

Budgetary Uncertainty: Adverse Selection or Disciplining Effect?

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Introduction

Research on and academic discussion of economic consequences of risk and uncertainty has a long history [Smith, 1776, p. 91]. Especially in recent years, uncertainty research has experienced a revival. Recent research focuses on uncertainty derived from macroeconomic and firm-level variables [Bloom, 2009, Jurado et al., 2015], categorical economic policy uncertainty derived from newspapers [Baker et al., 2016], or firm-level political risk obtained from conference calls [Hassan et al., 2017].

This research sometimes uses government procurement and purchases as a channel that concerns firms as government contractors to verify uncertainty and risk measures. It argues that firms as government agencies' contractors are policy-sensitive. This research shows that times of policy uncertainty negatively affect aggregate and firm-level economic outcomes [see e.g. Baker et al., 2016, Hassan et al., 2017]. Despite the argumentation that government agencies' procurement is a channel by which sensitivity to policy uncertainty can be shown, there is little research on the effect of uncertainty on government agencies themselves. The previously mentioned research simply assumes a negative reaction of government agencies procurement decisions.

Furthermore, there is a large, recent literature in accounting that examines firm behavior in policy-sensitive industries [see e.g. Mills et al., 2013, Samuels, 2018]. So far government procurement is an intuitive proxy for policy-sensitive firm activities. But again, this research spends little attention to how government agencies actually respond to uncertainty at the level of the agencies' decision-makers. Reaction of government agencies is - again - assumed to be uniform.

I intend to fill this gap by examining how budgetary uncertainty differentially affects the contracting decisions of government agencies' managers. I plan to condition my analyses of agencies' reaction to budgetary uncertainty on agencies' characteristics. These variables to condition on

could be e.g. past parliamentary evaluations of agencies' financial management, or past agencies' performance evaluations.

I define budgetary uncertainty as ambiguity of agencies' decision-makers about the level of future financial resources. Following [Knight \[1921\]](#) I consider uncertainty to refer to a state of imperfect knowledge about the future that impedes decision-makers to assign precise probabilities to future events. In the context of government agencies this relates to the definition Heather Krause, director of strategic issue at the U.S. Government Accountability Office, uses. She defines budgetary uncertainty as "uncertainties about the level of funding that will ultimately be available in a given (fiscal) year" [[Krause, 2017](#), pg. 2].

Prior evidence shows a reduction in hiring, investment and spending in uncertain environments. However, there is little research on the selection of products and services under uncertainty. From the perspective of a rational decision-maker who has a preferences order, less resources are available. The decision-maker would be expected to select the most preferred products and services leaving some unpurchased products and services. The purchased products exhibit higher average quality, since less money is spend for low quality projects. I argue that the preference order and thus the quality of purchased products and services is highly dependent on the decision-maker and on the degree of agency problems present in the setting.

The setting I intend to examine are contracting decisions of U.S. federal government agencies. I chose to focus on this setting for four reasons. First, U.S. federal agencies' contracting decisions are highly transparent. Publicly available data for all federal agencies contracting decisions, even with contract details, makes it possible to test my hypothesis. Second, in the U.S. government procurement comprises a large share of the economy. This gives a high number of observations on contracting decisions. Third, much of the research on government procurement centers around U.S. government agencies. This lays the ground for analyses that relate to an existent body of literature. Finally, there is quite a bit of variation in past U.S. policy-making that exhibits changes to uncertainty deriving from different policy areas [[Baker et al., 2016](#)]. This leaves me with a better ability to identify uncertainty reactions.

Decision-makers are managers of the agencies. I hypothesize that in the baseline case the average quality of selected contracts should increase, since the decision-makers spend less resources and resources are spend on higher priority projects. I further expect agencies with a higher degree of agency problems to exhibit less of an increase in or even constant contract quality. Whether

budgetary uncertainty¹ leads to adverse selection of contracts or whether it has a disciplinary effect in the sense that only better quality projects are chosen is the research question I plan to explore.

1 Prior literature on the effects of uncertainty on investments and spending

In this section I review evidence of uncertainty effects for firms and government agencies. I am aware that firms and government agencies differ structurally on several dimensions. This impacts their investment and spending decisions. However, I want to summarize on main channels by which uncertainty impacts decision-making in firms *and* government agencies in order to benchmark results of later analyses.

