Monetary Policy and Public Procurement

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Abstract

In this paper, I study the implications of public procurement for the transmission of monetary policy to asset prices and firm-level investment. I document that, among publicly-listed US companies, contracting with the government dampens the response of both stock returns and real investment to monetary policy shocks. I provide novel evidence suggesting that federal procurement is less responsive to monetary policy shocks than private sector demand, providing an additional channel of insurance to government contractors against the adverse effects of monetary policy on final demand. I find only limited evidence for a weaker credit channel among government contractors.

JEL Classification:
Keywords: Monetary Policy, Public Procurement, Credit Channel, Demand Composition

1 Introduction

Firms are at the center of the transmission of monetary and fiscal policy to the real economy. An extensive literature has, therefore, highlighted various dimensions of heterogeneity in firms' responsiveness to these policies and how such heterogeneity matters for their effect on macroeconomic aggregates like investment, employment, and output (Ottonello and Winberry, 2020; Cloyne et al., 2023; Casiraghi et al., 2021; Juarros, 2020).

Recent work has, furthermore, begun to emphasize the firm-level and macroeconomic implications of the disaggregated nature of government spending in form of public procurement. Namely, rather than spending one large amount of money on one single homogeneous good, governments invest and consume a wide variety of goods

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and services through millions of individual procurement contracts with private firms (Cox et al., 2020).

While the importance of firm heterogeneity – in particular with regards to firms' financial position – for the transmission of monetary and fiscal policy and the de facto disaggregated nature of government spending are, hence, well established, the extent to which government spending creates itself a margin of heterogeneity relevant for the transmission of monetary policy through firms has so far been largely unexplored.

In this paper, I, therefore, examine this link and study how contracting with the government affects firms' responsiveness to monetary policy along different dimensions of firm performance, including stock returns and physical investment.

Two main channels of monetary policy transmission to firms are the credit channel and the demand channel. While the former indirectly affects real outcomes through imperfections in financial markets that magnify the impact of monetary policy on a subset of borrowers, the latter operates directly through policy rates affecting the interest-sensitive portion of aggregate demand (Durante et al., 2022). From an individual firm's perspective, government spending to the private sector through public procurement can interact with both channels to shape its performance and factor demand decisions in response to monetary policy. While tighter monetary policy, for instance, generally hampers firms' access to external finance, the secure stream of cashflows from public procurement awards can improve a firm's borrowing conditions. In addition, firms' exposure to the demand channel is determined by the overall interest-rate elasticity of demand across its heterogeneous customer base. Differences in the interest-rate elasticity of demand between the private and public sector could, hence, imply a different exposure of firms to monetary policy through the demand channel. I test these hypothesis empirically, providing novel evidence on how public procurement interacts with the transmission of monetary policy.

To estimate the heterogeneous sensitivities between "procurement" and "non procurement" firms and test the hypotheses outlined above, I combine data from different sources. First, I use detailed information on federal procurement contracts awarded by the U.S. federal government to construct a new, forward-looking measure of firm exposure to government spending. Second, I obtain daily stock returns and quarterly balance sheet information for the universe of U.S. publicly listed companies to build my main outcome variables of interest, i.e. firms' stock returns and investment rates, as well as firm-level controls. My final sample covers the period from 2001q1 to 2019q4. To bridge the periods of conventional and unconventional monetary policy during my sample period, I use the monetary policy shocks constructed by Bu et al. (2021). I then study how public procurement affects firms' stock return and investment sensitivity to monetary policy using a panel event-study and a local projection approach à la Jordà (2005).

My main result is that firms which contract with the government are significantly

less sensitive to monetary policy shocks both in terms of their stock return and their investment in physical capital. Stock returns of government contractors fall by around one-fourth less than stock returns of other firms in response to a 1 percentage point surprise monetary policy tightening. Similarly, the response of investment is dampened by around one-tenth among government contractors compared to other firms. While previous literature has highlighted the benefits of public procurement for access to credit, I find only limited evidence for a weaker credit channel of monetary policy among government contractors. My results, however, are largely consistent with a reduced exposure of government contractors to the demand channel of monetary policy. Namely, I offer novel evidence suggesting that federal procurement is less sensitive to monetary policy than private consumption. A firm's customer base composition is, hence, an imporant determinant of its sensitivity to macroeconomic fluctuations and can provide firms with an additional channel of insurance against the adverse effects of monetary policy contractions through the demand channel.

Related Literature By focusing on public procurement as a source of heterogeneous exposure to monetary policy at the firm level, I contribute to both the growing literature on the importance of firm heterogeneity for the transmission of monetary policy and the literature focusing on the effect of public procurement on firm outcomes.

The literature has studied the importance of a wide range of dimensions of firm heterogeneity for the transmission of monetary policy to the real economy, with firms' financial position having received by far the most attention. In their seminal contribution, Gertler and Gilchrist (1994) focus on firm size to gauge the importance of financial propagation channels of monetary policy shocks. Along those same lines, more recent contributions include Crouzet and Mehrotra (2020), Ottonello and Winberry (2020), Cloyne et al. (2023), Jeenas (2019, 2018), Döttling and Ratnovski (2023) who further highlight the heterogeneity in firm responses to monetary policy shocks and the business cycle depending on various (balance sheet) characteristics, including leverage, distance-to-default, liquidity, size, age, and a firm's intangible capital ratio. Lakdawala and Moreland (2022) study the implications of firms' idiosyncratic uncertainty for the transmission of monetary policy and find that firms that face higher levels of uncertainty are less responsive to monetary policy shocks conistent with the real options effect of economic uncertainty. I contribute to this strand of literature by focusing on a previously unexplored source of firm heterogeneity that affects the transmission of monetary policy to firm outcomes, i.e. government spending.

At the same time, there is a fast-expanding body of research highlighting the beneficial effect of winning procurement contracts on different firm-level outcomes. Ferraz et al. (2015) and Lee (2021) exploit the institutional design of the procurement auction mechanism in Brazil and South Korea, respectively, and show that winning a procurement contract has positive effects on firm growth that extend beyond the dura-

tion of the contract. Budrys (2022) shows that there are valuable gains for contractors in terms of lower perceived uncertainty surrounding firms' prospects and reduced default probability. Cappelletti et al. (2022) show that winning a procurement contract increases firm survival probability in the market. Using a similar dataset as mine, Hebous and Zimmermann (2021) show that federal spending shocks on the firm-level increase firms tangible capital investment. Consistent with a financial accelerator channel they find that investment increases more among financially constrained firms. Along similar lines, di Giovanni et al. (2022) and Gabriel (2022) study the "credit channel of public procurement" in matched firm-bank data for Spain and Portugal, respectively. Both find evidence that winning a procurement contract improves firms' access to credit. A common finding in these papers is that winning a government contract is generally associated with better future performance. While this literature has mainly focused on the direct effects of winning a procurement contract, I highlight how government contracting can provide a cushion against the adverse effects of other macroeconomic policies, focusing on monetary policy in particular.

In this spirit, the paper closest to mine is Goldman (2020) who uses Compustat segment data to show that firms with significant exposure to government consumption performed better during the Great Financial Crisis (GFC).[1] My paper differs from the latter study in several ways. While Goldman (2020) focuses on the resilience of government contractors to severe macroeconomic downturns and its spillover effects to neighboring firms using the GFC as an event study, I focus on their regular exposure to monetary policy and how procurement shapes firms' responsiveness to monetary policy. Moreover, instead of relying on Compustat segment data, I exploit granular information on federal procurement contracts which allows me to study a larger set of firms at a higher frequency.

Outline The remainder of the paper is structured as follows. Section 2 describes the hypotheses that are studied in this paper in more detail. Section 3 describes the data used in the empirical analysis. Section 4 presents the main results and 5 discusses potential channels. Section 6 concludes.

2 Hypothesis Development

In this section, I detail the main hypotheses I examine in the remainder of the paper. Two of the main channels of monetary policy transmission are the credit channel and the demand channel. The credit channel affects real outcomes indirectly through imperfections in financial markets that magnify the impact of monetary policy on certain borrowers. The demand channel operates directly through policy rates affecting the

[1] By regulation, firms must disclose the identity of individual customers that account for more than 10% of their sales.

interest-sensitive components of aggregate demand. For a variety of reasons, firms are differently exposed to the two channels (Durante et al., 2022).

From the perspective of an individual firm, its exposure to monetary policy through the credit channel, on the one hand, depends on its financial position. If a firm's collateral value of assets is more sensitive to changes in monetary policy or a firm's overall financial position is poor, *ceteris paribus* the firm's exposure to monetary policy through the credit channel should be higher. Its exposure to the demand channel, on the other hand, depends on the overall demand elasticity of its heterogeneous customer base. A less interest-sensitive customer base implies a *ceteris paribus* lower exposure to the demand channel of monetary policy.

Government contracting interacts with both channels of monetary policy transmission. First, aside from the increase in revenues, the literature has recently highlighted the role of public procurement for easing firms' access to credit (di Giovanni et al., 2023; Gabriel, 2022; Hebous and Zimmermann, 2021). Namely, if a procurement contract is perceived as a secure future stream of cash flows, it can be used to improve a firm's access to credit, e.g. by expanding its cash-flow-based borrowing. Similarly, it could be that non-bank financial investors value the cashflow stability provided by procurement contracts and are, hence, less likely to rebalance their portfolio away from procurement firms in response to a monetary policy shock. One might, therefore, expect the credit channel of monetary policy transmission to be weaker among firms with the ability to borrow against the value of a government procurement award. Second, if public sector demand is less sensitive to monetary policy than private demand, firms which regularly sell part of their output to the government face a lower overall demand elasticity for their output and should, hence, be less affected by monetary policy through the demand channel.

Taken together these considerations give rise to the following hypotheses: (i) government contractors are less sensitive to monetary policy, (ii) the lower sensitivity is the result of a lower exposure to both the credit channel and the demand channel of monetary policy. I explore these hypotheses in sections 4 and 5.

3 Data

In this section, I describe the details of the data used in the empirical analysis. The sample covers the period from 2004Q4 to 2019Q4. This restriction is motivated by two reasons: first, detailed information on federal public procurement contracts is available from 2000Q4 onwards on `usaspending.gov`. Second, I want to exclude possible confounding effects of the recent Covid-19 period which saw severe public health measures significantly curbing private demand as well as unprecedented levels fiscal and

monetary support to households and firms.[2]

3.1 Federal Procurement Contracts

The main dataset for federal procurement contracts is usaspending.gov. usaspending.gov is a comprehensive database providing information about the universe of procurement contracts signed by the U.S. federal government. It has been created following the Federal Funding Accountability and Transparency Act of 2006 and contains detailed information about all federal obligations in form of grants, loans, financial assistance, and procurement awards. Information about procurement contracts is available for all fiscal years starting in 2001. For each contract, the available information includes the receiving entity as well as its parent company, the amount that was awarded, the awarding agency, and the procedure that was used to award the contract, i.e. whether the contract was awarded in a competitive bidding process or not. Cox et al. (2020) analyze the dataset in detail and report, amongst other things, that the contract data accounts for around 40% of federal government spending and around 3% of GDP.

