Consumer of Last Resort: Government procurement, firm-level evidence and the macroeconomy

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Abstract

Public spending has been shown to stimulate private consumption and aggregate output. Less is known about the extent to which public demand and procurement markets can affect individual firms, particularly their financial stability and resilience to shocks, and can re-balance risks across businesses in the economy. In this paper, I focus on these issues and investigate them both empirically and theoretically. To do so, I first build a novel database with firm-level data on US government procurement programs and establish the unpredictability of competitive contracts through an event study. I then explore the effects of procurement contracts on firms' balance sheets and find a significant positive impact on winning firms' sales, profits and investments. I contribute to the literature by showing that public procurement can dampen perceived uncertainty and volatility associated with the firm in times of stringent financial conditions. I generalise and confirm my empirical findings in a general equilibrium model with two types of firms, contractors and outsiders. Using the theoretical model, I provide a deeper understanding of the design of procurement markets and their interplay with public policies to balance uncertainty and risks across firms.

Keywords: Government procurement, fiscal policy, firm uncertainty

JEL Codes: H57, E62, H32

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1 Introduction

Public policies can boost employment and investment and counter uncertainties and instabilities in times of economic hardship. They can do so using government spending, a policy tool that has been a subject of extensive research efforts but for which the academic focus has been primarily on the stimulative effects on private consumption and aggregate output. The impact on firms' finances and their stability is often overlooked. Public institutions purchase work, goods and services from private companies via a procurement process by awarding contracts. Firms willing to serve public demand are exposed to the intrinsic features of the procurement market, like entry costs and sizeable government spending. In the United States, federal procurement accounts for around 41% of federal consumption and investment or 2-4% of GDP[1], and the public demand is relatively stable over time, benefitting about 2-3% of all firms in the economy, a share that changes little in contrast with other government programs that function as automatic stabilisers. The government is an essential consumer for some firms and can distort outcomes for others. Motivated by the importance of the government procurement market, in my paper I address the question: what is the role of public spending in reducing firm-level uncertainty and improving resilience to economic shocks?

In this study, my starting point is to exploit firm-level information and provide empirical evidence the way in which firms are affected once they receive a procurement contract. I identify firm-level exogenous demand shocks using a comprehensive source on federal public obligations in the United States, Usaspending.gov, that makes it possible to determine whether the issued contract is awarded following a competitive procedure. Depending on the competitive nature of the agreement, the firm may either receive an expected increase in demand or face an uncertain investment opportunity for future demand if it has to compete with other companies. I web-scrape award announcements from the website of the Department of Defense to show, using a high-frequency event study, that following the award of a competitive contract, the stock market returns of an awarded firm exert unpredictable variation, suggesting that market participants did not expect the firm to receive an award. However, there is no significant variation in returns following noncompetitive contracts.

I then proceed by using the amounts of competitive awards to explore the effects on firms' quarterly balance sheet items using local projections. Firms are attracted by government demand: once a firm receives a procurement award, its sales persistently increase over 12 quarters, compared to a counterfactual scenario. Some income settles in terms of higher profits of 10 cents for each dollar of government obligations, lasting over eight quarters. This also explains the firm's higher profitability of 4-5 percentage points, whereas markups are relatively stable, exhibiting a

[1] The value is larger if state and local spending is included. OECD estimates for aggregate procurement in the United States are in the range of 9-12% of GDP.

slight but significant decrease over around two quarters. Lastly, I reaffirm that fiscal measures can have stimulative outcomes in higher investment, with a cumulative effect of around 21 cents over a three-year horizon. The first set of results indicates that a firm's fundamentals are improved once it receives additional public demand. Although these results may seem intuitive, I document them using a novel dataset and provide a solid basis for a theoretical framework.

Using the exact empirical specification, I evaluate the impact on uncertainty proxies and spreads of credit default swaps to provide novel insights into public demand effects on these firm-level dimensions. The demand shock has a limited and insignificant impact on the standard deviation of realised stock market returns or disagreement among professional forecasters about a firm's expected earnings. Instead, the impulse responses are state-dependent on aggregate financial conditions. Notably, public demand can dampen perceived uncertainties for a firm during severe financial conditions, such as the Great Financial Crisis. Government spending also provides some insurance for the contractors. Spreads for credit default swaps decrease after a firm is awarded a competitive contract. Dampening effects on the perceived default probability are amplified in a macroeconomic environment of stringent financial conditions. In a nutshell, empirical findings indicate that public demand can reduce uncertainties associated with the firm and provide valuable insurance, particularly when financial conditions worsen.

I rationalise my empirical implications with a general equilibrium model, which serves as a footing for policy experiments to evaluate the macroeconomic impact of the procurement market design on the distribution of risk and uncertainty in the production sector. The theoretical setting is based on the stylised two-agent model by Galí et al. (2007) that serves as a tractable tool for understanding fiscal policy. I extend the specification to account for several key realistic features of government spending and procurement market structure to allow for feedback with the macroeconomy. In particular, I assume that the government purchases a basket of goods that is different from the consumer one, forming a procurement market. In the economy, only a fraction of firms, *contractors*, receive public demand directly that can be exogenously terminated. Companies that do not supply the government, *outsiders*, are keen on entering the market but face entry costs and congestion akin to those of a search and matching model.

The model assumes firm heterogeneity and generates a firm-entry optimality condition that explains heterogeneous firm-level effects across contractors and outsiders to aggregate economic shocks. The condition ensures that firms face an investment decision to enter the procurement market and present underlying factors that motivate an entry decision. The decision to join the procurement provides a rationale for the fact that firms supplying the government are affected differently by macroeconomic disturbances than firms that do not. Suppose the government increases its spending; contractors receive higher demand and profits, whereas the outsiders face general equilibrium consequences of lower consumption and higher production costs. In this case, the outsider exerts an effort to join the procurement and experience the same benefits as the contractor. I then show that the model generates an insurance mechanism of the procurement market reflected in lower risk premia and standard deviation of expected returns for contractors and can reproduce the empirical findings of my event study and local projections.

The theoretical framework presents some novel insights and serves as a valuable laboratory for understanding alternative designs of the government procurement market concerning the length of contracts, entry costs, competitiveness in the procurement market or the size of the market. The government can manage riskiness and uncertainty for businesses in the macroeconomy depending on the policy goal to target a specific aggregate portfolio of firms in the economy. In the counterfactual environment with a larger procurement sector such that more firms receive public demand and government spending is constant, equity premia and expected stock market volatility is almost unchanged to a baseline. While contractors receive a smaller piece of government spending, reducing the effects of public insurance, outsiders face smaller congestion in entering the procurement market. The concentration of risk is rebalanced from the private production sector onto the public one. The experiment can explain the "war volatility puzzle" by Schwert (1989) - an unusually low stock market volatility during wars, the occasions when government obliges private businesses to produce military goods. The model is equipped to provide insights into the effects on the macroeconomy when adjusting other dimensions, such as the average length of contracts or the level of competition in the procurement market.

Related literature My paper mainly contributes to three literature strands. First, it relates to the empirical literature that evaluates fiscal spending's effects on firm dynamics. Hebous and Zimmermann (2021) is a notable inspiration for this study. It provides the valuable idea of using competitive awards to identify exogenous firm-level demand shocks when exploring the impact of procurement awards on firm investment and how the effects vary depending on financial constraints. My contribution to this study is to refine the identification by providing robust evidence to validate it, using award announcements in a high-frequency event study. I extend the sample with a more comprehensive matching of the procurement database with firm-level information in Compustat to document the effects for a larger dimension of firm-level variables, which will guide my theoretical modelling. Other notable efforts are by Juarros (2021), who employs procurement data to identify firms in the proximity of awardees. The study analyses the size dimension across firms and the role of credit frictions to explain the heterogeneous effects of government stimulus. J. Goldman (2020) exploits heterogeneous exposures across firms to government spending using segment tables in Compustat to show that government contractors experienced positive performance during the Great Financial crisis compared to their peers. Ferraz et al. (2015) and Lee (2021) are other studies that provide evidence of beneficial outcomes for the awardees in a quasi-experimental framework. In this paper, I show that there are valuable gains for contractors in terms of lower perceived uncertainty surrounding firms' prospects and reduced default probability.

Secondly, the study contributes to extensive research efforts on modelling government spending in a general equilibrium framework (Baxter & King, 1993; Galí et al., 2007; Ramey, 2020, to name a few). These models are a tractable tool for studying macroeconomic implications. However, they typically assume that the government purchases goods from all firms in the economy, neglecting the role of the procurement market and its structure. In fact, they generate countercyclical dividends due to severe price frictions. In contrast to my empirical findings, they find that firms do not want additional or stimulative public demand, as it decreases profits. I contribute by introducing micro-founded aspects of public procurement into a model that features a novel mechanism of search and entry into the procurement market. The setting allows us to better understand the implications of the public procurement market in the macroeconomy. Unlike the workhorse model, it generates positive profits for contractors, reproducing empirical regularities.

Lastly, I contribute to the literature that studies the role of public procurement in the macroeconomy. To quote a study by di Giovanni et al. (2022): "There is practically no literature that analyses how the microeconomic aspects of public procurement can affect the macroeconomy", emphasising that this strand of economic research has been overlooked. Their analysis focuses on the procurement market in Spain, incorporating administrative information on public procurement and credit registries to show that procurement contracts serve as reliable collateral, ensuring the firm's growth in the future. The study also provides a comprehensive theoretical framework with heterogeneous firms to understand long-run implications for the macroeconomy under alternative procurement allocation systems. The paper of Cox et al. (2021) explores the federal procurement data of Usaspending.gov, the same information used in this analysis, to document several summarising facts characterising the procurement market. They note that government spending is allocated to sectors featuring relatively stronger pricing frictions and develop a model to rationalise that fiscal multipliers may vary depending on the sector where a government stimulus originates. My study contributes to this growing literature with a primary focus on firms' entry into procurement and public demand as an insurance mechanism.

Paper structure The rest of the paper is organised as follows. In Section 2, I detail procurement data, explain empirical and identification strategies, summarise the event study and present findings. In Section 3, I develop a model, explain underlying mechanisms and present policy experiments. Section 4 concludes.

2 Government spending and firm-level empirical evidence

In this section, I provide empirical evidence on how a firm is affected once it receives a procurement contract. I introduce procurement data sourced from Usaspending.gov, which provides contract-level information. I then describe the empirical specification and strategy to identify firm-level effects using instances of a firm receiving the procurement contract following a competitive procedure. To support my identification strategy, I perform a high-frequency event study which shows that, due to the competitive nature of contract allocations, financial market participants do not perfectly anticipate this allocation. Finally, I explore the effects on the firm's quarterly balance sheet and financial market elements using local projections and summarise my findings.

2.1 Government procurement contracts

The government of the United States is a regular consumer and investor: it purchases goods and services as well as acquires capital, e.g. highways, military equipment, etc., from the private sector. In other words, the government enters into contracts with private entities. To illustrate the process, suppose the Department of Defense (DoD) decides it needs an external facilitator to provide canteen services in one of its military bases. A dedicated staff member, a contracting officer, solicits this opportunity publicly in the System of Award Management (SAM.gov). Private entities apply to do business with the government and express their bid to fulfil the service. Officers of the federal agency review offer and select awardees. Then the contract award is recorded in the system and submitted to Usaspending.gov for public dissemination.

Usaspending.gov is a comprehensive database which collects information on public federal obligations. Following the Federal Funding Accountability and Transparency Act of 2006 (FFATA), the database was created to record federal obligations in the form of grants, loans, assistance programs and contracts to pursue public accountability and provide the public with an accessible, high-quality information source on federal spending. The information is collected across over 400 federal financial sources, primarily from federal agencies and central procurement or financial assistance data systems; the overall material is supplemented with sub-award information from entities awarded a contract.

The information in Usaspending.gov extends from the fiscal year of 2001 till the current day[2]. Aggregates account for around 15.8% on average of total government consumption and invest-

[2]The procurement data is collected before 2001 and can be accessed through the National Archives. However, the information is noted to be unreliable and often incomplete. For that reason, it is excluded from this analysis.

ment annually and 41% of the federal equivalent. Cox et al. (2021) provide a comprehensive analysis of the dataset; among many insights, using the national accounts, the study suggests that the procurement data is representative of intermediate goods and services purchased by the government and its investment into structures, equipment and software. Further decomposition reveals that the procurement aggregates account for approximately 29 p.p. of federal government consumption and 13 p.p. of federal investment. The dataset is granular and comprehensive, allowing me to investigate the question of this study. It includes contract-level information on the recipient, granting authority, and details on the contract, including the start and end dates of the award and obligated amounts.

I construct a firm-level dataset aggregating the amounts of federal obligations at the contract initiation over a quarter[3]. The reason for focusing on the initial obligated amounts is that they can arguably better reflect an unexpected cash flow due to receiving the reward. Further adjustments in the contract following its initiation may result from endogenous actions by the firm. For example, contracts sometimes specify additional clauses to award the entity with additional obligations if the firm successfully fulfils the initial requirements. I opt to exclude changes in obligations arising beyond the quarter of the initiation since they may be due to renegotiation, termination or just changes in contract conditions.

Prior to the aggregation, some additional corrections are necessary. Auerbach et al. (2020) and Demyanyk et al. (2019) find that the contracts are voided shortly after the initiation. More specifically, some obligated amounts are followed by an almost equally negative amount, resulting in a non-positive obligated amount. Based on the contract identifier, the contract is excluded if the original amount is as close as 0.5% of the de-obligated amount within the fiscal year. If the resulting obligated amount is positive after the modification, I consider the entry an imputation error and keep the resulting amount as the obligated amount at the contract initiation. I also exclude data points that suffer from other possible errors in the data entry, e.g. the starting date of the performance is before the initial date of the data entry, or the obligated amount is negative.

An alternative to this database would be to use segment tables from Compustat to identify a firm's sales to the government that amount to more than 10% of total sales. However, the granular database I build provides some advantages for constructing the treatment variable and the effectiveness of the identification strategy. First, the procurement database provides information on the government's obligations, a promise to spend money on the good or service after the contract is signed. It does not reflect actual outlays or revenue on a firm's financial statements.

[3]Each entry in the dataset includes a 'modification number' which identifies whether there have been changes to the initial award, allowing to observe the development of the contract over the years. Following the assistance from the staff at Usaspending.gov, I identify the initial contract if the field for the modification number is equal to zero or missing and if the field of action type is missing. In case multiple entries satisfy these criteria, I select the entry that has the earliest action date.

The latter can be considered as predetermined by the binding government's commitment[4]. Second, the timing of recording sales to the government on a financial statement can vary across contracts and firms for several reasons, e.g. it can depend on contract clauses having to be reimbursed in instalments or in full once a project is finished. Therefore, records on obligations provide consistent timing across contracts, ensuring higher reliability in capturing treatment effects[5]. Third, the procurement database covers a larger universe of firms that receive government spending, allowing to analyse effects for firms for whom the government is not only a significant source of income. Lastly and importantly, the contract level disaggregation provides information on whether the award followed a competitive selection procedure, facilitating the identification strategy explained below.

2.2 Empirical specification and identification

Empirical specification I consider panel local projections for the study:

$$\frac{x_{i,t+h}}{y_{i,t-1}} = \alpha_{i,h} + \alpha_{s,t,h} + \sum_{j=1}^{4} a_{j,h} I(Q_{i,j} = q_t) + \beta_h \frac{proc_{i,t}}{y_{i,t-1}} + B_h(L)Y_{i,t} + e_{i,h,t} \tag{1}$$

where $\frac{x_{i,t+h}}{y_{i,t-1}}$ denotes the variable of interest for the firm i at horizon h, scaled by variable $y_{i,t-1}$ to ensure stationarity, $\alpha_{i,h}$ is a unit fixed effect to capture time-invariant firm's covariates, $\alpha_{s,t,h}$ is a sector-specific, s, time-fixed effect; I use Fama-French 10 SIC industry classification. $I(Q_{i,j} = q_t)$ represents quarterly dummies for a firm's fiscal quarter, capturing seasonal accounting effects; $\frac{proc_{i,t}}{y_{i,t-1}}$ represents a variable of treatments: in this study, it stands for the aggregate amount of competitive procurement contracts awarded to firm i at time t and scaled with the respective variable; $B_h(L)Y_{i,t}$ is a lag polynomial of control variables also including dependent and treatment variables; I use 4 lags in the estimation; $e_{i,h,t}$ is an error term.

The coefficient β_h measures the impulse response effect of receiving a contract onto the variable of interest. To ensure causal interpretation, the coefficient is only consistently estimated if the treatment variable is uncorrelated with the error term at all leads and lags, conditional on other covariates. This introduces identification challenges.

Identification Government contracts are not awarded randomly: several plausible factors may

[4] Auerbach et al. (2020) and Cox et al. (2021) suggest that obligations and outlays, as recorded in national accounts, co-move to a great extent. Therefore, at least on aggregate, it is unclear if there is much difference in using either of the measures.

[5] Using macroeconomic level information, Ramey (2011) provides important discussion to correctly account for the timing, when computing effects of aggregate government spending on the output. Military spending announcements predate their implementation; thus, economic agents react in anticipation of future expenditures. Failure to capture these expected effects may seriously bias the estimates.

predict the firm being awarded. In particular, selection bias and political influence may be considered the most challenging to recognise. Firms are obliged to apply for a government contract, which naturally creates a selection bias. Many contributions in the political economy literature shed light on political favouritism and corruption in procurement allocation (Baltrunaite, 2020; Brogaard et al., 2021; Choi et al., 2021; E. Goldman et al., 2013, to name a few).

I address these concerns by, first, focusing only on arguably unanticipated awards to firms. Mainly, I follow a novel strategy proposed by Hebous and Zimmermann (2021) and collect a list of contracts that originated following a competitive procedure with at least two bidders. Competitive procedures are designed to facilitate a more efficient allocation of common funds and therefore lessen political favouritism[6]. However, due to its competitive nature, applying for an additional demand also represents an uncertain investment opportunity for a firm. For that reason, the firm faces an unexpected increase in its demand once it is awarded a contract. To corroborate the identification strategy, I conduct an event study that suggests that competitive awards are not anticipated. Market participants incorporate the information about the award into a higher firm valuation around the announcement date and not before that[7]. Compared to competitive contracts, noncompetitive ones are fully anticipated and do not include any unpredictable components.

The solicitation, awardee selection and contracting procedures must adhere to guidelines specified in the Federal Acquisition Regulation. One of the requirements is to ensure government contracts are subject to full and open competition so that the government allotment is efficient, ensuring competitive contract conditions and price, all while minimising various market distortions[8]. Not all contracts are fully competitive, however: some federal agencies may contract suppliers, whom they deem responsible for ensuring, e.g., national security objectives, or who have prior relationships and experience in providing specialised goods and services[9]. In other cases, competition may be limited to provide positive discrimination towards small and/or minority business owners. Particularly, contracts with smaller prospective obligations are encouraged to use 'Simplified Acquisition Procedures' (SAP) that favour more efficient contracting opportunities[10]. For the analysis, I select contracts subject to 'full and open competition' but

[6] Brogaard et al. (2021) provide evidence that firms tend to underbid to win a contract and exert their political influence in renegotiations after an award is allocated. They find that political connections have a smaller and almost economically non-negligible influence on ex-post renegotiation for competitive awards. Note that my definition of a competitive contract is more robust. In addition to focusing on the contracts subject to open competition, I also impose that the number of bids has to be higher than one. This rules out around 20% of formally competitive contracts.

[7] I expand on this later, see section 2.3.

[8] The attitude to foster competition in the procurement market is also shared elsewhere, e.g. in Europe, see European Commission (2017).

[9] Competition requirements are detailed under Federal Acquisition Regulation (FAR). 41 U.S.C. 253(c), whereas regulations allowing to limit competition are explained in FAR 6.2 and 6.3.

[10] Definitions of what constitutes a small and minority business as well as which contracts are subject to SAP differ across sectors and agencies. For more information, see https://www.sba.gov/federal-contracting.

also include 'competed under SAP' contracts.

Second, I use the comprehensive accounting data of Compustat as well as various sources of information on political and lobbying contributions in a panel setting. This allows me to exploit a saturated specification and capture any remaining covariates that may explain both dependent and treatment variables. Firm fixed effects capture invariant firm fundamentals, such as specialisation or some market power to supply government products or services and reliance on revenue from the government. Sector-specific time effects aid with accounting for common factors in the sector, such as reaching out for government demand in times of economic crisis or seasonality in procurement programs, among others[11].

Firm-level Data Quarterly information from balance sheets and financial statements at the firm level is sourced from Compustat, a database providing extensive coverage for publicly traded firms. I use conventional financial items and ratios for the control variables to capture the firm's fundamentals and alleviate self-selection concerns. Larger firms are more prone to serve the government due to lower operating costs and experience in the procurement market. Alternatively, companies may seek for public demand to alleviate bankruptcy risks. Included variables are total assets to proxy the firm's size, a book-to-market value of equity and return on assets to reflect profitability, a quick ratio to capture liquidity position and debt to capital for solvency. Definitions align with previous research efforts and recommendations by Compustat and Wharton Research Data Services (WRDS). Detailed explanations about the construction of variables and their definitions are summarised in Appendix A. I use various comprehensive methods to provide reliable matches for more than 5000 firms between the Compustat sample and the procurement information. A detailed explanation is provided in Appendix B.

I supplement the dataset with the stock market data on holding period market returns from the Center for the Research in Security Prices (CRSP). To proxy firm-level uncertainty[12], I first use the realised volatility of stock market returns, constructed as the log standard deviation of returns over the quarter. Second, I source the forecasters' disagreement measure of earnings per share (EPS), called the coefficient of variation from IBES, a depository of analysts' historical forecasts. The variable is constructed as the standard deviation of individual earnings predictions by professional forecasters and scaled by the absolute average. Spreads of credit default swaps are sourced from Datastream.

Political involvement by the firm in terms of contributions, relationships or active lobbying can lead to favourable allocation of procurement funds towards that firm. This raises plausible

[11] The allocation of government funds exhibit predictive seasonal movement at the end of fiscal years (Cox et al., 2021).

[12] Knight (1921) defined uncertainty as an agent's inability to forecast some event to occur, as opposed to risk, which stands for the quantifiable likelihood over possible outcomes. In this paper, I interchangeably refer to risk and uncertainty as the same concept.

endogeneity concerns that political involvement by the firm may explain its fundamentals as well as it being awarded the contract. To take that into consideration, I control for biannual political contributions from individuals associated with the firm and political action committees to various candidates, party committees or action committees, 527 groups and others, as sourced from opensecrets.org; additionally, I use yearly firm's expenditure on lobbying, obtained from Kim (2018).

The final sample ranges from 2000q4 till 2019q3 and includes 6868 firms, of which 1972 received at least one competitive contract over the sample period. I exclude observations that do not have positive quarterly assets or sales, firms that operate in financial, utilities, health or public sectors[13]. I also drop data points representing American Depository Receipts (ADRs) and foreign companies traded in the United States. Variables are winsorised to avoid distortions due to outliers. Summary statistics are presented in Appendix C.

2.3 Event study on stock market unpredictability

The identification of firm-level demand shocks relies on the idea that winning a contract, subject to a competitive procedure, is an unanticipated event. To support this, I conduct a 'finance-type' event study, evaluating to what extent stock market participants predicted that the firm would be awarded. For the sample of DoD contracts, competitive contracts are associated with significant abnormal returns around the announcement, suggesting that, on average, the win surprised market participants. However, there is no similar evidence for noncompetitive contracts.

Firms are eager to win a government contract; it is a source of income and future profitability. Thus, one would expect that a new award is associated with a higher valuation of the company and a higher stock price[14]. News about a government contract will only result in a greater price if it was not anticipated or, otherwise, already priced in. For that reason, if winning the contract is foreseen, the stock price should stay in line with the market variation, and there should not be any idiosyncratic variation around the announcement of the award. An event study allows the evaluation of exactly that.

For the study, one must establish a date when the event occurred, and the information about it is publicly shared. In this analysis, the exact date is difficult to come up with. Usaspending.gov database provides information on the so-called action date, which represents the time the con-

[13]More precisely, I drop firms whose primary historical SIC classification belongs to either 4900-4999, 6000-6999, 8000-8099 or above 9000.

[14]The similar rationale is followed by Fisher and Peters (2010) to identify aggregate government spending shocks.

tract was signed, establishing a new government obligation. However, the information about the award may become public before or post this date for some plausible reasons. For example, DoD contracts may be subject to national security exceptions and kept secret (Acquisition.gov, n.d.-a)[15]. Financial markets may only price in these events once the award information is published later. Market corrections are also possible before the action date if the information is either leaked or announced before signing the contract or, simply, the inputted data itself is one of many frequent errors in the database. For these reasons, the date the contract was signed cannot be used as an event date unless one can ensure that it corresponds to the day when the information about the firm awarded a contract became public knowledge.

To do so, I focus on DoD contracts and collect their announcement dates from a public website https://www.defense.gov/News/Contracts/[16]. Every weekday, the federal agency is obliged to publicly announce contract awards at 5 p.m. (UTC-05:00) on the same day of award (Acquisition.gov, n.d.-b), just after NYSE trading hours. This requirement applies only to large contracts with values over $4.5-$7.5 million[17]. Announcements for each contract tend to be rather brief, summarising information found in Usaspending.gov database[18]. The same information is also distributed across financial information platforms. For example, Refinitiv Eikon provides similar or sometimes identical content among a specific firm's news items. This indicates that market participants are monitoring these announcements.

