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Subcontracting in Federal Spending: Micro and Macro Implications*

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Abstract

This paper studies the critical but underexplored role of subcontracting in shaping the spatial and firm-level effects of federal government spending. Leveraging newly available data on defense subcontract awards since 2011, linked with NETS establishment-level data, we examine prime–subcontractor relationships across counties, industries and time. We document three stylized facts: (1) subcontracting leads to widespread geographic relocation of federal dollars; (2) it reallocates spending across sectors, notably from service-sector primes to manufacturing subcontractors; and (3) large firms dominate subcontracting networks, even receiving subawards from smaller primes. Accounting for this geographic relocation shows that conventional estimates understate local multiplier effects by approximately 20%. While subcontracting broadens the spatial reach of federal spending, its average local impact is smaller than that of prime contracts. Establishment-level evidence shows that subcontractors—especially large ones and those in goods sectors—exhibit weaker and less persistent employment and revenue gains than prime contractors, reflecting the shorter and less stable nature of subcontracts. These weaker multipliers also stem from the skewed distribution of subcontracts toward large manufacturers. Overall, our findings reveal substantial heterogeneity in how procurement opportunities diffuse through the private sector and shape the effects of federal spending.

Keywords: Fiscal multipliers, prime contracts, subcontracts, employment, firm dynamics

JEL Codes: E62, H30, H56, H57

*The views in this paper are soley the responsibility of the authors and should not be interpreted as reflecting the views of the Federal Reserve Bank of Dallas or the Federal Reserve System.

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1 Introduction

Government procurement spending is a cornerstone of U.S. fiscal policy, and defense contracts in particular have long served as the workhorse for identifying local multipliers. Since the influential contribution of Nakamura and Steinsson (2014), regional variation in Department of Defense (DoD) prime contracts has been widely used to estimate how federal spending propagates through local economies. A growing literature exploits these contracts at different levels of geographic aggregation and reaches a broadly consistent conclusion: prime contracts generate measurable, and often sizable, increases in local output, employment, and income, offering a powerful lens for understanding the regional transmission of fiscal policy.[1] Yet this literature rests on a key simplifying assumption that the geography of defense spending can be approximated by the location of *prime* defense contracts. In practice, prime contractors rarely fulfill the full scope of defense obligations themselves, instead outsourcing portions of production and services to subcontractors who may be located in faraway regions. As a result, prime contract data may not accurately reflect where federal dollars are ultimately spent or which firms benefit, making subcontracting a critical but largely unmeasured channel through which fiscal funds are redistributed across regions and firms.

Our paper is the first to bring subcontracting to the center of the analysis. We exploit a new dataset of defense subcontracting activity, which was made available continuously since 2011 as part of the Federal Funding Accountability and Transparency Act reporting requirements. These data provide detailed information on subcontract amounts, the place of performance, and contractual linkages to prime contracts. To our knowledge, this dataset has not previously been leveraged to study fiscal multipliers, and it allows us to document novel facts about subcontracting and revisit longstanding conclusions about the local effects of federal spending. In addition, by merging these data with the National Establishment Time Series (NETS), we connect prime and subcontracting firms to rich establishment-level outcomes, including employment and sales, enabling us to assess the direct microeconomic effects on firms.

Our analysis yields several key findings that substantially revise the way we understand the local impact of federal spending. First, subcontracting significantly alters the geography of defense spending. More than 70 percent of subcontract dollars cross state lines, and close to 90 percent cross county lines. This pervasive relocation means that the conventional

[1] Examples include Dupor and Guerrero (2017) and Basso and Rachedi (2021) who consider state-level variation, Demyanyk et al. (2019), Auerbach et al. (2020), Auerbach et al. (2022) and Briganti et al. (2025) who consider county or city level variation, and Hebous and Zimmermann (2021) and Barattieri et al. (2023) who consider industry and firm level variation.

approach-assigning all spending flowing to the location of the prime contractor—misidentifies where funds actually flow. Once this relocation is taken into account, local fiscal multipliers are systematically larger. Our corrected estimates suggest that multipliers are 10 to 20 percent higher than those based only on the prime contract location, with the implied cost per job falling from roughly $400,000 to about $300,000. Subcontracting therefore not only changes who benefits from federal procurement but also reveals that previous work has likely understated its overall local effectiveness, because of the measurement error and omitted variables embedded in the approach.

Second, while subcontracting broadens the geographic reach of federal funds, we find that its effects on local labor markets are weaker than those of prime contracting, based on our county-level analysis. To understand this difference, we turn to micro data at the establishment level, which capture the direct effect on employment of prime and subcontractors. Using matched data from NETS, we show that employment and sales rise following both prime and subcontract awards, but the responses of subcontractors are smaller and relatively short-lived. We provide evidence that this difference may be explained by the persistence of the two types of contracts: prime contracts with the DoD tend to be more stable and persistent, generating multi-year expansions in prime contracting firms' activity, while subcontracting relationships are less stable and attenuate more quickly, limiting their cumulative impact on local labor markets.

Third, the weaker responses to subcontracting reflect the composition of firms receiving these contracts. Subcontracts disproportionately flow to large, manufacturing-intensive firms that are less responsive on the margin to new business. By contrast, small firms and service-sector establishments show much stronger and more persistent employment gains when they receive subcontracts, but they remain underrepresented among the subcontractors. This skewness in allocation helps explain why the aggregate multiplier associated with subcontracting is smaller: it is not that subcontracting inherently lacks stimulative power, but rather that it tends to be concentrated in firms and sectors where the incremental effect on employment is limited and short-lived.

Together, our findings underscore the importance of incorporating subcontracting into analyses of fiscal policy and revise our understanding of how federal procurement shapes local economies. Ignoring subcontracting leads to systematic underestimation of multipliers and misidentifies the regions and firms that benefit from defense spending. Correcting for subcontracting reveals that multipliers are larger than previously thought, but also that their effects are shaped by meaningful heterogeneity across firms and industries. In particular, the weaker persistence of subcontracting effects, coupled with the concentration of awards

in large manufacturing firms with limited marginal responses, explains why subcontracting has a smaller aggregate multiplier than prime contracting. At the same time, the strong and longer-lived responses of small and service-sector firms suggest that subcontracting policy could be a powerful lever for amplifying employment gains. By shaping subcontracting requirements, enforcement, and stability, for example, federal agencies could potentially affect the local employment impact of government spending.

Relation to the Literature

A growing body of empirical work uses Department of Defense (DoD) contracts to study the economic impact of government spending. A foundational contribution by Nakamura and Steinsson (2014) leverages state-level variation in DoD prime contract obligations to estimate local fiscal multipliers, arguing that these contracts closely track production activity and serve as a credible proxy for localized government demand.[2]

Building on this, subsequent research has employed finer geographic units in varied contexts and explored aggregate implications of local fiscal multipliers.[3] Dupor and Guerrero (2017), for example, consider the mapping of local multipliers to aggregate multipliers by aggregating state-level data. Demyanyk et al. (2019) employ DoD contracts at the county level, documenting that local fiscal multipliers are larger in areas with higher pre-recession consumer indebtedness, possibly due to elevated marginal propensities to consume and slack-driven mechanisms. Basso and Rachedi (2021) consider local multipliers at the state level and find that fiscal effectiveness varies with local age composition. Jo and Zubairy (2025) examine how the size of local fiscal multipliers varies across different phases of the business cycle, emphasizing that the effects depend on whether the recession is driven by demand or supply forces. Auerbach et al. (2020) construct city-level DoD spending from ZIP-code data and find large local GDP responses. They also document significant cross-region spillovers. Our analysis suggests that subcontracting is an important and concrete channel for these spillovers.

Other studies exploit variation at the industry or firm level. Hebous and Zimmermann (2021) show that each dollar of U.S. federal procurement spending increases capital

[2]In their seminal work, Nakamura and Steinsson (2014) suggest that subcontracting might be a concern, but they abstract from a formal assessment of its quantitative importance for two reasons. First, there is no explicit data available for subcontracting for the sample period they consider (1966-2006). Second, prime military contract data move closely with shipments to the government (from defense-oriented industries) at the state level from 1963-1983, suggesting that subcontracting may not be quantitatively important for understanding state-level multiplier effects for the period they consider. Data availability and the sharp rise of subcontracting after 2010 partially motivated our analysis.

[3]See Chodorow-Reich (2019) for a review of the literature on estimating cross-sectional fiscal multipliers and the link between local and aggregate multipliers.

investment among financially constrained firms, with no significant impact on unconstrained firms, consistent with financial accelerator dynamics. Barattieri et al. (2023) show that upstream suppliers benefit from defense spending shocks through higher employment and producer prices. The new facts we established about prime-subcontractor relationships support these industry-level spillovers. Our firm-level analysis provides new insights on the transmission of federal spending through different contracting channels.

More recent contributions have expanded beyond aggregate effects to explore contract heterogeneity. Cox et al. (2024) explore the universe of prime contracts in great details and among other aspects, highlight distinctions between one-time and repeat contracts, documenting compositional differences and their implications for aggregate dynamics. Muratori et al. (2023) distinguish between goods and service based defense contracts, and establish that service based multipliers are larger than goods spending multipliers. Briganti et al. (2025) focus on defense prime contracts that are won through a bidding process to identify unanticipated federal contracts. They show that small firms expand employment and credit in response, and that the employment multiplier can be further decomposed into direct and spillover effects.

Together, these papers demonstrate the usefulness of DoD contract data for evaluating fiscal policy at multiple levels of aggregation. However, the analysis in these studies focuses almost exclusively on prime contracts. The subcontracting channel—which can significantly reallocate spending geographically and across firms—remains largely unexplored due to data limitations, a gap our paper aims to fill.[4] By incorporating newly available subcontracting data, our paper provides a more complete picture of where federal funds ultimately flow and how they shape local and firm-level economic outcomes.