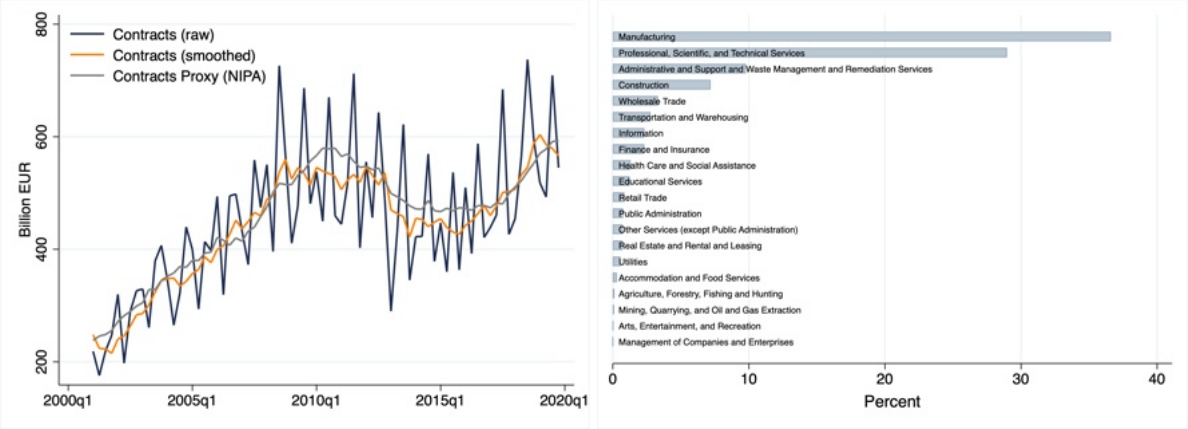
I make several modifications to the raw contracts data obtained from usaspending.gov. First, I exclude contracts with missing information on the "action date", i.e. the signing date of the contract or missing information on the recipient firm. Second, I exclude contracts for which the contract end date precedes the contract start or signing date or for which the contract start date precedes its signing date. Moreover, I exclude contracts with obvious mistakes in any of the dates, e.g. contract end year of 2901 instead of 2019. To account for such mistakes, I calculate the duration of each contract and exclude contracts for which the end date lies beyond the sample end date plus twice the 99.9^{th} percentile of the contract duration distribution.[3] At last, the database records both modifications to existing contracts which can consist of de-obligations, i.e. a downward revision in the obligated amount. I follow the literature, e.g. Muratori et al. (2023) and Auerbach et al. (2020), and exclude contracts for which the obligated amount and a following deobligation are within 0.5% of each other.

Prior to combining the contract data with firm-level information from Compustat, the procurement contracts database has a total of around 45.5 million contracts (on average ca. 2.18 million per year), amounting to a total of 3.14 trillion USD nominal spending (on average ca. 157 million USD per year). The data set contains 547,336 thousand unique recipient parent firms with an average of around 100,000 unique re-

[2] During the Covid-19 crisis there has also been a noticeable reallocation in government spending. In particular spending by the Department of Labor and the Small Business Administration increased from 49.5 bn USD (0.7% of total spending) and 1.7 bn USD (0.03% of total spending) in fiscal year 2019 to 600.9 bn USD (6.6 % of total spending) and 590.2 bn USD (6.5% of total spending) in fiscal year 2020 through various federal Covid-19 relief packages.

[3] The median duration of contracts in the sample is one year. The 99.9^{th} percentile corresponds to a contract with a length of nine years.

cipients per year. Figure 1 show total federal procurement spending covered in my sample over time as well as across NAICS 2-digit industries. Cox et al. (2020) show that the procurement contracts correspond closely to the national account items federal government intermediate consumption of goods and services plus gross investment in equipment, structures, and software. In Figure 1a I plot federal spending aggregated from the individual award level and confirm that the awards data aligns well with the national accounts over my sample period.



(a) Aggregate Procurement Spending (b) Procurement by Industry

Figure 1: Procurement in the U.S.

Notes — Panel (a) shows the total value of procurement awards aggregated to quarterly frequency. It shows in blue the raw data and in grey a 4-quarter moving average. The contract proxy constructed from national accounts data following Cox et al. (2020) is shown in orange. Panel (b) shows the distribution of contract spending across NAICS 2-digit industries.

In line with Cox et al. (2020), in terms of the distribution across industries, the major part of government spending is accounted for by three 2-digit NAICS sectors: manufacturing (NAICS 2-digit code 33), professional, scientific, and technical services (NAICS 2-digit code 54), and administrative support and waste management (NAICS 2-digit code 56).

3.2 Monetary Policy Suprises

To construct exogenous changes in monetary policy, I follow the literature on the high-frequency identification of monetary policy surprises pioneered by Kuttner (2001). Exploiting high-frequency movement in market prices in a narrow window around Federal Open Market Committee (FOMC) announcements ensures that the monetary policy surprises are uncorrelated with the state of the economy and macroeconomic conditions. In a tight window around FOMC announcements, changes in the expectations about monetary policy should mainly reflect new information released during the FOMC announcement that were unanticipated prior to the announcement.

Table 1: Summary Statistics: Monetary Policy Surprises

	Mean	Median	Std.dev.	Min	Max	Obs.
MP Surprises	-0.004	-0.005	0.047	-0.189	0.186	152
Contractionary MP Surprises	0.034	0.028	0.032	0.000	0.186	69
Expansionary MP Surprises	-0.035	-0.029	0.031	-0.189	-0.001	83

Notes — Summary statistics of monetary policy surprises of Bu et al. (2021) for the period 01/01/2001 to 31/12/2019 expressed in percentage points.

To capture monetary policy surprises across the pre-GFC and post-GFC period, I use the monetary policy shocks constructed by Bu et al. (2021), henceforth BRW. The BRW shocks are particularly suitable for my analysis since they (i) span the periods of both conventional and unconventional monetary policy in a stable manner, (ii) are largely unpredictable from available information, and (iii) contain no central bank information effects.[4] BRW construct the monetary policy shocks using a two-step procedure of the Fama and MacBeth (1973) type. First, they estimate the sensitivity of interest rates at 1- to 30-year maturities to monetary policy announcements, similar to the asset beta in the original Fama-MacBeth method. In the second step, all outcome variables are regressed on their corresponding estimated sensitivity from the first step for each time t (see, Di Giovanni and Rogers, 2023). Table 1 provide summary statistics of the monetary policy suprises across the 152 scheduled FOMC announcements over my sample period.

3.3 Firm-level Balance Sheet and Stock Price Data

Balance sheet variables I obtain firm-level investment and control variables from quarterly financial statements of US publicly listed companies in the CRSP-Compustat merged database. Compustat offers two major advantages over other firm-level data sources that are important for my study. First, it is available quarterly, a frequency high enough to study monetary policy. And second, it is a long panel, allowing us to use within firm variation. The main disadvantage of Compustat is that it contains information on publicly listed companies only. Hence, my sample does not cover private companies for which procurement contracts likely account for a larger share of total sales and which could be subject to more severe financial frictions.

Following the literature, I exclude financial firms (SIC codes: 4900-4999) and firms

[4]Recent studies emphasize the presence of an "information effect" in the monetary policy surprises constructed using such high-frequency movements in interest rates around monetary policy announcements (Jarociński and Karadi (2020); Miranda-Agrippino and Ricco (2021); Nakamura and Steinsson (2018); Bauer and Swanson (2023)). That is, the movement of interest rates around monetary policy announcements might not be driven by the interest rate decision alone but also by the central bank's communication about its assessment of future economic conditions.

Table 2: Summary Statistics

	Full Sample		Non-Procurement		Procurement	
	Mean	SD	Mean	SD	Mean	SD
Investment Ratio	0.076	0.094	0.079	0.103	0.068	0.073
Log Real Total Assets	6.012	2.088	5.657	1.980	6.810	2.102
Log Age	3.131	0.796	3.011	0.789	3.402	0.743
Leverage Ratio	0.221	0.230	0.220	0.240	0.223	0.207
Liquidity Ratio	0.231	0.254	0.254	0.273	0.179	0.195
Tobin's Q	2.106	1.677	2.158	1.794	1.991	1.377
Cashflow	0.006	0.073	-0.002	0.082	0.023	0.046
Real Sales Growth	0.131	0.608	0.149	0.686	0.093	0.400
Observations	254,497		176,477		78,020	

Notes — All balance sheet ratios are winsorized at the 1^{st} and 99^{th} percentile. "Non-Procurement" firms are defined as firms who have currently no income receiveable from procurement contracts. "Procurement" firms are firms with a positive amount of income receivable from procurement contracts. The sample covers the period from 2000q4 to 2019q4.

in the utilities (SIC codes: 6000-6999) and government (SIC codes: 9000 and above) sectors. I interpolate single missing values and drop observations with erroneous entries for all variables relevant for the construction of firm-level level outcome and control variables. I winsorize all constructed balance-sheet ratios at the 1^{st} and 99^{th} percentile.[5]

A firm's tangible investment and its capital stock are reported directly in firm financial statements as capital expenditure (capxy) and property, plant, equipment (ppentq), respectively. Variables ending in "-y" are recorded on a year-to-date basis. I obtain a corresponding quarterly measure by first-differencing within a fiscal year. In line with the previous literature, e.g. Döttling and Ratnovski (2023), Cloyne et al. (2023), Hebous and Zimmermann (2021), I construct my main outcome variable of interest, the investment rate, as quarterly capital expenditure over the lagged total capital stock, $I_t = \left(\frac{\text{capxq}_t}{\text{ppentq}_{t-1}}\right)$. In Table 2, I present summary statistics of all variables, both in the full sample of firms and separately for "procurement firms" and "non-procurement firms". "Procurement firms" are on average slightly larger, older, more highly levered and less liquid. The existing literature reviewed above has studied the role of these firm characteristics for the investment response to monetary policy. I control for the potentially confounding impact of these different characteristics in my analyses below.

Stock prices To study the stock price response of firms around *scheduled* FOMC announcement days, I, furthermore, obtain daily firm-level stock returns from the Centre of Research in Security Prices (CRSP). I consider only common shares trading on an U.S. exchange. The final sample contains around 6900 unique firms in total and on average approximately 2900 unique firms at each FOMC date. Aside from raw returns, I also obtain cumulative returns (CRet) and cumulative abnormal returns (CAR) for

[5]See Appendix A for variable definitions.

Table 3: Summary Statistics: Stock Returns

	Mean	Median	SD
Raw Return	0.327	0.031	5.540
Cumulative Return	0.331	0.026	8.266
Cumulative Abnormal Return	-0.020	-0.170	8.074
Observations	439,369	435,322	435,322

Notes — Summary statistics of stock returns around scheduled FOMC meetings in the period 01/01/2001 to 31/12/2019 expressed in percentage points.

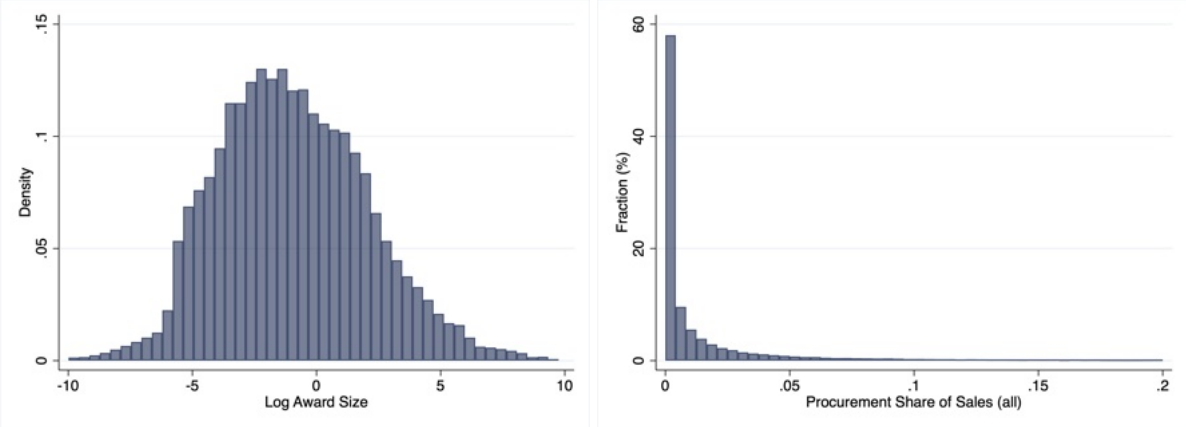
all firms in CRSP between one day prior and one day after each scheduled FOMC announcement between 1 January 2001 and 31 December 2019 from the WRDS Event Study Tool. CARs are calculated with betas estimated by a standard CAPM model over a 100-day window ending 7 days prior to the event date. Hence, compared to normal returns, a firm's CAR is defined relative to its expected return, accounting for a firm's stock volatility and its exposure to the macroeconomic environment. Using a window around FOMC announcements allows me to also capture the pre-FOMC announcement drift in equity prices highlighted in the literature (Lucca and Moench, 2015). Table 3 contains summary statistics for the returns.