Each announcement includes a unique contract code (e.g. SPE7LX-19-D-0133) that I extract and use to match the announcement dates published on the DoD website with a procurement database. In total, above 60000 notices are retrieved from the DoD website. Then, I drop contract releases that are awarded to multiple firms if there are more than five contract identifiers in the announcement. This allows me to filter out events that can be considered more sectoral or correlated shocks and may differ from the majority of announcements that concern a particular firm and arguably represent an idiosyncratic demand shock. After further corrections and small exclusions, I end up with more than 37000 unique contract identifiers, of which 35000 are successfully matched with a procurement database. In line with the main analysis, I focus on

[15] For the same reasons, DoD can legally report public purchases to Usaspending.gov with a considerable lag of one quarter.

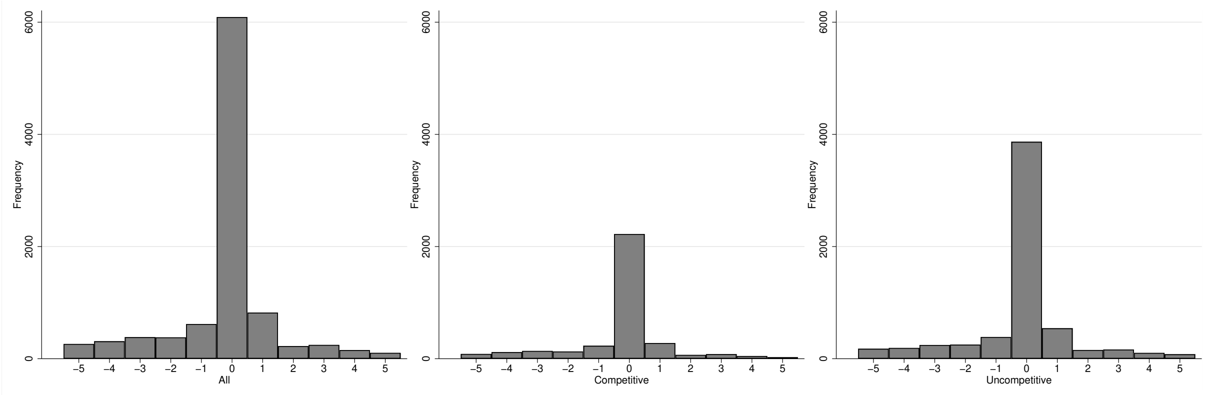
[16] The latest version of the website provides announcements till the 1st of July, 2014. For the information before this date, I rely on web archive https://web.archive.org/web/20140920201434/http://www.defense.gov/contracts/archive.aspx.

[17] The smallest contract value, for which public announcement is required, tends to change over time.

[18] One instance published on the 23rd of May, 2019:

> "General Dynamics, Williston, Vermont, has been awarded a maximum $42,443,476 firm-fixed-price contract for gun barrels. This was a sole-source acquisition using justification 10 U.S. Code 2304 (c)(1), as stated in Federal Acquisition Regulation 6.302-1. This is a three-year contract with no option periods. Locations of performance are Vermont and Maine, with a May 22, 2022, performance completion date. Using military services are Air Force and Army. Type of appropriation is fiscal 2019 through 2022 defense working capital funds. The contracting activity is the Defense Logistics Agency Land and Maritime, Columbus, Ohio (SPE7LX-19-D-0133)."

Figure 1: Distance between dates of contract legal agreement and announcement



Note: The figure shows the distribution of events' distances between the date when the binding agreement was reached and the date of announcement at the DoD website. Panels indicate different samples, respectively, all only competitive or noncompetitive contracts. Values of more or less than five days are excluded.

initial obligations; thus, I exclude all contract modifications, resulting in a total of around 12000 matches. To confirm the intuition that the date when the contract has been signed may not coincide with the date it was announced, I compute the distance between the two dates, such that positive values indicate that the contract award was announced before when it was signed. Figure 1 illustrates the frequency of discrepancies. Dates tend to agree in both sources for the majority of matches, albeit just close to 50%. Discrepancies cannot be ignored; therefore, for the event study, I use only matches that are either precisely paired or differ by one day, resulting in over 6700 events.

Using an event study framework, I compute daily abnormal returns (AR) as a difference between observed stock returns, $R_{i,t}$, and counterfactual normal returns, which are then averaged across multiple events. The regression specification is rather straightforward:

$$R_{i,t} = \alpha_i + \beta_i X_{m,t} + \sum_{k=-20}^{20} \gamma_k I(event_{i,t-k}) + \epsilon_{i,t} \tag{2}$$

where subscript t is a sequence of trading days around the event, and subscript i is an observational unit that may not necessarily correspond to one particular event or firm. Unlike most event studies, here, events are severely clustered next to each other, as contracts can be awarded to the same firm a few days apart. Event clustering could lead to biased abnormal returns before and post the announcement that may be due to the previous or following award. For that reason, each observational unit i may incorporate more than one event if the distance between events is less than 20 trading days, resulting in unequal event windows[19]. $X_{m,t}$ is a

[19] Alternatively, one can estimate specification 2 for each firm, however, limiting parameters α_i and β_i to be non-time-varying. The specification comes in contrast to modern consensus and a majority of event studies in the finance literature, emphasizing that a firm's riskiness in relation to market returns can evolve over time.

vector of aggregate factors, $I(event_{i,t-k})$ is an indicator if event happens at $t-k$ trading day. The parameter of interest is γ_k, which stands for the average abnormal returns (AAR).

Table 1 summarises estimates of AARs for both competitive (LHS) and noncompetitive (RHS) events around the announcement date. Different columns within panels represent distinct specifications of factors, 'MM' is a market model, where $X_{m,t}$ includes only CRSP value-weighted market returns; 'MM+Defense' adds Dow Jones U.S. Select Aerospace & Defense stock index, DJSASD, to account for a sector-specific variation; 'FF3' additionally includes Fama and French (1993) factors 'small minus big' and 'high minus low'; lastly, 'FF4' adds 'momentum'. To begin with the interpretation, abnormal returns one day after the announcement of the competitive award are positive, on average around 12 b.p., and strongly significant across all specifications. Competitive contract awards surprised market participants, leading to a positive correction one day after the announcement. One-day lag is natural, given that the announcement arrives at 5 p.m., just after NYSE trading hours. AARs leading to the announcement are, on average positive but insignificant, apart from one day before the announcement. This suggests that there is no statistical evidence supporting anticipation, whereas positive abnormal returns at one period before the announcement indicate possible information leakage. For noncompetitive events, market reactions are relatively muted throughout the event window. There is some statistical support for abnormal variation at periods -11 and -3. However, as explained below, they are both short-lasting and insignificant cumulatively.

To measure the cumulative effect of the announcement, I estimate a regression specification of the following form:

$$R_{i,t} = \alpha_i + \beta_i X_{m,t} + \sum_{k=-20}^{19} \rho_k \Delta I(event_{i,t-k}) + \rho_{20} I(event_{i,t-20}) + \epsilon_{i,t} \tag{3}$$

where the parameter of interest is ρ_k and stands for a cumulative abnormal return (CAR) at period k, $\sum_{q=-20}^{k} \gamma_k$. Figures 2 and 3 plot these coefficients for, respectively, competitive and noncompetitive events. Circles represent average values, whereas bold and thin bars stand for 95% and 99% confidence intervals. The dynamics of CARs are pretty robust across all specifications. For competitive events, CARs are rather stable from around zero until 9 days before the announcement, when they start to pick up. This upward trend in average CARs may indicate positive cumulative returns and, therefore, some anticipated behaviour by market participants. However, there is no statistical evidence that estimates are inconsistent with zero returns, so the non-anticipation of competitive awards can be upheld. CARs become positively significant at the 5% level one period before a news release, in line with suspected leakage effects found in table 1, and continue to stay above zero after the announcement. Results presented in Figure 3 confirm that participants in financial markets are not concerned about noncompetitive events, as demand effects may have already been priced in. CARs are insignificant and wobble

Table 1: Average abnormal returns around the announcement date

	(1) MM	(2) MM+Defense	(3) FF3	(4) FF4
-20	-1.62	0.04	-0.11	-0.10
-19	-2.12	-2.64	-1.61	-1.30
-18	3.35	3.26	4.47	4.85
-17	0.75	0.19	0.98	0.50
-16	1.82	1.95	2.07	2.33
-15	-0.68	-1.67	-0.28	-0.00
-14	-1.85	-1.67	-1.23	-1.34
-13	0.27	-0.80	-0.49	-0.30
-12	0.04	-2.19	-1.81	-2.54
-11	1.84	1.32	2.95	2.65
-10	2.23	1.40	-0.52	-0.14
-9	5.29	5.27	6.20*	5.51
-8	1.19	1.30	3.19	3.09
-7	1.63	-0.34	-0.01	-0.71
-6	7.84**	6.26*	7.12*	5.86
-5	-3.59	-3.12	-2.37	-2.43
-4	-1.16	-3.53	-4.17	-4.61
-3	3.66	6.08*	6.78*	6.80*
-2	5.24	3.86	3.67	3.96
-1	10.10**	9.56**	7.93*	7.90*
0	-1.19	-0.42	-1.74	-1.33
1	10.87**	11.19**	11.88***	12.61***
2	3.43	4.13	4.59	4.56
3	1.67	1.55	1.47	0.41
4	3.97	2.43	1.57	1.42
5	-0.64	-1.58	-1.43	-1.32
6	-5.41	-5.07	-4.21	-3.78
7	10.50***	9.59***	9.71***	9.83***
8	-3.26	-1.29	-0.82	-1.00
9	-10.41**	-7.46	-9.19*	-9.92**
10	8.05**	8.58**	7.95**	7.26*
11	-10.26***	-8.13**	-7.18*	-6.66*
12	-1.57	-1.58	-0.41	-1.12
13	-4.94	-4.97	-6.24	-6.08
14	-7.37*	-4.88	-5.78	-5.78
15	-2.13	-0.44	-0.40	-0.55
16	0.18	0.27	0.15	-1.22
17	-0.53	1.33	-0.26	0.48
18	-0.24	-1.64	-0.80	-0.51
19	-3.88	-3.34	-1.55	-1.31
20	7.14*	8.06**	7.17*	7.21*
N	474695	474695	474695	474695
Comp. Events	2088	2088	2088	2088
No of Firms	276	276	276	276

	(1) MM	(2) MM+Defense	(3) FF3	(4) FF4
-20	1.02	0.05	-0.09	-0.08
-19	1.74	2.82	1.77	2.11
-18	0.54	0.29	0.95	0.81
-17	1.28	1.20	0.57	0.30
-16	0.34	-0.13	0.33	0.49
-15	2.77	1.84	1.81	1.19
-14	0.23	0.42	0.90	0.31
-13	-2.65	-1.06	-1.07	-1.48
-12	2.98	3.70	4.27*	3.92
-11	-6.46**	-4.52*	-4.81**	-4.94**
-10	-0.96	-1.22	-1.10	-1.14
-9	-0.34	-0.30	-0.21	0.11
-8	-1.92	-3.43	-3.72	-3.48
-7	0.25	-0.45	-1.75	-1.98
-6	1.42	1.22	0.67	0.08
-5	-1.99	-1.25	-1.05	-0.99
-4	-1.87	-2.00	-2.58	-2.56
-3	5.02*	4.47*	4.40*	4.99**
-2	1.15	0.65	0.04	-0.03
-1	-0.03	-1.69	-1.98	-2.05
0	1.58	1.16	0.94	0.76
1	2.29	1.50	2.04	1.99
2	2.53	2.00	2.66	2.92
3	3.05	3.02	2.87	2.34
4	0.69	-1.00	0.25	-0.02
5	0.06	-0.57	-0.19	0.23
6	0.52	-0.39	-1.30	-0.44
7	1.61	2.68	2.15	1.84
8	0.97	2.79	2.43	3.08
9	-0.82	-0.26	-0.74	-0.67
10	-4.24	-1.14	-0.90	-1.19
11	-0.47	-0.45	-0.45	-0.66
12	2.25	2.61	2.48	1.96
13	-3.37	-2.87	-1.92	-2.34
14	1.74	2.08	2.36	2.39
15	3.28	4.47*	5.50**	4.69*
16	-6.42**	-3.86	-4.10	-3.99
17	-1.43	-0.51	-1.00	-1.10
18	2.09	0.06	-0.55	0.25
19	-4.05	-2.99	-3.53	-4.02
20	-2.73	-2.29	-2.84	-2.52
N	486208	486208	486208	486208
Uncompet. Events	3431	3431	3431	3431
No of Firms	240	240	240	240

Note: The table presents estimated abnormal returns,γ_k, around the announcement date ($t = 0$) using specification 2. On LHS, the panel presents results for events of competitive awards, and RHS for noncompetitive awards. In each panel, four columns present ARs estimated using four different specifications of expected returns: 'MM' - Market model; 'MM+Defense' adds Defense stock index DJSASD; 'FF3' additionally includes Fama and French (1993) factors 'small minus big' and 'high minus low'; lastly, 'FF4' adds 'momentum'. Asterisks denote significance levels (***=1%, **=5%, *=10%) using clustered standard errors over an estimation window.

around a zero value across the whole event window.

As a further robustness check, I compute a regression specification including competitive and noncompetitive events to account for possible contamination effects. On some weekdays, there are multiple announcements for the same company, which can include both competitive and noncompetitive awards. This may lead to biased results and invalidate the study. The event study design assumes that a particular day embodies a single event, often a valid presumption given the high-frequency variation used. However, with multiple events occurring on the same day, it is unclear if market correction arises due to news about the competitive or noncompetitive award. For that reason, controlling for both events allows distinguishing the two effects. Overall, results, as presented in the Appendix[20], indicate that this is not an important worry, as estimates are almost identical to the baseline.

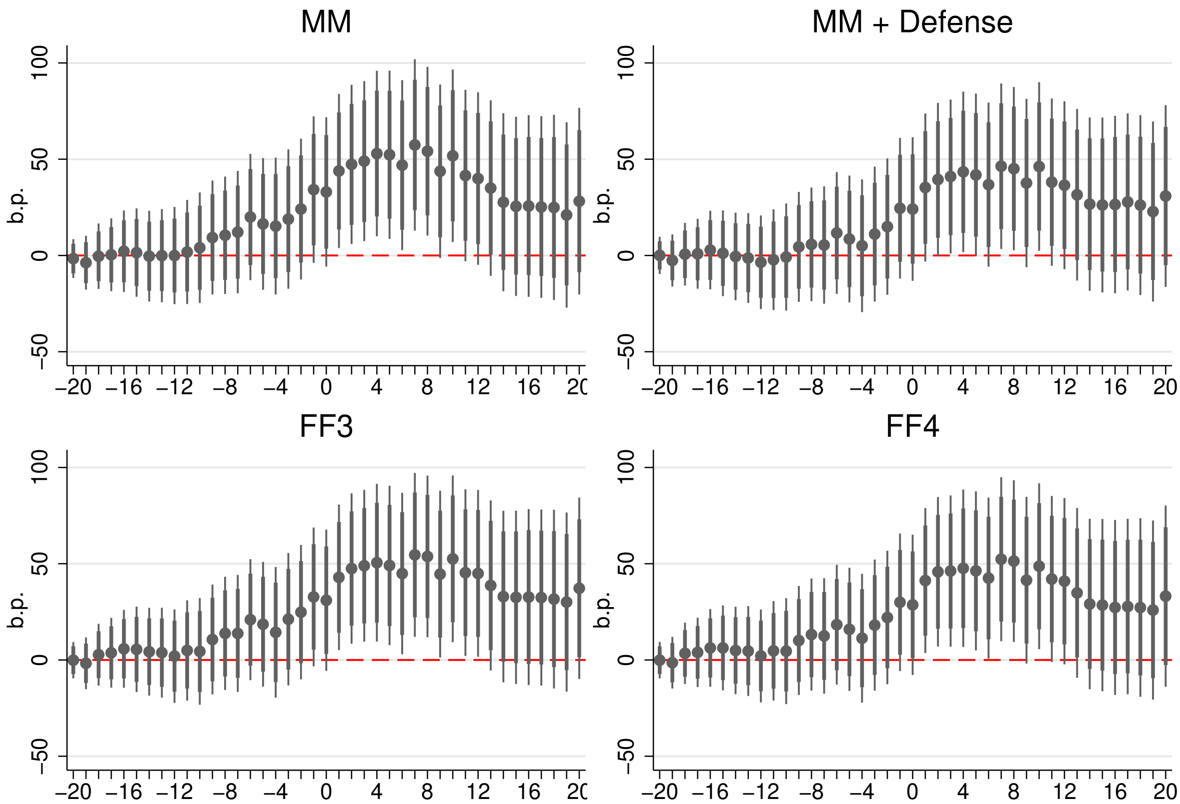
The event study results suggest that the stock market does not anticipate with certainty which firm will be awarded a competitive contract, and this validates the identification strategy of government demand shocks employed in the analysis above. Note that Hebous and Zimmermann (2021) are responsible for a first attempt to provide evidence on to what extent competitive awards are anticipated using stock market returns. They achieve the same conclusion by employing a Granger-causality test - whether daily returns can predict that a contract will be awarded to a firm. The analysis presented here is a valuable addition to theirs for several reasons. First, I supplement the information in Usaspending.gov with DoD announcements to establish arguably a correct event date and avoid possible discrepancies. As a result and second, this allows me to conduct a conventional event study in accordance to finance literature. Lastly, I contribute by showing that announcements about noncompetitive events do not lead to any variation in the stock price.

2.4 Findings

In the following subsection, I summarise results from local projections that guide my theoretical framework in the next section. I begin with first focusing on the favourable effects on the firm's financial statement following it was awarded a government contract. Then, I evaluate the impact on uncertainty proxies and spreads of credit default swaps, where I find that responses are state-dependent on aggregate financial conditions.

[20]See Table E.1 for ARs and Figure E.1 for CARs.

Figure 2: Cumulative abnormal returns for competitive events



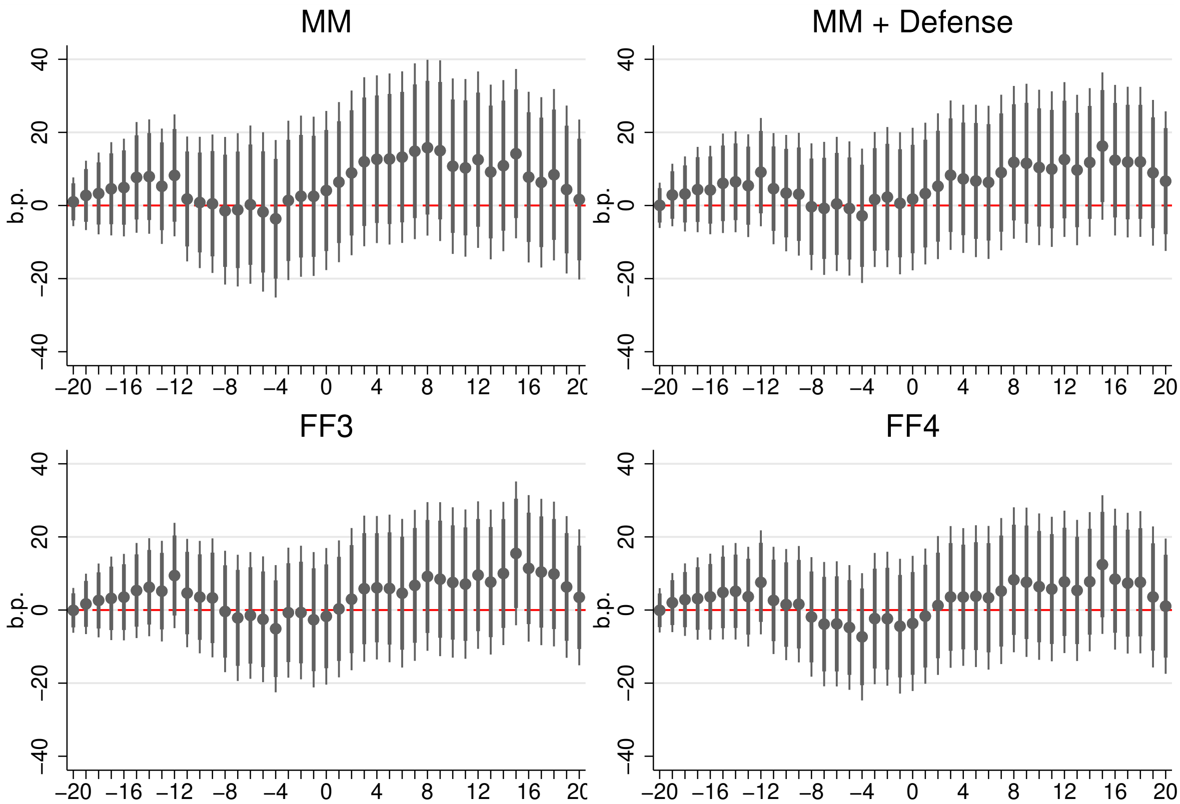
Note: The figure shows cumulative abnormal returns (CARs) for competitive events over 20 trading days before and post-announcement dates. The four panels present CARs estimated using four different specifications of expected returns: 'MM' - Market model; 'MM+Defense' adds Defense stock index DJSASD; 'FF3' additionally includes Fama and French (1993) 'small minus big' and 'high minus low'; lastly, 'FF4' adds 'momentum'. Circles represent average values, whereas bold and thin bars stand for 95% and 99% confidence intervals.

2.4.1 Effects on financial statement

Figures 4 and 5 present impulse responses to a positive demand shock of government spending on items of the firm's financial statement, profitability and capital investment. Black lines represent the point estimate, whereas areas in shades of grey stand for 68% and 95% confidence bands. Standard errors are estimated using clustering at the firm level. To begin with, an increase in demand naturally leads to a rise in sales. The increase is immediate and persistent over 12 quarters. On impact, sales are boosted by around 20 cents for one dollar increase in obligations, with a peak increase of 50 cents in quarter 9.

Firms reap the benefits of excess demand in terms of profits, which significantly increase by 10 cents for each dollar of government obligations. The effect lasts for around 8 quarters and vanishes after then. The baseline definition of profits is the operating income adjusted for capital

Figure 3: Cumulative abnormal returns for noncompetitive events



Note: The figure shows cumulative abnormal returns (CARs) for noncompetitive events over 20 trading days before and post-announcement date. The four panels present CARs estimated using four different specifications of expected returns: 'MM' - Market model; 'MM+Defense' adds Defense stock index DJSASD; 'FF3' additionally includes Fama and French (1993) factors 'small minus big' and 'high minus low'; lastly, 'FF4' adds 'momentum'. Circles represent average values, whereas bold and thin bars stand for 95% and 99% confidence intervals.

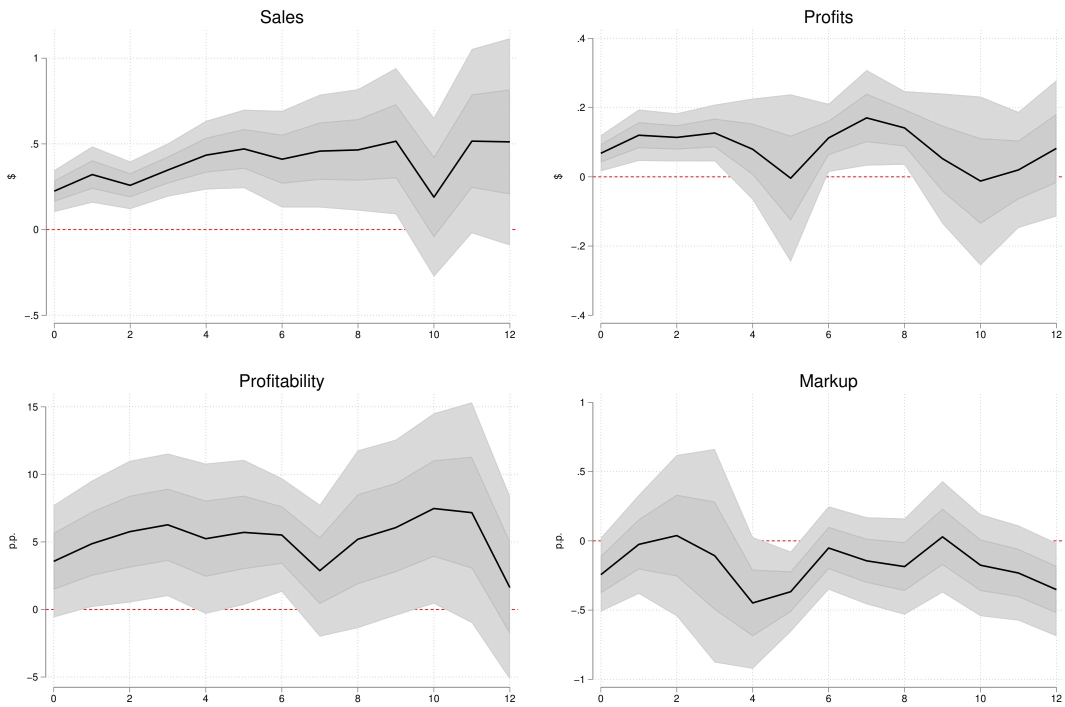
expenses sourced from Compustat. Alternatively, I find similar but somewhat weaker results if profits are measured using model-based definition as proposed by De Loecker et al. (2020) or income before extraordinary items, *ibq*[21]. To evaluate the effect on a firm's profitability, I compute to what extent profits increase in relation to sales. In this case, the dependent variable is profits over sales. The coefficient in local projections, β_h, is now interpreted in percentage points to one standard deviation increase in competitive obligations over total assets[22]. The impact is a rise of 4 p.p., increasing to 5 p.p. over later horizons. The impulse response is estimated less precisely but significantly from zero at some horizons.