Outline: The remainder of the paper is organized as follows. Section 2 describes the main datasets used for our empirical analysis and key summary statistics. Section 3 establishes three new facts on the prime-subcontracting relationship using linked prime-subcontractors data. Section 4 describes our empirical strategy for estimating local fiscal multipliers that accounts for the spatial relocation of federal funds through subcontracting and presents our multiplier effects on average, by industry and by contract type. Section 5 delves into the firm-level analysis, which provides supporting evidence to our county-level analysis and uncovers possible transmission mechanisms at the micro level. Section 6 concludes.

[4]Some of these studies (e.g., Section II B in Nakamura and Steinsson (2014) and footnote 12 in Dupor and Guerrero (2017)) acknowledge the potential for subcontracting to distort geographic attribution of fiscal shocks but they lack the data to quantify its effects.

2 Data and Summary Statistics

Our empirical analysis draws on a number of datasets at the contract, firm, county, and national levels. This section describes four main datasets and presents key summary statistics. In the interest of conserving space, additional summary statistics and institutional details about subcontracting are provided in Appendices A and D.

2.1 Defense Prime Contracts

Federal defense contracting has played a major role in shaping U.S. industrial activity, and the prime contract landscape has evolved meaningfully over the last few decades. Starting from fiscal year 2001, the universe of federal procurement contracts is publicly available at USASpending.gov. Federal prime contracts have been exploited in the literature widely and their properties have been well-documented in recent contributions (e.g. Cox et al. (2024)). Our focus is on defense prime contracts and we provide some relevant information and points of connection with the analysis on subcontractors that follows in the subsequent section.

Figure 1 shows that defense prime contracts constitute about 10% of total government spending in National Accounts and 2% of GDP, lining up well with NIPA data on defense expenditures.[5] Starting in 2001, there was a persistent run-up in military spending and defense prime contracts, caused by the 9/11 attacks and the subsequent Iraq and Afghanistan wars (see Ramey (2011)). Defense spending began to fall around 2010, the start of our subcontracting sample. A modest recovery started in 2014-2015, which may be explained by several factors including the end of sequestration, where budget caps from the 2011 Budget Control Act were relaxed in 2015, allowing for increased defense outlays. This coincided with the rise in geopolitical tensions such as Russia's annexation of Crimea and rising threats from ISIS in Iraq and Syria (see Amodeo and Briganti (2025)). This period has also been characterized by a push for modernization in military systems with a surge in investment in advanced technologies related to cyber, space and autonomous systems.[6] In the last few years of our sample, defense prime contracts fell during the Covid-19 period and a later reversal coincided with Russia's invasion of Ukraine in 2022.

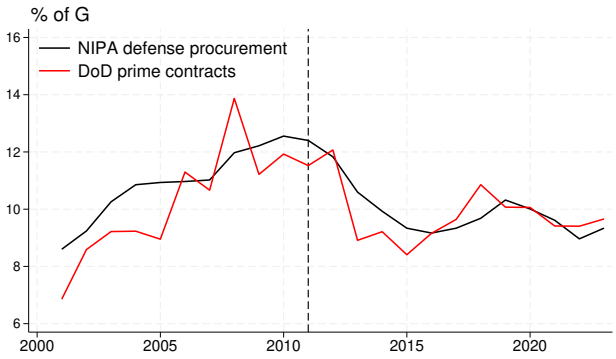
Prime contracts are formal agreements made directly between the federal government and firms, typically large firms with the capacity to fulfill sizable obligations. The DoD procurement dataset shows two distinct types of prime contracts: one-time contracts and repeat contracts. The former constitute the vast majority—roughly 80% to 90%—of the

[5] Consistent with our assessment on the importance of defense prime contracts, Cox et al. (2024) document that DoD contracts constitute just *over half* of federal contracts by count and around *two-thirds* of contracts by value.

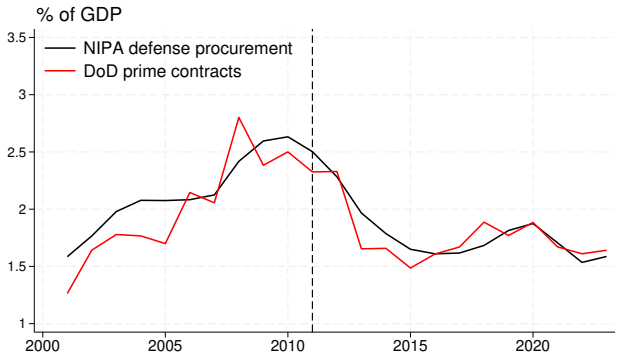
[6] See U.S. Department of Defense, Office of Industrial Policy (2021) and U.S. Department of Defense, Office of Industrial Base Policy (2023)

Figure 1: Defense procurement spending shares

(a) Share of govt. spending



(b) Share of GDP



Sources: BEA NIPA tables; USASpending.gov. Notes: NIPA defense procurement is the sum of (i) national defense intermediate goods and services purchased and (ii) gross investment in structure, equipment and software. The vertical line indicates the start of the mandatory subcontracting reporting.

total number of contracts awarded. However, despite their prevalence, one-time contracts account for a relatively small share of total contract value. In contrast, repeat or recurring contracts, which are linked by a consistent contract identification number over multiple periods, represent a much smaller share of the count but are significantly larger in dollar terms (see Appendix Figure A1).[7]

The industry compositions of one-time and repeat prime contracts also differ markedly. One-time contracts are concentrated in non-durable and non-complex manufacturing sectors such as food production, petroleum refining, medical equipment, pharmaceutical supply and other specialized equipment. Conversely, repeat contracts are predominantly found in capital- and technology-intensive sectors such as aircraft, missile and shipbuilding, along with science, professional, and technical services (Figure A2). Contract duration patterns further underscore these differences. One-time contracts tend to be short-lived, typically spanning one to two quarters, while repeat contracts have a longer duration, averaging four quarters in length (Figure A3). These compositional and temporal distinctions highlight the structural heterogeneity within prime contracting.

Given the complexity and size of many defense procurement efforts, prime contractors often rely heavily on subcontractors to execute large portions of their awarded contracts. This dependency creates contracting opportunities beyond the direct recipients of federal awards, shaping the subcontracting landscape analyzed in the following section.

[7]This patterns is consistent with Fact 4 in Cox et al. (2024), which for their entire sample and across all contracts, documents that the majority of contracts, 87%, constitute a single transaction, but only represent 17% of total contracted dollars.

2.2 Defense Subcontracts

2.2.1 Background

Subcontracting offers new and smaller firms a lower-risk and easier entry into federal procurement by partnering with prime contractors, bypassing the complexities of direct bidding while gaining experience and credibility in the government contracting space. Moreover, federal regulations have evolved over time and actively promote subcontracting to small businesses. For contracts exceeding $750,000 ($1.5 million for construction), prime contractors are required to submit and adhere to formal subcontracting plans.[8]

In addition to promoting subcontracting and engagement with small businesses, there are explicit federal regulations in place that dictate reporting of these subcontracts. The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006; reporting requirements were rolled out in 2010; the most consequential change took place on March 1, 2011, with reporting required for all subcontracts under federally awarded contracts and orders valued at least $25,000. To the best of our knowledge, the data on subcontracting have not been exploited by the literature and we are among the first to delve into it. Given the availability of subcontracting data in early 2011, this marks the beginning of our sample.

The growth in subcontracting also likely reflects a shift in the production process of major prime contractors. Many contractors no longer manufacture end products entirely in-house. Instead, they act as integrators, relying on extensive subcontracting networks for components, sub-assemblies, and specialized services. Table 1 shows an example of an $88 million prime contract awarded to Boeing, where the company location and the primary place of performance are both St. Louis, MO. The prime product is airframe structural components.[9] A large fraction of this prime contract was further sub-awarded to other firms across both coasts: some in neighboring states across different counties (such as Wellington, KS and Wichita, KS) and many across different states, including CA, AL, WA and PA. The table lists the top 10 subcontractors, with their total obligations amounting to $16 million (19% of the prime contract obligation). Subawards together accounted for 25% of the prime contract amount. In this case, subcontracts cover a broad range of products and services, including purchases made outside of the production, aerospace

[8]These thresholds have been revised over time. More institutional details and regulatory requirements are given in Appendix D. These plans must outline specific goals for engagement with small businesses, disadvantaged business enterprises (DBEs), and women-owned small businesses, historically underutilized business zone (HUBZone) firms, and service-disabled veteran-owned businesses. Critically, failure to propose an acceptable subcontracting plan renders a prime ineligible for the award, creating strong institutional incentives for prime contractors to seek and maintain partnerships with qualified small subcontractors.

[9]We chose an example of a one-time prime contract to make exposition easier.

support, interiors, and common aerospace commodities, demonstrating the supportive and non-production-service nature of subcontracting.[10]

Table 1: Subcontracting example

Company	Location	Product description	Obligation
Prime contractor			
The Boeing Company	St. Louis, MO	Airframe structural components	88,096,704
Top 10 subcontractors			
PPG Industries, Inc.	Huntsville, AL	Purchase outside production	5,973,532
Brek Manufacturing Co.	Gardena, CA	Purchase outside production	2,630,625
Hill AeroSystems, Inc.	Enumclaw, WA	Purchase outside production	1,889,858
Kitco, LLC	Springville, UT	Common aerospace commodities	1,716,000
Pioneer Aerospace Corp.	Columbia, MS	Aerospace support	1,371,106
AAR Allen Services, Inc.	Wellington, KS	Aerospace support	815,900
Sargent Aero & Defense LLC	Tucson, AZ	Common aerospace commodities	624,225
D-J Engineering Inc.	Augusta, KS	Purchase outside production	519,740
Brenner Aerostructures, LLC	Bensalem, PA	Aerospace support	480,402
Globe Engineering Co., Inc.	Wichita, KS	Purchase outside production	385,388
Total			
Top 10 subcontractors' obligation			16,406,776
Total subcontract obligation			21,850,198
% of prime contract obligation			24.8%

Source: USAspending.gov. Note: Obligation amounts are shown in dollars.