Zimmerman [1976] describes that uncertainty resolution is an increasing function of time within a fiscal year. As he remarks, the U.S. federal budget level is rarely certain at the beginning of a fiscal year. This statement might still be appropriate with respect to the large number of continuing resolutions and the funding gaps that occurred in the last two decades [see McClanahan et al., 2019, Nagel and Murray, 2019]. This might lead agencies' decision-makers to postpone spending to later periods within the fiscal year.

From a managerial perspective, managers' risk-aversion might lead to suboptimal underinvestment in the presence of firm-specific uncertainty. This effect increases for managers with larger stakes in the firm [Panousi and Papanikolaou, 2012]. Budgetary uncertainty deriving from revenue variation, limited sources of revenue, or growth might e.g. lead risk-averse decision-makers at government agencies to accumulate cash holdings [Gore, 2009].

Uncertainty as a determinant of precautionary savings might lead agencies to save rather than to spend [Leland, 1968]. This behavior depends on the eventual retention of financial resources at the end of the fiscal year [Liebman and Mahoney, 2017]. Liebman and Mahoney [2017] investigate how expiring budgets lead to wasteful spending by government agencies at the fiscal year end. They find that spending increases in the last weeks of a fiscal year, while the project quality decreases. They also find that a rollover of unused funds to the next fiscal year mitigates wasteful spending.

¹It should be noted that 'budgetary uncertainty' might relate to either budgetary risk or budgetary uncertainty, since government agencies might at some point be able to form a subjective probability distribution over the availability of future budget resources. However, the idea is to relate contracting decisions to situations where agencies struggle to derive such probability distributions - thus to uncertain situations.

Haka and Krishnan [2005] propose that rolling budgets, i.e. budgets that are adapted every three months for the following 12 months, might perform better than traditional yearly budgets under environmental uncertainty. This is because decision-makers might learn from frequent forecasting about their environment. However, rolling budgets only outperform yearly budgeting when uncertainty is high. Then, the benefits from learning exceed the costs of more frequent budget preparation.

Bernanke [1983] states two reasons for aggregate investment instability arising from the interaction of uncertainty and irreversibility. First, macro-level events happen to be important to micro-level decisions. Second, uncertainty can evolve endogenously. Uncertainty about the permanence of e.g. the demand for their products and services leads firms to delay their irreversible investment decisions in expectation of uncertainty to resolve over time.

Bloom [2014] summarizes uncertainty research and discusses two negative and two positive channels by which uncertainty is known to influence growth. The two negative channels are the real options value and risk aversion. The former relates to the option value of delaying irreversible (investment and spending) decisions. Decision-makers are inclined to wait, since by waiting time might reveal more and better options to choose from. The latter relates to the increase of risk premia in the presence of more risk, ambiguity aversion of decision-makers, and precautionary savings.

As positive channels Bloom [2014] mentions growth options and the Oi-Hartman-Abel effect. The first refers to cases where uncertainty leads to increased investment, because of the potential reward of a positive outcome exceeds the limited lower bound of costs in expectation. The second channel refers to cases where firms can compensate bad with good outcomes. If firms have low adjustment costs and compensation of good for bad news situations is possible in expectation, firms should be risk-loving.

Jurado et al. [2015, p. 1177] summarizes on three main mechanisms by which uncertainty can potentially decrease consumption, hiring, and investment by firms and agencies. First, it might delay decisions when they involve either irreversibilities or fixed costs. Second, risk-aversion can encourage decision-makers' precautionary savings. This serves as reserve funds during economically worse times. Third, financial frictions can lead to tighter financial constraints.

In summary, most research concludes uncertainty to cut investment and spending. Potential mitigating effects are positive expected outcomes for decision-makers in firms and government agencies. These can even lead to positive effects of uncertainty. Theoretical and empirical dis-

cussion on uncertainty effects centers much around universal reactions to uncertainty.

I suggest to take a more nuanced view to understand decision-makers' differential reactions to uncertainty. I try to condition my analyses of responses to uncertainty on characteristics of U.S. federal government agencies to show differential effects.