A contentious academic discussion concerns what happens to markups. The neo-Keynesian model predicts that product markups should decrease following an excess demand shock as a result of price rigidities. Neoclassical models question these foundations and present as an

[21]Results are presented in robustness section of Appendix F.

[22]One standard deviation of competitive obligations over assets amounts to approximately 0.157

Figure 4: Impulse responses to a procurement award



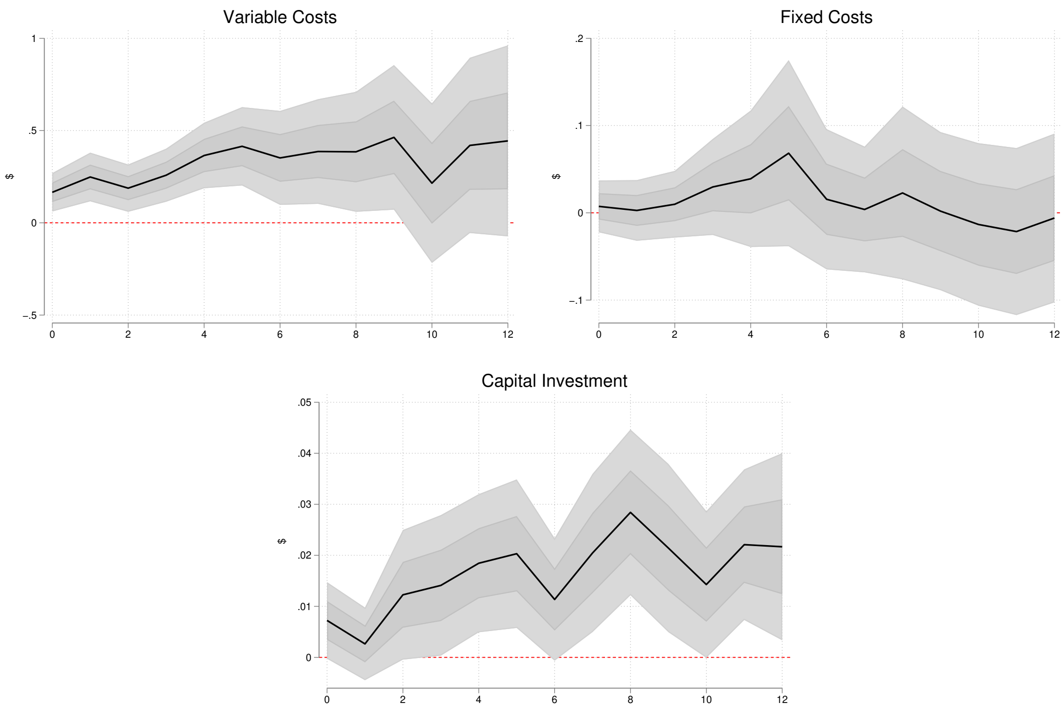
Note: The figure presents impulse responses over 13 quarters following a firm is awarded a contract. The black line presents coefficient point estimates, β_h, from the regression line 1, bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Note that the interpretation for different variables differs. Figures with the label "$" on the y-axis are interpreted in dollar terms, whereas variables with the label "p.p." are in percentage points. For a comprehensive description of variables, see Table A.1 in the appendix.

alternative. To shed some light on this discussion, I estimate the effect of a government demand shock on markups, constructed following a model-based approach inspired by De Loecker et al. (2020). Point estimates hint towards a decrease in product markup in line with prescriptions of the Neo-Keynesian model. However, confidence bands are rather wide. The statistically significant decrease is found at horizons 4 to 5[23].

A textbook firm's optimality problem suggests that profitability and markup should positively co-move, as average costs tend to correlate with marginal costs. However, results here find the opposite, profitability increases, whereas markups decrease or stay constant. To explain this divergence, I evaluate demand effects on a firm's cost structure. Variable costs, defined as the cost of goods sold, *cogs*, by Compustat, include all expenses for the company associated with production, such as materials, labour etc. Given that the firm receives orders from the government, it is rather ordinary to see that variable costs increase. The effect is persistent and

[23]In the robustness section in Appendix F, I also provide estimates using an alternative markup measure, as suggested by De Loecker et al. (2020). The substitute is constructed using a different production function with overhead costs. Estimates of local projection on the alternative are almost identical to the baseline.

Figure 5: Impulse responses to a procurement award



Note: The figure presents impulse responses over 13 quarters following a firm is awarded a contract. The black line presents coefficient point estimates, β_h, from the regression line 1, bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Note that the interpretation for different variables differs. Figures with the label "$" on the y-axis are interpreted in dollar terms, whereas variables with the label "p.p." are in percentage points. For a comprehensive description of variables, see Table A.1 in the appendix.

statistically significant over 9 quarter horizon. The variation resembles the impulse response of sales, but with a lower magnitude, the reminder represents higher recuperated profits. At the same time, fixed costs, *xsga*, do not change and stay not significantly different from zero[24]. The divergence between both responses can rationalise the divergence between markup and profitability. Higher variable costs explain higher marginal costs, decreasing the markup; average costs do not increase as much due to staggering expenses, leading to a higher profitability per unit of output sold.

One of many goals for excess government spending is to provide and distribute stimulative outcomes back to the economy and create multiplier effects. An increase in variable costs can be interpreted as a government demand passed onto households through higher employment and other corporate entities through value chains. However, the breakdown data of costs of goods sold is relatively poor to establish results for the downstream effects using local projections.

[24]Fixed costs are defined as selling, general and administrative expenses. The item represents advertising or corporate expenses, rent and other general expenses. The item is interchangeably interpreted as either overhead or fixed costs (De Loecker et al., 2020).

For example, Compustat does not provide quarterly information on employment or associated expenses[25]. Instead, I compute effects on capital investment, defined as capital expenditures, *capex* in Compustat[26]. Following an increase of one dollar in federal obligations, the capital investment increases by 0.7 cents on impact and gradually to, on average, 2 cents at the longer horizon. The cumulative effect is around 21 cents over the 12-quarter horizon. Estimates are statistically significant and robust to alternative definitions of capital investment. See Appendix F. Findings are also similar to magnitudes found by Hebous and Zimmermann (2021).

2.4.2 Impact on uncertainty

Results in the previous subsection suggest that a firm's fundamentals improve once it receives an additional government demand: sales rise, increasing profitability that leads to future prospects via investment into capital. The study's central question is whether the government, via its spending on private goods and services, can provide certainty and reduce volatility associated with the firm. To do so, I use two proxies of the firm-level uncertainty: a realised volatility of stock market returns over the quarter, whereas the second represents forecasters' disagreement about the expected firm's earnings per share for the current quarter.

$$\log \frac{x_{i,t+h}}{x_{i,t-1}} = \alpha_{i,h} + \alpha_{s,t,h} + \sum_{j=1}^{4} a_{j,h} I(Q_{i,j} = q_t) + \beta_h \frac{proc_{i,t}}{atq_{i,t-1}} + B_h(L)Y_{i,t} + e_{i,h,t} \tag{4}$$

To evaluate the effects on the uncertainty, I adjust the specification of local projections so that the dependent variable is expressed as a log-difference of uncertainty proxy, $x_{i,t+h}$, at horizon h for the firm i with respect to the lagged value[27]. Figure 6 presents findings of β_h, scaled by the increase of one standard deviation in competitive obligations. Point estimates suggest that both proxies decrease at short horizons following the demand shock. However, confidence bands are wide, so the hypothesis of no effect cannot be ruled out.

2.4.3 Uncertainty and state dependence

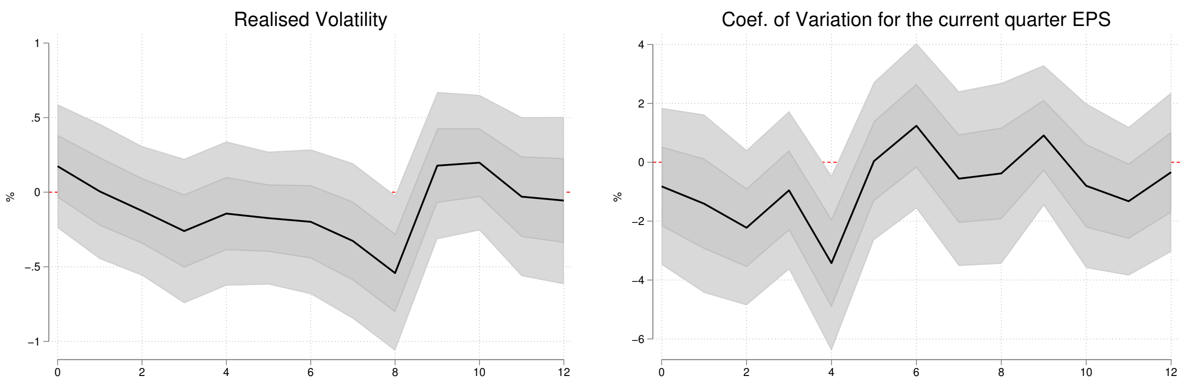
Previous results may understate the effects of government on uncertainty. Firms benefit from the additional demand they receive from the government. However, its effect on investors' perception of a firm's fundamentals can be marginal if the macroeconomic environment is favourable. This may change at the peak of an economic crisis when firms lack the private demand and face

[25] One could expect that stimulative effects are there. The employment and costs of goods sold are highly correlated at an annual frequency. The coefficient is around 0.67.

[26] For capital expenditures, I use net value of property, plant and equipment as a scaler, y_{t-1}.

[27] I also add quarterly stock market returns as an additional control variable to capture first moment effects.

Figure 6: Impulse response of uncertainty to a procurement award



Note: The figure presents impulse responses of uncertainty proxies over 13 quarters to a one standard deviation increase of competitive obligations over total assets. The black line presents coefficient point estimates, β_h, from the regression line 4, scaled by the standard deviation; bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Figures with the label "%" on the y-axis are interpreted in percentage terms.

higher financing premia as a result of worsened financial conditions. In those conditions, the intervention of the government may be more beneficial. Procurement contracts can serve as a more valuable substitute for an absent private demand and provide additional collateral to ease external financing limits. For that reason, I ask whether the effect of awarded government contracts reduces the uncertainty regarding a firm's earnings in times of worsened financial conditions.

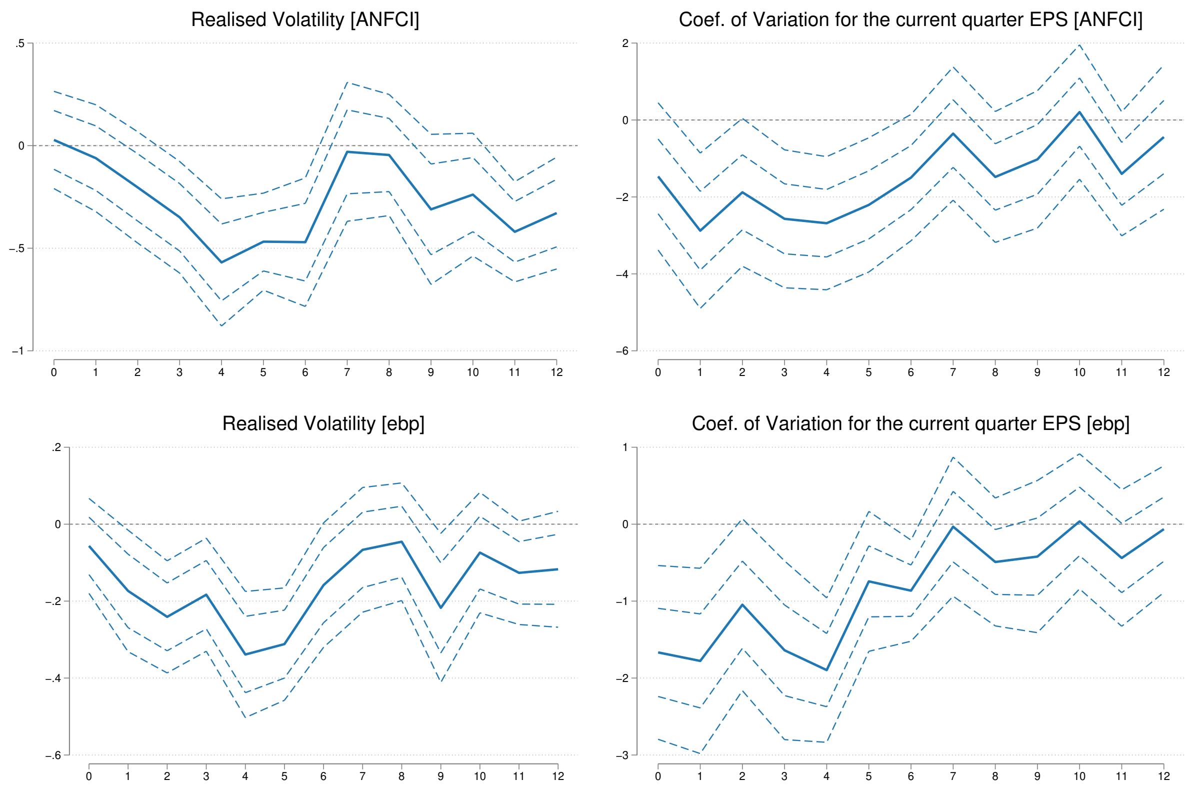
$$\log \frac{x_{i,t+h}}{x_{i,t-1}} = \alpha_{i,h} + \alpha_{s,t,h} + \sum_{j=1}^{4} a_{j,h} I(Q_{i,j} = q_t) + \beta_h \frac{proc_{i,t}}{atq_{i,t-1}} + \beta_{h,fci} FCI_t \frac{proc_{i,t}}{atq_{i,t-1}} + B_h(L) Y_{i,t} + e_{i,h,t} \tag{5}$$

To do so, I supplement the specification with an interaction term, $FCI_t \frac{proc_{i,t}}{atq_{i,t-1}}$, where FCI_t is a financial conditions index at time t. For the baseline, I use Chicago Fed adjusted national financial conditions index (ANFCI) and the excess bond premia (EBP), constructed by Gilchrist and Zakrajšek (2012)[28]. To facilitate the interpretation, both indices are standardized to have a mean of zero and a standard deviation of one[29]. Estimates of the interaction term are presented in Figure 7. For all combinations of uncertainty proxies and financial conditions indices, parameters are estimated to be negative and significantly different from zero at the short horizons. Results indicate that the dampening effect of a firm's uncertainty to government spending shock is state dependent on financial conditions.

[28]For robustness, I find similar conclusions using alternative financial conditions indices, including Kansas City Financial Stress Index (KCFSI) or St. Louis Fed Financial Stress Index (STLFSI3), see figures F.3, or using the specification with discrete deterministic states, see figures F.4.

[29]The time series of financial conditions indices are presented in appendix figure F.2.

Figure 7: Estimates of the interaction term, $\beta_{h,fci}$



Note: The figure presents estimates of coefficient $\beta_{h,fci}$ over 13 quarter horizons for different uncertainty proxies. The upper panel uses Chicago Fed adjusted national financial conditions index, the lower - excess bond premium. The solid line presents point estimates; dashed lines represent 68% and 95% confidence bands. Standard errors are clustered at the firm level.

The total effect on uncertainty is computed as the sum of coefficients, $\beta_h + \beta_{h,fci}$, and corresponds to a generalised impulse response when financial conditions are one standard deviation worse compared to a historical average. The value of one standard deviation reflects financial conditions at 2008q1, the onset of the Great Financial crisis. The generalised impulse responses are presented in Figure 8. A one standard deviation increase in competitive obligations reduces realised volatility at horizons from 1 to 8 quarters after the shock. The dampening effect is shorter but immediate for the coefficient of variation. The disagreement about expected current quarter earnings decreased for five quarters after the shock.

In terms of magnitude, the effect on realised volatility reaches the largest decrease of around 0.5-1 per cent in the fourth quarter after the shock, accounting for 2-4 per cent of its standard deviation. The alternative, coefficient of variation, drops by 5 per cent or 4 per cent of its standard deviation. Results may hint that the economic significance of government demand's effect on a firm's uncertainty level might be small, diminishing policy prescriptions for the government to act in times of economic crisis. However, a few important aspects should be considered when interpreting results. First, estimates in this framework present only a relative effect on the uncertainty for the firm that received a procurement contract compared to the firm that did not. For that reason, estimates neglect aggregate government countercyclical efforts that may reasonably affect the uncertainty. Second, the impulse response of uncertainty is much larger at the peak of a crisis. The specification is non-linear; effects on uncertainty do vary in relation to aggregate financial conditions. While for the baseline I picked 2008q1, financial conditions were considerably worse during the financial crisis in 1973-1975 or the Great financial crisis in 2009[30]. In these periods, effects increase by another 2.6 per cent for the realised volatility that accounts for around 12-13 per cent of standard deviation, whereas the coefficient of variation drops by an additional 12-15 per cent, which amounts to approximately 19-22 per cent of one standard deviation[31].

2.4.4 Effects on credit default swaps

Previous results indicate that government demand improves a firm's fundamentals, boosts its investment and reduces uncertainty surrounding its prospects, especially during worsened financial conditions. All points suggest that procurement awards position firms be more solvent and protected from a potential default. To evaluate the claim, I calculate the effects on spreads of firms' credit default swaps (CDS). CDS spread presents a premium demanded by the insurance issuer that agrees to compensate in case of default. Therefore, the spread serves as an indicator of the associated firm's credit risk.

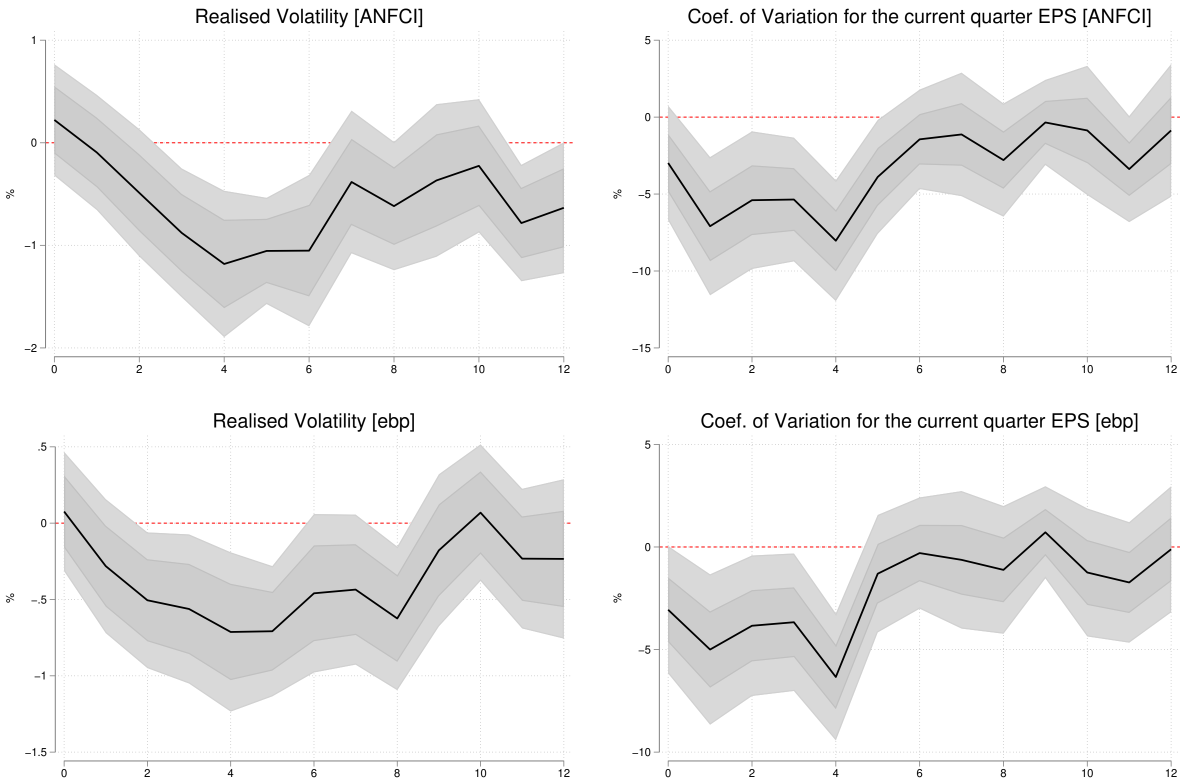
Figure 9 presents impulse response estimates for the spread using the specification 4. CDS spread falls one quarter after the firm is rewarded the contract, reaching the peak effect of a 5 per cent decrease after 3 quarters that remains over the rest of the 13-quarter horizon. The effect is persistent but only significant at 68% level[32]. Similarly to uncertainty proxies, the effect on spreads is also stronger and state-dependent on aggregate financial conditions, see figure 9. In a state of worse financial conditions, spreads fall immediately, reaching the largest decrease

[30] For example, the Chicago Financial Index was four standard deviations above its historical value during 1975, whereas the excess bond premia reached its peak of 6 standard deviations in 2009.

[31] To put estimates in yet another perspective, Baker et al. (2016) computes the effect of economic policy uncertainty onto firm's implied volatility. For the identification, authors explore heterogeneous sensitivity across firms, as measured by sectoral government purchases in relation to total sales. Using their replication package, I find that the increase in the policy uncertainty of 32.6 log points in 2008q1 for the firm that receives an average generous 24 per cent of income from the government or the highest 99th percentile amount, increases the firm-level uncertainty of realised stock market return by 1.5 per cent. The effect of economic policy uncertainty is arguably close in magnitude to baseline results of government demand shock onto a firm's realised stock volatility.

[32] Note that the estimation sample includes around 200 firms and is considerably smaller compared to previous specifications for other variables. The market of credit default swaps is less evolved in comparison to, e.g. equity markets, including most large firms. Alternatively, one could investigate the effects on corporate bonds. The dataset TRACE is a rich source of corporate debt securities and is freely available. It provides interesting avenues to explore effects on quantity and price of firm-level credit risk, inspired by previous efforts by Gilchrist et al. (2022), Gilchrist et al. (2021).

Figure 8: Impulse response of uncertainty to a procurement award in a state of worsened financial conditions



Note: The figure presents generalised impulse responses of uncertainty proxies over 13 quarters to a government demand shock at the state of worsened financial conditions. The black line presents coefficient estimates, $\beta_h + \beta_{h,fci}$, from the regression line 5, bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Figures with the label "%" on the y-axis are interpreted in percentage terms.

of 10% one quarter after the firm receives a contract. The response is less persistent, lasting around 7 quarters[33].

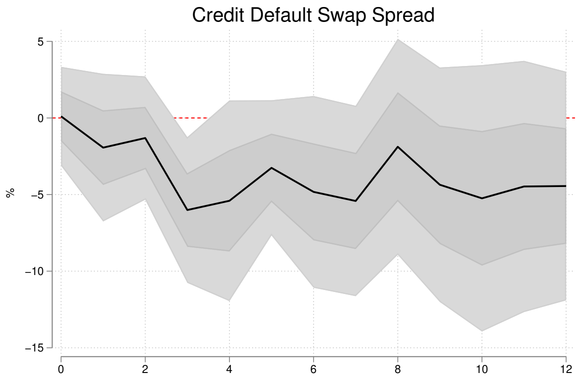
Results for spreads of credit default swaps corroborate previous findings that in addition to improving a firm's financial fundamentals and reducing associated uncertainty, government demand via procurement contracts can reduce perceived default possibility.

3 Theoretical Framework

I rationalise empirical firm-level implications with a theoretical model, on which basis I present various policy experiments to evaluate the macroeconomic impacts of the procurement market design on risk and uncertainty in the production sector. The theoretical setting is inspired

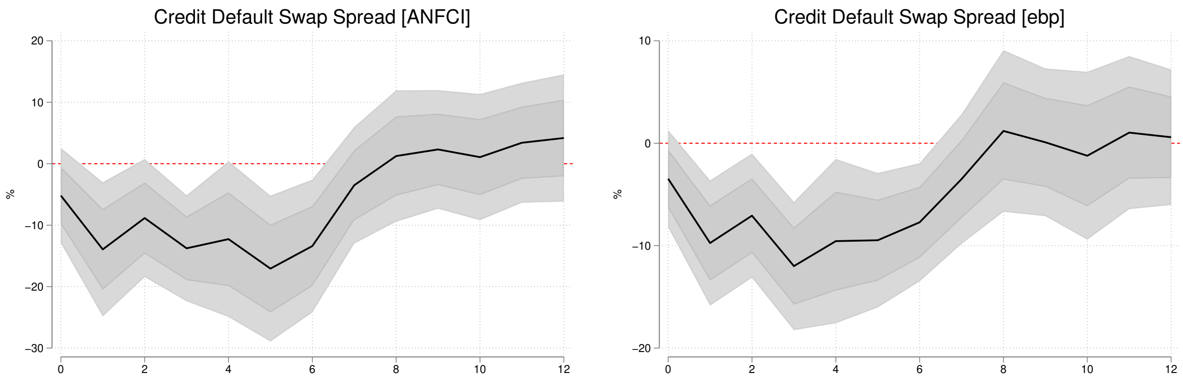
[33]Results are robust when using alternative financial condition indices, see figure F.5 in the appendix.

Figure 9: Impulse response of credit default swap spread to a procurement award



Note: The figure presents impulse responses of credit default swap spread over 13 quarters to a one standard deviation increase of competitive obligations over total assets. The black line presents coefficient point estimates, β_h, from the regression line 4, scaled by the standard deviation; bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Figures with the label "%" on the y-axis are interpreted in percentage terms.