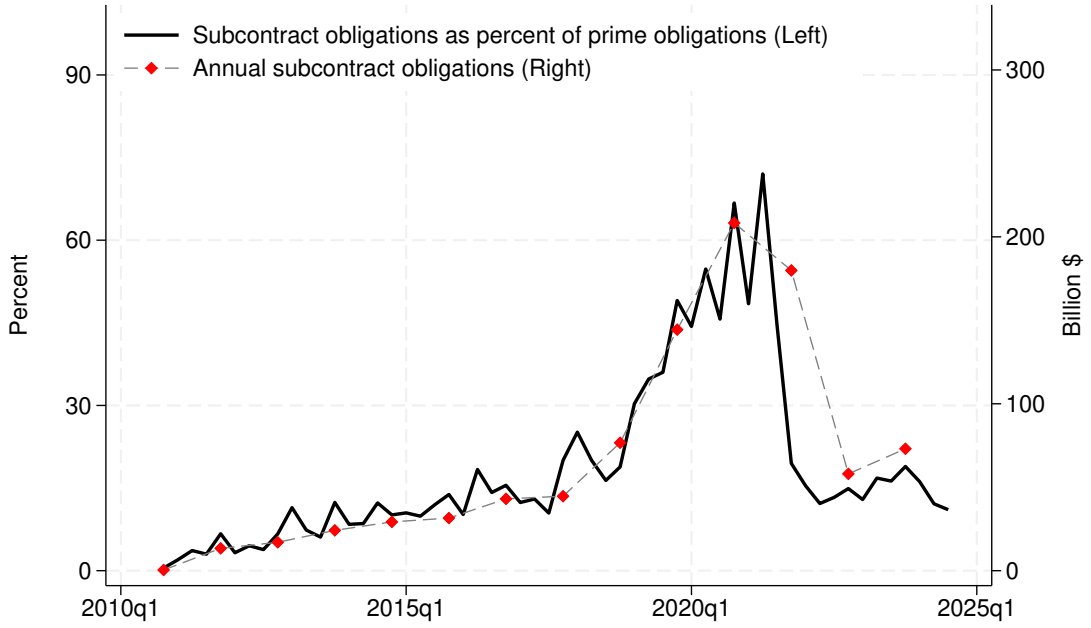
2.2.2 Subcontracting Data and Summary Statistics

The federal procurement contract database also provides information on subcontracts since 2011, following the reporting requirements. The data contain the subcontract obligation date, amount, and place of performance, along with a brief description of the subcontract. Information about the original prime contract that leads to the subcontract is also provided, allowing us to construct a comprehensive dataset that includes all prime contracts merged with their subcontracts, if any.[11]

[10] Additional illustrative examples underscore the scale of this dependence. For instance, AlliedSignal, a top-tier prime contractor, has relied on 7,500 to 10,000 suppliers for materials and components, who at one point accounted for 60% of its defense contract costs. Northrop subcontracted with over 500 firms to manufacture 19,000 parts for the MX missile's inertial guidance system. At Lockheed/Fort Worth, subcontracts represented 75% of the cost of producing the F-16 aircraft. These examples highlight the symbiotic relationship between prime contractors and their subcontractors and the central role subcontracting plays in U.S. defense procurement.

[11] Subcontracts that occurred before October 2007 were not captured by the federal procurement contract data. There are some subcontracting records for FY2008-FY2010, but very sparse compared with 2011, the start of our sample. This discontinuity implies that there were probably more subcontracts that took place than reported before 2011. That said, even in 2011, the aggregate count and value of subcontracts were small and quantitatively unimportant compared to later years.

Figure 2: Aggregate trends in defense subcontracts



Source: USAspending.gov. Note: The figure shows subcontract obligations (aggregated over all subcontracts based on the timing when the subcontract was obligated) as a percent of prime obligations (solid line on the left axis). It also shows annual subcontract obligations in dollar terms (red diamond line on the right axis).

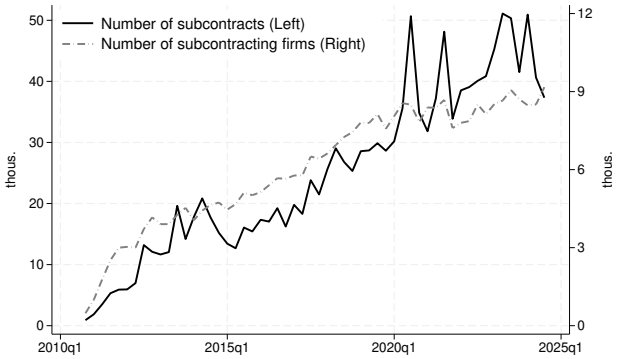
Subcontracting has become an increasingly important component of federal defense procurement in recent years. Figure 2 shows that while subcontracting grew steadily from 2011 to 2018, the period between 2019 and 2021 witnessed a sharp acceleration in subcontracting expenditures, followed by a notable decline after 2022. As shown in Figure 3, the acceleration and subsequent decline during 2019-2024 were not driven by the extensive margin of subcontracting, i.e., the number of subcontracts obligated or the number of subcontractors (panel a), but instead due to the intensive margin of subcontracting, i.e., the average dollar amount of subcontracts and, in particular, subcontracts associated with large repeat prime contracts in aircraft, missile and shipbuilding industries (panel b). This emphasizes the role of high-value contracts rather than broad diffusion during this period.[12]

An important dimension of subcontracting is its timing relative to the associated prime contracts. We show in Appendix Figure A4 that, subcontracts linked to one-time prime contracts tend to follow closely, with little lag between the obligation dates of the prime

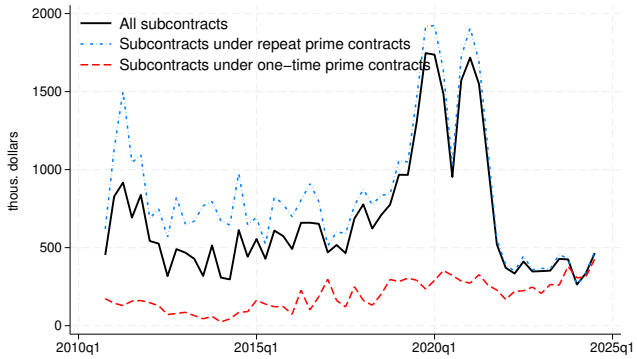
[12]DoD publications point to several sources of the post-2021 increase in subcontracting, including urgent pandemic catch-up, pushing DoD to use subcontracts to counter delays, and new initiatives including a strategic shipbuilding surge under the FY 2021–22 budget and just broad industrial base revitalization projects via prime contracts and supplier expansion. See, for instance, U.S. Department of Defense, Office of Industrial Policy (2021) and Appendix D.2 for details on defense contracting during the Covid-19 pandemic.

Figure 3: Extensive vs intensive margin of subcontracts

(a) Number of subcontracts



(b) Average amount of subcontracts



Source: USAspending.gov. Note: The left panel shows the number of subcontracts obligated in a given quarter (solid line on the left axis) and the number of unique subcontracting firms (dahsed line on the right axis). The units are thousands in both cases. The right panel shows the average subcontracting amount obligated across all subcontracts (black solid line), across subcontracts associated with repeat prime contracts (blue dot-dashed line), and across subcontracts associated with one-time prime contracts, respectively, in thousands of dollars.

and the subcontract. In contrast, those associated with repeat prime contracts exhibit substantial delay, averaging around eleven quarters between the base prime contract date and the subcontract date.[13] We note that there often exists a more proximate prime action date within the repeat contract series, which aligns more closely with the timing of the subcontract. This is useful when we conduct further analysis that accounts for the timing of the geographic relocation of prime contracts through subcontracting.

Taken together, these patterns underscore the complex and evolving nature of subcontracting in defense procurement, with potentially significant implications for how and where federal dollars are ultimately spent.

2.3 NETS Establishment-Level Data

To obtain more detailed information about prime and subcontractors and to understand their responses to defense procurement better, we employ establishment-level data from the National Establishment Time Series (NETS). This is a longitudinal dataset collected by Dunn & Bradstreet (D&B) for the Duns Marketing Information file. It contains information on employee counts, sales, credit ratings, industry, and business ownership structure. The data cover approximately 65 million U.S. establishments since 2011 (the start of our sample), with a unique identifier (called *dunsnumber*) assigned to each establishment. Our NETS sample

[13]This extended lag largely reflects a data limitation: only the date of the base prime contract is recorded in the subcontracting data, rather than the specific prime action date that triggered the subcontract. Also, unlike prime contracting data, subcontracting data do not have information on the subcontract duration.

ends in 2022, which is the latest year we have data available.[14]

We use NETS to measure employment, sales, and financial health of firms that receive prime or subcontracts, by merging firms in DoD procurement data with those in NETS. Thanks to the availability of the *dunsnumber* in both datasets, we were able to conduct an exact merge using this variable as the identifier. Table 2 shows that 91% of firms in DoD procurement data can be found in NETS, indicating the broad coverage and usefulness of NETS for our purposes.

Table 2: NETS data summary statistics

		Establishments that receive		
	Total	only prime contracts	only sub-contracts	both contracts
# of establishments in DoD	188,187	138,659	23,021	26,507
# of establishments matched in NETS	171,966	123,411	22,545	26,010
excl. employees≤10	94,020	60,617	13,559	19,844
excl. employees≥1000	85,930	54,933	12,690	18,307
excl. certain industries (Baseline)	83,012	52,518	12,506	17,988
Baseline sample				
# of establishment-year observations	996,144	630,216	150,072	215,856
% of establishments w. employees<50	66%	70%	64%	57%
% of establishments in service industries	60%	67%	41%	53%

Sources: USAspending.gov; NETS annual establishment-level panel data from 2011-2022.

That said, the accuracy of the NETS data is challenged by imputations and other potential data artifacts. We therefore follow the prescription by Barnatchez et al. (2017) in applying further sample restrictions: (i) dropping establishments with fewer than 10 employees or more than 1,000 employees, and (ii) dropping certain industries that have significant discrepancies with official data or high imputation rates, including educational services, public services, agriculture, mining and utilities. With these restrictions, our final sample covers 44% of firms in the original DoD procurement data.[15]

[14] Although not covering the entirety of the Census-based employer and nonemployer universe, the NETS can be made to mimic official employer datasets such as the County Business Patterns (CBP) and the Quarterly Census of Employment and Wages (QCEW) with appropriate sample restrictions (Barnatchez et al., 2017).