3.4 Merging Procurement Contracts with Compustat

The federal procurement contract database `usaspending.gov` uses the Dun & Bradstreet (DUNS) number to identify recipient firms as well as their parent companies. In order to merge the procurement contracts to Compustat firm-level information, I first sum over the amount of all awards a firm receives in a given quarter. I then use a linking table constructed from S&P Capital IQ's Business Entity Cross Reference Service (BECRS) to match firms DUNS number to their GVKEY in Compustat. The BECRS provides the possibility to cross-reference entities using standardized and S&P proprietary identifiers. Finally, I cross check my linking table with the one constructed by Hebous and Zimmermann (2021) and complement my matches with their links.[6] The matched sample covers a total of 7,788 firms of which 1,747 (2,672) have received at least once a competitively awarded (any) contract. The sample covers on average around 43% of annual procurement spending. Figure 2a graphs the distribution of contract values across firms.

I construct two main indicators of the exposure to public procurement at the firm-quarter level: First, I construct the procurement share of sales at the firm level as the total future receivables from procurement contracts as of quarter t as a fraction of lagged

[6] Hebous and Zimmermann (2021) construct a linking table between the company's DUNS number and its ticker via Bureau van Dijk's ORBIS and Osiris databases.



(a) Distribution of Log Award Size (b) Distribution of Procurement Share

Figure 2: Procurement in the U.S.

Notes — Panel (a) shows the distribution of procurement spending across firm-quarter combinations. Panel (b) shows the distribution of the procurement share, $g^{\text{all}}_{i,t}$, across firms-quarter combinations.

total sales:

$$g^{j}_{i,t} = \frac{\text{Outstanding Procurement Award Receivables}^{j}_{t}}{\text{Sales}_{t-1}}$$

Second, I construct a dummy variable, taking the value one if the firm has a positive amount of procurement receivables outstanding as of quarter t, i.e.

$$\mathbb{D}^{j}_{i,t} = \begin{cases} 1 & \text{if} \quad g^{j}_{i,t} > 0 \\ 0 & \text{if} \quad g^{j}_{i,t} = 0 \end{cases}$$

I define each of the two measures for both *all* contracts, $j = \{\text{all}\}$, and *competitively-awarded* contracts only, $j = \{\text{c}\}$.

The contracts data only provides the total amount obligated through the contract at the time the contract is signed. To construct my procurement measures at the firm level, I, therefore, assume that the total contract amount is disbursed uniformly over the duration of the contract.[7] Figure 2b shows the distribution of the procurement share for all contracts, $g^{\text{all}}_{i,t}$ across firms in the merged sample. The distribution is heavily right-skewed with most firms having procurement award receivables accounting only for a small fraction of their total sales. The distribution is similarly skewed for competitive awards only, $g^{\text{c}}_{i,t}$. Table 4 shows summary statistics of the procurement share for all firms and firms with a positive amount of procurement receivables, i.e. $\mathbb{D}^{j}_{i,t} = 1$.

[7] A contract with a total amount of 1 mn USD and a duration of 5 years, is, hence, assumed to pay 50,000 USD each quarter over the five years.

Table 4: Summary Statistics

	All Firms			Firms w/ $\mathbb{D}^j_{i,t} = 1$		
	Mean	SD	Obs.	Mean	SD	Obs.
All Awards						
Procurement Share ($g^{\text{all}}_{i,t}$)	0.031	0.164	254,524	0.100	0.284	78,021
Competitive Awards						
Procurement Share ($g^{\text{c}}_{i,t}$)	0.008	0.048	254,524	0.046	0.109	44,042

Notes — The table shows summary statistics of the procurement share for all firms and firms with a positive amount of procurement receivables, i.e. $\mathbb{D}^j_{i,t} = 1$.

4 Monetary Policy and Public Procurement

In this section, explore the heterogeneous impact of monetary policy across "procurement firms" and "non-procurement" firms. To this end, I, first, estimate the impact of monetary policy on firms' stock prices using event-study panel regressions as in Patozi (2023) or Döttling and Ratnovski (2023). I then examine the heterogeneity in the dynamic effects of monetary policy on real outcomes at the firm-level by employing a panel local projections approach (Jordà, 2005). This methodology has been widely applied to study the heterogeneous transmission of monetary policy across firms, e.g. by Ottonello and Winberry (2020), Cloyne et al. (2023), Döttling and Ratnovski (2023) or Lakdawala and Moreland (2022). In the context of public procurement, it has recently been applied by Hebous and Zimmermann (2021) or Gabriel (2022).

4.1 Stock Price Response to Monetary Policy Shocks

Stock returns provide a useful first metric for analysing the heterogeneous effects of monetary policy on firms as they reflect future cash flows and succinctly summarize the investors' assessment of a firm's future earnings and growth prospects, including slower-moving variables like firm capital investment which are studied below. Moreover, their availability at a high frequency facilitates the identification of the effects of monetary policy since the frequency of the outcome variable and the monetary policy shock are more closely aligned. I, hence, do not have to aggregate monetary policy suprises to a lower-frequency, potentially introducing time aggregation bias. (Rigobon and Sack, 2003) argue that equity markets are an important determinant of monetary policy through their effect on macroeconomic aggregates like consumption. At lower frequencies at which FOMC decisions may be influenced by equity market movements, there is, hence, an endogeneity issue in identifiying the effect of monetary policy on stock returns. No such endogeneity concerns exist at daily frequency.

Empirical Strategy To assess the stock price response of firms around FOMC announcements, I collect daily stock return information for all firms in the CRSP-Compustat merged database around all *scheduled* FOMC announcements between 1 January 2001 and 31 December 2019.

In my empirical analysis, I use three different measures of firms' stock returns: First, I consider the raw return of a firm's stock at the FOMC announcement date. Second, I consider cumulative returns bracketing one day prior to one day after the announcement dates. And third, I consider cumulative abnormal returns (CAR) within the same window estimated as described in section 3.

To study whether stock prices of "procurement firms" react differently to monetary policy announcements, I introduce an interaction term of the monetary policy shock with the procurement dummy variable, $\mathbb{D}_t^j$, defined above (see Section 3.4). While the focus of my analysis is on federal purchases on the firm-level in general, it is possible that, in particular in view of the credit channel, the effect is stronger for competitively awarded awards which might provide a stronger signal to lenders about the quality of the firm. I, therefore, separately report the results based on competitive awards only.

I estimate the following regression

$$y_{i,t} = \alpha_i + \eta_{j,t} + \psi_{fq} + \beta_1 \varepsilon_t^m + \beta_2 \mathbb{D}_{t-1}^j + \beta_3 (\varepsilon_t^m \times \mathbb{D}_{t-1}^j) + \Phi'(\varepsilon_t^m \times X_{i,t-1}) + \Gamma' X_{i,t-1} + e_{i,t} \quad (1)$$

where $y_{i,t}$ refers to firm i's (cumulative) stock return on (around) the announcement day t and ε_t^m is the BRW monetary policy suprise on the announcement day. As defined above, $\mathbb{D}_{t-1}^j$ is a dummy variable taking the value one if the firm currently has an active procurement contract. $X_{i,t-1}$ is a vector of other time-varying firm characteristics and includes firm size (log real assets), age, leverage ratio, liquidity ratio, Tobin's Q, cashflows, and sales growth.[8] The procurement dummy and all control variables are lagged by one quarter. To ensure that any differences between "procurement firms" and "non-procurement firms" are not driven by any of these other firm characteristics, I additionally control for their interaction with the monetary policy surprise. α_i, $\eta_{j,t}$, and ψ_{fq} are firm fixed effects, industry $\times$ event date fixed effects and firm fiscal quarter fixed effects, respectively. I include the industry $\times$ event date fixed effects to absorb any unobserved differences across industries at the announcement date.

Results Column (1) of Table 5 shows the average effect, β_1 of a reduced version of equation (1) excluding any interaction terms. It documents that a contractionary monetary policy shock of 100 basis points decreases stock returns by 8% on average across all firms.

Columns (2) to (4) show that the stock return of firms that currently have an outstanding procurement contract falls two percentage points less on an FOMC announcement date. This effect is statistically significant and is robust to considering cumulative

[8] See Appendix A for details on the construction of all variables.

(abnormal) returns which account for a firm's systematic risk compared to the broader market. Columns (5) to (7) show that this result is, furthermore, robust to focusing only on firms that have a competitively awarded outstanding procurement contract.

Table 5: Stock Price Response to Monetary Policy

		All Awards			Only Competitive Awards		
	(1) Ret	(2) Ret	(3) CRet	(4) CAR	(5) Ret	(6) CRet	(7) CAR
ε_t^m	-7.123**						
	(3.013)						
$\varepsilon_t^m \times$ L.$\mathbb{D}_i^{\text{all}}$		1.777#	3.770**	2.910+			
		(1.266)	(1.834)	(1.804)			
L.$\mathbb{D}_i^{\text{all}}$		0.002	0.007	0.015			
		(0.027)	(0.052)	(0.050)			
$\varepsilon_t^m \times$ L.$\mathbb{D}_i^{\text{c}}$					1.855*	4.260**	3.076*
					(1.071)	(1.821)	(1.745)
L.$\mathbb{D}_i^{\text{c}}$					0.042+	0.077+	0.057
					(0.026)	(0.048)	(0.046)
$\varepsilon_t^m \times$ L.Log Real Assets		-0.192	-1.278*	0.687#	-0.201	-1.317*	0.670#
		(0.428)	(0.711)	(0.475)	(0.440)	(0.715)	(0.480)
$\varepsilon_t^m \times$ L.Leverage Ratio		-3.515+	-4.845*	-2.574	-3.456+	-4.688+	-2.477
		(2.345)	(2.913)	(3.256)	(2.339)	(2.908)	(3.251)
$\varepsilon_t^m \times$ L.Log Age		-0.519	0.289	-0.508	-0.489	0.335	-0.461
		(0.501)	(0.813)	(0.786)	(0.475)	(0.798)	(0.761)
$\varepsilon_t^m \times$ L.Tobin's Q		-0.007	0.347	1.021***	0.005	0.371	1.042***
		(0.252)	(0.424)	(0.367)	(0.251)	(0.429)	(0.372)
$\varepsilon_t^m \times$ L.Liquidity Ratio		3.703#	4.470	6.004+	3.714#	4.543	6.028+
		(2.814)	(3.868)	(3.895)	(2.791)	(3.871)	(3.884)
$\varepsilon_t^m \times$ L.Cashflow		37.410+	43.234+	44.103#	37.659+	43.887+	44.530#
		(25.745)	(29.748)	(31.751)	(25.813)	(29.936)	(31.915)
$\varepsilon_t^m \times$ L.Sales Growth		0.387	-0.736	-0.372	0.382	-0.747	-0.380
		(0.669)	(0.817)	(0.957)	(0.667)	(0.815)	(0.957)
Constant	2.667***	1.299***	3.188***	1.631**	1.305***	3.198***	1.637**
	(0.971)	(0.356)	(0.661)	(0.684)	(0.356)	(0.661)	(0.684)
Observations	361,969	361,870	361,543	361,543	361,870	361,543	361,543
R-squared	0.047	0.105	0.144	0.063	0.105	0.144	0.063
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry $\times$ Event FE	No	Yes	Yes	Yes	Yes	Yes	Yes

Notes — The dependent variable is the stock return on (around) the FOMC announcement day.The sample covers 152 scheduled FOMC announcements between 1 January 2001 and 31 December 2019. Firm-level control variables are log real assets, log age, leverage ratio, liquidity ratio, Tobin's Q, real sales growth, and cashflow. ε^m the BRW monetary policy shock (in percent). "Return" refers to the raw stock return. "CAR" refers to the cumulative abnormal return with betas estimated with a standard CAPM model over a 100-day window ending 7 days prior to the event date. The regression coefficients of controls variables are not shown here for brevity. The numbers in parenthesis are standard errors clustered at the event level. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$, + for $p < 0.15$, # for $p < 0.2$).