Figure 10: Impulse response of credit default swap spread to a procurement award in a state of worsened financial conditions



Note: The figure presents generalised impulse responses of credit default swap spread over 13 quarters to a government demand shock at the state of worsened financial conditions. The black line presents coefficient estimates, $\beta_h + \beta_{h,fci}$, from the regression line 5, bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Figures with the label "%" on the y-axis are interpreted in percentage terms.

by a workhorse model of fiscal policy by Galí et al. (2007) and extended to account that the government buys a different good basket compared to the consumer (Cox et al., 2021). The government forms a public procurement market, which provides a public demand for only a share of firms in the economy. In contrast, firms outside the market are attracted due to the associated profits and public insurance that the procurement market offers. They try to enter the market but face entry costs and congestion akin to those of a search and matching model. I introduce firm heterogeneity to illustrate that firms subject to government spending are affected differently by aggregate shocks than other firms in line with empirical findings.

In this study, I do not attempt to stretch a stylised model to fit empirical magnitudes, associated dynamics properties or possible state dependencies. The setting provides valuable and possibly overlooked insights about government procurement and how participation in the market can generate heterogeneous effects on firms across a few dimensions of interest. It should not discourage but instead provide a basis for further extension.

3.1 Model

Final good producers There are two final good producers, one for the consumption good, $Y_{c,t}$, and one for the government good, $Y_{g,t}$[34]. Both use a continuum of differentiated inputs from intermediate producers, indexed i, to produce those goods. The consumption good includes inputs from all intermediate producers in the economy, $Y_{i,c,t}$. However, the government's basket differs due to different needs. For that reason, the government good contains a share ω_t of intermediate inputs, $Y_{i,g,t}$, and the basket may alter in every period with purchases from new contractors. Aggregators for both goods are of a constant elasticity of substitution technology with one slight modification that the government purchases from a fraction of ω_t companies in the economy.

$$Y_{c,t} = \left(\int_0^1 Y_{i,c,t}^{\frac{\eta_c - 1}{\eta_c}} \mathrm{d}i \right)^{\frac{\eta_c}{\eta_c - 1}} \qquad Y_{g,t} = \omega_t^{-\frac{1}{\eta_g - 1}} \left(\int_0^{\omega_t} Y_{i,g,t}^{\frac{\eta_g - 1}{\eta_g}} \mathrm{d}i \right)^{\frac{\eta_g}{\eta_g - 1}} \tag{6}$$

To simplify the problem further, I assume that the government does not have any bargaining power when negotiating with the intermediate producers. This assumption ensures that the final producer for government goods earns zero profits and intermediate producers continue to face a usual downward sloping demand curve[35]. Instead, intermediate producers face demand functions of different elasticity, as governed by the elasticity of substitution between inputs, η_c and η_g. Demand functions for the intermediate good i:

$$Y_{i,c,t} = \left(\frac{P_{i,c,t}}{P_{c,t}} \right)^{-\eta_c} Y_{c,t} \qquad Y_{i,g,t} = \omega_t^{-1} \left(\frac{P_{i,g,t}}{P_{g,t}} \right)^{-\eta_g} Y_{g,t} \tag{7}$$

[34] The producer of final government good should not be interpreted literally but a modelling tool to simplify the problem. Instead, the producer can be understood as either the agency representing the government and purchasing goods on its behalf or simply a goods basket different to the consumption one.

[35] This allows to avoid the Nash bargaining and keep the framework in line with conventional modelling set-ups. One could assume that some reduced form specification governs a markup to capture a time-varying bargaining power. One possible avenue would be to assume that parameter, η_g, is affected by tightness in the procurement market.

Two final goods have price deflators of the form:

$$P_{c,t} = \left(\int_0^1 P_{i,c,t}^{1-\eta_c} \mathrm{d}i \right)^{\frac{1}{1-\eta_c}} \qquad P_{g,t} = \omega_t^{\frac{1}{\eta_g - 1}} \left(\int_0^{\omega_t} P_{i,g,t}^{1-\eta_g} \mathrm{d}i \right)^{\frac{1}{1-\eta_g}} \tag{8}$$

where $P_{i,c,t}$ and $P_{i,g,t}$ are prices charged by an intermediate good producer to, respectively, consumption and government final good producers.

Unlike in the usual set-up with government spending, such as Galí et al. (2007), the government shock is not an aggregate demand shock that results in direct government purchases from every firm in the economy. Here only ω_t of companies are receiving government spending, and the others are being affected by general equilibrium effects.

Procurement market The procurement market is subject to search frictions. Government supplies a limited number of new contracts, v_t, in every period that grants access to government spending. Intermediate firms face uncertainty about whether they will become a contractor. They apply for access to additional demand but may not be instantaneously successful. There are ω_t of companies in the economy at time t that are receiving government spending. In every period, a share of δ_g randomly loses this access and m_{t-1} of previously non-awarded companies gain access at period t. I define the law of motion for the size of the government sector as:

$$\omega_t = \omega_{t-1}(1 - \delta_g) + m_{t-1} = \omega_{t-1}(1 - \delta_g) + v_{t-1} \tag{9}$$

In the search and matching framework, the matching function can be specified as some constant returns-to-scale function, a black box that relates several new contracts and applications to form matches (Pissarides, 2000). I simplify the problem by assuming that government exogenously determines the number of government contracts, v_t, and can satisfy its demand to the fullest, such that $m_t = v_t$. Consequently, the government determines the size of the government sector, ω_t, by varying the number of contracts posted.

Intermediate good producers There is a continuum of intermediate good producers. All of them produce inputs for the consumption good, but only a fraction ω_t receive additional demand from the government. Firms, *outsiders*, that serve only final consumption good producers are denoted with the subscript 1, whereas firms, *contractors*, that are also selling to the government are denoted with 2. All firms have the same constant returns-to-scale production function with one input of labour:

$$Y_{i,t} = z_t h_{i,t} \tag{10}$$

where $Y_{i,t}$ is the firm's i output at time t; $h_{i,t}$ is labour hours; z_t is aggregate labor productivity that follows a non-stationary exogenous process $\log \frac{z_t}{z_{t-1}} = (1-\rho_z) \log \overline{g_z} + \rho_z \log \frac{z_{t-1}}{z_{t-2}} + \sigma_z \epsilon_{z,t}$. The non-stationary dynamics introduce long-run risks in the economy, such that future consumption and dividend streams are less certain or more volatile. As a result, households request a higher return to hold firm equity (Bansal & Yaron, 2004)[36]. Cost minimisation ensures that real marginal costs are the same across firms, such that $mc_t = \frac{w_t}{z_t}$. Firms are owned by the optimisers, as explained below. Thus, firms use the stochastic discount factor of optimisers, $\Lambda^o_{t,t+1}$, to price future dividends. In every period, firms face costs when adjusting their prices à la Rotemberg.

The outsiders are price setters of the consumption good, $P_{i,c,t}$, but also apply for access to sell to the government by exerting effort. The application requires entry costs in the form of labour hours:

$$\Phi_t \frac{o_{i,t}^{1+\phi_o}}{1+\phi_o} = w_t(\kappa_0 + \kappa_1 p_{e,t}) \frac{o_{i,t}^{1+\phi_o}}{1+\phi_o} \tag{11}$$

where $o_{i,t}$ presents the labour effort allocated by the firm i at time t to fill in application forms, and it takes values between zero and one. The associated cost, Φ_t is time-varying; it is proportional to wages and can vary with a perceived probability to enter a contract with a government, $p_{e,t} = v_t/o_t$[37]. o_t is an aggregate effort in the economy, s.t. $o_t = \int_0^{1-\omega_t} o_{i,t} \mathrm{d}i$. While the labour effort for the application is costly, it represents the firm's willingness to become a government contractor. The application is risky and can be understood as an investment into a relationship with the government; however, the higher willingness increases the firm's chance to become the contractor[38]. The ex-ante value of the outsider:

$$\begin{aligned} Q_{i,1,t}\left[P_{i,c,t-1}, \Omega_t\right] &= \left(\frac{P_{i,c,t}}{P_t} - mc_t\right) Y_{i,t} - \frac{\theta_p}{2}\left(\frac{P_{i,c,t}}{P_{i,c,t-1}} - \bar{\pi}\right)^2 \frac{P_{i,c,t}}{P_t} Y_{i,t} - \Phi_t \frac{o_{i,t}^{1+\phi_o}}{1+\phi_o} \\ &+ \mathbb{E}_t \Lambda^o_{t,t+1}\Bigg[o_{i,t}\Big(p_{e,t} Q_{i,2,t+1}\left[P_{2,g,t}, P_{i,c,t}, \Omega_{t+1}\right] + (1-p_{e,t}) Q_{i,1,t+1}\left[P_{i,c,t}, \Omega_{t+1}\right]\Big) \\ &+ (1-o_{i,t}) Q_{i,1,t+1}\left[P_{i,c,t}, \Omega_{t+1}\right]\Bigg] \end{aligned} \tag{12}$$

The firm maximises its value by choosing the price for the consumption good, $P_{i,c,t}$, and deciding its willingness to become a government contractor, $o_{i,t}$. The recursive specification for the firm's value, $Q_{i,1,t}$, has two sets of state vectors: $P_{i,c,t-1}$ - the firm-specific price for the consumption

[36]Introducing long-run risks into the model is one of the possibilities to generate a larger risk equity premia and match financial regularities in the data. Yet another interesting avenue that can benefit general equilibrium models in matching equity risk premia is introducing involuntary unemployment in the economy. Bai and Zhang (2022), Petrosky-Nadeau et al. (2018), and Swanson (2020) suggest that search frictions in labour markets can considerably reduce household's ability to insure themselves from adverse shocks as well as generate endogenous disasters.

[37]The specification of entry-costs is inspired by Petrosky-Nadeau et al. (2018) to capture two margins: a proportional amount, κ_0, and a fixed amount κ_1 to capture countercyclical marginal effort.

[38]As an alternative to firm's effort, $o_{i,t}$, the decision to apply and participate in the gamble to enter procurement market can be specified as a discrete choice. In that case, $o_{i,t}$, would take values of either 1 or 0. However, the model with effort is continuous, simplifying the solution greatly.

good at period $t-1$ and Ω_t - aggregate state. The first term in the valuation presents income adjusted for production costs; the second is price adjustment costs; the third is application costs; lastly, the continuation value is an effort-weighted value of entering the gamble to become a government contractor in the following period, $Q_{i,2,t+1}\left[P_{2,g,t}, P_{i,c,t}, \Omega_{t+1}\right]$, with probability $p_{e,t}$ and the continuation value of continue selling only consumption goods[39].

Contractors are subject to additional demand from the government, though they face an exogenous probability, δ_g, that it will be discontinued in the future. Contractors can price discriminate between two types of final good producers. They can set different prices for the consumption good, $P_{i,c,t}$, and the government good, $P_{i,g,t}$, though they face adjustment costs for both of them. The ex-ante value of the contractor:

$$\begin{aligned} Q_{i,2,t}\left[P_{i,g,t-1}, P_{i,c,t-1}, \Omega_t\right] &= \frac{P_{i,c,t}}{P_t} Y_{i,c,t} + \frac{P_{i,g,t}}{P_t} Y_{i,g,t} - mc_t (Y_{i,c,t} + Y_{i,g,t}) \\ &- \frac{\theta_p}{2}\left(\frac{P_{i,c,t}}{P_{i,c,t-1}} - \bar{\pi}\right)^2 \frac{P_{i,c,t}}{P_{c,t}} Y_{i,c,t} - \frac{\theta_p}{2}\left(\frac{P_{i,g,t}}{P_{i,g,t-1}} - \bar{\pi}\right)^2 \frac{P_{i,g,t}}{P_{g,t}} Y_{i,g,t} \\ &+ \mathbb{E}_t \Lambda^o_{t,t+1}\Bigg[(1-\delta_g) Q_{i,2,t+1}\left[P_{i,c,t}, P_{i,g,t}, \Omega_{t+1}\right] + \delta_g Q_{i,1,t+1}\left[P_{i,c,t}, \Omega_{t+1}\right]\Bigg] \end{aligned} \tag{13}$$

Households The economy is populated by a continuum of households over one unit of mass. There are two types of agents: a share of γ are 'rule-of-thumb' consumers, who consume their net income in every period; $1-\gamma$ are the optimisers or Ricardian households that follow optimal decision-making by maximising the utility function. Two agents are denoted with subscripts, respectively, r and o, in the following section.

Wage unions Both households include differentiated types of labour input, indexed by j, that also form wage unions. Unions collect work efforts, $h_{j,t}$, across different agents uniformly, such that $h_{j,o,t} = h_{j,r,t}$, and choose an optimal nominal wage, $W_{j,t}$, to maximise a weighted average of life-time utilities across households, $\gamma V_{r,t} + (1-\gamma) V_{o,t}$ (Colciago, 2011). The wage adjustment is costly; the collective incurs costs à la Rotemberg. The union has some market power and faces firms' labour demand function for type j:

$$h_{j,t} = \left(\frac{w_{j,t}}{w_t}\right)^{-\eta_w} h_{d,t} \tag{14}$$

where $h_{d,t}$ represents an aggregate labour demand of composite work effort by intermediate producers; the market power is determined by a parameter, η_w, the elasticity of substitution between labour inputs. $w_{j,t}$ is a real wage determined by the union j, given a price level; w_t - a real wage index.

[39] A simplifying assumption is that the outsider, if lucky to become a contractor, will face same price adjustment costs for the government good as the firm with current average production price, $P_{2,g,t}$.

Optimisers Ricardian households maximise the generalised recursive value function, $V_{o,t}$ (Epstein & Zin, 1989; Kreps & Porteus, 1978; Weil, 1989). Following prescriptions of Swanson (n.d.) and Tallarini (2000) among others, the preferences allow fitting financial regularities by separately controlling for risk-aversion and intertemporal elasticity of substitution while preserving macroeconomic dynamics. Epstein-Zin type of value function is inspired by Swanson (n.d.) to allow for convenient specification of the balanced path:

$$V_{o,t} = (1-\beta)u_{a,t}u(c_{o,t}, h_{o,t}) - \frac{\beta}{\iota}\log\left(\mathbb{E}_t \exp[-\iota V_{o,t+1}]\right) \tag{15}$$

Higher parameter values of ι increase the agent's risk aversion towards early resolution of risk; β is a discount factor; $u_{a,t}$ is an aggregate preference shock with larger values indicating a preference for current over future consumption; it follows an AR(1) process. The utility flow at period t is defined as:

$$u(c_{o,t}, h_{o,t}) = \log c_{o,t} - \nu\frac{h_{o,t}^{1+\phi_h}}{1+\phi_h} \tag{16}$$

such that agents like more consumption, $c_{o,t}$, and dislike working long hours, $h_{o,t}$. The intertemporal rate of substitution is normalised to unity to allow for a balanced growth; ν is a relative weight on the disutility of labour; ϕ_h is an inverse Frisch elasticity of labour supply. The stochastic discount factor for the optimiser is:

$$\Lambda^o_{t,t+1} = \beta\frac{u_{a,t+1}}{u_{a,t}}\frac{c_{o,t}}{c_{o,t+1}}\frac{\exp[-\iota V_{o,t+1}]}{\mathbb{E}_t \exp[-\iota V_{o,t+1}]}\frac{\pi_{t+1}}{\pi_{c,t+1}} \tag{17}$$

The Ricardian household pools wage income from the continuum of its members with differentiated types of labour input that receive wage $w_{j,t}$. Households form wage unions that determine wages for each member but share nominal adjustment costs à la Rotemberg across families. The household can also borrow and lend using a nominal one-period bond $b_{o,t}$ at the nominal interest rate R_t. They are subject to lump-sum taxes $T_{o,t}$ but own firms in the economy and receive real profits $\Pi_{o,t}$. The budget is summarised as follows:

$$\frac{P_{c,t}}{P_t}c_{o,t} + \frac{b_{o,t}}{R_t P_t} = h_{d,t}\int_0^1 w_{j,t}\left(\frac{w_{j,t}}{w_t}\right)^{-\eta_w}\mathrm{d}j - \int_0^1 \frac{\theta_w}{2}\left(\frac{\pi_t}{\bar{\pi}}\frac{1}{\bar{g_z}}\frac{w_{j,t}}{w_{j,t-1}} - 1\right)^2 Y_t \mathrm{d}j + \frac{b_{o,t-1}}{P_t} + \Pi_{o,t} - T_{o,t} \tag{18}$$

'Rule-of-thumb' household This type of household has the same utility as the optimisers but irrespectively consumes all the labour income, net of nominal adjustment costs and lump-sum taxes.

$$\frac{P_{c,t}}{P_t}c_{r,t} = h_{d,t}\int_0^1 w_{j,t}\left(\frac{w_{j,t}}{w_t}\right)^{-\eta_w}\mathrm{d}j - \int_0^1 \frac{\theta_w}{2}\left(\frac{\pi_t}{\bar{\pi}}\frac{1}{\bar{g_z}}\frac{w_{j,t}}{w_{j,t-1}} - 1\right)^2 Y_t \mathrm{d}j - T_{r,t} \tag{19}$$

Monetary and fiscal policies, contract posting The monetary policy follows the Taylor rule when setting the nominal gross interest rate, R_t:

$$\log R_t = \rho_R \log R_{t-1} + (1-\rho_R)\left[\log \bar{R} + \phi_{R,y}\left(\log \frac{y_t}{y_{t-1}} - \log \bar{g_z}\right) + \phi_{R,\pi_c} \log \frac{\pi_{c,t}}{\bar{\pi_c}}\right] + u_{m,t}$$

The authority reacts to deviations of consumption basket inflation, π_c, from the steady-state level; and output growth, $\log \frac{y_t}{y_{t-1}}$, from the balanced growth path. $u_{m,t}$ is a monetary policy shock that follows AR(1) specification $u_{m,t} = \rho_m u_{m,t-1} + \sigma_m \epsilon_{m,t}$. The government collects tax revenues in the form of lump-sum taxes, T_t, issues nominal bonds, b_t, to finance its government spending, G_t:

$$\frac{P_{g,t}}{P_t} G_t = T_t + \frac{b_t}{R_t P_t} - \frac{b_{t-1}}{P_t} \tag{20}$$

Lump-sum taxes are set in relation to the debt-to-output ratio, $\frac{b_{r,t-1}}{y_{t-1}}$, and government spending:

$$T_t = \bar{T} + \phi_{T,b}\left(\frac{b_{t-1}}{y_{t-1}} - \frac{\bar{b}}{y}\right) + \phi_{T,g}\left(\frac{G_t}{z_t} - \frac{\bar{g}}{z}\right) \tag{21}$$

Government spending follows an exogenous process to reflect the fact that procurement aggregate in the US is rather acyclical:

$$\frac{G_t}{z_t} = \bar{g} + u_{g,t} \tag{22}$$

where $u_{g,t}$ is a government demand shock that follows AR(1) specification $u_{g,t} = \rho_g u_{g,t-1} + \sigma_g \epsilon_{g,t}$.

In this specific setting, the government has monopoly power in issuing new procurement contracts, v_t, that provide firms with access to sell goods for the government. Given the assumption that all posted contracts by the government are fulfilled, the government determines the share of intermediate producers that serve the government, ω_t. In other words, the government sets the size of the government sector. But what determinants could explain the government's behaviour in issuing new contracts? At the time of writing, I am unaware of any research efforts to model contract posting behaviour by the government. For that reason, I rely on a reduced form rule, guided after exploring various time-series models to fit dynamics of a share of new entrants into the government sector, as constructed using Usaspending.gov information[40]. The contract posting is heightened in proportion to the higher government spending:

$$v_t = \bar{v} + \phi_{v,G} \frac{G_t - \bar{G}}{\bar{Y}} + \sigma_{v,t} \epsilon_{v,t} \tag{23}$$

[40] In Appendix H, I determine that the share of entrants follows a downward trend since 2005 that is common across sectors, suggesting an increase in market concentration. The trend is best explained using the unobserved component model, implying that the trend is neither predictable nor cyclical. For the sake of keeping the model simple, the contract posting rule here excludes the trend and focuses on short-term variations.

where $\bar{v} = \delta_g \bar{\omega}$ denotes a steady-state level of a new contract; the second term reflects the government's need to expand the number of new contracts to fulfil its demand; $\epsilon_{v,t}$ is an exogenous shock to vacancies. The decision not to rely on some optimal posting of new contracts is to keep the model simple but may still be innocuous. The vacancy creation, as it would happen in the conventional model with search friction in labour markets by Pissarides (2000), is governed by a free entry condition, such that the value of vacancies posted is zero. Regarding the procurement market, one could argue that government is a sole agent and, therefore, does not face this condition. Instead, an exogenous contract posting merely reflects its needs to fulfil its demand irrespective of aggregate macroeconomic conditions. A lot of procurement contracts serve as essentials to ensure the functioning of the government or military enrichment that are rather acyclical[41], in contrast to the aggregate government spending that includes transfers serving as automatic stabilisers.

3.2 Calibration and solution

The described framework extends the workhorse model of fiscal policy with a procurement market to capture mechanisms that can reproduce empirical findings. To do so, I rely on previous research efforts to calibrate parameters with standard values, except for a few newly introduced parameters that govern procurement market aggregates, that I estimate 'outside' the model. The calibration illustrates but would greatly benefit from a comprehensive estimation of a larger scale model at a later stage[42].

The model is solved using a third-order perturbation method around a stable path. The third-order approximation is instrumental in accounting for the intrinsic heteroscedasticity in the model that governs time variation in risk-premia and volatility. The framework is relatively 'well-behaved', so local approximations are not pruned to account for explosive dynamics (Andreasen et al., 2018).

Table 2 summarises the calibration. The model is stated at the quarterly frequency. I set the gross rate of labour productivity growth, $\overline{g_z}$, to be 1% annually (Leeper et al., 2017). The gross inflation rate, $\overline{\pi}$, is at 6.4% over the year at the steady-state, though it comes down to be below standard 2% at the stochastic steady-state. The discount rate, β, is combined with the other two parameters to ensure a nominal interest rate of 3.6% in annual terms.

[41] The literature on identifying exogenous government spending shocks relies on the assumption that military conflicts and, therefore, military spending are rather unpredictable, see, e.g. Ramey (2011) and Ramey and Zubairy (2017).

[42] Particularly, the estimates of impulse response using local projections may serve as potential and informative targets to be matched.

Table 2: Parameterization

Parameter	Value	Description	Parameter	Value	Description
β	0.99257	Discount factor	$\overline{g/y}$	0.13181	Government spending share in SS
γ	0.33	Share of Rule-of-thumb consumers	$\overline{b/y}$	1.7996	SS debt share
$\overline{\pi}$	1.016	SS gross inflation	ρ_g	0.945	Persistence of government spending
θ_p	58.6925	Rotemberg price adjustment cost	σ_g	0.008	St.dev of government spending shock
θ_w	508.6683	Rotemberg wage adjustment cost	ρ_z	0	Persistence of technology shock
$\overline{\mu_w}$	1.2	SS wage markup	σ_z	0.007	St.dev of technology shock
$\overline{\mu_c}$	1.2	SS price markup for consumption goods	$\overline{g_z}$	1.0025	SS technology growth
$\overline{\mu_g}$	1.2	SS price markup for government goods	ρ_a	0.93564	Persistence of preference shock
ρ_R	0.75	Taylor rule: Interest smoothing	σ_a	0.026251	St.dev of preference shock
ϕ_{R,π^c}	1.5	Taylor rule: CPI inflation	σ_m	0.0053	St.dev of MP shock
$\phi_{R,y}$	0.125	Taylor rule: output growth	$\phi_{v,G}$	0.0091796	Vacancy posting to G/Y
$\phi_{T,g}$	0.1	Tax response to spending	σ_v	0.00010895	St.dev of V shock
$\phi_{T,b}$	0.33	Tax response to debt-to-GDP	ϖ	0.02533	SS procurement market size
ι	60	Twisting parameter for the expected utility	δ_g	0.074083	Exogenous rate of relationship destruction
ϕ_h	2	Inverse Frisch elasticity	ϕ_o	-0.6	Convexity of entry costs
ν	1	Weight on disutility of labor	κ_0	0.086189	Fixed entry cost

Note: Table presents a quarterly calibration of the model. The abbreviation "SS" stands for the steady state.

The weight on the disutility of labour, ν, is set to a standard value of one. The parameter for the inverse Frisch elasticity, ϕ_h, is set to 2 in a range of previous estimates in Del Negro et al. (2015) and Leeper et al. (2017), though higher compared to the early literature on fiscal multipliers (Baxter & King, 1993; Galí et al., 2007). However, the importance of parameter value should not be underappreciated for the purpose of this paper. In this model setting, higher values are associated with smaller stimulative effects of the government spending and lower fiscal multipliers (Ramey & Zubairy, 2017), but it can also explain higher perceived risk-aversion and risk-premium due to the inflexible labour margin (Swanson, 2018). The parameter for the expected utility, ι, is set following recommendations of Swanson (2018, n.d.) and Tallarini (2000) to imply high risk-aversion and compensate for the lack of riskiness in a medium-scale model.

The amount of rule-of-thumb consumers, γ, is one third as suggested by Kaplan et al. (2014). Parameter values for the rule of monetary policy and the response of lump-sum taxes are in a range of standard values (Born & Pfeifer, 2014; Leeper et al., 2017; Smets & Wouters, 2007). Rotemberg adjustment costs for prices and wages are set to correspond to a four-quarter Calvo duration at first-order approximation (Born & Pfeifer, 2020). Steady-state markup values for wages and prices (μ_w, μ_c and μ_g) are at 20%. I set the steady-state value of government spending share in output, $\overline{g/y}$, at 13% to match the average ratio of general procurement amount to the sum of general procurement and personal consumption expenditures in US over 2007-2019[43]. The steady-state share of governments' debt to output, $\overline{b/y}$, is set to match 45%, a quarterly mean of federal debt to GDP over 2001q1-2019q4[44].