2 Determinants of contracting of U.S. federal government agencies

I intend to concentrate on contracting decisions of U.S. federal government agencies to show responses to uncertainty. Agencies direct their spending along the budgets available to them. Investment and spending decisions are governed by different sets of determinants. The intensity of influence of determinants might be related to the presence of determinants to decision-makers.

2.1 Three sets of determinants of government agencies' contracting decisions

There are three different sets of determinants I discriminate. First, Agencies' managers want to fulfill the direct objective of spending for a certain contract or set of contracts. This might be defined by the agency's mission, its specific goals, and is often subject to legal constraints on under- and overspending. These determinants are the direct contract-centered determinants. Legal constraints on budget execution [see [Krause, 2017](#)] for U.S. federal agencies include characteristics of the funding, e.g. time and purpose of appropriated budgets as well as rules on under- and overspending. Current appropriations may not be used for future fiscal years². Budget law prevents agencies from spending in advance of an appropriation, more than appropriated, or underspending³.

Second, agencies determine their spending according to their current economic situation, and the agency's mission. So, the direct contract-centered set of determinants is embedded into the precise context the agency operates in. This set of determinants I call agency-level determinants. These can be changes in the demand for the agency's products and service, the available human resources to pursue a certain objective, or competing spending objectives such as projects competing for the same resources.

Third, an agency's expectations about its future economic (and even legal) conditions influence

²The bona fide needs rule.

³Antideficiency Act, Impoundment Control Act.

its current spending. This set of determinants are environmental characteristics. If an agency is one that has prosperous funding outlooks, it will be willing to spend according to its current needs. This agency might tend to expand its spending. But certainly, it will not cut it as long as there is no need to do so. There is no need for strategic behavior. Conversely, when the agency's expectations on its positive future funding situation diminish, it could be inclined to behave strategically. The agency might feel the need to use the available degrees of freedom to ensure that current and future objectives are reached.

I tend to focus on the third determinants set, the environmental characteristics. I try to identify and use events that are arguably exogenous and influence the budgetary uncertainty to agencies' contracting decisions to examine how this uncertainty relates to agencies' contracting decisions.

2.2 Budgetary uncertainty as a spending determinant

Budgetary uncertainty affects the agency decision-makers' expectations about probabilities of future funding. This is the channel that might provoke strategic behavior of decision-makers. If for example decision-makers expect leftover funds in a period to be cut in the following period they might be inclined to spend them, even for projects of lower-than-average quality [see [Liebman and Mahoney, 2017](#)]. [Krause \[2017\]](#) states that the U.S. Government Accountability Office found agencies to limit their spending early in fiscal year when the ultimate total funding available may be less than anticipated. The expectation of a decision-maker is a function of the available information. With the arrival of new information decision-makers update their expectations.

This translates to budgetary uncertainty. When decision-makers of government agencies receive negative information e.g. on budget sequestration or funding gaps, future funding becomes more uncertain to them in expectation. They are (more) uncertain about the fulfillment of their set of (current and expected future) objectives. This leads them to think about their objectives – in short- and long-term. They tradeoff personal competing objectives and derive a priority list for their current and scheduled objectives. Budgetary uncertainty then might provoke strategic behavior of decision-makers to assure that they reach their objectives.

At the firm-level budgetary uncertainty has been shown to be factored into investment decisions [see e.g. [Baker et al., 2016](#)]. At the level of research projects [Tham \[2019\]](#) shows that budgetary uncertainty induced by funding interruptions leads principal investigators of research projects to substantially reduce their spending. Strategic behavior also involves stretching available funding. [Bautista et al. \[2019\]](#) found evidence that state agencies smooth their consumption expenditures

during times of cyclical revenue fluctuations. This relates to the real-options theory and might also be linked to risk aversion of decision-makers.

Risk aversion might even increase strategic behavior, since decision-makers might be inclined to insure themselves against risk-taking to be able to reach their objectives. Generally, information shows an inverse relation to uncertainty. However, information can also evoke uncertainty, e.g. in case of political decisions with uncertain future outcomes.

It is ex ante unclear whether budgetary uncertainty leads to an increase or a decrease in project quality in case of reduced spending. I first plan to evaluate how U.S. federal government agencies' spending in contracts evolves in uncertain times. Then, I want to examine how changes in contracting decision of agencies relate to changes in contract quality.