To shed further light onto the intensive margin of procurement use, I focus on firms with a positive procurement share of sales and split those firms into high- and low-

procurement firms based on the median of their procurement share of sales in every quarter t. Table 6 shows that the effect of monetary policy on stock returns in weaker among "high-procurement" firms, both in terms of raw returns and CARs.

Table 6: Stock Price Response to Monetary Policy: Sample Split

	Incl. Non-competitive awards				Only competitive awards			
	Low Procurement		High Procurement		Low Procurement		High Procurement	
	Ret	CAR	Ret	CAR	Ret	CAR	Ret	CAR
ε^m	-7.263**	-2.225+	-6.228**	-0.814	-6.734**	-0.226	-6.185*	-0.968
	(3.41)	(1.51)	(3.05)	(1.04)	(3.37)	(1.04)	(3.17)	(1.09)
Constant	4.227***	1.482+	2.859**	1.134	3.937***	0.617	3.058**	1.786
	(1.29)	(0.98)	(1.19)	(1.04)	(1.47)	(1.10)	(1.31)	(1.43)
Observations	63,072	63,030	63,620	63,571	36,324	36,295	36,486	36,466
R-squared	0.063	0.050	0.050	0.035	0.074	0.055	0.050	0.034
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes — The dependent variable is the stock return on the FOMC announcement day. The sample covers 152 scheduled FOMC announcements between 1 January 2001 and 31 December 2019. Firm-level control variables are log real assets, log age, leverage ratio, liquidity ratio, Tobin's Q, real sales growth, and cashflow. ε^m the BRW monetary policy shock (in percent). "Return" refers to the raw stock return. "CAR" refers to the cumulative abnormal return with betas estimated with a standard CAPM model over a 100-day window ending 7 days prior to the event date. The regression coefficients of controls variables are not shown here for brevity. The numbers in parenthesis are standard errors clustered at the event level. The asterisks denote statistical significance (*** for p < 0.01, ** for p < 0.05, * for p < 0.1).

Robustness Exercises To explore the sensitivity of the previous results, I conduct two further analyses.

First, I follow Patozi (2023), and take a cross-sectional average of stock returns at FOMC date across firms with and without outstanding procurement awards receivables in the quarter preceeding the FOMC announcement, i.e. $\mathbb{D}^{\text{all}}_{i,t-1} = 0$ and $\mathbb{D}^{\text{all}}_{i,t-1} = 1$. That is, I construct two different equally-weighted portfolios consisting of "procurement-" and "non-procurement firms", respectively. I then run an OLS regression for each portfolio on the BRW monetary policy shock and risk factors of standard equilibrium models of stock returns to examine the impact of monetary policy surprises on portfolio returns. I use the Fama-French 5 Factor model which relates equity returns to a market factor, a size factor, a value factor, a profitability factor, and an investment factor.[9] I, furthermore, construct a portfolio that goes long in "procurement firms'" ($\mathbb{D}^{\text{all}}_{i,t-1} = 1$) and short in "non-procurement firms" ($\mathbb{D}^{\text{all}}_{i,t-1} = 0$). The results from the portfolio analysis are reported in Table 7. Consistent with the differential response of stock returns in Table 5, the "Procurement-minus-Non-Procurement"

[9]I obtain the pricing factors from Kenneth French's website: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

portfolio yields significant returns during periods of contractionary monetary policy surprises.[10]

Table 7: Stock Price Response to Monetary Policy: Asset Pricing Test

	Non-Procurement $\mathbb{D}^{all}_{i,t-1} = 0$	Procurement $\mathbb{D}^{all}_{i,t-1} = 1$	Long-Short Strategy $(\mathbb{D}^{all}_{i,t-1} = 1)$ - $(\mathbb{D}^{all}_{i,t-1} = 0)$
ε^m_t	-2.817***	-0.849*	1.968**
	(0.981)	(0.465)	(0.793)
(mkt - rf)	0.750***	0.894***	0.145***
	(0.030)	(0.020)	(0.024)
smb	0.815***	0.625***	-0.190***
	(0.066)	(0.040)	(0.046)
hml	0.092	-0.008	-0.100
	(0.106)	(0.041)	(0.095)
rmw	-0.266***	-0.162**	0.104**
	(0.087)	(0.071)	(0.044)
cma	-0.112	0.138*	0.250***
	(0.134)	(0.075)	(0.087)
Constant	0.054**	0.039**	-0.014
	(0.023)	(0.018)	(0.019)
Observations	152	152	152
R-squared	0.945	0.973	0.329

Notes — The numbers in parenthesis are standard errors clustered at the event level. The asterisks denote statistical significance (*** for p < 0.01, ** for p < 0.05, * for p < 0.1).

Second, a concern might be that "procurement" firms being inherently different from "non-procurement" firms. While I make use of an extensive set of controls and fixed effects to account for differences across firms, I additionally apply a propensity score matching (PSM) strategy similar to Hebous and Zimmermann (2021) to match each "procurement firm" with its closest "non-procurement firm" to construct a coherent control group. Specifically, I match firms that have a current outstanding procurement contract in the quarter preceeding the FOMC announcement with a firm that does not have an outstanding contract but has ex-ante a similar probability of having one based on its observable characteristics. I match firms based on their propensity score. I use the same firm characteristics as before to estimate each firm's propensity score and additionally require firms to be in the same industry. Figure 7 in Appendix B.2 shows the distribution of propensity scores of "procurement", i.e. treated, vs. "non-procurement", i.e. untreated, firms for both all contracts (Figure 7a) and for competitively awarded contracts only (Figure 7b). The overlapping distributions suggest that good matches among firms can be found.

[10] In Appendix B I show that this strategy also yields significant returns when focusing only on competitively awarded contracts.

Table 8 presents the results of this matching strategy based on both all awards and competitive awards only. While slightly less significant, the baseline results are largely unchanged: stock returns of "procurement firms" are less responsive to monetary policy surprises.

Table 8: Stock Price Response to Monetary Policy: Propensity Score Matching

	Incl. Non-Competitive Contracts			Only Competitive Contracts		
	Ret	CRet	CAR	Ret	CRet	CAR
$\varepsilon_t^m \times \text{L.}\mathbb{D}_i^{\text{all}}$	1.651#	3.618*	3.139*			
	(1.203)	(2.028)	(1.799)			
$\text{L.}\mathbb{D}_i^{\text{all}}$	0.014	-0.060	-0.019			
	(0.041)	(0.064)	(0.063)			
$\varepsilon_t^m \times \text{L.}\mathbb{D}_i^{\text{c}}$				1.071	2.924*	2.648*
				(0.920)	(1.645)	(1.542)
$\text{L.}\mathbb{D}_i^{\text{c}}$				0.034	0.008	0.013
				(0.037)	(0.060)	(0.060)
Constant	0.352***	0.416***	0.030	0.377***	0.415***	0.049+
	(0.022)	(0.033)	(0.032)	(0.019)	(0.030)	(0.030)
Observations	155,533	155,416	155,416	110,666	110,594	110,594
R-squared	0.143	0.169	0.076	0.223	0.240	0.099
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Event FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes — The numbers in parenthesis are standard errors clustered at the event level. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$, + for $p < 0.15$, # for $p < 0.2$).

Summary So far, I have provided novel evidence that the short-run effects of monetary policy on stock market outcomes are less pronounced among government contractors. A one percentage point contractionary monetary policy shock depresses stock returns by about one-fourth less among firms with current outstanding receivable income from procurement contracts. Stock returns are a useful first pass to study the effect of monetary policy on firms as they summarize a host of information about the firm and equity investors' forward-looking assessment of a firm's earnings potential. It is, however, possible that these results reflect only short-run reactions of equity prices without generating lasting effects on other firm outcomes. The next section, therefore, studies slower-moving, lower-frequency firm outcomes, focusing specifically on firms' physical capital investment responsiveness to monetary policy shocks.

4.2 Investment Response to Monetary Policy Shocks

In this section, I turn to the investment response of firms to monetary policy in quarterly firm-level data. I, first, document the average response of firm tangible capital investment to monetary policy shocks. I then focus on the cross-sectional heterogeneity in terms of firm's exposure to public procurement.

Empirical Strategy. To estimate the dynamic impact of monetary policy shocks on firm investment, I use a panel local projections approach following Jordà (2005). Opposed to stock prices, firm-level investment is rather slow-moving and measured only at quarterly frequency in Compustat. As is common in the literature, I, therefore, cumulate the high-frequency surprises by Bu et al. (2021) to quarterly frequency. Similar to Döttling and Ratnovski (2023) I use the cumulative shock series as a level measure of monetary policy surprises and control for key macroeconomic variables in the regression. The main outcome variable of interest is the tangible capital investment rate, defined as $I_{i,t} = \frac{\text{capxq}_{i,t}}{\text{ppentq}_{i,t-1}}$.

Average Effect. I, first, documemt the average effect of monetary policy shocks on firm investment, abstracting away from differences across firms. That is, for each horizon h, I estimate the regression:

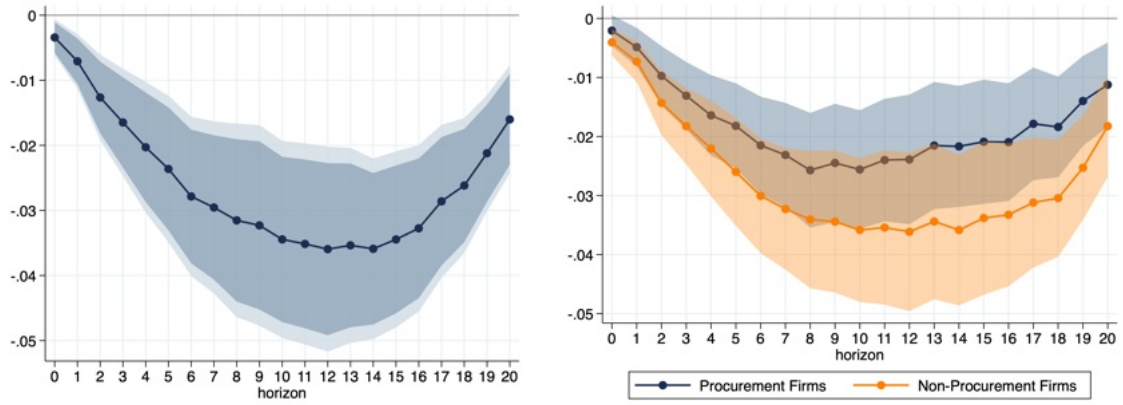
$$\Delta y_{i,t+h} = \alpha_i + \delta_{fq} + \beta^h \varepsilon_t^m + \gamma_1^h X_{t-1}^m + \gamma_2^h X_{i,t-1}^f + e_{i,t} \tag{2}$$

where $\Delta y_{i,t+h} = y_{i,t+h} - y_{i,t-1}$ is the cumulative change of the log investment rate over h quarters ahead. ε_t^m is the cumulative BRW monetary policy shock. I scale the monetary policy shock series so that a unit increase in ε_t^m is equivalent to a 25 basis point increase in the 2-year Treasury rate. α_i and δ_{fq} are firm and fiscal-quarter fixed effects, respectively. Note, that I cannot include time fixed effects in this regression as it would absorb the aggregate monetary policy shock. X_{t-1}^f are one-quarter lagged firm-level controls, including, as before, size, age, leverage, liquidity, real sales growth, cash flow, and Tobin's Q. X_{t-1}^m are lagged macro controls, including CPI growth, real GDP growth, and the excess bond premium of Favara et al. (2016).