[43]The aggregates for general procurement is from OECD, see https://stats.oecd.org/Index.aspx?QueryId=94406#. Fred's mnemonic for personal consumption expenditures is PCECA. The average share of procurement to GDP is 10%; however, the selected value is appropriate since the model does not feature either investment or net exports to account for an exact definition of GDP.

[44]The combination of Fred series used to compute the ratio FYGFGDQ188S-HBFRGDQ188S.

To calibrate exogenous processes, I rely on previous research efforts that employ models solved using at least third-order perturbations: monetary policy (Mumtaz & Theodoridis, 2020), government spending and productivity (Born & Pfeifer, 2021) and preference (Basu & Bundick, 2017). Parameter values generate overall riskiness in the model. Therefore, they are rather important to illustrate dynamics and magnitudes for risk-premia and conditional volatility, as shown in the section below. Ideally, one would like to estimate them in unison in the same setting with at least third-order perturbation. However, computational hurdles are immense and beyond the scope of this paper.

Lastly, I contribute novel insights into the US procurement market when calibrating the general equilibrium model. For more comprehensive explanations, I dedicate the section in the Appendix H. The steady-state share of firms with access to government spending, $\overline{\omega}$, is estimated to be 2.5%. The value is an average share of contractors in the US economy from 2001-2019. Using Usaspending.gov procurement data, I compute an aggregate amount of contractors every year using parent identifiers and compare it to an aggregate amount of firm units in Business Dynamics Statistics by Census[45]. An exogenous probability to exit the procurement market, δ_g, is robustly estimated using the law of motion, equation 9, to imply the average of being a contractor of around 3.7 years[46]. The vacancy posting is estimated to be slightly correlated to the aggregate share of procurement over the potential level of GDP, $\phi_{v,G} \approx 0.009$. Parameters related to entry costs (ϕ_o, κ_0, κ_1) are set to ensure a non-negligible hurdle of entry and market clearing in the procurement market.

3.3 Inspecting the mechanism

The model is extended to account for the fact that only 2.5% of all firms in the US are contractors and directly receive government spending in the economy. In contrast to a workhorse model of fiscal policy by Galí et al. (2007), where a government buys goods from every single firm, introduced extensions allow one to understand better, first, what underlying factors motivate firms to enter a procurement market are, and, second, how the participation in the procurement market affects contractors differently to other firms.

In the described setting, outsiders are facing the decision to select an optimal level of effort, $o_{1,t}$.

[45] For comparison, di Giovanni et al. (2022) find that around 3.8% of firms in Spain participate in the procurement.

[46] The value is close to estimates by Cox et al. (2021) for contracts that are large and awarded to large firms, though it is higher compared to a turnover for the median firm, which is less than two years.

The problem generates a first-order optimality condition of the following form:

$$\Phi_t o_{1,t}^{\phi_o} = \mathbb{E}_t \Lambda_{t,t+1}^o p_{e,t} \Big(Q_{2,t+1} \left[P_{c,t}, P_{g,t}, \Omega_{t+1} \right] - Q_{1,t+1} \left[P_{c,t}, \Omega_{t+1} \right] \Big) \tag{24}$$

The equation says that the marginal cost of applying for the government contract is equal to the expected discounted gain in the value of becoming a contractor. Note that the model setting with an assumption of symmetric equilibrium for Rotemberg price-setting ensures that there are two representative firms in the economy. Both contractors and outsiders face an identical price-setting optimality condition and, therefore, set the same prices for the consumption good. Subscripts of i to identify atomistic firms are dropped for convenience.

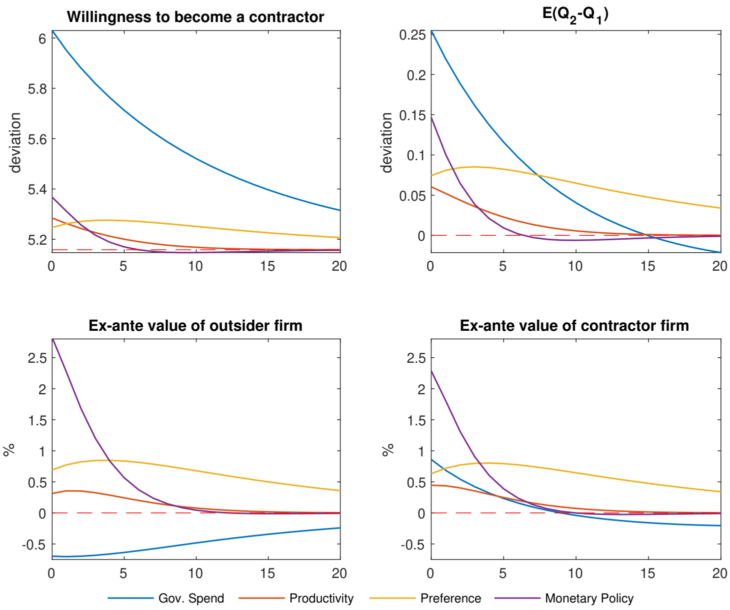
The optimality condition suggests the outsider copes with an investment decision with a risky return. In this case, the investment costs are marginal entry costs, whereas the return is an increase in the firm's future value. The firm is willing to face those costs in relation to expected gains. To understand various aspects regarding the variation in an effort to join the procurement, the expression can be simplified further:

$$\begin{aligned} \Phi_t \frac{o_{1,t}^{\phi_o}}{p_{e,t}} &= \mathbb{E}_t \Lambda_{t,t+1}^o \Bigg(\left(\frac{P_{g,t+1}}{P_{t+1}} - mc_{t+1} \right) Y_{g,t+1} - \frac{\theta_p}{2} \left(\frac{P_{g,t+1}}{P_{g,t}} - \bar{\pi} \right)^2 Y_{g,t+1} + \Phi_{t+1} \frac{o_{1,t+1}^{1+\phi_o}}{1+\phi_o} \\ &+ (1 - o_{1,t+1} p_{e,t+1} - \delta_g) \mathbb{E}_{t+1} \Lambda_{t+1,t+2}^o p_{e,t+1} \Big(Q_{2,t+2} \left[P_{c,t+1}, P_{g,t+1}, \Omega_{t+2} \right] - Q_{1,t+1} \left[P_{c,t+1}, \Omega_{t+2} \right] \Big) \Bigg) \end{aligned} \tag{25}$$

Intuitively, the expected return from becoming a contractor is the sum of different elements: first, an expected net income from receiving government demand, $Y_{g,t+1}$, adjusted for price adjustment costs in the next period; second, the associated savings due to possible entry-costs in the next period, and, lastly, the continuation value that summarises future gains conditional on staying the contractor. Shocks in the economy affect these components differently, leading to the different dynamics of the effort exerted by outsiders to enter the procurement market.

Figure 11 presents impulse responses to exogenous shocks in the economy. An increase in government spending directly affects the associated future profits of contractors, increasing an ex-ante value of the contractor, $Q_{2,t}$. Outsiders, instead, have to bear the general equilibrium effects of higher wages and relatively small increases in future consumption, reducing the firm's valuation, $Q_{1,t}$. These divergences across valuations encourage outsiders to gamble and become contractors. If the economy experiences a positive productivity shock, marginal costs for both firms are reduced, ensuring higher current and future profits. However, the effect on the contractor is larger as it produces government goods in addition to the consumption one, raising its value above the value of an outsider. As a result, the willingness to join the procurement market rises.

Figure 11: Entry into the procurement market across different shocks



Note: The figure presents impulse responses to exogenous shocks. Shocks are normalised to increase the effort to become a contractor, $o_{1,t}$. This corresponds to an increase in government spending, a positive productivity shock, a preference shock to postpone consumption and a stimulative monetary policy shock. The red dashed line presents the baseline of the stochastic steady-state. Subplots with the label "%" on the y-axis are interpreted as a percentage deviation from the stable path; "deviation" - deviations from the stable path.

3.4 Heterogeneous firm-level effects

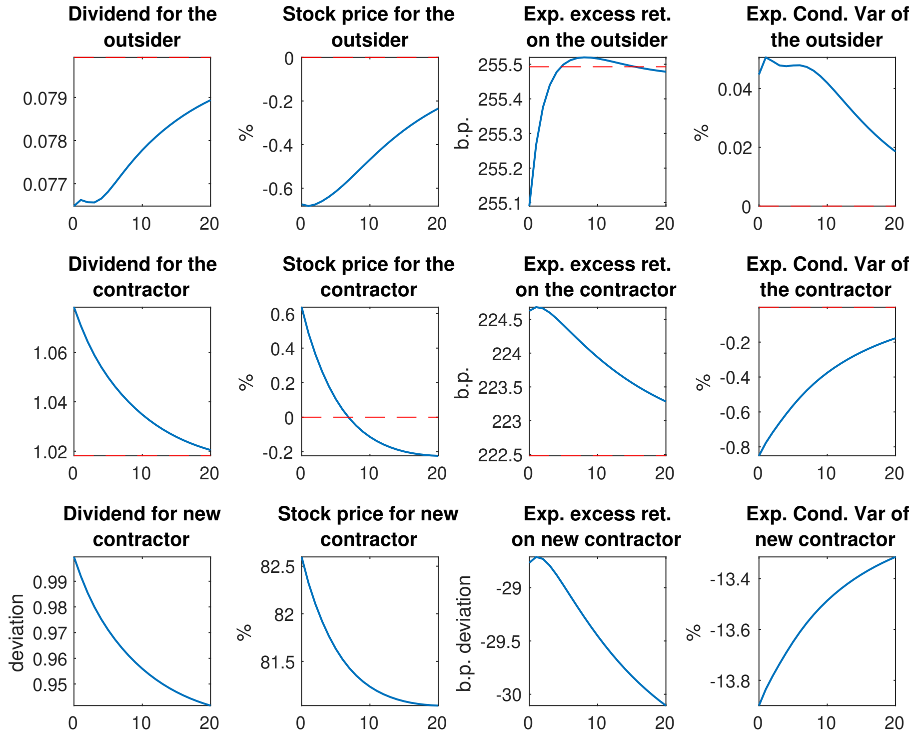
The rationale for entering procurement is linked to heterogeneous firm-level effects on aggregate shocks in the economy. Intuitively, if the shock benefits the contractor more than outsiders, firms increase their effort to become a contractor and bear the same 'fruits'. I generate impulse responses for firm-level variables to one standard deviation of government spending shock in order to understand heterogeneous effects better and display that the model can reproduce empirical regularities established in the previous section.

I present four variables of interest for firms in the model: dividends, stock price, excess return and expected conditional variance of a firm's return. Dividends, $d_{i,t}$, are the firm's sales after production, price adjustment and entry costs. The stock price, $p_{e,i,t}$, is defined as a post-dividend price of an equity, $p_{e,i,t} = Q_{i,t} - d_{i,t}$. The gross expected return, $\mathbb{E}_t R_{i,t+1}$, for outsider and contractor are:

$$\mathbb{E}_t \left(\frac{Q_{1,t+1} + o_{1,t} p_{e,t}(Q_{2,t+1} - Q_{1,t+1})}{p_{1,t}} \right) \qquad \mathbb{E}_t \left(\frac{Q_{2,t+1} - \delta_g (Q_{2,t+1} - Q_{1,t+1})}{p_{2,t}} \right) \tag{26}$$

I define the risk premium as an annualised deviation of the expected return from the risk-free

Figure 12: Impulse response for firm-level variables to a government spending shock



Note: The figure presents impulse responses for firm-level variables to a one standard deviation government spending shock. The top row shows results for the outsider, the middle for the contractor, and the last one is for a firm that becomes a contractor at the time of shock, $t = 0$, and stays for the whole horizon of 21 periods. The red dashed line presents the baseline of the stochastic steady-state. Subplots with the label "%" on the y-axis are interpreted as a percentage deviation from the stable path; "deviation" - deviations from the stable path; "b.p. deviation" - deviations from the stable path in basis points; "b.p." - the variable is presented in basis points.

rate

$$4(\mathbb{E}_t R_{i,t+1} - R_{f,t}) = -4\mathbb{C}ov_t\left(\frac{\Lambda^o_{t,t+1}}{\mathbb{E}_t\Lambda^o_{t,t+1}}, R_{i,t+1}\right) \tag{27}$$

I construct the expected conditional volatility of stock market returns using a suggested definition of $100\sqrt{4\mathbb{V}_t(R_{i,t+1})}$ by Basu and Bundick (2017).

Figure 12 summarises results. Implications for aggregate variables are standard and, therefore, presented in the appendix section I. In short, the increase in government spending generates higher output and a short-lasting increase in aggregate consumption followed by a decrease. Since outsiders produce only consumption goods, their sales drop, adversely affecting the dividend; see the top row in the figure. The valuation for the firm also drops as consumption is expected to stay below the trend for a prolonged period of time. The excess return for outsider's equity slightly falls, and agents request a smaller return for holding a risky asset. To better understand risk premium dynamics, note that the Ricardian households price assets in this economy. Given that their consumption drops at the time of government demand shock, the expected growth of marginal utility to consumption is negative, explaining an expected decrease in the household's stochastic discount factor. At the same time, the expected return of holding an outsider's equity decreases. For those reasons, the covariance term in equation 27 is positive, explaining the drop in the risk premium. Note that magnitudes of risk premia variations are unsurprisingly small. This stems from a relatively simple theoretical framework employed to illustrate key points related to the procurement market while avoiding complexities related to comprehensively modelling firms. Lastly, the expected conditional variance for outsider's equity returns increases.

In contrast to the outsider, the government spending shock benefits contractors (middle row). Even though consumer demand drops, an exogenous increase in demand for government goods induces contractors to reap higher dividends and valuation. The stock price increase on impact but tends to decrease after ten periods due to new entrants into the procurement market. The incumbent contractors do not welcome new contractors in this setting. They have to share the government's pie in smaller pieces. Investors require a higher return to hold contractor's equity, as it provides slightly less insurance. The dividend stream from having contractor's equity pays positive dividends when household consumption is expected to increase.

The higher demand by the government encourages outsiders to join the procurement market, as previously explained. For the firm that becomes a contractor at the time of the shock, dividends and stock price increase considerably, slowly converging to the new level of stochastic steady-state. The increase happens for two reasons. First, the firm is now subject to an additional demand by the government and second, the government buys more from each contractor. A portion of the increase in valuation follows as agents require a slight return to hold the asset since the equity is considered less risky. Lastly, the uncertainty regarding the firm's future expected return is lower and decreasing following the demand shock.

The presented dynamics for new contractors can rationalise empirical findings of section 2.4. The model can reproduce that firms join the procurement market to enlarge their sales and improve profitability, as presented in figure 4. Equity market participants monitor if firms become contractors as it increases the firm's valuation in line with the findings of the event study. See figure 2. They consider the equity less risky, mimicking results of lower spreads of credit default swaps, figure 9. The implied volatility decreases in agreement with suggestive conclusions of figure 6[47].

[47]Note that the empirical findings for uncertainty proxies use realised volatility and disagreement among forecasts that may plausibly be correlated with expected or implied volatility. At the time of writing, I do not possess access to firm-level data on implied volatility. However, exploring implications for the measure could provide robustness to results and a direct comparison between empirical and theoretical indicators.

Table 3: Comparative statics of expected excess returns and conditional standard deviation

	Expected excess returns				Expected conditional standard deviation			
	Outsider	Contractor	Population weighted portfolio	Sale weighted portfolio	Outsider	Contractor	Population weighted portfolio	Sale weighted portfolio
Baseline	255	222	254	228	616	535	610	590
$\sigma_z = 0.01$ [0.007]	427	414	426	395	645	577	640	620
$\sigma_g = 0.016$ [0.008]	340	149	332	231	667	573	654	590
$\sigma_a = 0.04$ [0.026251]	297	263	296	275	656	579	650	643
$\overline{\omega} = 0.2$ [0.02533]	258	241	254	241	613	571	602	590
$\delta_g = 0.2$ [0.074083]	256	240	256	224	620	532	616	592
$\mu_g = 1.5$ [1.2]	318	155	303	220	694	530	654	585
$\overline{g/y} = 0.2$ [0.13181]	311	228	306	246	650	495	636	588
$\phi_{v,G} = 0$ [0.0091796]	249	204	248	216	611	571	605	592

Note: The table presents comparative statics for moments of expected excess returns and conditional standard deviation at the stochastic steady state. Apart from the baseline calibration, rows correspond to alternative parameterisation when one parameter has deviated from the baseline. Baseline values are presented in square brackets. Both excess returns and standard deviation are presented in basis points.

3.5 Comparative statics and policy experiments

The theoretical model can provide some novel insights into the design of the government procurement market and how different macroeconomic environments can determine distinctive perspectives for firms. In this study, I am particularly interested in understanding the role of the procurement market in managing riskiness and uncertainty for individual firms and the production sector in the macroeconomy. For that reason, I conduct an exercise of comparative statics to present intuition regarding the model's dynamics and provide policy experiments.

Table 3 compares the implications of the baseline specification on expected excess returns and conditional standard deviation at the stochastic steady-state with alternatives when changing one parameter at a time. Four columns per panel are for different policy targets summarised as asset portfolios: only outsiders, contractors, population-weighted or sale-weighted portfolios. The population-weighted portfolio is heavily influenced by outsiders, who position around 97.5% of firms in the economy. The sale-weighted portfolio is more balanced as contractors represent a non-negligible share of employment and income[48]. The latter portfolio provides a polar comparison, given that the model does not feature heterogeneous firm sizes within the two representative firms. Values are annualised and in basis points. For the first experiment, suppose the standard deviation of labour productivity, σ_z, is higher. The economy is riskier; expected risk premium and conditional volatility increases for both firms but more for the contractor. As previously mentioned, the contractor's advantage of serving the government is subject to variation in production costs; see equation 25. The higher volatility of productivity shocks exposes the contractor disproportionally, reducing the insurance provided by the procurement. If the volatility is higher for government spending shocks, σ_g, the outsider's equity becomes riskier,

[48] Firms in the procurement markets tend to be large, multinational and publicly-traded entities (Cox et al., 2021).

whereas the contractor offers a better hedge. Even though the economy becomes riskier, the sale-weighted portfolio of firms barely increased compared to the baseline. The same applies to the uncertainty about expected returns. This provides an exciting implication that, even though government policy is less predictable, the overall effect on riskiness and uncertainty in the production sector is negligible but re-balanced from contractors on outsiders. In contrast to the previous two shocks, the volatility of preference shock, σ_a, increases both measures proportionally across outsiders and contractors. Firms serve the consumer equitably in this economy - the aggregate shock cannot be easily diversified.

By organising the procurement market, the government can re-balance the concentration of risk and uncertainty across sectors depending on its policy priorities. Suppose the procurement sector is more significant, $\overline{\omega}$, such that more firms in the economy participate, the risk premium increases only slightly. The insurance provided by the government for contractors is reduced, as they have to share the demand into smaller pieces. In contrast, outsiders can more easily enter the procurement due to more minor congestion. The uncertainty in the economy is reduced or stable depending on the weighted portfolio. The experiment resembles an environment during wars when the government forces private businesses to produce military goods and can rationalise the so-called "war volatility puzzle" of Schwert (1989) - an unusually low stock market volatility during periods of war conflicts. If the exogenous probability to exit the procurement market, δ_g, is higher, such that the average duration to stay as a contractor is five quarters, the contractor's equity becomes riskier. However, effects on excess premium and expected standard deviation for weighted portfolios are relatively negligible, suggesting the length of a contract with the government has little macroeconomic implications. Suppose the procurement market is not as competitive, such that contractors can charge a larger markup for government goods, μ_g; the consequence favours contractors at the expense of the outsiders, who now face higher entry costs. The riskiness and uncertainty may increase or decrease depending on the policy target. The equity becomes riskier for the economy with a larger share of the government spending, $\overline{g/y}$. The associated higher taxes to finance the expenditure reduce demand for the consumption good and, therefore, impair the outsider. This increases risk premium and volatility for the outsider as well as in the macroeconomy. Assume yet another counterfactual scenario where the government keeps the size of the procurement sector, $\phi_{v,G}$, stable; that is, it does not increase the number of contracts in proportion to government spending. The policy reduces the equity premium and market volatility. While the implication may be counter-intuitive, note that in the current setting, new entrants in the procurement market are not desirable by incumbent contractors, as firms have to share the government's demand across a more significant number of entities. Meanwhile, if more contracts are posted, the outsiders perceive that it is more probable to enter the procurement market and exert costly and wasteful effort.

4 Conclusion and discussion

In this paper, I study the capacity of public demand and procurement markets to provide insurance and reduce associated uncertainties for firms and the macroeconomy. I investigate the issue both empirically and theoretically. I present firm-level evidence that competitive procurement contracts boost a firm's fundamentals. Moreover, they can dampen uncertainty regarding a firm's prospects and perceived default probability, particularly during worsened financial conditions. To achieve these conclusions, I use a novel database with firm-level data on US procurement contracts and perform an event study providing evidence about the unpredictability of competitive contracts being awarded to support the identification. In a stylised general equilibrium model, I incorporate firm-level evidence by introducing the option for firms to enter the procurement market, through which they are provided insurance as a result of stable government demand. The framework serves as a laboratory for policy experiments and provides valuable insights about the design of procurement markets to balance uncertainty and risks across businesses in the macroeconomy.

This study improves our understanding of public spending policies and the procurement market, serving as a basis for future research efforts. Various complexities, such as firms' heterogeneity, market concentration, and innovation production, to name a few, still need to be accounted for. Meanwhile, policymakers across the world aim to reorganise procurement markets to provide better access to small and medium enterprises, as they are heavily underrepresented in the procurement market; to gather reliable data empowering research and allowing the use of procurement as a strategic tool; and to improve competitiveness, promoting a more efficient allocation of better quality goods and services. Further investigating these aspects will provide a comprehensive view of procurement allocation in the macroeconomy and guide policy-makers towards well-informed decision-making.