[15] When we conduct analysis employing this data in later sections, the main results are robust to further restrictions, such as dropping observations with imputed employment.

Appendix Figure A5 shows the average establishment-level employment, sales and annual growth rates from 2011-2022 by the type of contracts received. Firms receiving both prime and subcontracts tend to be larger in terms of employment and sales, whereas those receiving only prime contracts tend to be smaller (which can also be seen from the firm-size distribution in Figure A6). The annual growth rates of employment and sales have been trending down and volatile, especially toward the end of the sample period.

2.4 County-Level Labor Market Data from QCEW

We measure local labor market outcomes using the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW). QCEW aggregates administrative establishment-level records from state unemployment insurance programs, yielding a near universe coverage of wage-and-salary jobs, which is also consistent across localities. The data report employment, total wages and the number of establishments by county and NAICS industry at the quarterly frequency, which we use for estimating cross-sectional multipliers.

3 Stylized Facts about Prime and Subcontractor Linkages

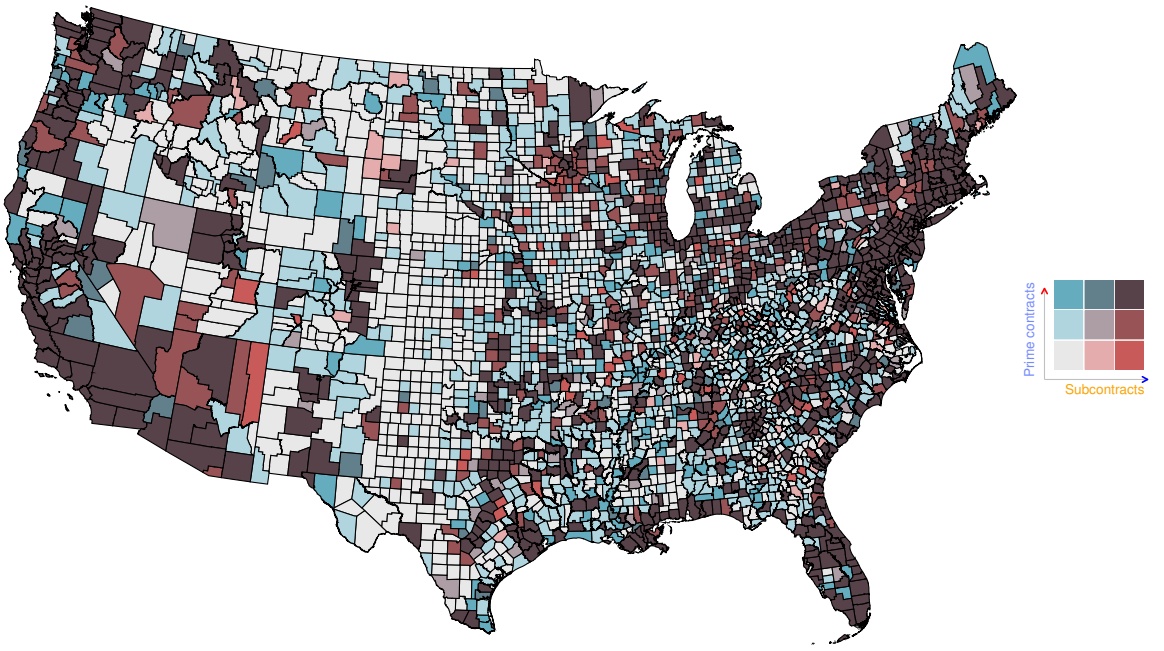
In this section, we explore the linkages between prime and subcontractors in various dimensions and establish three key facts. The first fact involves the geographic relocation of federal prime contract spending through subcontracts. The second and third facts focus on the industry and firm-size linkages between prime and subcontractors. The first fact will have implications for cross-sectional fiscal multipliers, which we explore in Section 4. The other two facts guide us in conducting the firm-level analysis in Section 5.

Fact 1: Subcontracting has led to widespread geographic relocation of federal spending.

Figure 4 presents an initial view of the geographic distribution of prime and subcontracting activities. It shows that coastal areas and large population centers are more likely to receive both prime and subcontracts. In contrast, the Mountain and Central regions of the U.S. tend to be active only in prime contracting activity (teal colored areas), suggesting that prime contracts received by these regions (e.g., NM, CO, WY and ID) are likely to be relocated to other parts of the country through subcontracting.

Next we focus on the prevalence of cross-county and cross-state subcontracting using the linked prime-subcontract data. Table 3 shows that 90% of subcontracting happens between firms that are not in the same county and 70% between firms not in the same state, based on the location of the firm. When considering the places of work performed, these shares are lower, but still notable. Over 80% of subcontracts are performed in a different county from

Figure 4: Geographic distribution of prime and subcontracts



Notes: This map shows the intensity of prime and subcontracting activity for a given county in 2019. It summarizes information from a two-dimensional space. In the prime-contract dimension, we group counties into high, middle, and low activity based on their prime contract obligation amount in 2019. Likewise, in the subcontract dimension, we group counties into three groups according to their subcontract obligation amount in 2019. This gives nine groups of counties as indicated by the legend, with darker colors representing higher intensities in both dimensions.

the prime contracting work place, and near two-thirds of the subcontracts are performed outside the state. When separating prime contracts into one-time and repeat, subcontracts associated with the former are even less likely to be conducted in the same location, although they constitute a much smaller share of prime-subcontract pairs.

Figure 5 presents further evidence on the distance between prime and subcontractors. It shows that the proximity of firm locations remains an important factor in explaining the subcontracting relationship, as the probability of forming such a relationship decreases with distance. This pattern supports the well-known spillover effects of defense spending across regions (e.g., Auerbach et al. (2020)), highlighting a concrete transmission channel. However, we also note that the dispersion is large, with the long tail indicating a non-negligible share of prime and subcontractors located more than 2,000 miles apart.

Table 3: Prime and subcontract location shares

	All subcontracts	Subcontracts under	
		One-time prime	Repeat prime
Firm locations:			
Same county	10%	7%	10%
Same state	29%	15%	32%
Same region	51%	40%	54%
# Obs.	1,393,175	259,587	1,133,588
Places of work performed:			
Same county	18%	13%	19%
Same state	36%	21%	40%
Same region	56%	43%	59%
# Obs.	1,384,041	258,474	1,125,567

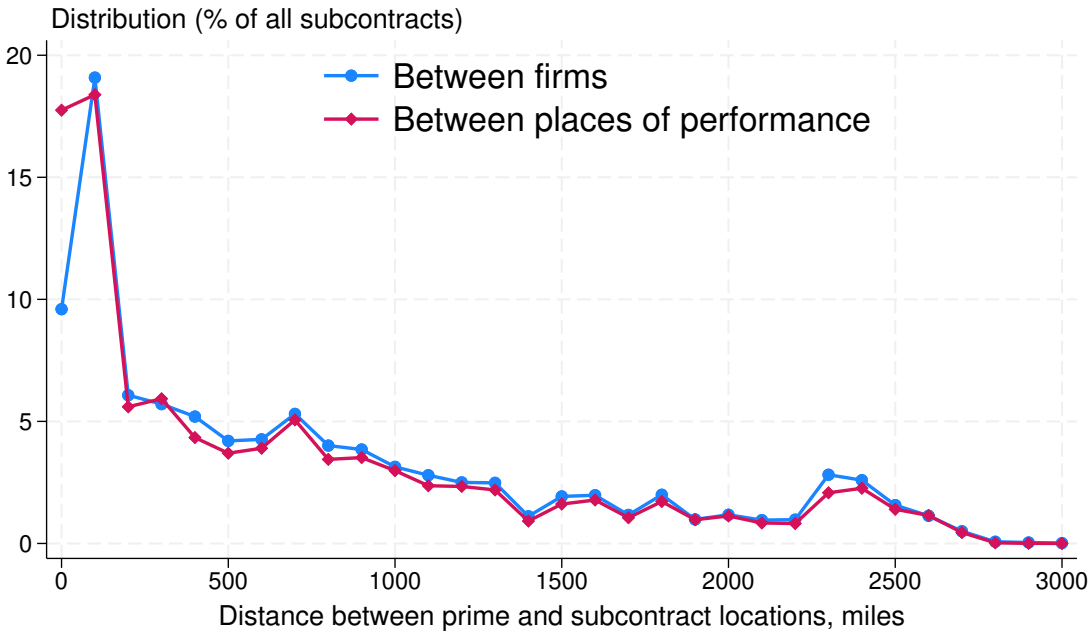
Notes: This table uses prime-subcontract pairs and assesses the frequencies that the prime and subcontracting firms are in the same location (top panel) and that the places of performance of the prime and subcontracts are in the same location (bottom panel).

Fact 2: Sectoral relocation of federal spending through subcontracting is substantial, especially from service sectors.

We now explore the sectoral and industry linkages between prime and subcontractors. Figure 6 displays these linkages in the annual data since 2011. The upper panels show the composition of subcontracting based on the prime contractor's industry. The amount of subcontracting associated with one-time prime contracts has been clearly on the rise, whereas that associated with repeat prime contracts has experienced a surge and subsequent decline since 2019, consistent with the trend documented earlier in Figures 2 and 3. Panel (a) shows that prime contractors in medical and specialized equipment wholesale industries, as well as manufacturing other than aircraft and shipbuilding, initiate a large fraction of subcontracts for their one-time prime contracts. In contrast, prime contractors in aircraft and shipbuilding industries and science and professional services generate the most subcontracts for their repeat prime contracts (panel b).

The striking pattern is the relocation of prime contract spending across industries through subcontracting. The lower panels of Figure 6 show the composition based on the subcontractor's industry. Most of the subcontracts fall in other manufacturing (non-aircraft, non-shipbuilding) and other industries (mainly services and construction). This suggests that although capital- and scale-intensive sectors contribute the most to generating subcontracts

Figure 5: Distance between prime and subcontracting locations



Notes: The figure uses prime-subcontract pairs and shows the distribution of the distance between the prime and subcontracting firms (blue circle line) and the distance between prime and subcontract places of performance (red diamond line) in bins of 100 miles.

