago  
and visual changes after four randomly chosen natural disasters**



**Internet Appendix**  
**for**

***Choose Your Battles Wisely: The Consequences of  
Protesting Government Procurement Contracts***

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### **Table A.I**

This table revisits the results reported in Table V, Panel A by using different fixed effects structures. Panels A to F present our results and Panel G presents our controls and fixed effect structures. \*\*\*, \*\*, and \* indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

<b>Panel A: Second stage results predicting agency contracting to protesters in year T</b>					
	(1)	(2)	(3)	(4)	(5)
Predicted corrective action	-0.50*	-0.57*	-0.67*	-0.80**	-0.63*
	(0.25)	(0.26)	(0.31)	(0.31)	(0.30)
Observations	9,647	9,645	9,612	9,610	9,527
R-squared	0.663	0.642	0.599	0.536	0.687
<b>Panel B: Second stage results predicting agency contracting to protesters in year T +1</b>					
	(1)	(2)	(3)	(4)	(5)
Predicted corrective action	-0.82**	-0.89**	-0.91**	-1.03**	-0.66**
	(0.32)	(0.33)	(0.38)	(0.38)	(0.29)
Observations	9,647	9,645	9,612	9,610	9,527
R-squared	0.578	0.547	0.545	0.477	0.741
<b>Panel C: Second stage results predicting agency contracting to protesters in year T +2</b>					
	(1)	(2)	(3)	(4)	(5)
Predicted corrective action	-0.87**	-0.93**	-1.05**	-1.12**	-0.69**
	(0.35)	(0.38)	(0.42)	(0.43)	(0.30)
Observations	9,647	9,645	9,612	9,610	9,527
R-squared	0.588	0.565	0.500	0.467	0.758
<b>Panel D: Second stage results predicting agency contracting to protesters in year T +3</b>					
	(1)	(2)	(3)	(4)	(5)
Predicted corrective action	-0.89**	-1.06**	-1.02*	-1.17**	-0.63*
	(0.37)	(0.47)	(0.47)	(0.51)	(0.31)
Observations	9,647	9,645	9,612	9,610	9,527
R-squared	0.585	0.487	0.533	0.443	0.797
<b>Panel E: Second stage results predicting agency contracting to protesters in year T +4</b>					
	(1)	(2)	(3)	(4)	(5)
Predicted corrective action	-0.62	-0.70	-0.67	-0.75	-0.49
	(0.39)	(0.40)	(0.49)	(0.47)	(0.31)
Observations	9,647	9,645	9,612	9,610	9,527
R-squared	0.741	0.710	0.735	0.705	0.849
<b>Panel F: Second stage results predicting agency contracting to protesters in year T +5</b>					
	(1)	(2)	(3)	(4)	(5)
Predicted corrective action	-0.15	-0.18	-0.01	-0.05	-0.07
	(0.10)	(0.13)	(0.08)	(0.11)	(0.18)
Observations	9,647	9,645	9,612	9,610	9,527
R-squared	0.870	0.874	0.888	0.895	0.923
<b>Panel G: Control variables included in regressions in Panels A to F</b>					
	(1)	(2)	(3)	(4)	(5)
Docket, Year, State, Agency x Year, State x Year FEs	Y/Y/N/N/N	Y/Y/Y/N/N	Y/Y/N/Y/N	Y/Y/N/Y/Y	Y/Y/N/Y/Y
Firm-level controls	N	N	N	N	Y

### Figure A.I

This figure shows sample request for debrief letters that can be submitted to government agencies in order to start a bid protest process. The letter on the left is for a pre-award debriefing and the letter on the right is for a post-award debriefing.

(a) Request for a pre-award debriefing

[CONTRACTOR LETTERHEAD]

[Date]

**VIA EMAIL**  
[Contracting Officer's Name]  
[Title]  
[Agency Name]  
[Street Address]  
[City, State, ZIP Code]

**Re: Request for pre-award debriefing under RFP/  
Solicitation No. [RFP no.]**

Dear [Contracting Officer's Name]:

[Contractor] respectfully requests a pre-award debriefing pursuant to FAR 15.505. This request is timely submitted within three (3) days after the date on which [Contractor] received notification of exclusion from the competition under RFP No. [RFP no.].

Please confirm receipt, and contact me if you need any further information.

Very truly yours,

[Contractor Representative Name]  
[Title]  
[Contractor Name]  
[Street Address]  
[City, State ZIP Code]  
[Contractor Representative telephone no.]  
[Contractor Representative email address]

(b) Request for a post-award debriefing

[CONTRACTOR LETTERHEAD]

[Date]

**VIA EMAIL**  
[Contracting Officer's Name]  
[Title]  
[Agency Name]  
[Street Address]  
[City, State, ZIP Code]

**Re: Request for post-award debriefing under RFP/  
Solicitation No. [RFP no.]**

Dear [Contracting Officer's Name]:

[Contractor] respectfully requests a post-award debriefing pursuant to FAR 15.506. This request is timely submitted within three (3) days after the date on which [Contractor] received notification of contract award under RFP No. [RFP no.].

Please confirm receipt, and contact me if you need any further information.

Very truly yours,

[Contractor Representative Name]  
[Title]  
[Contractor Name]  
[Street Address]  
[City, State ZIP Code]  
[Contractor Representative telephone no.]  
[Contractor Representative email address]

Source: <https://www.hollandhart.com>

**Figure A.II**

This figure shows the bid protesting process at the GAO. The image on the left shows the pop-up message that reminds potential bid protesters the bid protest regulations and the timeline. The image on the right shows the page bid protesters use for bid protest submissions.

(a) Bid-protest warning

**Warning**

Before filing a protest, you should carefully review our Bid Protest Regulations. The Regulations are accessible by clicking the GAO logo at the top of the screen, which will redirect you to our website. You should first select Bid Protests Appropriations Law, then select Our Process.

You are strongly encouraged to review the following sections for important information:

- § 21.1 Filing a protest;
- § 21.2 Time for filing; and
- § 21.5 Protest issues not for consideration.

These sections include important information regarding what is necessary to include in your protest and what protests our Office will not consider. No refunds of the filing fee will be made in the event a protest is dismissed for failing to comply with or otherwise does not meet the requirements set forth in our Bid Protest Regulations.

Do you want to proceed to file a new protest ?

(b) Bid protest submission

**State (Required)**  
Company State

**Country (Required)**  
Company Country

---

**Protest Detail**

**Solicitation Number (Required)**  
Solicitation Number  
If unknown, please indicate "unknown"

**Confirm Solicitation Number (Required)**  
Confirm Solicitation Number

**Agency Tier 1**  
Please Select Agency

**Upload Protest Document (Only PDF & Excel files can be attached) (Required)**

#	Name	Size	Progress
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**Do any of these documents contain information that is proprietary, confidential, or otherwise not releasable to the public? (Required)**  
 Yes  No

**Comments**  
Comments  
250 characters remaining

Source: <https://epds.gao.gov/protest-request>