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A Variables and their definitions

Table A.1: Variable definitions

Name	Description	Source
Capital Investment (*capI*)	Ratio between capital expenditures over the net value of property, plant and equipment $\frac{capxq_t}{ppentq_{t-1}}$. The variable is winsorized at 1% and 99% percentiles.	Compustat
Capital Investment adjusted for sales of PPE (*capI2*)	Ratio between capital expenditures minus sales of PPE over the net value of property, plant and equipment $\frac{capxq_t - sppeq_t}{ppentq_{t-1}}$. The variable is winsorized at 1% and 99% percentiles.	Compustat
Capital Investment consistent with the capital accumulation (*capI3*)	Capital expenditures estimated to reflect the law of motion in capital accumulation, as suggested by Gonçalves et al. (2020). $(ppentq_t - ppentq_{t-1} + dpq_{t-1})/ppentq_{t-1}$. The variable is winsorized at 1% and 99% percentiles.	Compustat
Stock Market Return (*retcrps*)	Compounded quarterly returns that includes dividends and adjusted for delisting (ret). I use returns for the common stocks ($shrcd = 10$ or $shrcd = 11$). The variable is winsorized at 1% and 99% percentiles.	CRPS
Realised Volatility (*lnretSDcrps*)	Natural logarithm of annualised standard deviation of a realised CRPS holding period returns (ret) estimated within a quarter. Before computing the standard deviation, I drop missing stock market returns and winsorize at 0.5%. To ensure that the volatility does not arises due to the lack of liquidity, I keep quarterly values with more than 40 tradings days over the quarter.	CRPS
Competitive Federal Obligation (*cob2at, cob2ppe*)	Total quarterly federal obligations received by the firm following an openly competitive procedure with more than one bid. The variable is normalised by total assets two years ago or the book value of property, plant and equipment two years ago. If the value for a firm is not available at specific date, it is assumed that the firm is not issued an obligation, the value is set to zero. The variable is winsorized at 99% percentile.	USAspending.gov
Competitive Federal Obligation as issued by the department of Defence (*cobd2at, cobd2ppe*)	Total quarterly federal obligations received by the firm and issued by the department of defence following an openly competitive procedure with more than one bid. Apart from constraining the awarding agency to be DoD (awarding_agency_code= 97), the variable is constructed as the competitive federal obligation variable.	USAspending.gov
Firm Size (*size*)	Log of total assets $ln(atq_t)$. The variable is winsorized at 1% and 99% percentiles.	Compustat

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Name	Description	Source
Return on Assets (*roaQ*)	$\frac{\sum_{j=0}^{3} oibdpq_{t-j}}{0.25\sum_{j=0}^{3} atq_{t-j}} = \frac{\sum_{j=0}^{3} saleq_{t-j}+xoprq_{t_j}}{0.25\sum_{j=0}^{3} atq_{t-j}}$ The variable is winsorized at 1% and 99% percentiles.	Compustat, WRDS Financial Ratios
Book to Market value of equity (*bmQ*)	Book value of equity as a fraction of market value of equity $\frac{seqq_t+txditcq_t-pstkq_t}{prccq_t*cshoq_t}$. The variable is winsorized at 1% and 99% percentiles.	WRDS Financial Ratios
Quick Ratio (*quickratio*)	A financial ratio to proxy liquidity position of the firm. It is defined as ratio between current assets net of inventories over the current liabilities $\frac{actq_t-invtq_t}{lctq_t} = \frac{cheq_t+rectq_t}{lctq_t}$. The variable is winsorized at 1% and 99% percentiles.	WRDS Financial Ratios
Debt/Capital (*debtcapital*)	A financial ratio to proxy a solvency of the firm. It is defined as a total debt over total capital $\frac{\sum_{j=0}^{3} apq_{t-j}+dlcq_{t-j}+dlttq_{t-j}}{\sum_{j=0}^{3} apq_{t-j}+dlcq_{t-j}+dlttq_{t-j}+ceqq_{t-j}+pstkq_{t-j}}$. The variable is winsorized at 1% and 99% percentiles.	WRDS Financial Ratios
Sales (*saleq2at*)	Total sales as a fraction of assets $\frac{saleq_t}{atq_{t-1}}$.The variable is winsorized at 1% and 99% percentiles.	Compustat
Net Income (*ibq2at*)	Net income as a fraction of assets $\frac{ibq_t}{atq_{t-1}}$.The variable is winsorized at 1% and 99% percentiles.	Compustat
Fixed Costs (*xsgaq2at*)	Selling, general and administrative expenses as a fraction of assets $\frac{xsgaq_t}{atq_{t-1}}$.The variable is winsorized at 1% and 99% percentiles.	Compustat
Variable Costs (*cogsq2at*)	Cost of goods sold as a fraction of assets $\frac{cogsq_t}{atq_{t-1}}$.The variable is winsorized at 1% and 99% percentiles.	Compustat
Chicago Fed Adjusted National Financial Conditions Index (*ANFCI*)	Summary index of financial conditions across multiples financial markets and assets. The adjusted index controls for the cyclical economic conditions. For more information, see Chicago Fed website.	FRED
Excess bond premium (*ebp*)	An indicator for sentiment in a corporate bond market, as constructed by Gilchrist and Zakrajšek (2012). It is a reminder of corporate bond spread after adjusting for an expected corporate default.	Federal Reserve Board
Lobbyism (*lobbyism2at, lobbyism2ppe*)	Yearly expenditure amounts that are dedicated to lobbying activities by the firm. The variable is normalised by total assets one year ago or the book value of property, plant and equipment one year ago. If the value or the match for a firm is not found in Lobbyview database, it is assumed that the firm does not engage in any lobbying activities, the value is set to zero. The variable is winsorized at 99.7% percentile.	Kim (2018)

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Name	Description	Source
Political Contributions (*DONtotalD2at, DONtotalD2ppe*)	Total expenditures for political contributions over two years period. It include contributions from individuals associated with the firm and political action committees to various candidates, party committees or action committees, 527 groups and others. For more information, see a methodology page of OpenSecrets. The variable is normalised by total assets two years ago or the book value of property, plant and equipment two years ago. If the value or the match for a firm is not found in OpenSecrets database, it is assumed that the firm does not engage in any political activities, the value is set to zero. The variable is winsorized at 99.7% percentile.	OpenSecrets
Markup (*mu1, mu2*)	Markups are estimated following the replication of De Loecker et al. (2020) that uses so-called production approach for the measurement. The study provides two suggestive estimates of markups: one using the production function with variable and capital inputs, denoted as *PF1*; second also including overhead as an input, *PF2*. Estimates of variable input's output elasticity are obtained from the replication package and limited till 2016. To measure markups in the quarterly frequency, the elasticity estimates are assumed to be constant over the fiscal year. The variable is winsorized at 1% and 99% percentiles.	Compustat, De Loecker et al. (2020)
Profitability (*spi*)	Profit rate estimated as the operating income before depreciation adjusted for capital expenses, as arising from the balance sheet. $(oibdpq - kexp)/saleq$.	Compustat, De Loecker et al. (2020)
Profitability ($pi1$)	Following De Loecker et al. (2020), I replicate profit rates by using estimated parameters from the production function, $1 - (\theta_{WI1ct}/mu1) - (xsgaq/saleq) - (kexp/saleq)$, where θ_{WI1ct} is the output elasticity of the variable input.	Compustat, De Loecker et al. (2020)
Coefficient of variation (CV) for EPS at various horizons ahead (*EPSI1CV*)	CV provides a dispersion measure of forecasters' disagreement as constructed by taking the standard deviation across individual predictions for the earnings per share at various future horizons, scaled by the absolute mean $EPSI1CV = \frac{EPS1SD}{\lvert EPS1MN \rvert}100$. The variable is winsorized at 1% and 99% percentiles.	IBES
Spreads for credit default swaps (*cds*)	Spreads present a premium in basis points that investor is obligated to pay to insure against an adverse credit event happening over 5 year period.	Datastream and Eikon by Refinitiv

B Merging databases

- **Matching with USAspending.gov database**. Database of USAspending.gov provide rich details about the firm: its name, address, zip code, country, city as well as details of its parents organization. It also includes DUNS as unique identifier for the contract recipient and its parent organization but DUNS identifiers cannot be directly matched to standard unique identifiers of Compustat's gvkeys or CRPS's permnos[49]. I also do not have access to S&P matching tables nor to the dataset of Dun & Bradstreet that use DUNS as identifiers. Instead, I follow steps of Hebous and Zimmermann (2021) and use historical matching tables of Bureau van Dijk's Orbis database to obtain around 238000 unique matches. Using Orbis, I retrieve identifiers CUSIP, CIK and tickers for almost 12000 matches, mostly discarding small firms that do not issue any financial assets for the public and, therefore, are not assigned to any of those identifiers. In the following step, I proceed by matching these identifiers to Compustat data in an order of first, CUSIP, followed by CIK and stock market tickers[50]. Differently to efforts of Hebous and Zimmermann (2021), at this stage I use CUSIP identifiers as the primary identifiers as it is considered to be the most reliable identifier of the three (see, WRDS documentation). Plus, I also consider contract recipients in addition to their parent organisations, as it greatly expands the universe of companies and captures recipients that are at their highest level of consolidation and do not have the parent. To further extend the sample and provide a rigorous double-check, I apply probabilistic record linkage of Stata package *reclink2* by (Flaaen, 2015) to match dataset on a basis of firm's name, address, entity type, state, city, zip code, phone number and country[51]. Prior to the procedure, I normalise all these fields by removing common phrases, fixing typos, abbreviations, punctuation and formats. For the matching, I require the score to be above 0.7 and at least have an exact match of the state, zip code or company's name. I hand-check every match, occasionally determining the similarity using internet searches. In the end, I obtain a reliable match of 5032 companies across USAspending.gov and Compustat database.

- **Matching with OpenSecrets database**. OpenSecrets database on political contributions does not provide a unique identifier. For that reason, I resort to matching the name of organization to full names provided in Compustat. To do so, I first standardize names by removing common characters and phrases, correcting misspelling, adjusting abbreviations, punctuation in both datasets. Then, I apply STATA command *reclink2* by (Flaaen, 2015) that uses a probabilistic record linkage to establish a match between records. I keep preliminary matches with the score of at least 0.7. Then I rigorously check each of them to determine whether the match is reasonable with an occasional double-check using an online search. In the end, I establish a unique match for 1950 gvkey identifiers.

- **Matching with Lobbyview database**. The database on lobbying expenditures by Kim (2018)

[49] At the time of writing, federal agencies are transitioning towards using unique entity identifiers (UEI) instead of DUNS, see this link for more information. The change is expected to facilitate a less burdensome public access and, therefore, matching of procurement data to other datasets.

[50] Note that tickers are not reliable identifiers as they tend to change following, for example, a merge, as well as they can be reused for the firm listed after. I double-check if tickers retrieved from Orbis match historical Compustat tickers. For more information, see WRDS documentation.

[51] Previous attempts of matching in the literature rely on using firm's name as primary variable. After a careful matching evaluation, I come to believe that those attempts led to many erroneous matches that arise due to wrong entity types or mixing subsidiaries to parent companies.

provide a matching tables with gvkey identifiers. See matching files. I obtain a unique match for more than 1700 gvkey identifiers.

- **Matching with IBES database**. IBES relies on unique tickers that can be easily matched with Compustat as provided by Compustat Global table *security* and variable *ibtic*. The recommendation is sourced from WRDS[52].
- **Matching with Datastream information on credit default swaps**. Mnemonics for credit default swaps (CDS) in Datastream do not facilitate a direct matching with neither of databases. For that reason, I use Refinitiv Eikon to retrieve identifiers of either ISIN or CUSIP for the borrower whose default protection is provided by CDS. Both identifiers provide a reliable and unique match with Compustat for around 250 US firms. Information prior to 2008 is extended using Datastream's CMA database. The mapping is provided by internal spreadsheet kindly provided by Datastream's staff.

[52]See https://wrds-www.wharton.upenn.edu/pages/support/support-articles/ibes/merging-international-ibes-compustat-global/

C Summary Statistics

Table C.1: Summary statistics

	mean	sd	min	p25	p50	p75	max	count
0								
cob2at	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	109142
cob2ppe	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	109142
lnretWSD_crps	-0.77405	0.48866	-4.38463	-1.10754	-0.79016	-0.45104	1.16233	85325
ret_crps	3.00837	29.61516	-64.24419	-14.23786	0.84388	16.36363	115.29412	85325
capI	0.07582	0.10514	-0.01794	0.01867	0.04484	0.09044	0.73885	108355
quick_ratio	2.59801	3.21839	0.02740	0.90451	1.52649	2.88600	20.41466	109099
bmQ	0.75379	0.81540	0.01825	0.27435	0.51249	0.90255	4.66330	107673
size	5.17412	2.13487	-1.21066	3.63411	5.16670	6.64786	11.35250	109142
roaQ	0.00268	0.08278	-0.76989	-0.01160	0.02102	0.04172	0.15704	108659
debt_capital	0.34669	0.29790	-2.39057	0.10675	0.30249	0.52648	4.22491	108777
saleq2at	0.27570	0.22497	0.00326	0.11326	0.22475	0.37518	1.31216	108944
cogs2at	0.18895	0.18359	0.00099	0.06061	0.13651	0.25746	1.18792	108442
xsga2at	0.09369	0.09408	0.00193	0.02979	0.06930	0.12793	0.89789	98028
ibq2at	-0.02198	0.09770	-1.05773	-0.02914	0.00358	0.01897	0.15439	108984
s_pi	-2.14921	9.42035	-80.78410	-0.68800	-0.19430	-0.02379	0.80955	67531
mu_spec1	1.73188	1.35594	0.19353	1.06003	1.32386	1.84908	25.32785	89572
EPSI4CV	30.45011	53.05218	0.00000	5.61800	12.50000	29.16700	325.00000	13206
DONtotalD2at	0.00000	0.00004	-0.00001	0.00000	0.00000	0.00000	0.00054	109142
lobbyism2at	0.00006	0.00038	0.00000	0.00000	0.00000	0.00000	0.00477	109142
1								
cob2at	0.00146	0.00864	0.00000	0.00000	0.00000	0.00004	0.11112	85817
cob2ppe	0.02324	0.16922	0.00000	0.00000	0.00000	0.00024	2.45033	85814
lnretWSD_crps	-1.01085	0.48393	-4.37701	-1.34751	-1.02909	-0.69053	0.97763	77646
ret_crps	3.86074	23.84407	-64.24419	-9.19763	2.61168	14.70588	115.29412	77646
capI	0.06616	0.07724	-0.01794	0.02578	0.04566	0.07882	0.73885	85504
quick_ratio	2.17298	2.25808	0.02740	1.01524	1.50574	2.45269	20.41466	85798
bmQ	0.62285	0.56288	0.01825	0.28615	0.47961	0.77540	4.66330	85336
size	6.42361	2.21126	-1.21066	4.90537	6.52883	7.92516	11.35250	85817
roaQ	0.02205	0.04864	-0.76989	0.01312	0.02854	0.04265	0.15704	85514
debt_capital	0.35959	0.25544	-2.39057	0.14210	0.34707	0.52710	4.22491	85520
saleq2at	0.29399	0.20723	0.00326	0.15785	0.24389	0.36628	1.31216	85754
cogs2at	0.19755	0.18543	0.00099	0.07534	0.14517	0.25344	1.18792	85522
xsga2at	0.07757	0.06456	0.00193	0.03503	0.06179	0.10033	0.89789	82145
ibq2at	0.00030	0.05744	-1.05773	-0.00216	0.01055	0.02140	0.15439	85759
s_pi	-0.39581	3.11634	-80.78410	-0.23599	-0.07089	0.01825	0.80955	54164
mu_spec1	1.67107	1.19147	0.20487	1.08695	1.28944	1.76043	24.34037	73584
EPSI4CV	21.52794	44.66194	0.00000	4.11000	7.89500	18.12900	325.00000	53173
DONtotalD2at	0.00002	0.00007	-0.00006	0.00000	0.00000	0.00001	0.00054	85817
lobbyism2at	0.00010	0.00044	0.00000	0.00000	0.00000	0.00002	0.00477	85817
Total								
cob2at	0.00064	0.00578	0.00000	0.00000	0.00000	0.00000	0.11112	194959
cob2ppe	0.01023	0.11286	0.00000	0.00000	0.00000	0.00000	2.45033	194956
lnretWSD_crps	-0.88687	0.50058	-4.38463	-1.23016	-0.90208	-0.55491	1.16233	162971
ret_crps	3.41447	27.02303	-64.24419	-11.67954	1.76000	15.48224	115.29412	162971
capI	0.07156	0.09399	-0.01794	0.02210	0.04527	0.08456	0.73885	193859
quick_ratio	2.41090	2.84382	0.02740	0.95570	1.51537	2.66901	20.41466	194897
bmQ	0.69589	0.71779	0.01825	0.27998	0.49657	0.84165	4.66330	193009
size	5.72412	2.25577	-1.21066	4.08546	5.75018	7.31420	11.35250	194959
roaQ	0.01121	0.07049	-0.76989	0.00161	0.02510	0.04222	0.15704	194173
debt_capital	0.35237	0.28008	-2.39057	0.12028	0.32415	0.52680	4.22491	194297
saleq2at	0.28376	0.21753	0.00326	0.13517	0.23462	0.37102	1.31216	194698
cogs2at	0.19274	0.18446	0.00099	0.06703	0.14065	0.25559	1.18792	193964
xsga2at	0.08634	0.08234	0.00193	0.03259	0.06501	0.11404	0.89789	180173
ibq2at	-0.01217	0.08317	-1.05773	-0.01472	0.00730	0.02022	0.15439	194743
s_pi	-1.36881	7.37067	-80.78410	-0.42215	-0.12422	0.00052	0.80955	121695
mu_spec1	1.70446	1.28473	0.19353	1.07324	1.30704	1.80821	25.32785	163156
EPSI4CV	23.30299	46.58801	0.00000	4.34800	8.53700	20.00000	325.00000	66379
DONtotalD2at	0.00001	0.00005	-0.00006	0.00000	0.00000	0.00000	0.00054	194959
lobbyism2at	0.00008	0.00041	0.00000	0.00000	0.00000	0.00000	0.00477	194959

Note: The table presents summary statistics for the estimation sample. Upper panel stands for the sample of firms that did not receive a single competitive contract; middle are for contractors; lowest is for totals. Columns present various statistics: 'mean' presents mean, 'sd' - standard deviation, 'p25' - 25th percentile, 'p50' - median, 'p75' - 75th percentile, 'count' - a number of non-missing observations. Rows present variables denoted in mnemonics, as defined in variable definitions' table in Appendix A.

D Representative Sample

Here I evaluate to what extent the sample is representative of the population – a question to consider in order to generalise the conclusions of this study to a greater scale and reflect on whether results are relevant at the aggregate level. To do so, I compare various sample aggregates to population's ones across a number of dimensions. Results are summarized in table D.1. In short, the sample represents large and publicly traded firms, as the firm-level data is sourced from Compustat. The analysis covers only a minuscule share of all companies in the US economy. Nevertheless, it captures a large share of total US private economic activity as measured in terms of revenues, employment or government purchases. Overall, the sample is clearly underrepresented, though it can still, arguably, hint about aggregate macro effects.

Table D.1 presents raw numbers and shares relating sample aggregates to population ones across four economic census rounds. My sample sources information from Compustat, thus, it is subject to a selection of large, multinational enterprises and clearly underrepresent firms in the economy. The sample includes around 0.05% of all companies in the US economy and around 36% of the Compustat sample, the universe of publicly traded firms in US or Canada.

Different picture arises when measuring the representativeness in terms of employment or revenues. The sample covers a great amount of employment in the economy, around 27% of employees. Note that the number is inflated as firms in the sample are multinational and report employment data that also capture employees from establishments in foreign countries, whereas census and BLS data reflect employees across the universe of domestic employer establishments[53]. Davis et al. (2006) also recognises this issue but computes that on average around 70-73% of Compustat employment is domestic employment. For that reason, one could conservatively suggest that the sample reflects 19% of employees in US economy. The sample also covers a large share of private revenues, accounting for around 37% of the total. Publicly traded companies contribute more to the overall share of value added than employment for plausible reasons related to their size, economies of scale, market concentration or weaker competition.

In relation to the universe of all procurement contracts as provided in the USAspending.gov dataset, the sample represents a small share of contractors per year, on average around 0.19%. But, as mentioned before, the selected sample represents large and publicly traded firms, therefore, contracts tend to be large, accounting for an average 44% of the overall value. This reflects the fact that the procurement market is heavily concentrated among several key firms[54].

The sample includes a large share of constituents for major stock market indices, see Table D.2. Above 70% current and 55% historical constituents enter the sample.

[53]See glossary on statistics of US business https://www.census.gov/programs-surveys/susb/about/glossary.html. Other discrepancies arise due to different recording of employment in two datasets. Compustat captures employment that it is reported to shareholders, likely average or end values over the year, whereas Census information reflects workers as recorded at March 12th. In addition, the employment data in Compustat is missing for around 10% observation per year that may increase the total share.

[54]See Cox et al. (2021) for a more comprehensive analysis on concentration

Table D.1: Sample's representativeness

	Year			
	2002	2007	2012	2017
# of Firms in the Sample	2854.00	2798.00	2579.00	2066.00
Total in Compustat	8478.00	7030.00	6807.00	6105.00
%	33.66	39.80	37.89	33.84
Total in Census	5697759.00	6049655.00	5726160.00	5996900.00
%	0.05	0.05	0.05	0.03
Employment in the Sample (in mln)	28.51	31.87	32.39	33.59
Total in Compustat	43.39	44.24	44.44	46.49
%	65.70	72.05	72.88	72.25
Total in Census	112.40	120.60	115.94	128.59
%	25.36	26.43	27.94	26.12
Employees, (private, nonfarm)	109.13	115.76	112.24	124.26
%	26.12	27.53	28.86	27.03
Receipts in the Sample (in bln $)	7391.63	11348.02	13024.56	13423.62
Total in Compustat	10822.58	15100.89	16916.53	17848.72
%	68.30	75.15	76.99	75.21
Total in Census	22062.53	29746.74	32637.81	37370.08
%	33.50	38.15	39.91	35.92
# of Contractors in the Sample	180.00	234.00	251.00	279.00
Total	84704.00	164511.00	138301.00	117027.00
%	0.21	0.14	0.18	0.24
Contract value (in bln $)	114.40	191.12	252.37	240.44
Total	284.06	463.54	542.22	510.53
%	40.27	41.23	46.54	47.10

Note: The table presents to what extent the sample used in the analysis is representative. The representativeness is evaluated across a number of dimensions and presented in terms of raw numbers and shares to various aggregates. The number of firms and the value of revenues are compared to all Compustat firms (excluding ARDs and companies that are not traded in US exchanges) and the universe Census (Statistics of U.S. Businesses); employment, in addition, is compared to the total number of employees in nonfarm private sector as reflected in Current Employment Statistics by BLS (FRED:USPRIV); the number and value of contracts are evaluated with respect to the procurement universe as provided by USAspending.gov.

Table D.2: Stock indices, constituents and sample's representativeness

	Count	Share (p.p).
S&P500, Historical	619	0.579
Dow, Historical	45	0.938
Nasdaq, Historical	192	0.555
S&P100, Historical	144	0.696
S&P500 Aerospace&Defence, Historical	18	0.857
S&P500, Current	387	0.774
Dow, Current	28	0.933
Nasdaq, Current	70	0.693
S&P100, Current	88	0.880
S&P500 Aerospace&Defence, Current	12	0.923

Note: The table presents number and share of companies that are in the sample and are constituent to one of stock market index. For each index, there are two entries: 'Historical' and 'Current', the former represents estimates for historical constituents of the index, whereas 'Current' stands for current constituents, at the time of writing, 2022-May.

E Additional results for the event study

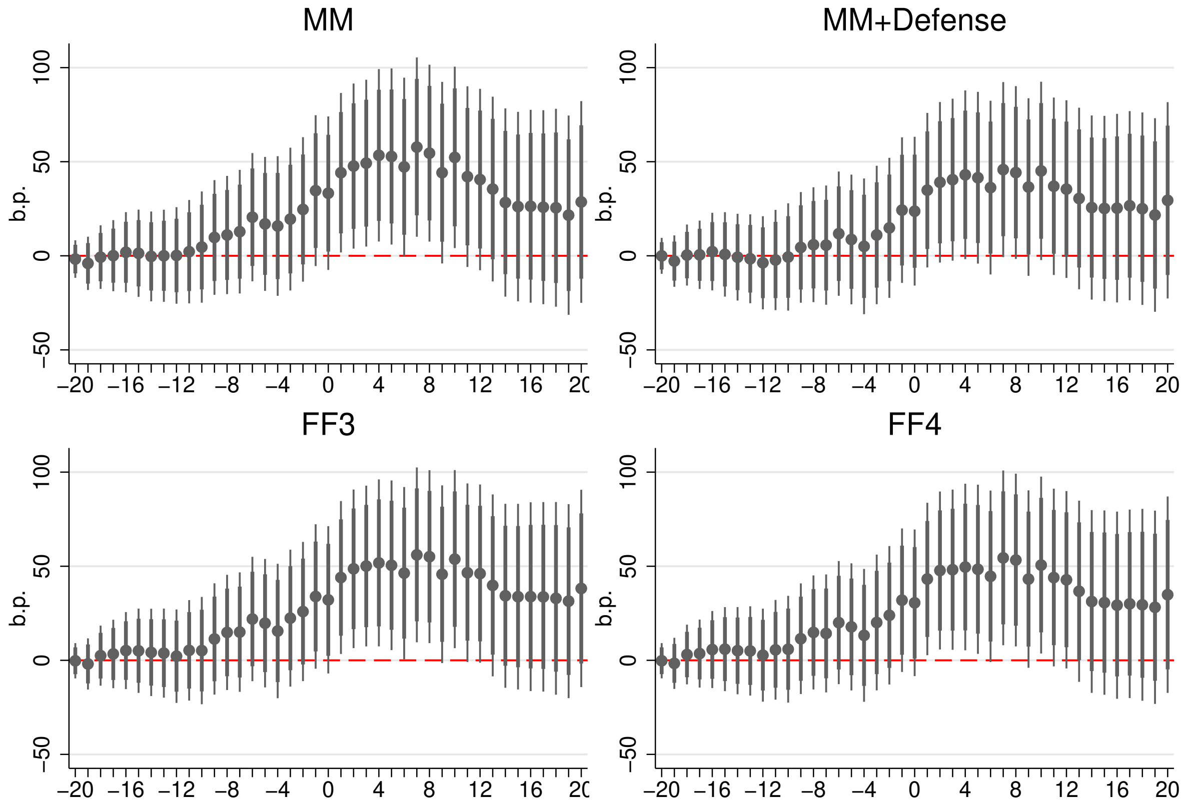
Table E.1: Abnormal returns around the announcement date

	(1) MM	(2) MM+Defense	(3) FF3	(4) FF4
-20	-1.73	-0.03	-0.25	-0.23
-19	-2.28	-2.79	-1.68	-1.39
-18	3.30	3.20	4.40	4.69
-17	0.79	0.15	0.90	0.52
-16	1.81	1.70	1.80	2.14
-15	-0.54	-1.48	-0.10	0.21
-14	-1.67	-1.48	-0.87	-0.81
-13	0.33	-0.85	-0.40	-0.13
-12	0.17	-2.12	-1.61	-2.26
-11	2.01	1.47	3.09	2.85
-10	2.44	1.60	-0.11	0.32
-9	5.12	5.10	6.19*	5.58
-8	1.31	1.43	3.46	3.34
-7	1.76	-0.23	0.18	-0.53
-6	7.69**	6.10	6.96*	5.74
-5	-3.58	-3.09	-2.22	-2.27
-4	-1.11	-3.65	-4.15	-4.51
-3	3.68	6.04*	6.83*	6.85*
-2	5.14	3.78	3.50	3.82
-1	9.99**	9.44**	8.00*	8.01**
0	-1.37	-0.58	-1.77	-1.38
1	10.89**	11.17**	11.86***	12.66***
2	3.53	4.18	4.63	4.52
3	1.55	1.41	1.48	0.42
4	4.18	2.59	1.67	1.43
5	-0.62	-1.56	-1.27	-1.20
6	-5.54	-5.25	-4.17	-3.74
7	10.52***	9.55***	9.70***	9.81***
8	-3.22	-1.57	-0.96	-1.16
9	-10.37**	-7.69	-9.34*	-10.12**
10	8.13**	8.58**	8.05**	7.44*
11	-10.23***	-8.15**	-7.23**	-6.63*
12	-1.55	-1.51	-0.47	-1.18
13	-5.05	-4.99	-6.27	-6.11
14	-7.17*	-4.81	-5.52	-5.44
15	-2.14	-0.49	-0.47	-0.58
16	0.16	0.16	0.01	-1.39
17	-0.51	1.30	-0.11	0.74
18	-0.29	-1.60	-0.80	-0.52
19	-3.94	-3.34	-1.49	-1.32
20	7.01*	7.80**	6.75*	6.70*
N	789302	789302	789302	789302
Compet. Events	2088	2088	2088	2088
Uncompet. Events	3431	3431	3431	3431
No of Firms	366	366	366	366

	(1) MM	(2) MM+Defense	(3) FF3	(4) FF4
-20	0.75	-0.17	-0.21	-0.16
-19	1.71	2.75	1.60	1.97
-18	0.31	0.03	0.70	0.64
-17	0.92	0.79	0.07	-0.15
-16	0.09	-0.39	-0.01	0.22
-15	2.47	1.61	1.43	0.81
-14	0.19	0.39	0.71	0.07
-13	-2.73	-1.11	-1.20	-1.61
-12	2.86	3.64	4.24*	3.83
-11	-6.68***	-4.73**	-5.07**	-5.21**
-10	-1.07	-1.36	-1.28	-1.35
-9	-0.38	-0.26	-0.26	0.05
-8	-2.19	-3.69	-4.06*	-3.83*
-7	0.03	-0.62	-2.04	-2.24
-6	1.35	1.19	0.61	0.09
-5	-2.23	-1.38	-1.22	-1.13
-4	-2.15	-2.34	-2.91	-2.79
-3	5.00*	4.40*	4.24*	4.82*
-2	1.12	0.67	0.06	-0.02
-1	-0.30	-1.90	-2.12	-2.22
0	1.33	0.90	0.58	0.41
1	2.06	1.18	1.65	1.58
2	2.25	1.72	2.39	2.61
3	2.88	2.96	2.85	2.40
4	0.55	-1.16	0.02	-0.24
5	-0.10	-0.77	-0.50	-0.07
6	0.40	-0.37	-1.34	-0.47
7	1.50	2.57	1.97	1.70
8	0.91	2.70	2.28	2.92
9	-0.89	-0.36	-0.83	-0.74
10	-4.38	-1.29	-1.03	-1.33
11	-0.46	-0.44	-0.48	-0.68
12	2.21	2.45	2.23	1.70
13	-3.38	-3.00	-1.98	-2.40
14	1.69	1.91	2.14	2.18
15	3.28	4.42*	5.39**	4.52*
16	-6.38**	-3.79	-4.03	-3.84
17	-1.40	-0.54	-0.99	-1.08
18	1.95	-0.03	-0.71	0.12
19	-3.97	-2.93	-3.42	-3.87
20	-2.80	-2.55	-3.06	-2.75
N	789302	789302	789302	789302
Compet. Events	2088	2088	2088	2088
Uncompet. Events	3431	3431	3431	3431
No of Firms	366	366	366	366

Note: The table presents abnormal returns around the announcement date ($t = 0$). On LHS, the panel present results for events of competitive awards, RHS for noncompetitive awards. In each panel, four columns present ARs estimated using four different specifications of expected returns: 'MM' - Market model; 'MM+Defense' adds Defense stock index DJSASD; 'FF3' additionally includes Fama and French (1993) 'small minus big' and 'high minus low'; lastly, 'FF4' adds 'momentum'. Asterisks denote significance levels (***=1%, **=5%, *=10%) using clustered standard errors over an estimation window.