(in terms of values), these subcontracts are diffused more broadly to other industries.

Table 4 provides a more complete view of the cross-industry linkages between prime and subcontractors at the NAICS 2-digit level. The rows categorize prime contractors by their industry, while the columns indicate the industry of their subcontractors. Each cell reports the percentage of prime contracts issued by a given industry that are subcontracted to firms in the corresponding industry bracket. The table shows that goods sectors (construction and manufacturing) tend to form subcontracting relationships primarily within the sector, whereas services sectors tend to form the relationships outside the sector, especially with manufacturing and professional and technical services, consistent with the patterns shown in Figure 6.

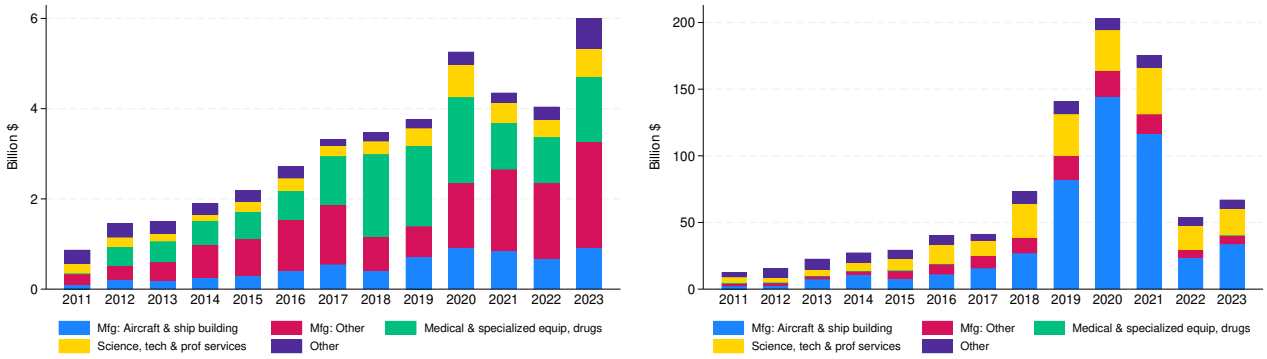
We also examine variation across the type of product supplied by the prime contractor. Unlike the industry information, the product-type information is specific to a prime contract, which indicates the predominant product or service purchased by the DoD (e.g., weapons, IT and Telecom services, and R&D).[16] Appendix Figure A7 shows that one-time prime

[16]The DoD procurement data provide this information through the product and service code, which is consistent across the Federal Procurement Data System. Codes starting with a letter indicate services, while those starting with a number indicate products. Muratori et al. (2023) also utilized this information in their study.

Figure 6: Industry composition of subcontracts

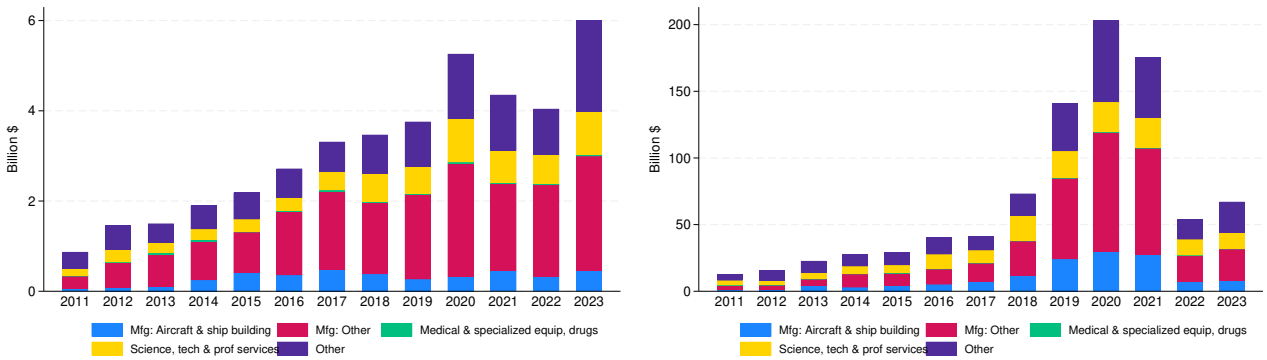
(a) Prime contractor's industry: subcontracts under one-time prime contracts

(b) Prime contractor's industry: subcontracts under repeat prime contracts



(c) Subcontractor's industry: subcontracts under one-time prime contracts

(d) Subcontractor's industry: subcontracts under repeat prime contracts



Source: USAspending.gov; NETS annual establishment-level panel data. Note: The figure shows the subcontract amount by the industry of the prime contractor (panels a and b), by the industry of the subcontractor based on the merged NETS data (panels c and d), and by the type of the prime contract (left vs right columns). The amount is in billions of dollars in all panels.

contracts mostly deliver products, whereas repeat contracts are split evenly between products and services. In the bottom panel of Table 4, we show that prime contractors delivering products tend to form subcontracting relationships primarily with firms in the manufacturing sector. On the other hand, those delivering services tend to form relationships with firms in both professional services and manufacturing sectors. Together, our evidence suggests that subcontracts are diffused broadly to various industries, but goods sectors overall tend to receive a disproportionately large share of these subcontracts than service sectors.

Table 4: Industry linkages between prime and subcontracts

Sub industry → Prime industry ↓	Cons-truction	Manu-facturing	Wholesale & Retail	Trans-portation	Info & Finance	Professional & Technical	Education & Health	Leisure & Hospitality	Other Services
Goods industry									
Construction	**45**	7	10	2	1	11	0	0	5
Manufacturing	3	**62**	10	2	1	7	0	0	2
Service industry									
Wholesale & Retail	0	59	**26**	0	1	5	1	0	1
Transportation	3	33	23	**9**	2	15	0	0	11
Info. & Finance	3	26	18	1	**4**	26	2	0	9
Prof. & Technical	4	17	11	1	3	**46**	2	0	7
Educ. & Health	1	14	5	0	3	32	**32**	0	4
Leisure & Hospitality	3	28	13	10	3	25	3	**2**	5
Other services	15	12	15	8	3	27	2	1	**8**
Product type									
Products	2	65	12	2	1	5	0	0	1
Non-R&D services	10	18	11	4	3	34	1	1	9
R&D services	1	29	11	0	3	40	5	0	3

Notes: The table shows the percent of prime contracts in an industry or a product category that are subcontracted into a given industry. The within-industry subcontracting share is highlighted in bold. Information on the prime contractor's industry and product type is obtained from USAspending.gov, while the subcontractor's industry information is from NETS. Columns do not add up to 100, because a small fraction of subcontractors have the industry information missing in the NETS data.

Fact 3: Large firms primarily subcontract to large firms, while small and mid-sized firms also give a non-negligible share of subcontracts to large firms.

Next we explore the linkages between prime and subcontractors based on their size. Table 5 presents the distribution of subcontracting relationships by firm size, based on NETS data. Each cell reports the percentage of the prime contracts issued by a given firm-size category (indicated by the left column) that are subcontracted to firms in the corresponding size bracket (indicated by the first row). At the two extremes, prime contractors are more likely to form subcontracting relationships with firms of the same size category. For example, 31% of prime contracts awarded to the smallest primes (fewer than 19 employees) are subcontracted to similarly small firms, while 24% of contracts from the largest primes (over 300 employees) go to other large firms.

Table 5 also reveals a striking pattern in the structure of subcontracting relationships: A disproportionate share of subcontracts flow toward large firms (see the last column). This is

Table 5: Firm size linkages between prime and subcontracts

Subcontractors → Prime contractors ↓	Fewer than 19	20-49	50-99	100-299	More than 300	More than 49
Fewer than 19	**31**	21	14	16	18	48
20-49	28	**17**	14	16	24	54
50-99	33	22	**17**	14	15	46
100-299	28	17	14	**17**	24	55
More than 300	17	22	16	21	**24**	61

Notes: The table shows the percent of prime contracts in a firm-size category that are subcontracted into a given firm-size category. The within-firm-size-category subcontracting share is highlighted in bold. The firm size information is from NETS.

notable given the conventional view that subcontracting is a channel through which smaller, more specialized firms supply to larger prime contractors. Instead, the evidence suggests that large firms not only act as prime contractors but also play a significant role as subcontractors, revealing a hierarchical structure where scale advantages, capacity, or being well-embedded in federal procurement networks potentially make them attractive downstream partners as well.

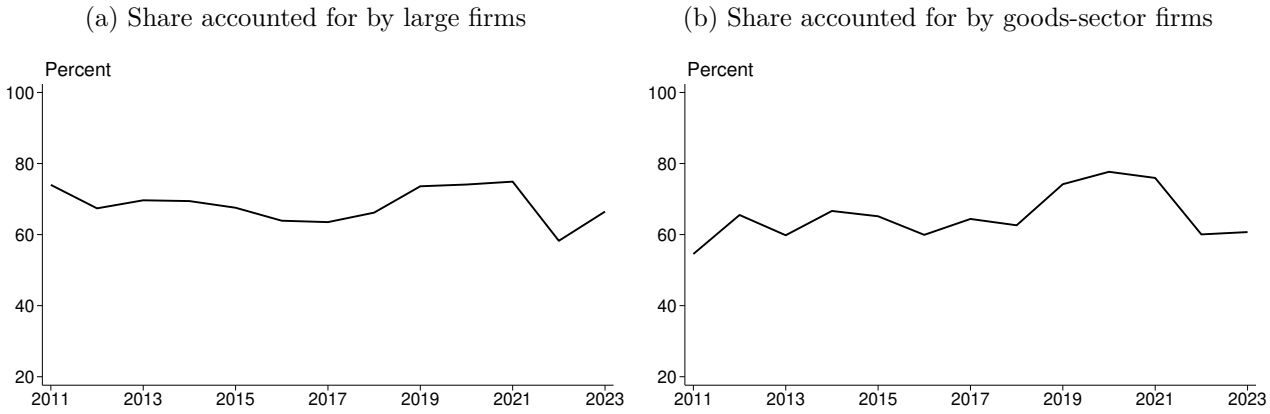
Discussion:

We have established that subcontracting has led to widespread relocation of federal defense spending across locations, industries, and firms of different sizes. We conclude this section by noting that, despite policies that were intended to promote small businesses and service providers in the realm of subcontracting, the majority of subcontracting funds eventually flow to big firms and goods-producing firms, as shown in Figure 7. The composition of where these subcontracting funds end up might have important implications for the local and aggregate economy, as we explore in later sections.