Figure 3a shows that a monetary policy shock equivalent to a 25 bp increase in the 2-year Treasury rate significantly decreases the average investment ratio across firms with a trough of 3.5% around two and half years following the shock. The magnitude of this effect is in line with the investment responsiveness reported in Döttling and Ratnovski (2023). The effect weakens thereafter but remains significant until the end of the forecast horizon.

In Figure 3b I split the sample into firms that currently have a procurement contract and those that do not. I then re-estimate equation (2) for each group separately. The Figure shows that the impact of monetary policy on firm investment is on average

around one percentage point weaker among procurment firms consistent with their stock return response.



(a) Baseline Effect (β^h)

(b) Split Sample by $\mathbb{D}^{\text{all}}_{i,t-1}$

Figure 3: Investment Response to Monetary Policy

Notes — Panel (a) shows the average effect of a contractionary monetary policy shock on firm investment rates estimated as in equation (2). The dark (light) shaded areas indicate 90% (95%) confidence bands. Panel (b) shows the average effect of a monetary policy shock on "procurement firms" and "non-procurement" firms separately. "Procurement firms" are defined as firms with current outstanding receivables from procurement contracts, $\mathbb{D}^{\text{all}}_{i,t-1} = 1$. The blue and orange shaded areas are 90% confidence bands. The sample covers the period from 2004q4 to 2019q4. Standard errors are two-way clustered at the firm and quarter level.

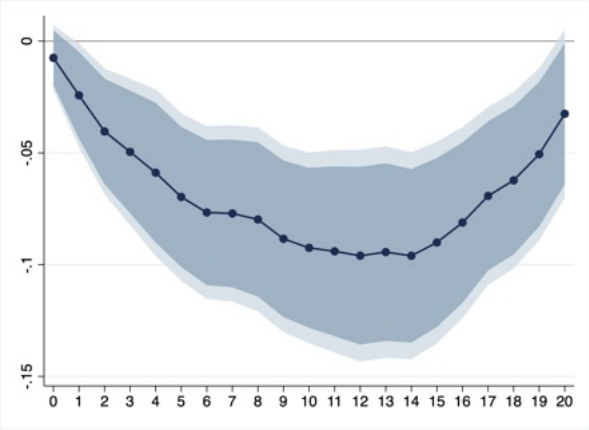
Interaction Effect. To ensure that the effect in the two subsamples is not confounded by other firm characteristics, I enrich equation (2) with interaction terms between the monetary policy shock and all firm characteristics, including the procurement measure. I also control for the differences in the cyclicality of "procurement-" and "non-procurement firms" by including an interaction term between real GDP growth and the procurement dummy. The estimated equation is, hence, given by

$$\Delta y_{i,t+h} = \alpha_i + \delta_{fq} + \beta_1^h \varepsilon_t^m + \beta_2^h \mathbb{D}^{\text{all}}_{i,t-1} + \beta_3^h (\varepsilon_t^m \times \mathbb{D}^{\text{all}}_{i,t-1}) + \gamma_1^h (\varepsilon_t^m \times X^f_{i,t-1}) + \gamma_2^h (\Delta Y_{t-1} \times \mathbb{D}^{\text{all}}_{i,t-1}) + \gamma_3^h \Delta Y_{t-1} + \gamma_4^h X^f_{i,t-1} + \gamma_5^h X^m_{t-1} + e_{i,t} \quad (3)$$

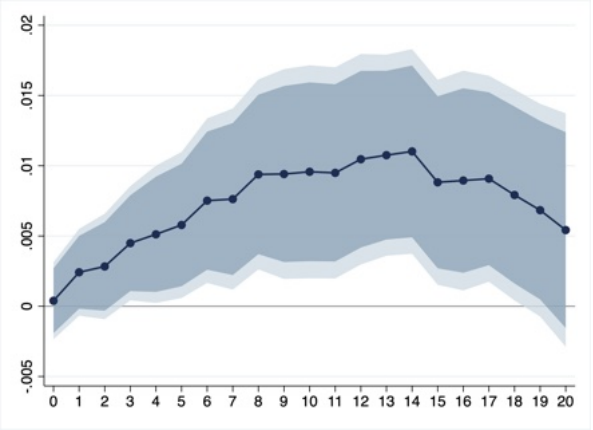
where $\Delta y_{i,t+h} = y_{i,t+h} - y_{i,t-1}$ is the cumulative change of the log investment rate and ΔY_{t-1} is the growth rate of real GDP. All other variables are defined as above. Hence, $\{\beta_1\}_0^h$ is the impulse response function (IRF) of investment in response to monetary policy for firms without any outstanding procurement contract, $\mathbb{D}^{\text{all}}_{i,t-1} = 0$, and $\{\beta_1 + \beta_3\}_0^h$ is the IRF for firms with current procurement receivables, $\mathbb{D}^{\text{all}}_{i,t-1} = 1$.

As can be seen from Figure 4b, procurement firms are statistically significantly less responsive to monetary policy shocks. The attenuating effect of procurement is

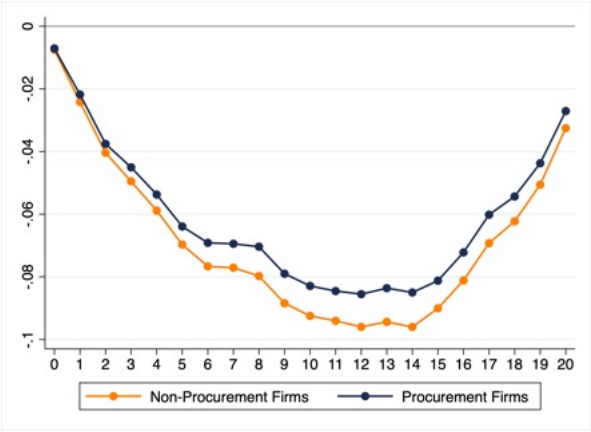
strongest at the medium-term horizon at which "procurement firms" have a one percentage points weaker decline in their investment rate. This result confirms that the weaker investment response of "procurement firms" in Figure 3b is not driven by other firm characteristics.



(a) Baseline Effect (β_1^h)



(b) Interaction Effect (β_3^h)



(c) Group Comparison

Figure 4: Heterogeneous Effects of Monetary Policy

Notes — The effect for non-procurement firms is given by β_1^h shown in Panel (a). Panel (b) shows the coefficient on the interaction term, β_3^h. The effect on procurement firms is given by $(\beta_1^h + \beta_3^h)$. Panel (c) plots the average effect for the two groups of firms. The dark (light) shaded areas indicate 90% (95%) confidence bands. Standard errors are two-way clustered at the firm and quarter level.

Robustness. In Appendix C, I document that this result is robust to including industry-quarter fixed effects (see Figure 8a) as well as to distinguishing firms based on only their competitively-awarded contracts, i.e. $\mathbb{D}^c_{i,t-1}$ (see Figure 8b).

5 Economic Channels

In the previous section I have shown that “procurement firms" are less responsive to monetary policy shocks in terms of their stock return as well as their physical capital investment. In this section, I explore potential explanations for this difference.

5.1 Credit Channel

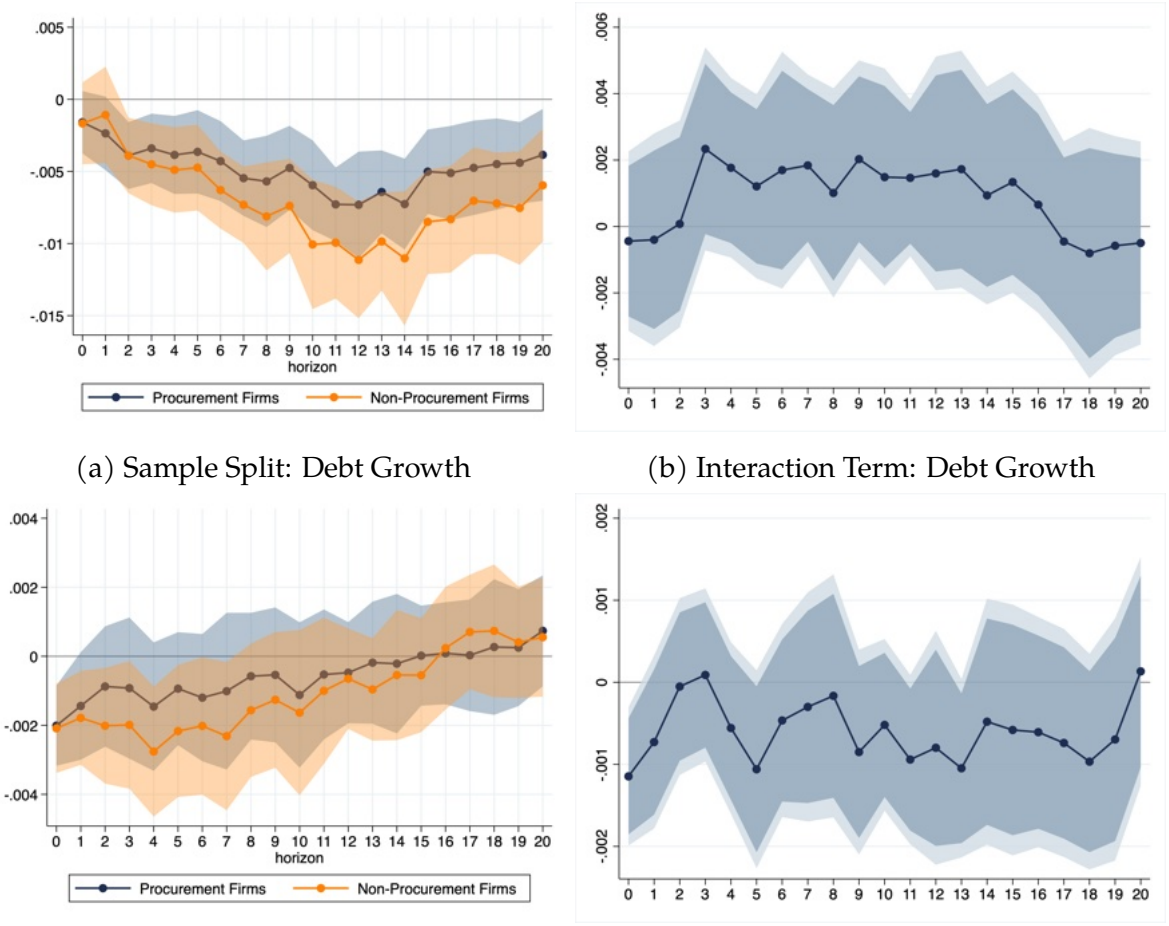
The credit channel is a monetary policy transmission mechanism through which interest rates, due to capital market imperfections, affect the price and quantity of credit available to firms through their effect on firms' balance sheets, e.g. the collateral value of firm assets, and, hence, their borrowing constraints. As discussed in section 2, previous literature has argued that firms who receive a government contract have easier access to credit and increase their amount of cashflow-based borrowing (Gabriel, 2022; di Giovanni et al., 2023; Hebous and Zimmermann, 2021). Along similar lines, it could be that non-bank financial investors value the cashflow stability provided by procurement contracts and are, hence, less likely to rebalance their portfolio away from procurement firms in response to a monetary policy shock. The implication is that corporate borrowing by procurement firms should be less responsive to monetary policy shocks.