[Krause \[2017\]](#) explains three events for budgetary uncertainty to disrupt federal agencies' spending decisions. First, continuing resolutions enacted by the Congress that enable agencies to keep operating in case appropriation bills have not been enacted on time. Continuing resolutions are funding appropriations that help agencies to maintain operations in case that regular appropriations for funding are not enacted on time [[McClanahan et al., 2019](#)]. Federal agencies were found to delay contracts during continuing resolutions [[Krause, 2017](#)]. Second, sequestration, i.e. government-wide cuts in spending, lead to budgetary uncertainty. Those agencies with later spending throughout the year have more flexibility for implementation of these cuts. Third, government shutdowns, i.e. the lack of funding due to delayed appropriations, lead to delays in budgeting and thus program execution.

2.3 A potential disciplining effect of uncertainty

The mechanism that induces decision-makers to change their spending behavior is their change in expectations on the availability of future period's financial resources due to budgetary uncertainty. This reaction is not necessarily homogeneous across decision-makers. Given the discussed evidence I expect agencies to reduce their spending in contracts during uncertain times. Also modifications of contracts might be possible, e.g. shorter contract duration, or more contracts with smaller amounts [see for qualitative evidence e.g. [Joyce, 2012](#)].

I expect uncertainty to have a differential effect on government agencies' contracting decisions. I plan to condition my analyses of changes in agencies' contracting on agencies' evaluated financial management practices. Potential conditioning variables could be e.g. past parliamentary evaluations of agencies' financial management, or past agencies' performance evaluations.

3 Data

I plan to examine the following events that might induce budgetary uncertainty on federal agencies for fiscal years 2012 to 2017⁴:

1. Tight elections (Clinton vs. Trump in 2016),
2. Continuing resolutions (several continuing resolutions fall in the sample period),
3. Sequestrations (there is one sequestration during the sample period starting in 2013),
4. Government shutdowns, including threats of government shutdowns (funding lapse of 2013).

I use data on U.S. federal government agencies' contract awards to examine the impact of budgetary uncertainty on their spending. I decided to examine agencies' IT spending for two reasons. First, because IT projects often involve large fixed costs or irreversibilities. Thus, from a real-options perspective reductions in spending might be more pronounced under uncertainty. Second, contracting data for the U.S. federal level agencies exhibit the special feature that certain contracts are rated by the agency's chief information officer (CIO) of the agency along several dimensions. The ratings include quality and risk criteria and let me relate changes in contracting decisions and contract characteristics to quality attributes of contracts.

The contract data comes from two sources⁵. First, [USAspending.gov](https://www.usaspending.gov) offers publicly available data on all U.S. federal-level contracts with information on many dimensions of contracts. This helps me to track e.g. contract duration, amount of the contract, or the purpose of contracts. The webpage lists contract awards that are agreements for specific goods and services the federal government makes based on bids [[Teefy, 2019](#)]. I intend to use this data to show how contracting decision change in response to events that increase uncertainty.

Second, the [I.T. dashboard](#) is a publicly available webpage that offers details on information technology investments of 26 U.S. federal government⁶. The data include information on the IT

⁴The fiscal year-end on the U.S. federal level starts on October 1 and ends on September 30. Thus, the precise proposed sample period runs from 01.10.2011 to 30.09.2017.

⁵I follow the basic data collection procedure of [Liebman and Mahoney \[2017\]](#).

⁶These agencies include the following 26 agencies: Department of Agriculture, Department of Commerce, Department of Defense, Department of Education, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of Housing and Urban Development, Department of the Interior, Department of Justice, Department of Labor, Department of State, Department of Transportation, Department of the Treasury, Department of Veterans Affairs, U.S. Agency for International Development, U.S. Army Corps of Engineers, Environmental Protection Agency, General Services Administration, National Aeronautics and Space Administration, National Archives and Records Administration, National Science Foundation, Nuclear Regulatory Commission, Office of Personnel Management, Small Business Administration, and Social Security Administration.

contracts, including award date, projected start and end date, amount spend, recipient information, type of IT investment, CIO name, and CIO's IT project ratings. The project ratings comprise different rating dimensions on a five point scale, including evaluations of risks, project requirements, contractor oversight, and project performance⁷.