4 Subcontracting and Cross-Sectional Fiscal Multipliers

In the previous section, we showed that a large share of subcontracting flows to areas outside the prime contractor's location. This suggests that conventional cross-sectional multiplier estimates may be biased, because they ignore the exodus of funds through subcontracting and the inflows of funds from other regions. In this section, we first present our empirical approach, highlighting the corrections to the conventional prime contract-based

Figure 7: Composition of subcontract obligations (dollar amount)



Source: USAspending.gov; NETS annual establishment-level panel data. Note: Panel (a) shows the share of subcontracting obligations (dollar amount) by large firms (more than 49 employees). Panel (b) shows the share of subcontracting obligations (dollar amount) by firms in goods sectors.

spending measure and our instruments. We then illustrate the potential bias embedded in the conventional estimates. Our results show that fiscal multipliers are 10%-20% higher than those estimated by the conventional approach, and that they vary over time and across industries. To close the section, we present evidence that the multiplier effects of subcontract spending tend to be smaller than those of prime contracting spending, a novel and interesting result that motivates our firm-level analysis in Section 5.

4.1 Empirical Approach

We use county-level quarterly data from 2011q1-2024q3 to estimate local fiscal multipliers. To account for the dynamic cumulative effects of government spending shocks, we use a local-projection specification similar to Auerbach et al. (2020), building on Nakamura and Steinsson (2014),

$$\sum_{h=0}^{K-1} \frac{Y_{i,t+h} - Y_{i,t-1}}{Y_{i,t-1}} = \beta_K \sum_{h=0}^{K-1} \frac{G_{i,t+h} - G_{i,t-1}}{Y_{i,t-1}} + \alpha_i + \delta_t + \epsilon_{i,t+h}, \quad K = 4, 8, ... \tag{1}$$

where i is the location (county), t is time and h is the horizon. $Y_{i,t}$ is a local economic outcome, and G_i is the total military spending directed to location i at time t, measured by defense contract obligations.[17] The LHS and key RHS terms sum over h, so that the

[17] We follow Auerbach et al. (2020) in using a flow spending measure for each contract by allocating the contracted amount equally over the duration of the contract, which helps capture the component of defense contracts that directly affects output contemporaneously. For prime contracts, the DoD procurement data have information on their durations. For subcontracts, however, such information is not available. We therefore use the duration of the prime contract whose obligation date is closest to the subcontract's obligation date to approximate the subcontract's duration.

coefficient, β_K, captures the cumulative multipliers at a given horizon, K. All of our regressions include location and time fixed effects, α_i and δ_t, to control for unobserved heterogeneity and aggregate trends.

The conventional approach in the literature uses only prime-contract data and assumes that defense spending stays in the location where the prime contractor performs its work, i.e., $G_{i,t} = G_{i,t}^{prime}$. We first correct this measure by subtracting the outflows of funds to other locations through subcontracts and adding inflows of funds from other locations in the same period,

$$G_{i,t} = G_{i,t}^{prime} - \sum_{j \neq i} G_{i,j,t}^{Sub} + \sum_{j \neq i} G_{j,i,t}^{Sub}, \tag{2}$$

where the first subscript of $G_{i,j,t}^{Sub}$ denotes the location of the prime contractor, and the second subscript denotes the location of the subcontractor.[18] As we will show in Section 4.2, the conventional approach without accounting for the relocation of funds through subcontracting leads to a biased estimate of β_K, with the magnitude of the bias depending on β_K.

Even after accounting for the funds relocation due to subcontracting, the OLS estimate is still likely to be biased due to the potential reverse causality, anticipation effects and other unobserved confounding factors. To address this concern, we use an instrumental-variable (IV) approach with a shift-share instrument (Bartik, 1991; Goldsmith-Pinkham et al., 2020). We estimate the following first-stage regression for the key RHS term of equation (1),

$$\sum_{h=0}^{K-1} \frac{G_{i,t+h} - G_{i,t-1}}{Y_{i,t-1}} = \theta_K \sum_{h=0}^{K-1} \frac{s_{i,0}(G_{t+h} - G_{t-1})}{Y_{i,t-1}} + \alpha_i + \delta_t + v_{it+h}, \tag{3}$$

where $G_{t+h} - G_{t-1}$ is the change in national defense contract obligations, and $s_{i,0}$ is the initial share of national defense spending received by region i. We use the 2011 annual average of quarterly shares for location i as the initial share. Our results are robust to using alternative initial periods.

This instrument addresses two key sources of endogeneity in estimating local multipliers of defense spending. First, regional changes in contract allocations may reflect anticipatory behavior by firms or agencies expecting future awards (Auerbach et al., 2020). Second, defense procurement may be influenced by local political dynamics or lobbying (Nakamura

[18] In constructing the corrected local spending measure, we adjust the timing of subcontracts to align with that of the prime contracts, which helps mitigate the concern that subcontracting may be anticipated when the prime contract is realized. Specifically, we use the obligation timing of the prime contract (or the prime contract that has the closest action date as the subcontract, as explained in footnote 17) as the obligation timing of the subcontract. Appendix Figure A4, panels (b) and (d) show that this adjustment has minimal impact, because the obligation of subcontracts typically follow closely with that of the prime contract.

and Steinsson, 2014; Choi et al., 2024). The instrument mitigates these concerns by interacting national shifts in defense spending, driven by geopolitical or strategic considerations, with the predetermined exposure based on the locality's initial share of national procurement flows. As in Nakamura and Steinsson (2014), identification relies on the exogeneity of either the shift or the share, and is particularly credible in a cross-sectional setting with a large number of geographic units, where national military buildups are less likely to be correlated with local business cycles.

4.2 Bias in Conventional Multiplier Estimates

As discussed earlier, the conventional approach uses only prime contract data to construct the local spending measure: $G_{i,t} = G_{i,t}^{prime}$. The relocation of federal spending across regions through subcontracting poses a measurement-error and an omitted-variable problem for the conventional approach, which leads to biased estimates. In this subsection, we derive the bias due to the omission of subcontracting and show how this bias relates to the true multiplier effect.

DGP: For notational simplicity, we suppress the t subscript and focus on the cross-sectional setting, as all of our regressions include time fixed effects. We also suppress h and K, because our derivation can be applied to any horizon. Assume that the data generating process (DGP) governing the effect of defense spending is given by

$$\begin{aligned} y_i =& \alpha + \beta x_i + \varepsilon_i, \quad \varepsilon_i \perp x_i \\ x_i =& x_i^p + \underbrace{x_i^{sub,in} - x_i^{sub,out}}_{\equiv x_i^s} \end{aligned}$$

where y_i denotes the change in a local economic outcome, i.e., the LHS of equation (1). x_i is the corrected government spending shock measure, i.e., the key RHS of equation (1) with corrections shown in equation (2). x_i^p denotes the prime contract-based measure used in the conventional approach (without correction), and $x_i^{sub,in}$ and $x_i^{sub,out}$ denote the correction terms accounting for the ins and outs of subcontracting across regions. Let x_i^s denote the net subcontracting inflow measure, i.e., $x_i^s \equiv x_i^{sub,in} - x_i^{sub,out}$. $\beta > 0$ is the true multiplier effect.

Bias in the conventional estimates: The conventional approach regresses y_i on x_i^p,

$$\text{Misspecified model:} \quad y_i = \alpha + \beta x_i^p + u_i, \quad u_i = \varepsilon_i + \beta x_i^s.$$

It is straightforward to show that $\hat{\beta}$ is a biased estimator of β, because

$$\hat{\beta} = \frac{\sum_{i=1}^{n}(x_i^p - \bar{x}^p)(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i^p - \bar{x}^p)^2} \to \beta + \beta \underbrace{\rho(x^p, x^s)}_{-} \frac{\sigma_{x^s}}{\sigma_{x^p}} < \beta$$

where $\rho(x^p, x^s)$ is the correlation between x_i^p and x_i^s. $\bar{x}$ and σ_x denote the mean and standard deviation of variable x_i. In the data, $\hat{\rho}(x^p, x^s) < 0$. According to the DGP, $\hat{\beta}$ is downward biased, with the magnitude depending on the true multiplier effect β. Given $\rho(x^p, x^s) < 0$, the magnitude of the bias increases with β.

Alternative DGP: So far, we have imposed the same response of the local economy to a defense spending shock, whether this shock is driven by prime or subcontracts. A more realistic DGP allows for different responses to different types of contracts, i.e.,

$$y_i = \alpha + \beta(x_i^p - x_i^{sub,out}) + \gamma x_i^{sub,in} + \varepsilon_i, \quad \varepsilon_i \perp x_i^p, x_i^{sub,out}, x_i^{sub,in} \tag{4}$$

where the second term on the RHS of equation (4) is the prime spending shock, adjusted for the outflows of funds to subcontractors both within and outside location i. The third term is the subcontract spending shock, resulting from subcontracts given by prime contractors both within and outside location i. β and γ are the true multiplier effects of prime and subcontracts, respectively.