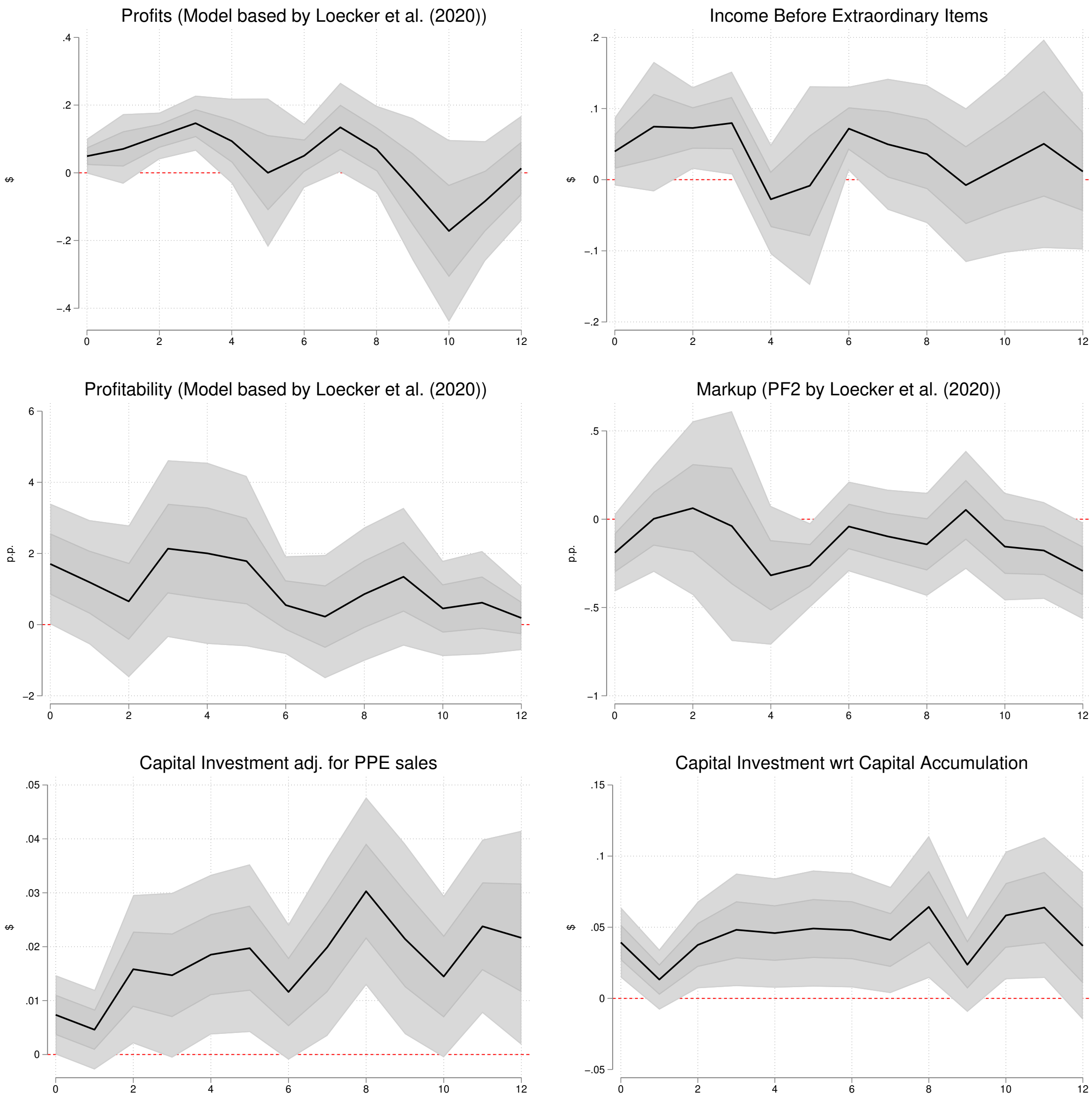
Figure E.1: Cumulative abnormal returns for competitive events



Note: The figure shows cumulative abnormal returns (CARs) over 20 trading days prior and post announcement date. The four panels present CARs estimated using four different specifications of expected returns: 'MM' - Market model; 'MM+Defense' adds Defense stock index DJSASD; 'FF3' additionally includes Fama and French (1993) factors 'small minus big' and 'high minus low'; lastly, 'FF4' adds 'momentum'. Circles represent average values whereas bold and thin bars stand for 95% and 99% confidence intervals.

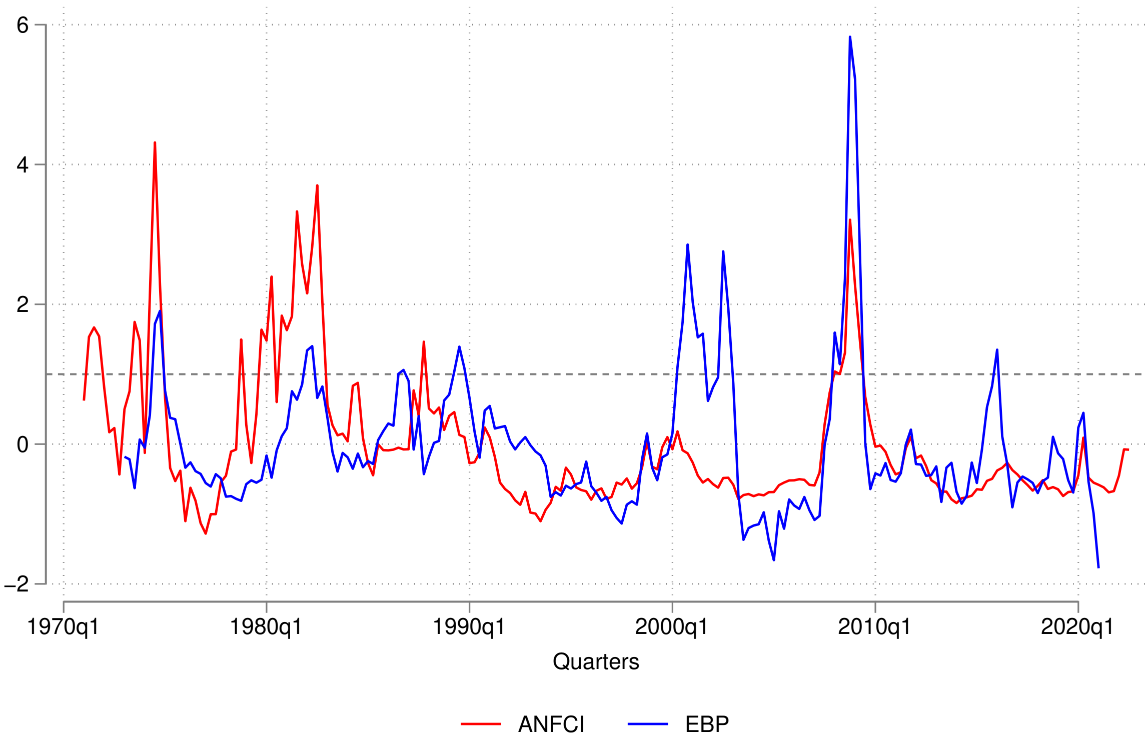
F Supplementary material for local projections

Figure F.1: Impulse response to a procurement award



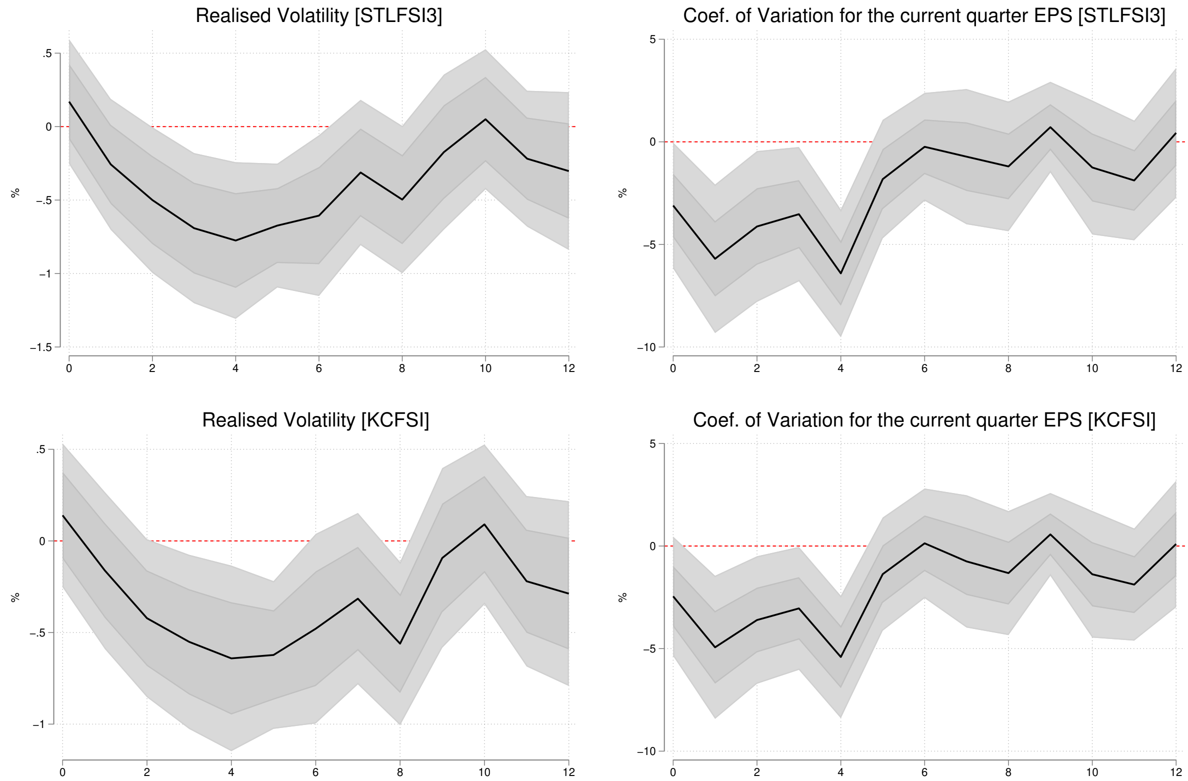
Note: The figure presents impulse responses over 13 quarters following a firm is awarded a contract. Black line presents coefficient estimates, β_h, from the regression line 1, bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Note that the interpretation for different variables differ. Figures with the label "$" on y axis are interpreted in dollar terms, whereas variables with the label "p.p." in percentage points. For a comprehensive description of variables, see Table A.1 in appendix.

Figure F.2: Time-series of financial condition indices



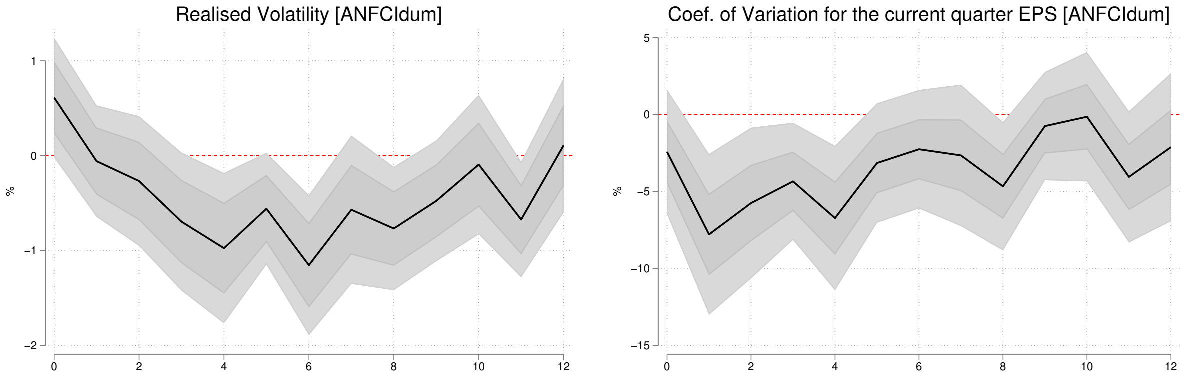
Note: The figure presents financial condition indices used in the analysis to construct interaction terms. The dashed line indicate the level of one standard deviation above the historical mean, used a benchmark to compute the generalised impulse responses.

Figure F.3: Impulse response of uncertainty to a procurement award in a state of worsened financial conditions (alternative financial condition indicators)



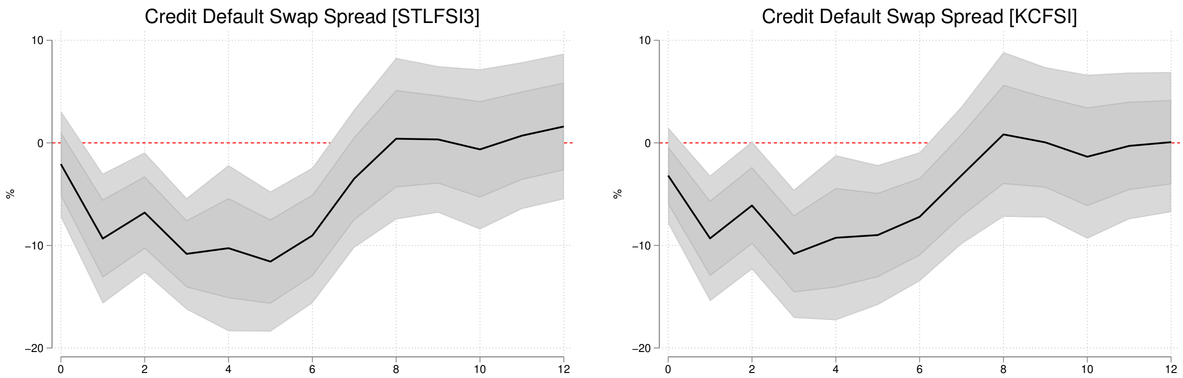
Note: The figure presents generalised impulse responses of uncertainty proxies over 13 quarters to a government demand shock at the state of worsened financial conditions. Black line presents coefficient estimates, $\beta_h + \beta_{h,fci}$, from the regression line 5, bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Figures with the label "%" on y axis are interpreted in percentage terms.

Figure F.4: Impulse response of uncertainty to a procurement award in a financial stress (Discrete states)



Note: The figure presents impulse responses over 13 quarters following a firm is awarded a contract with a size of one standard deviation in a state of FCI above an average level. Black line presents coefficient estimates, $\beta_h + \beta_{h,stress}$, from the regression line with discrete deterministic states $\ln\left(\frac{x_{i,t+h}}{x_{i,t-1}}\right) = \alpha_{i,h} + \alpha_{s,t,h} + \beta_h \frac{proc_{i,t}}{atq_{i,t-1}} + B_h(L)Y_{i,t} + I(FCI_{t-1} > 0)\left(\beta_{h,stress}\frac{proc_{i,t}}{atq_{i,t-1}} + B_{h,stress}(L)Y_{i,t}\right) + e_{i,h,t}$. Bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level.

Figure F.5: Impulse response of credit default swap spread to a procurement award in a state of worsened financial conditions (alternative financial condition indicators)



Note: The figure presents generalised impulse responses of credit default swap spread over 13 quarters to a government demand shock at the state of worsened financial conditions. Black line presents coefficient estimates, $\beta_h + \beta_{h,fci}$, from the regression line 5, bands in grey represent 68% and 95% confidence bands. Standard errors are clustered at the firm level. Figures with the label "%" on y axis are interpreted in percentage terms.

G Discussion on Fixed Costs

Deriving a relationship between profits and markup. Let C(Y) be a general cost function that depends on a level of production; average costs can be defined as $AC = \frac{C(Y)}{Y}$ and the price markup $\mu = \frac{P}{MC}$. Then:

$$\pi = PY - C(Y) \tag{G.1}$$
$$= \left(1 - \frac{C(Y)}{PY}\right) PY \tag{G.2}$$
$$= \left(1 - \frac{AC}{P}\right) PY \tag{G.3}$$
$$= \left(1 - \frac{MC}{P} \frac{AC}{MC}\right) PY \tag{G.4}$$
$$= \left(1 - \frac{1}{\mu} \frac{AC}{MC}\right) PY \tag{G.5}$$

Deriving a ratio of average costs to marginal costs for Cobb-Douglas. Let's assume the production function has two inputs: labor, L, and capital, K. It takes a form of CES with an overheard labor costs. The cost minimisation problem:

$$wL + rK + \Phi + \lambda\left(Y - \left(\alpha_L[Z(L - \bar{L})]^\rho + \alpha_K K^\rho\right)^{\frac{\nu}{\rho}}\right) \tag{G.6}$$

Marginal costs are then:

$$MC = \lambda = \frac{w}{\alpha_L Y^{1-\frac{\rho}{\nu}} [Z(L - \bar{L})]^{\rho-1}} \tag{G.7}$$

Average costs:

$$AC = \frac{wL + rK + \Phi}{Y} \tag{G.8}$$

The ratio:

$$\frac{AC}{MC} = \alpha_L \left(\frac{Z(L - \bar{L})}{Y^{\frac{1}{\nu}}}\right)^\rho \left(\frac{wL + rK + \Phi}{wZ(L - \bar{L})}\right) \tag{G.9}$$

$$\tag{G.10}$$

It can be shown that the the first term in the brackets is equal to:

$$\left(\frac{Z(L - \bar{L})}{Y^{\frac{1}{\nu}}}\right)^\rho = \left[\alpha_L + \left(\frac{K}{Z(L - \bar{L})}\right)^\rho\right]^{-1} \tag{G.11}$$

Now if one assumes that capital is a variable input, the ratio is determined by the factor prices:

$$\frac{\alpha_K}{\alpha_L} \left(\frac{K}{Z(L - \bar{L})}\right)^{\rho-1} = \frac{r}{w} \tag{G.12}$$

For that reason the first term is constant but only in the partial equilibrium. The second term in the brackets has three terms. The first one decreases with a higher labor input if labor overhead exists, $\bar{L} > 0$.

$$\frac{\partial \frac{wL}{wZ(L-\bar{L})}}{\partial L} = \frac{-\bar{L}}{Z(L-\bar{L})^2} \tag{G.13}$$

The second term varies with factor inputs, assuming the capital is variable. The third term ensures that the ratio decreases with an increase in production for positive fixed costs:

$$\frac{\partial \frac{\Phi}{wZ(L-\bar{L})}}{\partial L} < 0 \tag{G.14}$$

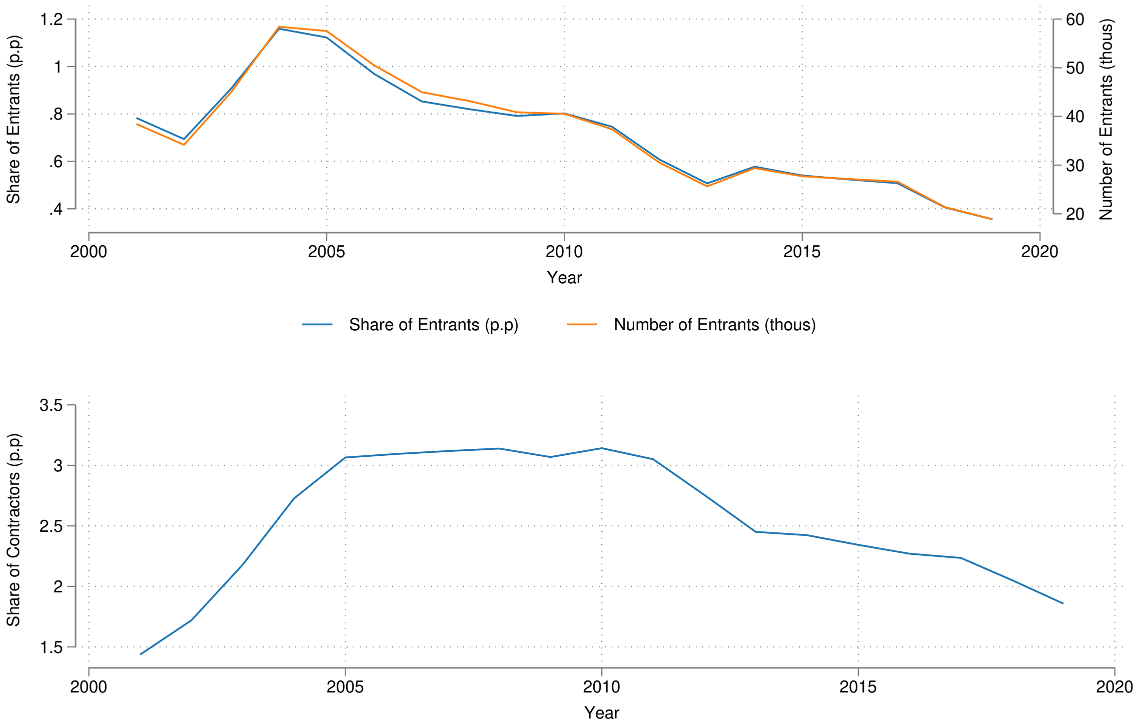
The ratio of average to marginal costs decreases in partial equilibrium if either there are labor overhead ($\bar{L} \neq 0$) or fixed costs ($\Phi \neq 0$). This hold for any degree of return to scale, ν, and also irrespective of share parameters, α. If one assumes a Cobb-Douglas, s.t. $\rho = 0$, the ratio decreases also in general equilibrium if the production is increased.

$$\frac{AC}{MC} = \alpha_L \left(\frac{wL + \Phi}{wZ(L-\bar{L})} + \frac{\alpha_K}{\alpha_L} \right) \tag{G.15}$$

$$\tag{G.16}$$

Additional complexities in costs may compensate effects in this setting. Overheard costs arising due, e.g. to price adjustment ala Rotemberg, can introduce time-varying costs that depend on other state variables irrespective of the production. This could further increase or decrease average costs and explain deviation from marginal costs.

Figure H.1: Number and share of entrants



Note: The upper panel of the figure shows time-series of count and share of entrants to a procurement market to all firms in US economy from 2001 till 2019; The lower panel presents share of contractors in the economy.

H Calibration of Procurement market

Using USAspending.gov procurement dataset, one can capture firm dynamics in and out of the procurement market. I focus on an aggregate number of entrants into the procurement market. Constructing this aggregate allows, first, to estimate an average level of entrants in the economy and calibrate it in the model; second, to understand plausible drivers that could guide specification of policy rule for the contract posting in the model; second, to estimate an average duration that firm stays as a contractor that then can be used to calibrate a parameter of exogenous relationship destruction.