4 Descriptive evidence supporting the research idea

A first exploratory data analysis shows that there is considerable variation in contract amounts, duration, and CIO overall project ratings between and within government agencies. I present descriptive statistics and figures here to support of my idea.

I use sample data from the I.T. dashboard website for fiscal 2013 to fiscal year 2017. This data include projects completed and in progress for which contract details and project ratings are available. There are 960 unique IT investment projects for these years. These investments relate to 12,695 unique contracts. The mean (median) contract duration is 525 (364) days. First (third) quartile contract duration is 194 (573) days. Winsorized at the 5 percent level, mean (median) contract amount is USD 7,879,067 (USD 2,260,686). First (third) quartile contract amount is at USD 400,359 (USD 8,056,222).

The decision to contract shows considerable variation. Fig. 1 plots the number of contracts by their award date. It shows that contracting decision for IT projects are made rather later than earlier throughout the fiscal year. The Loess-smoother indicates an increasing trend in the number of awarded IT-related contracts from fiscal years 2012 to 2015.

The federal agencies' CIO has to rate every IT investment. This rating needs to be updated in case new information is available, or every calender month⁸. The rating scale goes from 1 (high risk, bad quality) up to 5 (low risk, high quality). All together, there are 116,466 CIO ratings available. These include updated ratings on IT projects that have starting dates back in the 1990s.

Fig. 2 shows how rating distributions change for the years 2009 up to 2015. The number of ratings per year varies. In 2009 there are 5,600, in 2010 14,200, in 2011 18,300, in 2013 12,952, in 2014 10,600, and in 2015 there are 4200 ratings available (numbers rounded). From the figure it is apparent that especially in the later years there is an increase in the best rating category, while the lower categories almost disappear.

⁷See [I.T. dashboard FAQs, question 7](#).

⁸See [I.T. dashboard FAQs, question 8](#).

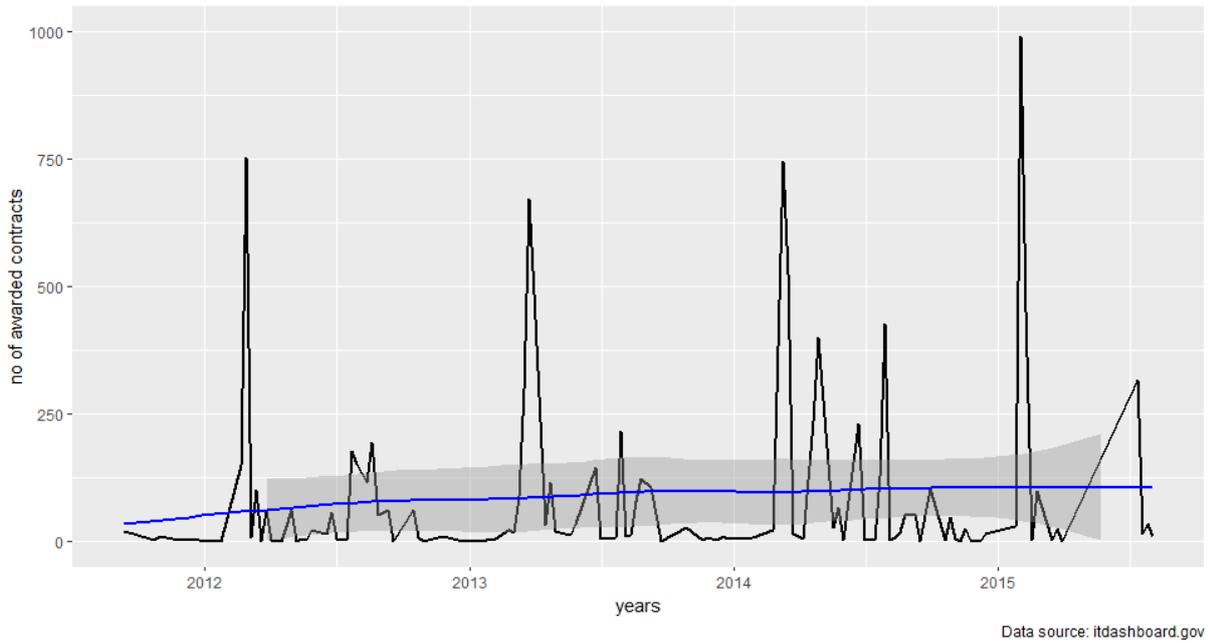


Figure 1: Contracts awarded weekly, fiscal years 2012-2015, $N = 18,530$ (Loess-Smoother to indicate trend in contracting)