In this case, if the researcher uses the conventional misspecified model to estimate β, the bias is given by

$$\begin{aligned}\hat{\beta} &= \frac{\sum_{i=1}^{n}(x_i^p - \bar{x}^p)\left[\beta(x_i^p - \bar{x}^p) - \beta(x_i^{sub,out} - \bar{x}^{sub,out}) + \gamma(x_i^{sub,in} - \bar{x}^{sub,in}) + (\varepsilon_i - \bar{\varepsilon})\right]}{\sum_{i=1}^{n}(x_i^p - \bar{x}^p)^2} \\ &\to \beta - \beta \underbrace{\rho(x^p, x^{sub,out})}_{+} \frac{\sigma_{x^{sub,out}}}{\sigma_{x^p}} + \gamma \underbrace{\rho(x^p, x^{sub,in})}_{-} \frac{\sigma_{x^{sub,in}}}{\sigma_{x^p}} < \beta.\end{aligned}$$

In the data, $\hat{\rho}(x^p, x^{sub,out}) > 0$, suggesting that the outflows of subcontracts increase with the volume of prime contracts received by the county. In addition, $\hat{\rho}(x^p, x^{sub,in}) < 0$, indicating that counties receiving larger prime contracting shocks do not simultaneously experience larger subcontracting shocks originated from prime contractors in other counties. These observations, together with the fact that multiplier effects are positive, imply that the conventional estimate is biased downward. All else equal, the magnitude of the bias increases with both β and γ. Even if $\gamma \to 0$ (the true subcontracting multiplier is small), $\hat{\beta}$ is still biased downward.

4.3 Corrected Multiplier Effects

We now turn to the estimates of the local fiscal multipliers and illustrate how accounting for subcontracting alters our understanding of the effects of federal defense spending. The central comparison is between the conventional multiplier estimates, which do not account for the relocation of funds through subcontracting, and the corrected estimates. We study a set of labor market outcomes that help characterize the local economic more broadly and examine heterogeneity across industries and time.

Labor-market effects: Table 6 shows that the earnings multiplier, using the conventional IV approach based on the prime contract location, is between 0.1 and 0.3, larger than the OLS estimates. Specifically, a one percentage point increase in defense spending raises local earnings by 0.1% in the first two years and by about 0.23% in four years (upper panel). These estimates are in line with the previous literature.[19] However, once accounting for the relocation of funds through subcontracting, our corrected multiplier estimates are larger at all horizons: 0.13% at the 2-year and 0.25% at the 4-year horizon (lower panel). The corrected IV estimates are approximately 10% to 20% larger than the conventional IV estimates, suggesting the downward bias embedded in the conventional approach.

Table 7 considers broader labor market effects and reports IV estimates for employment, average weekly wages, and establishment count multipliers. For all outcomes at all horizons, our corrected multiplier estimates are larger than the conventional estimates. Both the conventional and our corrected estimates suggest that the earnings multiplier is mainly explained by the strong employment growth, not so much due to the wage increase, although wage rises modestly in response to the spending shock. Since employment and wage both increase, our results are consistent with the view that defense spending acts like a demand shock to local labor markets. Interestingly, there is no statistically significant change in establishment counts, indicating that most of the employment gains stem from the expansion of existing firms rather than the entry of new firms. This motivates us to focus on the behavior of existing firms in Section 5.

Our corrected employment multiplier, in particular, is about 20% larger than the conventional estimates, but still within the range suggested by previous studies using cross-sectional variation (e.g., Auerbach et al. (2020) and Briganti et al. (2025)). In this literature, a metric of interest, especially from the policy point of view, is cost per job-year.[20]

[19] For example, Auerbach et al. (2020) find a slightly larger earnings multiplier but in the same ballpark. They use CBSA-level annual data from 1997-2017.

[20] This is computed using a formula of the following form:

$$\text{jobs-year}_h := \beta_h \cdot \frac{1}{N \cdot T} \sum_{\ell=1}^{N} \sum_{t=2011+1}^{2025} \frac{1{,}000{,}000}{Y_{\ell,t-1}} \cdot E_{\ell,t-1},$$

Table 6: Conventional vs corrected local multipliers

	Outcome variable: Earnings				
	4-Quarter	8-Quarter	12-Quarter	16-Quarter	20-Quarter
Conventional (Prime contracts only)					
OLS estimate	0.024***	0.036***	0.044***	0.053***	0.063***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)
IV estimate	0.094***	0.103***	0.179***	0.230***	0.259***
	(0.017)	(0.018)	(0.021)	(0.023)	(0.025)
1st-stage F	4,099	3,595	2,783	2,415	2,300
# Obs.	96,496	84,806	74,892	66,095	57,912
Corrected (Accounting for subcontract relocation)					
OLS estimate	0.002**	0.002*	0.002*	0.004***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IV estimate	0.109***	0.126***	0.210***	0.253***	0.286***
	(0.021)	(0.025)	(0.031)	(0.032)	(0.034)
1st-stage F	249	117	119	166	171
# Obs.	96,496	84,806	74,892	66,095	57,912

Notes: The table reports cumulative multipliers for local earnings at various horizons. The estimates are for specification (1) estimated using an OLS approach and then estimated using an instrumental variable (IV) approach. For the IV estimates, the robust F-statistics of the first stage regression are also reported. The upper panel shows the conventional multipliers which allocate the entire prime contract amount to the place of performance reported by the prime contractor. The lower panel shows the corrected multipliers that incorporate the relocation of subcontract amounts. The unit of observations is county-quarter. *, **, and *** indicate significance at the 10%, 5%, and 1% levels. The sample in each regression spans 2011q1-2024q3.

We show in Appendix Figure B1 that the conventional multiplier estimates would imply the cost per job-year above $400K (in 2019 dollars) at a two-year horizon, whereas the corrected multipliers suggest a lower cost per job-year of about $300K. Thus, the downward bias in the conventional employment multiplier translates into an upward bias in the cost per job-year number, which matters for program evaluation.[21]

where β_h is the horizon h employment multiplier.

[21] Our cost per job-year estimate is higher than those surveyed in Chodorow-Reich (2019) based on the effects of the American Recovery and Reinvestment Act (ARRA) of 2009, even after accounting for the inflation from 2009 to 2019. This difference may be driven by the unique economic environment surrounding the ARRA implementation. In a related paper, Briganti et al. (2025) also obtained employment multipliers and cost per job-year estimates similar to ours. They used MSA-level data from 2006-2019 that cover all

Table 7: Conventional vs corrected local multipliers: additional outcomes

Outcome	4-Quarter	8-Quarter	12-Quarter	16-Quarter	20-Quarter
Earnings					
Conventional	0.094***	0.103***	0.179***	0.230***	0.259***
	(0.017)	(0.018)	(0.021)	(0.023)	(0.025)
Corrected	0.109***	0.126***	0.210***	0.253***	0.286***
	(0.021)	(0.025)	(0.031)	(0.032)	(0.034)
Employment					
Conventional	0.063***	0.078***	0.138***	0.174***	0.204***
	(0.012)	(0.013)	(0.014)	(0.016)	(0.016)
Corrected	0.074***	0.095***	0.162***	0.192***	0.225***
	(0.015)	(0.018)	(0.022)	(0.022)	(0.024)
Average weekly wage					
Conventional	0.037***	0.031***	0.042***	0.049***	0.044***
	(0.012)	(0.012)	(0.013)	(0.014)	(0.014)
Corrected	0.042***	0.038***	0.049***	0.054***	0.049***
	(0.014)	(0.015)	(0.016)	(0.016)	(0.016)
Establishment counts					
Conventional	0.013*	0.014*	0.004	0.004	0.010
	(0.007)	(0.008)	(0.009)	(0.011)	(0.011)
Corrected	0.016*	0.017*	0.005	0.004	0.011
	(0.008)	(0.010)	(0.011)	(0.012)	(0.013)

Notes: The table reports cumulative multipliers for different outcome variables at various horizons, estimated using specification (1) with the IV approach. Local economic outcome variables are obtained from the QCEW for 2011q1- 2024q3. See notes for Table 6.

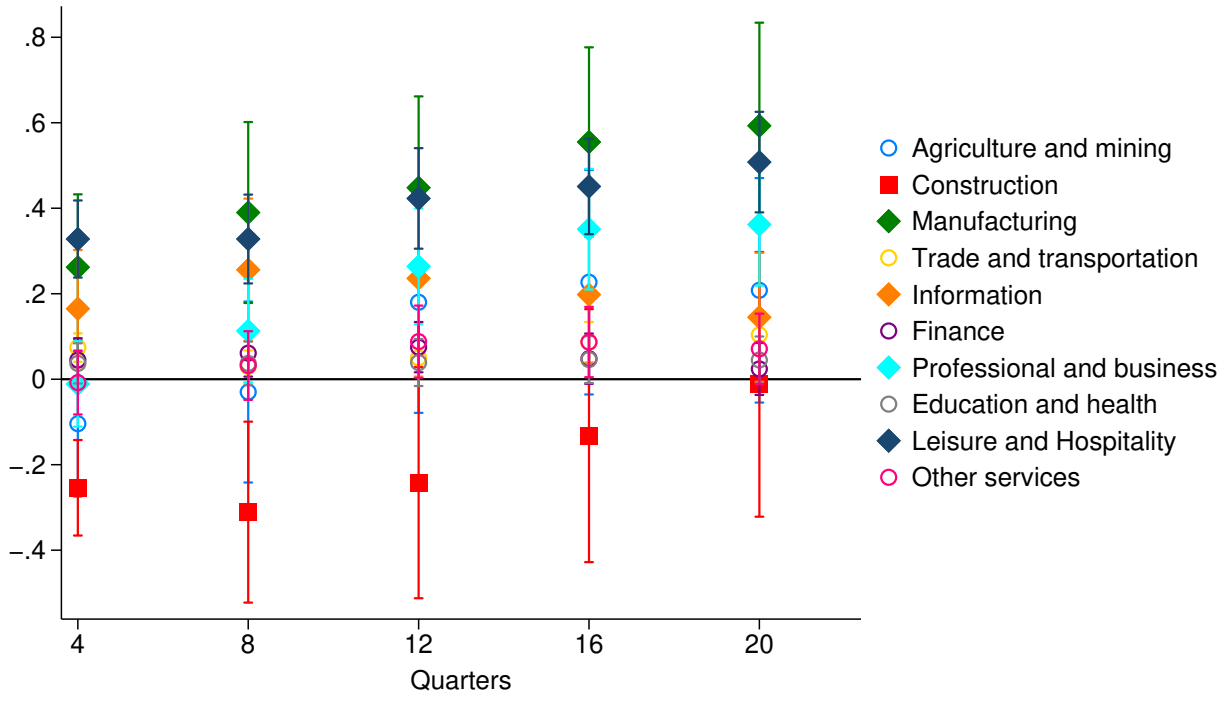
Time variation: In order to further probe the role of subcontracting in fiscal multipliers, we contrast the conventional and corrected multipliers in subsamples. Since subcontracting has risen over time (except for the last two years of our sample), the downward bias of the conventional multiplier estimates should be more pronounced over time. Table B1 in the appendix shows that this is indeed the case. In the earlier period (2011-2016), the difference between the conventional and corrected earnings multiplier is minimal, whereas it

types of federal procurement contracts.

increases as subcontracting becomes more prevalent. Using the entire pre-pandemic sample (2011-2019), we see that the corrected multiplier estimates are approximately 15%-20% larger than conventional estimates at longer horizons. This subsample analysis also shows that our baseline results are robust to excluding the data from 2020 onwards.