To begin with, I specify that the entrant is a firm that did not have new federal obligations issued in the past fiscal year but obtained a positive amount of federal obligations this year. The definition resembles one used to define startups in the economy by Business Dynamics Statistics (BDS)[55]. Though, in contrast, I focus on a firm as the unit and not an establishment to be in line with a model. The establishments are aggregated over parent firms to establish a unit.

Figure H.1 presents dynamics of number and share of entrants to an overall number of firms in US economy from 2001 till 2019. On average around 0.67 percent of firms are becoming government contractors each

[55]See https://www.census.gov/programs-surveys/bds/documentation/methodology.html.

Figure H.2: Share of entrants across sectors

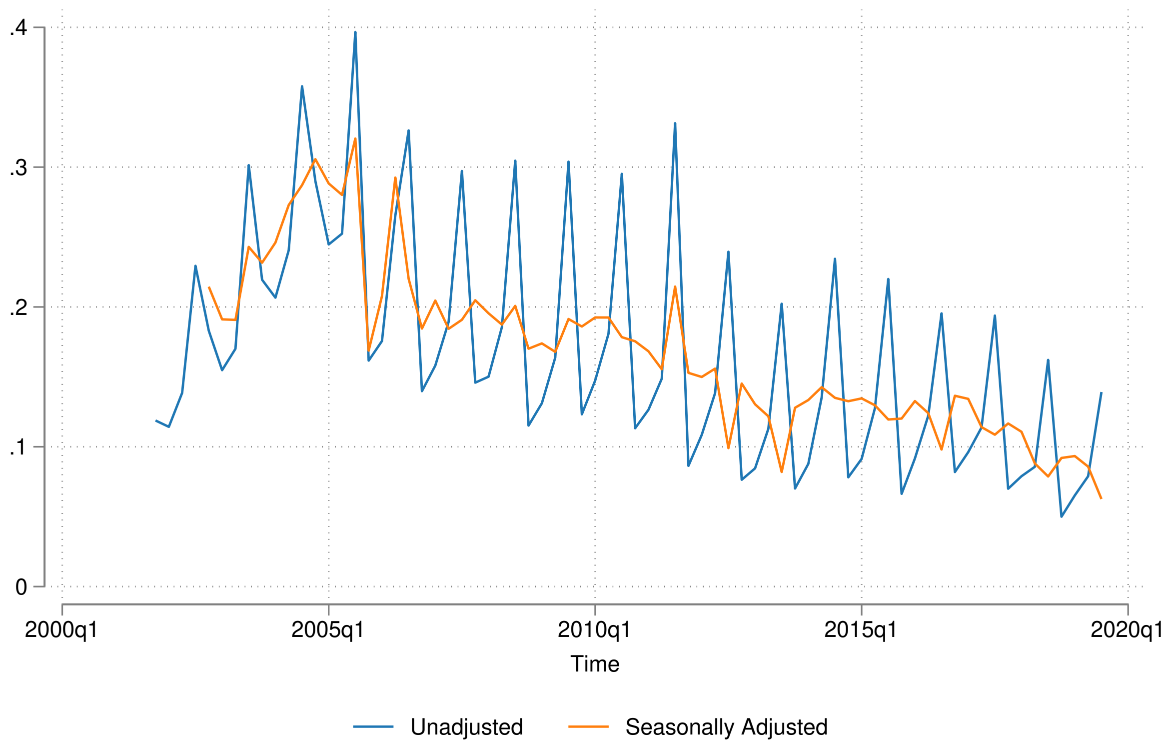
Note: The figure shows time-series of share of entrants to a procurement market in relation to all firms in US economy from 2001 till 2019 across NAICS2 sectors. The left-hand-side y-axis portray scale for sectors' shares, whereas the y-axis on the right correspond to total share of entrants in US economy.

year. Both the share and count has been steadily decreasing from its highest point in 2003 till 2019. By eye-balling, one can suspect a non-stationary dynamics that are confirmed by Dickey-Fuller tests - both variables are integrated of order one. At the current stage, there are no previous theoretical or empirical evidence to support this. Figure H.2 presents estimates across sectors as identified using NAICS classification of two digits. The downward trend of entrants is common across sectors, suggesting that it may arise due to some aggregate variation and not distributional changes in government spending.

In the theoretical framework, the specification for the contract posting by government arises outside the model and is not subject to some optimal behaviour but instead follows a stylised reduced form rule. To construct a reasonable approximation, it is important, first, to account for the persistent decrease and, second, to evaluate possible explanatory variables that may predict the share of entrants into the government sector, v_t. I explore to what extent the share is correlated to an aggregate government spending and/or its components. Intuition is the following: if there is more spending, the government should post more contracts that may attract new entrants into the procurement market. However, a number of attempts do not suggest any significant relationship. Alternatively, I construct quarterly series of share of entrants into the procurement contracts[56]. This turns out to boost a statistical power

[56] The number of firms in US economy from BDS comes in the annual frequency. To construct quarterly series, I linearly interpolate across years. Results, shown below, are robust to alternative interpolations when either

Figure H.3: Share of entrants in a quarterly frequency



Note: The figure shows time-series of a share of entrants to a procurement market to all firms in US economy from 2001 till 2019

and capture timing of entries more precisely. Figure H.3 presents quarterly series in blue. The seasonality is obvious with spikes appearing at the third quarter, reflecting the clustering of contract issuance to meet public allotments at the end of a fiscal year. The series, adjusted for the seasonality, are presented in orange. The downward trend is also prominent at the quarterly frequency.

I explore two standard time-series models to fit the series: a unobserved component model (UCM) of local-level model and an autoregressive model (AR). The former acknowledges a non-stationary dynamics and is summarised:

$$v_t = \mu_t + \gamma_{q,t} + x_t\beta + e_t \qquad e_t \sim \mathcal{N}(0,\, \sigma_e^2) \tag{H.1}$$

$$\mu_t = \mu_{t-1} + u_t \qquad u_t \sim \mathcal{N}(0,\, \sigma_u^2) \tag{H.2}$$

where μ_t presents a stochastic trend that is subject to i.i.d. shocks u_t, $\gamma_{q,t}$ are deterministic seasonal dummies[57], x_t are independent variables and e_t is an idiosyncratic component. On a basis of this specification, I assume that the downward trend is unpredictable and I focus on short-term variations,

keeping the yearly value of the year or interpolating on a linear relationship to GDP.

[57] I also explored specifications with stochastic seasonal components but I could not reject the null of deterministic seasonality.

$x_t\beta + \epsilon_t$. The alternative AR process may fit a highly persistent but stationary series:

$$v_t = \phi_i(L)v_{t-1} + \gamma_{q,t} + x_t\beta + e_t \tag{H.3}$$

where $\phi_i(L)$ is a lag polynomial[58]. In both specifications, vector x_t includes various government spending aggregates. For the sake of brevity, I focus on the selective set of significant relationships that provide a basis for the specification of contract posting in the model. Best fits are obtained when using aggregate government procurement obligations, specifically, I use two variants: aggregate obligations, a sum over all contracts in a given quarter; and initial obligations, that are obligations issued at the beginning of the contract excluding modifications. Both variables are scaled by a potential level of GDP as constructed by U.S. Congressional Budget Office.

Table H.1 presents results. The coefficient in the first column suggests that if aggregate obligations increase by one percentage point above the potential output, the share of entrants increases by 0.015 percentage points. All associations are significant using the full sample, see first four columns. Various indicators, AIC, BIC and log likelihood, prefer UCM, suggesting that a stochastic unpredictable trend explains better the decrease of entrants in procurement markets in the last 18 years.

Note that the full sample estimates may easily overstate the correlation, when including small procurement contracts. For that reason, I exclude firms whose obligations are below 40000 dollars over the sample period and re-estimate the specifications. Last four columns present results. Estimates for UCM models are still significant and noticeably smaller. Estimates in columns 5 and 6 serve as baseline numbers for the calibration of the model.

Table H.1: Estimates for the share of new contractors

	(1) UCM/Full	(2) UCM/Full	(3) AR(3)/Full	(4) AR(3)/Full	(5) UCM/Small	(6) UCM/Small	(7) AR(3)/Small	(8) AR(3)/Small
Agg. Obligations	0.015**		0.010*		0.0092**		0.0062*	
	(0.0069)		(0.0055)		(0.0036)		(0.0035)	
Initial Obligations		0.067***		0.042***		0.029***		0.013
		(0.017)		(0.016)		(0.0096)		(0.0080)
No. obs.	72	72	69	69	72	72	69	69
AIC	-290	-300	-280	-284	-383	-386	-370	-369
BIC	-276	-286	-262	-266	-370	-372	-352	-351
LL	151	156	148	150	198	199	193	193

Note: The table presents estimates for the relationship between the share of new contractors and aggregate government procurement obligations. Columns summarise specifications using either different independent variables or time-series model or the sample variant. Asterisks denote significance levels (***=1%, **=5%, *=10%). Standard errors are in brackets.

Moreover, the overall share of contractors, ω_t, follows a law of motion in the model:

$$\omega_t = \omega_{t-1}(1 - \delta_g) + v_{t-1} \tag{H.4}$$

Using information on the entrants, one can more precisely estimate an exogenous rate of relationship destruction, δ_g. Results are summarised in Table H.2. Different specifications agree that the true parameter value lies in confidence interval between 0.215 and 0.315 with a point estimate of 0.265. This implies that the average duration of being a contractor is around 3.77 years. Values are in the ballpark of estimates by Cox et al. (2021). Using micro-level information, the study finds that median duration is less than 2

[58] 3 lags are selected as suggested by AIC, BIC or LL criteria.

years. However, authors also emphasize that larger firms tend to be contractors for longer, for example, the median of largest top 10 percent firms endure for 4 years. Both points suggest that heterogeneity matters, the average duration is longer than the median. Given that the proposed model assumes homogeneous probability to lose relationship with government, the estimate obtained using specification H.4 is more adequate, it maps directly to model's parameter as well as presents an average duration and not a median one.

Table H.2: Estimates for dynamics of share of contractors

	(1) Share of Contractors	(2) Share of Contractors	(3) Difference between Contractors and Entrants	(4) Diff of the Share
L.Share of Contractors	0.813***	0.735***	0.734***	-0.265***
	[0.553,1.073]	[0.685,0.785]	[0.685,0.783]	[-0.315,-0.215]
Share of Entrants (p.p)		0.992***		0.992***
		[0.873,1.112]		[0.873,1.112]
Observations	18	18	18	18
R^2	0.793	0.987	0.981	0.949

Note: The table presents estimates for dynamics of contractors' share in the economy for various specifications. Specification 1 - has only a lag of dependent variable; 2 - includes a share of entrants; 3 - imposes that the coefficient on share of entrants is equal to one; 4 - estimates specification with dependent variable expressed in a difference. Asterisks denote significance levels (***=1%, **=5%, *=10%) using Newey-West standard errors. 95% confidence intervals in square brackets. All specification include a constant.

I Impulse responses to aggregate shocks

Figure I.1: Impulse responses to a government spending shock

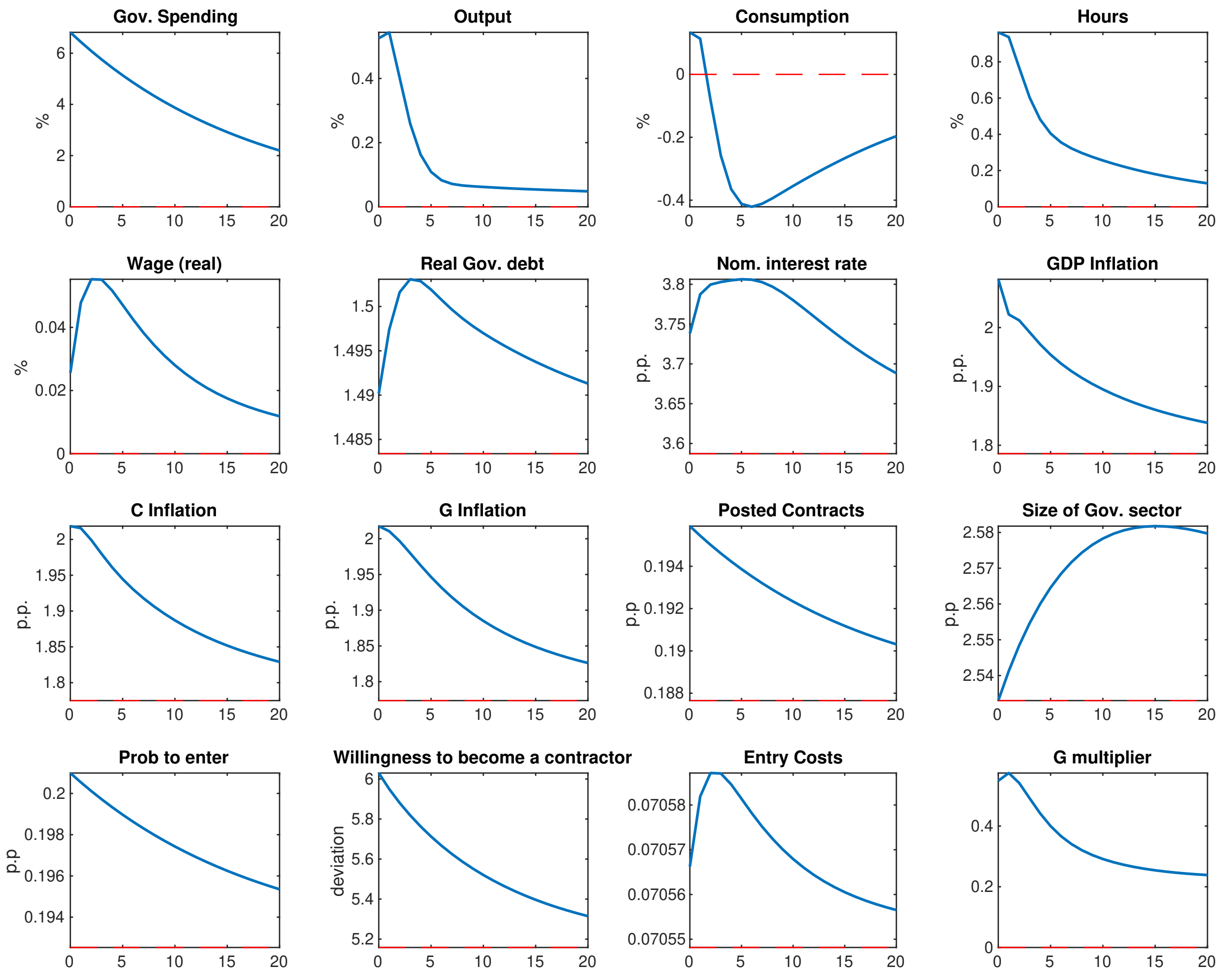


Figure I.2: Impulse responses to a productivity shock

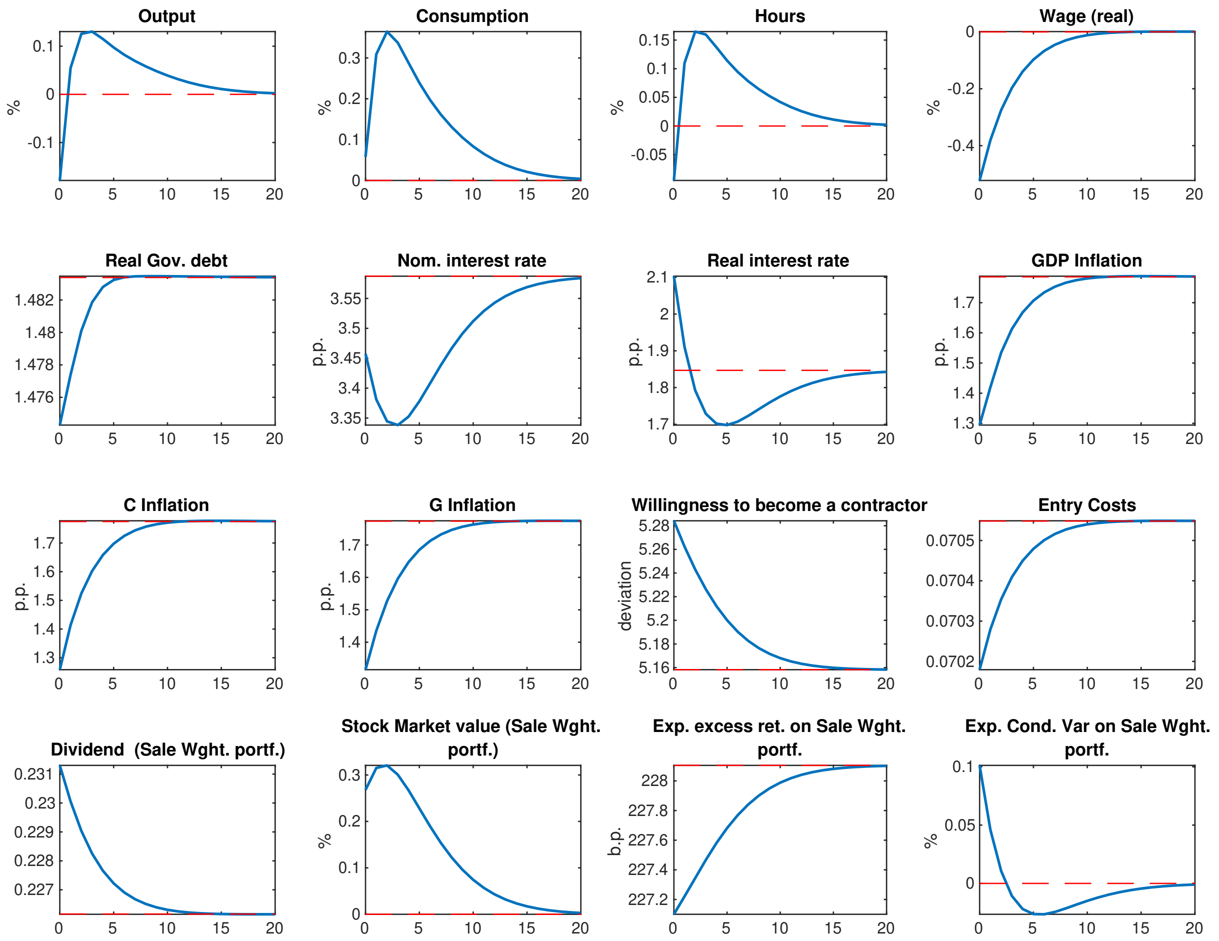


Figure I.3: Impulse responses to a preference shock

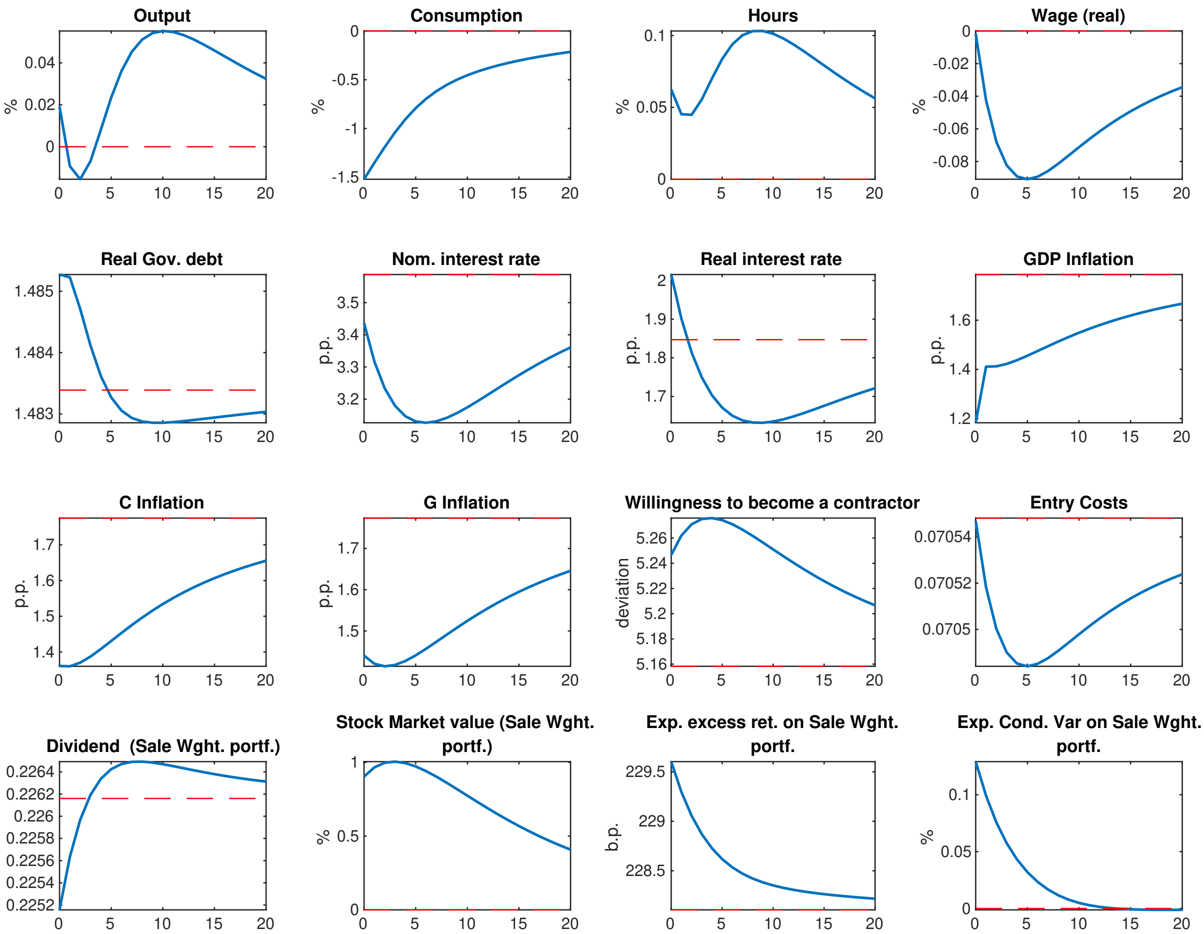
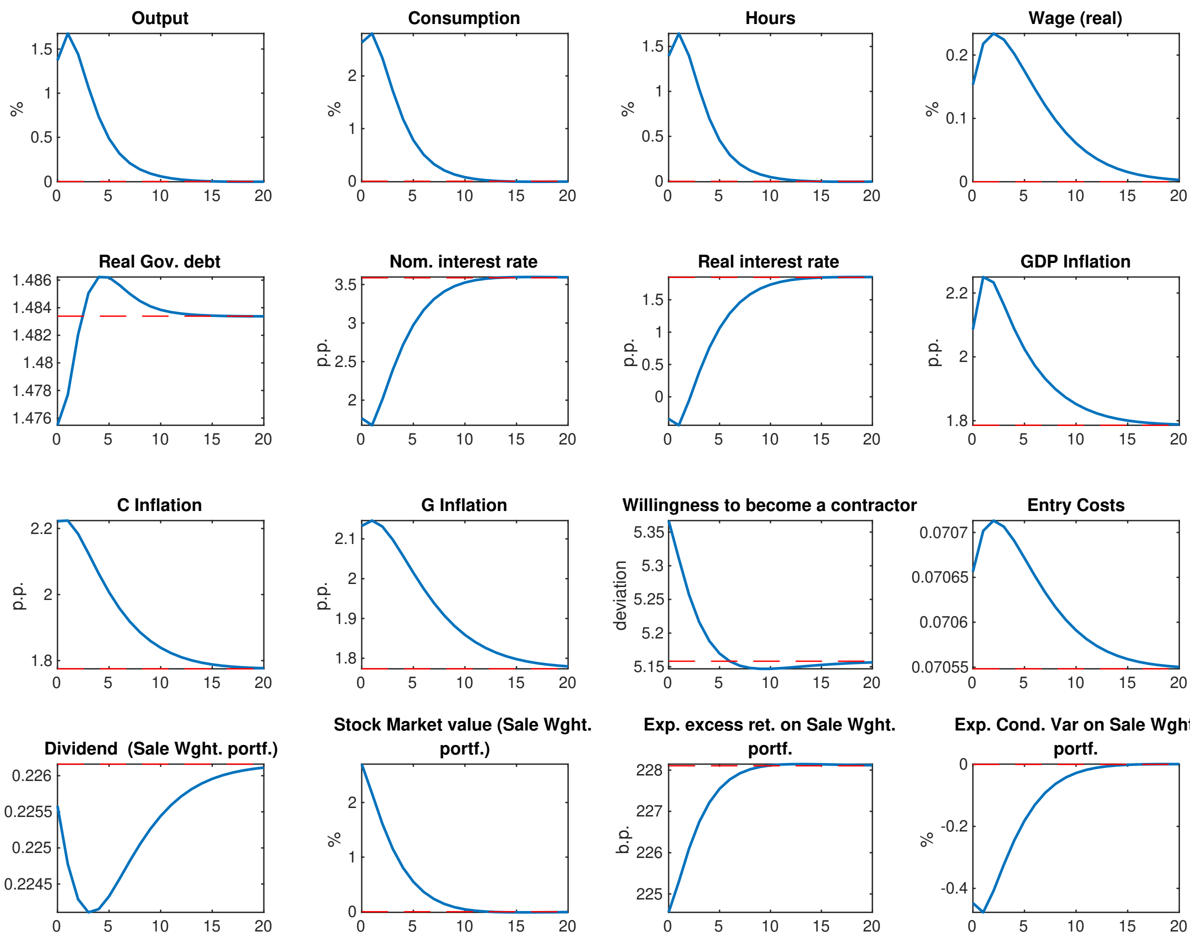


Figure I.4: Impulse responses to a monetary policy shock



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