To test this prediction, I re-estimate equation (2) within “procurement" and “non-procurement firms" separately and equation (3), using firms' debt growth and equity growth, respectively, as outcome variables.

Figure 5 shows that while firms reduce their debt growth significantly in response to a contractionary monetary policy shock, the effects differ only marginally between “procurement" and “non-procurement" firms. The response of equity growth is generally weaker and I do not find significant differences across “procurement" and “non-procurement" firms. This is confirmed by the coefficient of the interaction term from re-estimating equation (3).

Theory, furthermore, suggests that the credit channel exerts a stronger influence on relatively more financially constrained firms. The literature has proposed a multitude of measures for financial constrainedness based on observable firm characteristics. Young and small firms, for instance, might face larger difficulties obtaining external finance because they have a shorter credit history and more uncertain returns leading to greater information asymmetry vis-à-vis lenders. Hence, the literature often uses firm age (Cloyne et al., 2023; Durante et al., 2022) and firm size (Gertler and Gilchrist, 1994) as proxies for a firm's level of financial constrainedness.

To assess how the beneficial effects of public procurement accrue across the distribution of financial constraints, I follow this large literature, and re-estimate my baseline regression (3) in subsamples of firms split by size and age as well as their combination. The results in Table 9 suggest that the insulating effect of public procurement is stronger



(a) Sample Split: Debt Growth

(b) Interaction Term: Debt Growth

(c) Sample Split: Equity Growth

(d) Interaction Term: Equity Growth

Figure 5: Borrowing Response

Notes — The dependent variable is the cumulative debt and equity growth, respectively Panel (a) estimates equation (2) separately for "procurement firms" and "non-procurement firms". "Procurement firms" are defined as firms with current outstanding receivables from procurement contracts. The blue and orange shaded areas are 90% confidence bands. Panel (b) shows the coefficient of the interaction term in equation (3). The dark (light) shaded areas are 90% (95%) confidence bands. Standard errors are two-way clustered at the firm and quarter level.

among younger and smaller firms.[11]

Overall, the evidence on the cushioning effect of public procurement for firm investment responses to monetary policy through the credit channel appears mixed. While the differences in borrowing behaviour in response to monetary policy shocks does not provide clear cut results, there seems to be an important interaction of publc procurement with financial constraints in response to monetary policy. In particular with regards to the latter, it is worthwhile to emphasize that the sample of firms in this analysis is limited to publicly listed U.S. companies. It lacks coverage of smaller firms which

[11] In Appendix D I report the results from repeating this exercise for stock returns around FOMC announcements as in section 4.1. The results are less clear in terms of firms' stock returns.

Table 9: Procurement and Financial Constraints

	(1) h = 4	(2) h = 8	(3) h = 12	(4) h = 16	(5) h = 4	(6) h = 8	(7) h = 12	(8) h = 16
Split by Size								
	Small Firms				Big Firms			
$\varepsilon_t^m \times \mathbb{D}_{i,t-1}^{\text{all}}$	0.008*	0.013***	0.017***	0.018***	0.001	0.000	-0.001	-0.001
	(0.004)	(0.004)	(0.005)	(0.006)	(0.002)	(0.003)	(0.003)	(0.004)
Observations	72,727	62,953	54,459	46,981	92,519	83,290	74,864	67,066
Split by Age								
	Young Firms				Old Firms			
$\varepsilon_t^m \times \mathbb{D}_{i,t-1}^{\text{all}}$	0.009***	0.010***	0.012**	0.010+	0.001	0.003	0.004#	0.006#
	(0.003)	(0.004)	(0.005)	(0.006)	(0.002)	(0.003)	(0.003)	(0.004)
Observations	74,621	64,935	56,514	49,120	90,773	81,430	72,921	64,992
Split by Age & Size								
	Small & Young Firms				Big & Old Firms			
$\varepsilon_t^m \times \mathbb{D}_{i,t-1}^{\text{all}}$	0.015***	0.018***	0.023***	0.023**	-0.000	-0.000	-0.001	0.001
	(0.006)	(0.007)	(0.008)	(0.010)	(0.002)	(0.003)	(0.004)	(0.005)
Observations	40,504	34,739	29,793	25,509	58,503	53,176	48,210	43,509

Notes — Small (big) firms are defined as firms with below (above) median log real total assets. Young (Old) firms are defined as firms with below (above) median age. All regressions include firm, fiscal quarter, and quarter fixed effects. The numbers in parenthesis are standard errors twoway clustered at the firm and quarter level. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$, + for $p < 0.15$, # for $p < 0.2$).

might be more financially constrained on average and, hence, benefit relatively more from the effect of public procurement as a tool to improve access to credit.

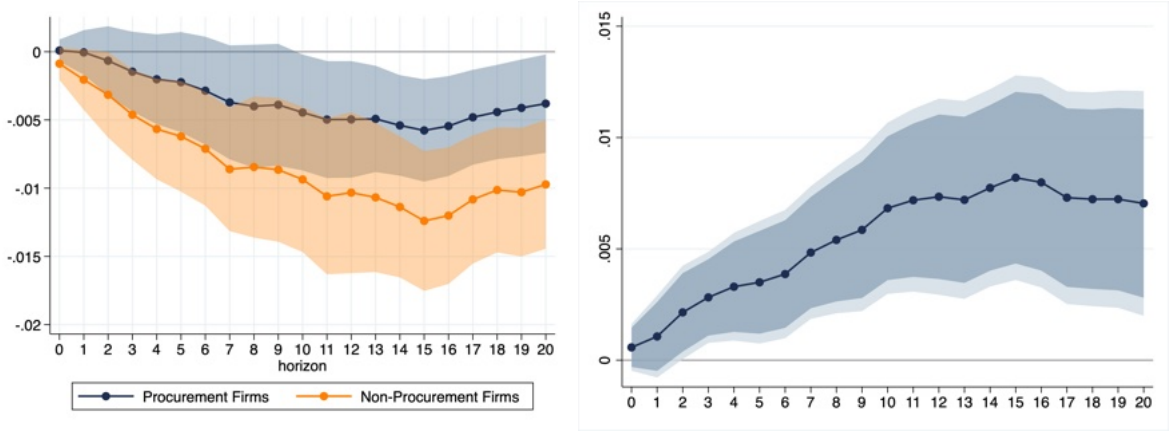
5.2 Sensitivity of Private vs. Public Consumption

Firms sell to a heterogeneous set of customers each with its own sensitivity to monetary policy. This demand composition of the firm, hence, determines its exposure to monetary policy through the demand channel. Another explanation for the muted effect of monetary policy on procurement firms could, therefore, be that public sector demand is less sensitive to monetary policy than private demand. A more stable demand composition in the face of monetary policy shocks would reinforce the credit channel discussed in the previous section.

To explore firms sensitivity to this channel, I proceed in two steps: First, directly compare the response of sales growth to monetary policy shocks across “procurement" and “non-procurement firms". An implication of the lower sensitivity of federal purchases is that the sales growth of firms with a higher procurement share of sales should be less sensitive to monetary policy shocks. To that end, I re-estimate equations (2) and (3) using sales growth as the dependent variable. The specification is otherwise un-

changed.

Indeed, Figure 6 shows that the reponse of sales growth to contractionary monetary policy shocks is statistically significantly lower among "procurement firms". Figure 6a shows the effect of monetary policy from equation (2) on sales growth in the two subsamples of firms. Figure 6b shows the interaction term coefficient, β_3^h, from equation (3) for sales growth as the dependent variable.



(a) Sample Split: $\mathbb{D}_{i,t-1}^{\text{all}}$ (b) Interaction Term: β_3^h

Figure 6: Sales Growth

Notes — Panel (a) estimates equation 2 separately for firms that current have and do not have an outstanding procurement contract. The blue and orange shaded areas are 90% confidence bands. Panel (b) estimates 3. The dependent variable is the cumulative sales growth between t and $t+h$. The shaded areas are 90 and 95% confidence bands. Standard errors are two-way clustered at the firm and quarter level.

Moreover, theory suggests that demand for durable goods should respond stronger to monetary policy than demand for non-durable goods (Durante et al., 2022). The value of having the government as a customer might, hence, be higher for durable goods producing firms. To verify this conjecture, I focus on firms in the manufacturing sector sector and split firms into durable vs. non-durable goods producers.[12]

Table 10 presents the results from estimating equation (3) for firms in either of the two groups. The specification includes quarter fixed effects that absorb the monetary policy shock.[13] The insulating effect of public procurement seems marginally more significant among durable goods producing firms.[14]

[12]Within manufactruing, durable goods manufacturing is covered by NAICS codes 321, 327, 331-337, and 339. Non-durable goods manufacturing is covered by NAICS codes 311–316 and 322-326.

[13]Removing the fixed effect reveals that between one and four years following the shock the investment ratio of "non-procurement firms" falls between 5 and 8% in durable manufacturing and between 4 and 6% in non-durable manufacturing. In line with the theoretical predictions, the baseline effect of monetary policy is, hence, slightly stronger among durable manufacturing firms.

[14]In Appendix E.1 I report the results from repeating this exercise for stock returns around FOMC announcements as in section 4.1. The results show that also in terms of stock returns the insulating

Table 10: Procurement and Goods Durability

	(1) h = 4	(2) h = 8	(3) h = 12	(4) h = 16	(5) h = 4	(6) h = 8	(7) h = 12	(8) h = 16
	Durable Firms				Non-durable Firms			
$\varepsilon_t^m \times \mathbb{D}_{i,t-1}^{\text{all}}$	0.005+	0.006+	0.009*	0.010*	0.002	0.003	0.011*	0.012+
	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)	(0.008)
Observations	54,697	48,956	43,830	39,065	30,394	26,874	23,659	20,854

Notes — Durable firms are defined as firm belonging to the following three-digit NAICS industries: 321, 327, 331, 332, 333, 334, 335, 336, 337, 339. Non-durable firms are defined as firm belonging to the following three-digit NAICS industries: 311, 312, 313, 314, 315, 316, 322, 323, 324, 325, 326. All regressions include firm, fiscal quarter, and quarter fixed effects. The numbers in parenthesis are standard errors twoway clustered at the firm and quarter level. The asterisks denote statistical significance (*** for p < 0.01, ** for p < 0.05, * for p < 0.1, + for p < 0.15, # for p < 0.2).

Second, I analyze the sensitivity of private and public spending to monetary policy in the aggregate. To that end, I follow Cox et al. (2020) and construct a proxy variable for the `usaspending.gov` contracts data from the National Income and Product Accounts Tables (NIPA). Specifically, I proxy the contracts data with the sum of federal purchases of intermediate goods and services and federal gross investment in structures, equipment, and software. The proxy is highly correlated with the aggregated contracts data at the quarterly frequency. The main benefit of using this proxy variable rather than aggregated contract data itself is that the contracts proxy is consistent with other the other variables retrieved from the NIPA tables, e.g. in terms of seasonal adjustments. Moreover, it allows me to extend the time series to prior to 2001, the start of the contracts data on `usaspending.gov`. I use the longest possible sample ranging from 1994Q1 to 2019Q4. I deflate private and federal spending with their respective implicit price deflators. I estimate an aggreagte local projection of the form

$$y_{t+h} = c^h + \beta^h \varepsilon_t^m + \gamma^h X_{t-1}^m + e_{t+h} \tag{4}$$

where y_{t+h} is the log level of private consumption or the log level of federal purchases as defined above, respectively. X_{t-1}^m is a set of control variables including one lag of the monetary policy shock, log real GDP, log CPI, log private consumption, log federal government consumption, and the excess bond premium of Favara et al. (2016). This specification is similar to Bu et al. (2021) extended to include the two consumption measures. As before, I scale the cumulative monetary policy shock to induce a 25 bps increase in the 2-year Treasury rate.