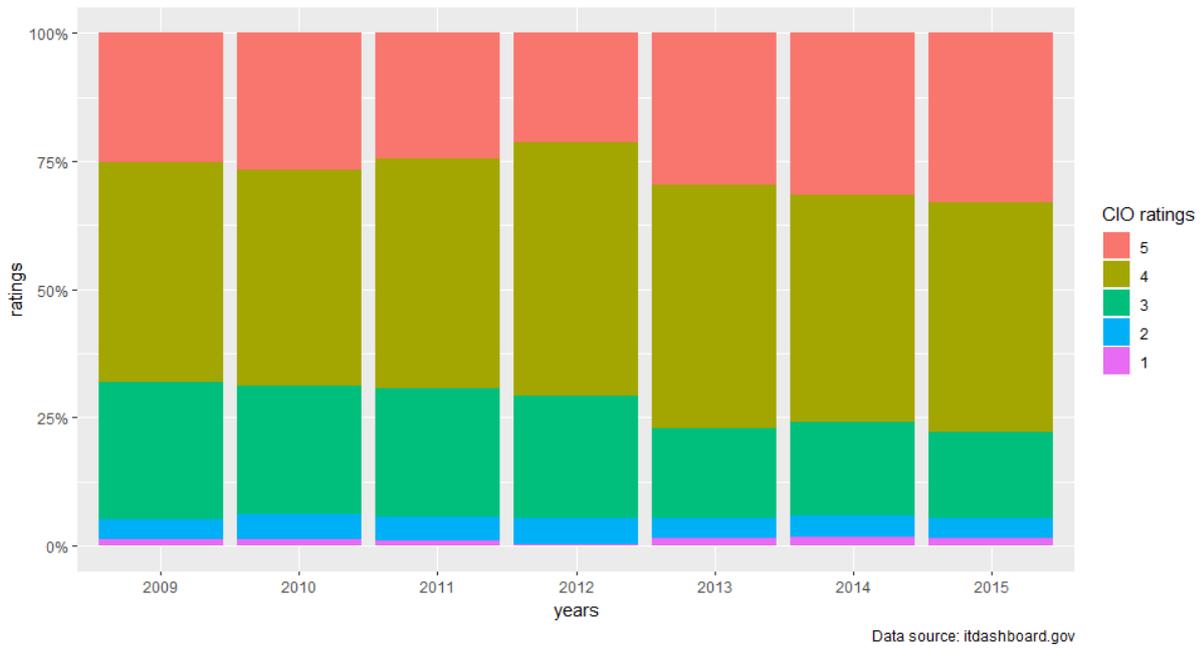


Figure 2: CIO contract rating distributions, fiscal years 2013-2016, $N = 116,466$ (1 is the lowest, 5 is the highest project rating)

Overall, the presented variation leaves the opportunity to test how budgetary uncertainty might impact U.S. federal government agencies' contract design and CIO investment ratings.

5 Potential extensions to financial accounting research

If possible, I plan to extend the research topic to transparency implications of firms that are government contractors. Prior research suggests that government agencies serve as monitors improving external financial reporting quality [Samuels, 2018], inducing political costs, e.g. less tax avoidance or aggressiveness [Mills et al., 2013], or changing a firm's customer base [Green et al., 2017]. Government contracting has been shown to have a stabilizing effect on firms, e.g. during the financial crisis [Goldman, 2018] or financial distress [Burke et al., 2015]. Also, there is evidence that government contracting firms tend to have less capital investment and lower future sales growth [Cohen and Malloy, 2016]. Another potential link to current research might be to examine importance of investor relations in the presence of government contracting practices induced by varying degrees of budgetary uncertainty [see e.g. Chapman et al., 2019].

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