The results in Table 11 document that private consumption decreases significantly after several quarters following a contractionary monetary policy shock. Federal purchases, on the other hand, are much less sensitive to monetary policy shocks and actually increase in response to monetary policy shocks. This points towards an additional

effect of public procurement seems more significant among durable goods producing firms.

Table 11: Aggregate Demand Sensitivity

	Private Consumption			Contracts Proxy (NIPA)		
	h=4	h=8	h=12	h=4	h=8	h=12
ε_t^m	-0.002+	-0.002*	-0.003***	0.005***	0.007**	0.007***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)
L.ε_t^m	-0.001	-0.002#	-0.002**	0.003*	0.007***	0.008***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
L.Log Real GDP	0.340	0.415	-0.017	-3.992***	-2.644***	-2.542***
	(0.285)	(0.446)	(0.452)	(0.748)	(0.800)	(0.629)
L.Contracts Proxy (NIPA)	-0.021	-0.041	-0.090***	0.569***	0.383***	0.069
	(0.022)	(0.033)	(0.031)	(0.050)	(0.065)	(0.061)
L.Log Real Private Cons.	0.809***	0.638+	0.839**	4.245***	3.829***	4.536***
	(0.237)	(0.388)	(0.404)	(0.625)	(0.707)	(0.514)
L.Log CPI	-0.257***	-0.222+	-0.037	0.035	-0.495*	-1.027***
	(0.092)	(0.147)	(0.169)	(0.211)	(0.275)	(0.237)
L.Excess Bond Premium	-0.004#	-0.000	0.002	0.018***	0.017**	0.003
	(0.003)	(0.005)	(0.004)	(0.006)	(0.008)	(0.007)
Constant	-0.243	0.596	2.405***	1.861#	-3.756***	-6.969***
	(0.504)	(0.751)	(0.788)	(1.294)	(1.385)	(1.120)
Observations	87	87	87	87	87	87
F-Stat	1394	534.1	455.7	443.8	359.8	564

Notes — The numbers in parenthesis are standard errors twoway clustered at the firm and event level. The asterisks denote statistical significance (*** for p < 0.01, ** for p < 0.05, * for p < 0.1, + for p < 0.15, # for p < 0.2).

insurance effect of government spending for firms that should reinforce the credit channel discussed above. Appendix E.2 reports the full set of IRFs and documents that the local projection produces conventionally signed IRFs for other standard macroeconomic aggregates.[15]

5.3 Discussion

Two of the most studied channels of monetary policy transmission are the credit channel and the demand channel. The former affects the real economy by amplifying the effects of monetary policy on borrowers for which information asymmetries vis-à-vis the lender are large or whose overall financial position is weak. The demand channel works through the intertemporal substitution of consumption induced by changes in interest rates. A firm's exposure to this channel, hence, depends on the overall interest rate elasticity of demand of its heterogeneous customer base. Public procurement affects

[15] In Appendix E.2 I also report the results of estimating equation (4) at a monthly frequency, interpolating the quarterly consumption measures for both the private and the public sector. In the monthly specification, I use 3 lags of the cumulative monetary policy shock as in Bu et al. (2021).

a firm's exposure to both channels. First, winning a procurement contract can *ceteris paribus* improve a firm's access to credit. While previous literature (e.g., di Giovanni et al., 2023; Gabriel, 2022; Hebous and Zimmermann, 2021) has established this beneficial impact of public procurement on firms' financing conditions, I find only mixed evidence that this plays a role in response to monetary policy. Second, as I have argued in the previous section, government demand through public procurement is less sensitive to monetary policy than private demand. Selling a larger portion of its total production to the public sector, hence, implies that the firm faces a lower overall interest-rate elasticity of demand and, thus, a lower exposure to the demand channel of monetary policy, dampening its responsiveness to monetary policy.

6 Conclusion

Governments are important customers for the private sector and winning a procurement contract can have a significant positive impact on firm growth. Previous literature, for instance, has shown that winning procurement awards has a sizeable and lasting positive impact on firm investment and employment through both a direct revenue increase and improved access to credit. Aside from its direct effects, public procurement, hence, introduces a previously largely unexplored source of heterogeneity in firms' sensitivity to macroeconomic fluctuations and policies.

In this paper, I study the implications of public procurement for firms' responsiveness to monetary policy. The main result is that public procurement acts as a shock absorber for firms in response to unexpected changes in monetary policy. I find that both stock prices and investment rates fall less among firms that contract with the government. I examine potential explanations for this result, focusing on two of the main channels of monetary policy transmission, the credit channel and the demand channel. While I find only limited evidence for a weaker credit channel of monetary policy among government contractors, I offer novel evidence suggesting that the composition of a firm's customer base is an important determinant of the responsiveness of firms to monetary policy. Government spending through public procurement is less sensitive to monetary policy than private consumption, resulting in a lower overall interest-elasticity of demand among government contractors. A firm's customer base composition, hence, constitutes an additional channel of insurance against the adverse effects of monetary policy contractions.

These findings point towards important interactions of government spending and monetary policy on the firm level and have relevant implications for policy makers, e.g. regarding the targeting of public procurement to specific firms. Initiatives promoting the participation of small firms in public procurement, for instance, could not only foster growth among those firms but also insulate them from cyclical conditions.

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A Variable Definitions

A.1 Firm-level Variables

Table 12: Variable Definitions

Variable	Definition
Age	–
Leverage Ratio	$\frac{\text{DLCQ + DLTTQ}}{\text{ATQ}}$
Total Assets	ATQ
Liquidity Ratio	$\frac{\text{CHEQ}}{\text{ATQ}}$
Tobin's Q	$\frac{\text{ATQ + PRCCQ*CSHOQ - CEQQ}}{\text{ATQ}}$
Cash flow	$\frac{\text{OIBDPQ}}{\text{L.ATQ}}$
Sales Growth	Δ_4 Log Real SALEQ

Notes — Age is constructed using data on firms' foundation date from WorldScope. If this is missing, we use successively either the firm's incorporation date (BEGDAT) from CRSP or the first year the firm appears in the sample. All other variables are constructed from the CRSP-Compustat merged database.

A.2 Other Variables

Table 13: Variable Definitions

Variable	Code	Source
GDP	GDP	FRED
GDP deflator	GDPDEF	FRED
Real GDP index	–	S&P Global
CPI	CPALTT01USM661S	FRED
Unemployment Rate	UNRATE	FRED
Private Cons.	PCE	FRED
Private Cons. Deflator	DPCERD3Q086SBEA	FRED
Contracts Proxy (NIPA)	–	Cox et al. (2020)[16]
Excess Bond Premium	–	Favara et al. (2016)

B Stock Return Response to Monetary Policy Shocks

B.1 Portfolio Analysis

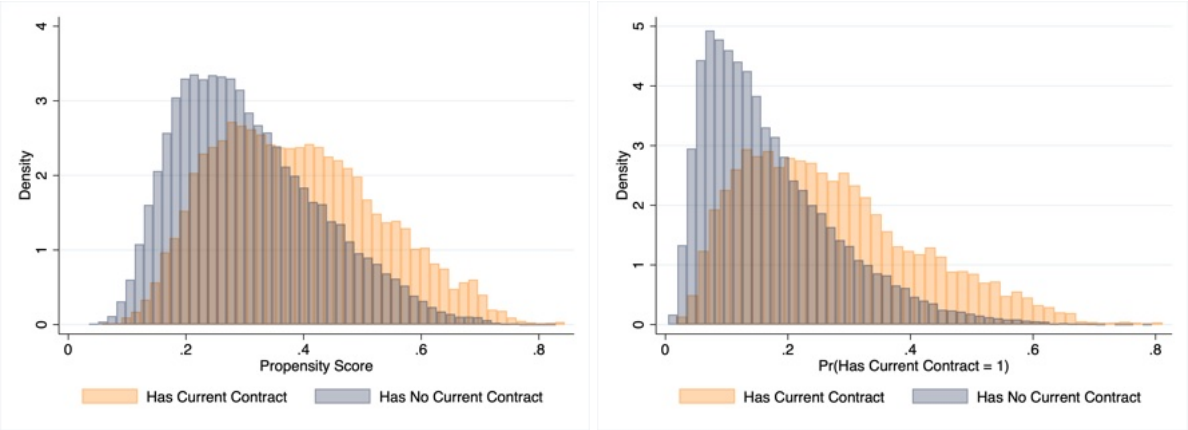
Here I present the results from the portfolio analysis exercise when grouping firms by whether or not they have outstanding receivables from competitive procurement awards. Table 14 shows that the results are similar to the case including also non-competitive awards.

Table 14: Stock Price Response to Monetary Policy: Asset Pricing Test

	Non-Procurement $\mathbb{D}^c_{i,t-1} = 0$	Procurement $\mathbb{D}^c_{i,t-1} = 1$	Long-Short Strategy $(\mathbb{D}^c_{i,t-1} = 1)$ - $(\mathbb{D}^c_{i,t-1} = 0)$
ε^m_t	-2.491***	-0.487	2.004***
	(0.840)	(0.484)	(0.681)
(mkt - rf)	0.770***	0.926***	0.156***
	(0.027)	(0.020)	(0.020)
smb	0.786***	0.608***	-0.179***
	(0.057)	(0.045)	(0.035)
hml	0.074	-0.002	-0.076
	(0.089)	(0.042)	(0.084)
rmw	-0.259***	-0.067	0.192***
	(0.084)	(0.072)	(0.048)
cma	-0.064	0.175**	0.240***
	(0.119)	(0.081)	(0.074)
Constant	0.049**	0.047**	-0.002
	(0.021)	(0.018)	(0.018)
Observations	152	152	152
R-squared	0.956	0.973	0.401

Notes — The numbers in parenthesis are standard errors twoway clustered at the firm and event level. The asterisks denote statistical significance (*** for p < 0.01, ** for p < 0.05, * for p < 0.1).

B.2 Propensity Score Matching

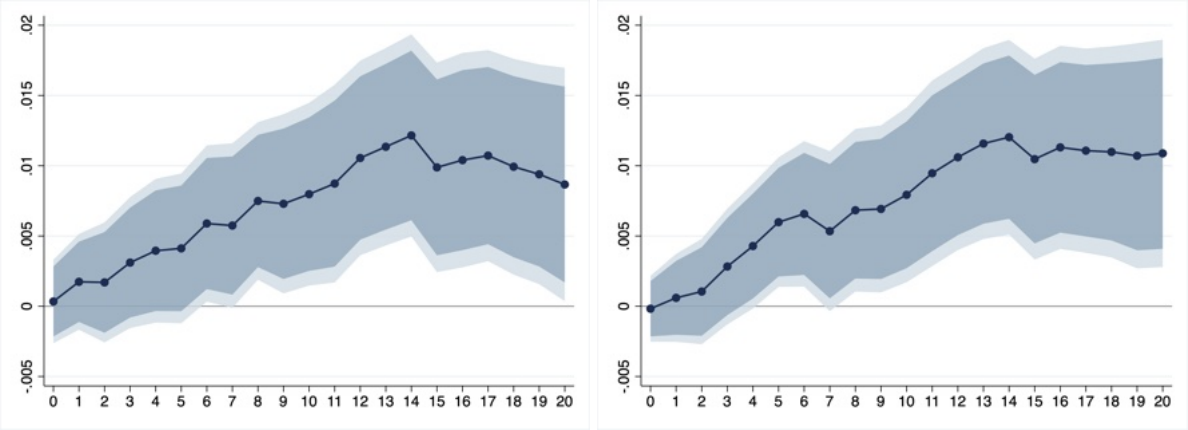


(a) All awards (b) Only competitive awards

Figure 7: Distribution of Propensity Scores

Notes — This Figure shows the distribution of propensity scores between treated and non-treated firms as described in section 4. Panel (a) refers to the propensity score estimation including all, i.e. non-competitive and competitive awards. Panel (b) refers to the propensity score estimation including only competitive awards.

C Investment Response to Monetary Policy Shocks



(a) Industry × Quarter Fixed Effects (b) Only competitive awards

Figure 8: Investment Response to Monetary Policy

Notes — This figure shows the coefficient of the interaction term, γ_0^h in equation (3) for two alternative specifications. Panel (a) is for the baseline regression including industry (SIC 1) × quarter fixed effects. Panel (b) reproduces the specification in Panel (a) but defining procurement firms based on their income from competitive awards only.

D Credit Channel

In this section, I present the results from exercise in Table 9 but for stock returns. The specification in each column is the same as in Table 5. Firms are split at the median of their distribution in each quarter in terms of their size (measured as log real total assets), age, and the interaction of the two.

Table 15: Procurement and Financial Constraints

	(1) Ret	(2) CRet	(3) CAR	(4) Ret	(5) CRet	(6) CAR
Split by Size						
	Small Firms			Big Firms		
$\varepsilon_t^m \times \text{L.}\mathbb{D}^{\text{all}}$	1.750#	3.262+	2.996#	1.757#	3.628**	2.895*
	(1.299)	(2.125)	(2.240)	(1.278)	(1.647)	(1.477)
Observations	172,304	172,073	172,073	189,400	189,304	189,304
Split by Age						
	Young Firms			Old Firms		
$\varepsilon_t^m \times \text{L.}\mathbb{D}^{\text{all}}$	2.047#	3.844**	3.856*	1.492	3.511*	2.009
	(1.468)	(1.884)	(2.035)	(1.270)	(2.019)	(1.869)
Observations	172,943	172,744	172,744	188,673	188,544	188,544
Split by Age & Size						
	Small & Young Firms			Big & Old Firms		
$\varepsilon_t^m \times \text{L.}\mathbb{D}^{\text{all}}$	3.421#	4.778+	5.492+	2.347#	3.880*	3.148+
	(2.391)	(2.966)	(3.373)	(1.711)	(2.206)	(1.995)
Observations	101,726	101,592	101,592	118,125	118,094	118,094

Notes — All regressions include the same set of controls as in section 4.1 as well as firm, fiscal quarter, and industry × event date fixed effects. The numbers in parenthesis are standard errors clustered at the event level. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$, + for $p < 0.15$, # for $p < 0.2$).

E Demand Channel

E.1 Durable vs. Non-Durable Manufacturing

Table 16: Procurement and Goods Durability: Stock Returns

	(1) Ret	(2) CRet	(3) CAR	(4) Ret	(5) CRet	(6) CAR
	Durable Firms			Non-durable Firms		
$\varepsilon_t^m \times \mathbb{D}_{i,t-1}^{\text{all}}$	1.158+	3.702***	2.304*	2.864	7.231+	4.706
	(0.707)	(1.233)	(1.200)	(3.014)	(4.621)	(4.054)
Observations	121,960	121,872	121,872	68,213	68,165	68,165

Notes — Durable firms are defined as firm belonging to the following three-digit NAICS industries: 321, 327, 331, 332, 333, 334, 335, 336, 337, 339. Non-durable firms are defined as firm belonging to the following three-digit NAICS industries: 311, 312, 313, 314, 315, 316, 322, 323, 324, 325, 326. All regressions include firm, fiscal quarter, and event-date fixed effects. The numbers in parenthesis are standard errors clustered at the event level. The asterisks denote statistical significance (*** for p $<$ 0.01, ** for p $<$ 0.05, * for p $<$ 0.1, + for p $<$ 0.15, # for p $<$ 0.2).

E.2 Sensitivity of Private vs. Public Consumption

In Figure 9 I present the full set of IRFs corresponding to the results reported in Table 11. The monetary policy shock is scaled to equal a 25 bps increase in the 2-year Treasury rate. The sample spans the period from 1994Q1 to 2019Q4.

In Figure 10 I estimate the same impulse response functions at a monthly frequency using linear interpolation to convert the quarterly contracts proxy and quarterly private consumption to a monthly frequency. The sample spans the period from January 1994 to December 2019.

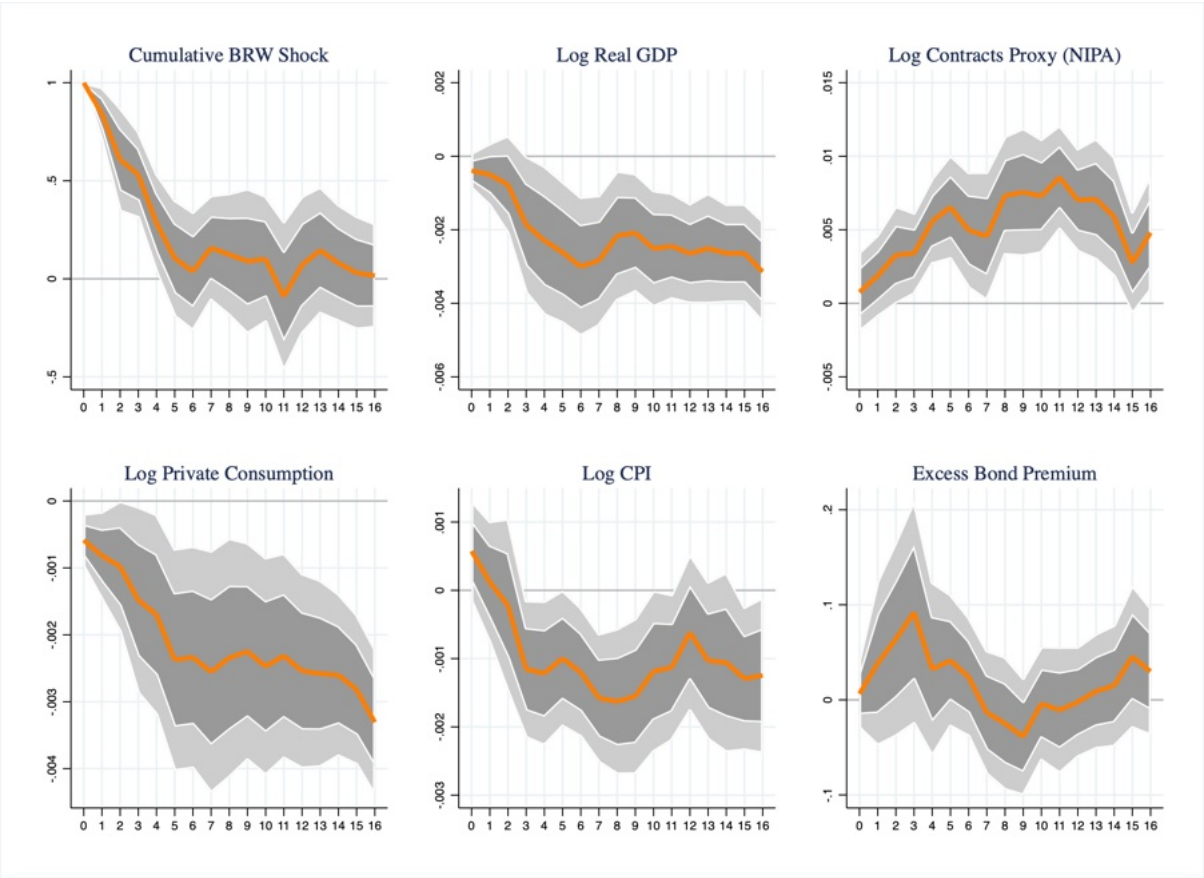


Figure 9: IRFs to Monetary Policy Shock

Notes — This Figure shows the full set of IRFs to change in the BRW cumulative monetary policy shock scaled to induce a 25 bps change in the 2-year Treasury rate. The light (dark) grey shaded areas are 90 (68) percent confidence bands from Newey-West standard errors.

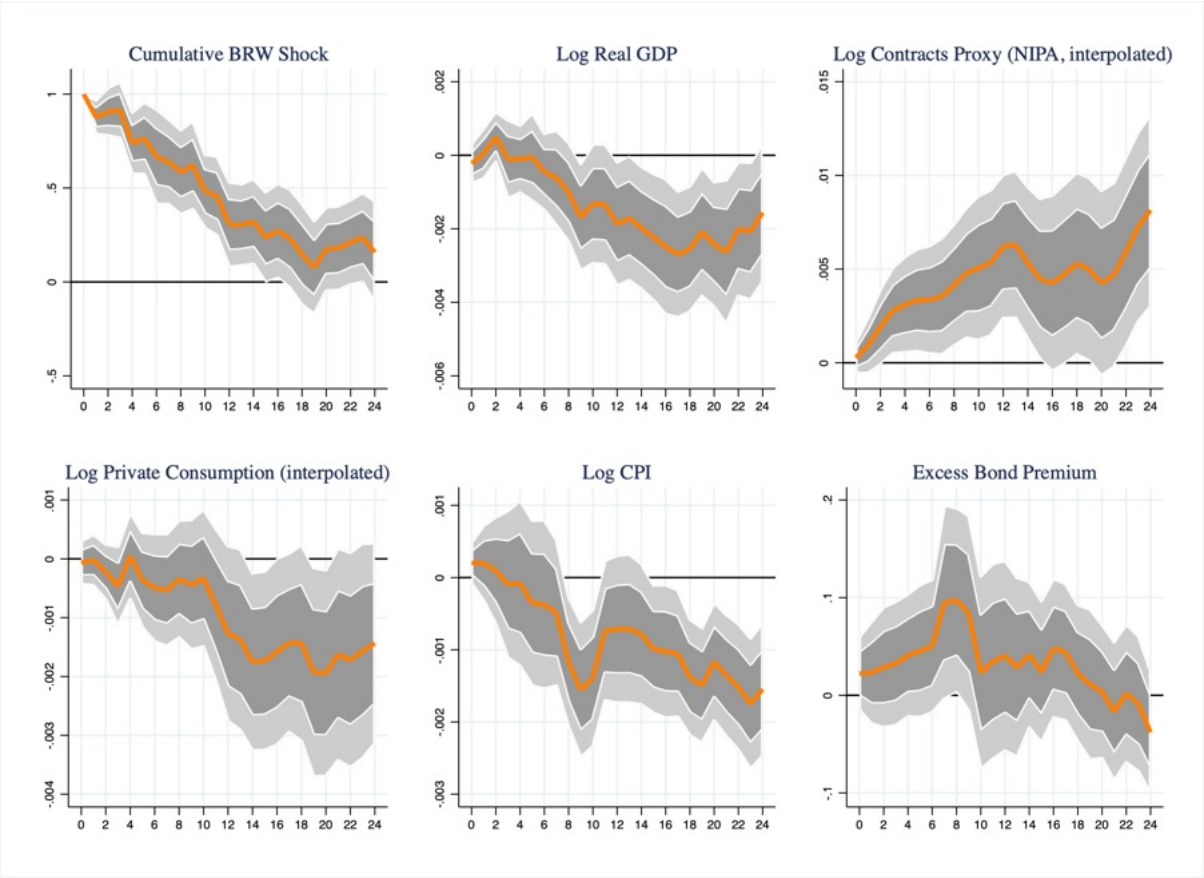


Figure 10: IRFs to Monetary Policy Shock

Notes — This Figure shows the full set of IRFs to change in the BRW cumulative monetary policy shock scaled to induce a 25 bps change in the 2-year Treasury rate using monthly data. The contracts proxy and private consumption are linearly interpolated. The light (dark) grey shaded areas are 90 (68) percent confidence bands from Newey-West standard errors.