Heterogeneity by industry: An important related question is how the defense spending effect manifests across industries. To address this question, we estimate equation (1) using the corrected spending measure and IV approach, but replacing total employment growth on the LHS with the employment growth of a specific industry. Figure 8 shows that the manufacturing industry is the primary driver of the employment multiplier, which comes as no surprise given our earlier finding that prime and subcontracts are heavily concentrated in manufacturing industries (Figures 6 and A2). Other industries that show statistically and economically significant effects include leisure and hospitality, professional and business, and information services. This supports the view of "spillovers" and "general-equilibrium multiplier effects" across industries beyond those directly impacted by defense contracts.

Figure 8: Employment effects by industry



Notes: The figure reports the cumulative effects on employment by industry at various horizons. They are estimated using specification (1) with the cumulative employment change in a industry as the RHS. We report IV estimates with corrected spending measures that account for subcontracting. The estimates are shown with 95% confidence intervals. Diamonds indicate the estimates statistically significantly positive, squares statistically significantly negative, and circles statistically or economically insignificant.

4.4 Prime vs Subcontracting Effects: County-Level Evidence

In equation (1), we impose the same multiplier effect of prime and subcontracts. To allow for the possibility that subcontracting may impact the local economy differently, we use the following specification to estimate this differential effect,

$$\sum_{h=0}^{K-1} \frac{Y_{i,t+h} - Y_{i,t-1}}{Y_{i,t-1}} = \beta_K \sum_{h=0}^{K-1} \frac{G^P_{i,t+h} - G^P_{i,t-1}}{Y_{i,t-1}} + \gamma_K \sum_{h=0}^{K-1} \frac{G^S_{i,t+h} - G^S_{i,t-1}}{Y_{i,t-1}} + \alpha_i + \delta_t + \epsilon_{i,t+h}. \quad (5)$$

Consistent with the notation in equation (2), the prime-contract spending measure, $G^P_{i,t} = G^{prime}_{i,t} - \sum_j G^{Sub}_{i,j,t}$, accounts for the outflow of funds through subcontracting, and $G^S_{i,t} = \sum_j G^{Sub}_{j,i,t}$ represent the inflow of funds from all locations through subcontracting.

Similar to the IV strategy used for equation (1), we instrument prime and subcontract spending variables with shift-share instruments in the first stage,

$$\begin{aligned}
\sum_{h=0}^{K-1} \frac{G^P_{i,t+h} - G^P_{i,t-1}}{Y_{i,t-1}} =& \hat{\theta}^P_K \sum_{h=0}^{K-1} \frac{s^P_{i,0}(G^P_{t+h} - G^P_{t-1})}{Y_{i,t-1}} + \hat{\omega}^P_K \sum_{h=0}^{K-1} \frac{s^S_{i,0}(G^S_{t+h} - G^S_{t-1})}{Y_{i,t-1}} + FE \\
\sum_{h=0}^{K-1} \frac{G^S_{i,t+h} - G^S_{i,t-1}}{Y_{i,t-1}} =& \hat{\theta}^S_K \sum_{h=0}^{K-1} \frac{s^P_{i,0}(G^P_{t+h} - G^P_{t-1})}{Y_{i,t-1}} + \hat{\omega}^S_K \sum_{h=0}^{K-1} \frac{s^S_{i,0}(G^S_{t+h} - G^S_{t-1})}{Y_{i,t-1}} + FE,
\end{aligned}$$

where G^P_t and G^S_t are aggregate prime and subcontract obligations. The initial share of prime obligations for county i, $s^P_{i,0}$, is the 2011 annual average of quarterly shares, as in equation (3). The initial share of subcontract obligations, $s^S_{i,0}$, is the 2011-2013 average of quarterly shares. We use a slightly longer period to construct the subcontracting initial share, because the aggregate subcontracting amount was small and volatile based on the 2011 data alone. Exogenous variation comes from three sources: (i) the change in aggregate prime-contract spending, driven by geopolitical or national strategic considerations, (ii) the change in aggregate subcontracting, driven by regulation and policies that were intended to promote subcontracting and business network (as discussed in Section 2.2.1 and Appendix D), and (iii) county-level initial shares of prime and subcontracting spending. These aggregate shifts interacted with county-specific shares create plausible exogenous variation, especially at fine geographic levels such as counties.

Table 8 reports the IV estimates. Note that the first-stage F statistics suggest strong instrumental relevance. The prime contract multiplier effects, $\hat{\beta}_K$, are slightly larger than in Table 7.[22] Notably, the subcontracting multipliers are in general *smaller* than the prime contract multipliers. Formally testing $\beta_K = \gamma_K$ shows that the difference is

[22] As shown in Section 4.2, if the data generating process is such that the prime and subcontract multipliers differ, the conventional approach would introduce even larger downward bias.

Table 8: Prime vs subcontracting multipliers

Outcome	4-Quarter	8-Quarter	12-Quarter	16-Quarter	20-Quarter
Earnings					
$\hat{\beta}$ (Prime effect)	0.111***	0.126***	0.218***	0.262***	0.294***
	(0.020)	(0.022)	(0.027)	(0.029)	(0.033)
$\hat{\gamma}$ (Sub effect)	0.039*	0.029**	0.061***	0.119***	0.198***
	(0.020)	(0.014)	(0.012)	(0.014)	(0.019)
p-value for testing $\beta = \gamma$	0.005	0.000	0.000	0.000	0.000
1st-stage F	135	162	274	320	242
Employment					
$\hat{\beta}$ (Prime effect)	0.075***	0.095***	0.168***	0.200***	0.234***
	(0.015)	(0.016)	(0.018)	(0.019)	(0.022)
$\hat{\gamma}$ (Sub effect)	0.023	0.019**	0.039***	0.069***	0.119***
	(0.014)	(0.010)	(0.008)	(0.010)	(0.013)
p-value for testing $\beta = \gamma$	0.004	0.000	0.000	0.000	0.000
1st-stage F	135	162	274	320	242
Average weekly wage					
$\hat{\beta}$ (Prime effect)	0.043***	0.038***	0.051***	0.055***	0.048***
	(0.014)	(0.014)	(0.016)	(0.016)	(0.017)
$\hat{\gamma}$ (Sub effect)	0.020	0.012	0.022***	0.044***	0.065***
	(0.014)	(0.009)	(0.007)	(0.008)	(0.010)
p-value for testing $\beta = \gamma$	0.204	0.074	0.059	0.481	0.312
1st-stage F	135	162	274	320	242
Establishment counts					
$\hat{\beta}$ (Prime effect)	0.016**	0.017*	0.005	0.004	0.011
	(0.008)	(0.010)	(0.011)	(0.012)	(0.014)
$\hat{\gamma}$ (Sub effect)	-0.004	-0.004	-0.002	0.011*	0.014*
	(0.008)	(0.006)	(0.005)	(0.006)	(0.008)
p-value for testing $\beta = \gamma$	0.051	0.037	0.542	0.560	0.827
1st-stage F	135	162	274	320	242

Notes: The table reports cumulative multipliers for different outcome variables at various horizons, estimated using specification (5) with instruments. P-values for testing equal effects between prime-contract spending (β) and subcontract spending (γ) are shown, with p-values less than 0.1, 0.05 and 0.01 indicating the difference significant at the 10%, 5%, and 1% levels.

strongly statistically significant for earnings and employment. These results imply that subcontracting exerts weaker local economic effects than prime contracting, a novel result to the literature. In the next section, we explore potential explanations by focusing on the direct effects and their heterogeneity at the firm level, where we have more detailed information about prime and subcontractors.

In sum, our analysis in this section underscores the importance of accounting for the geographic redistribution of federal spending via subcontracting. Ignoring this channel leads to an underestimation of local fiscal multipliers and obscures meaningful variation in the incidence and transmission of government spending shocks across regions, industries and time.

5 Prime vs Subcontracting Effects: Establishment-level Evidence

In the previous section, we find an important result that is new to the literature: subcontracting multipliers are smaller than prime contracting multipliers. While potentially useful for mapping to aggregate implications, county-level evidence is less informative about the underlying transmission mechanism. In this section, we turn to micro data with three purposes: (1) to find support for our county-level result, (2) to uncover which firms primarily drive this difference, and (3) to provide possible explanations for this differential effect.

To this end, we use NETS establishment-level data (detailed in Section 2). Although it is possible to aggregate these data to the firm level, we conduct establishment-level analysis for three reasons.[23] First, DoD contracts are performed in specific locations by the establishments operating in those locations. Focusing on establishment-level data, as opposed to aggregating them across regions to the firm level, is consistent with our county-level analysis. Second, establishment-level data allow each individual location to be classified into a specific industry, which is crucial for our analysis on heterogeneity across industries. Third, since most businesses in the U.S. are single-establishment firms (Sadeghi et al., 2016), the choice of aggregation is likely to be quantitatively unimportant. This also means that our analysis speaks to the direct effects of federal contracts at the establishment level, not spillovers to other establishments within the same firm or enterprise, or, more broadly, to the local economy through general-equilibrium effects. Later in our analysis, we use the terms *establishment* and *firm* interchangeably to mean establishment.

[23] An establishment is a single physical location where one predominant activity occurs, identified by the *dunsnumber* in our merged dataset. A firm is an establishment or a combination of establishments operating in one or multiple industries, typically identified by the Employer Identification Number (EIN) by the IRS. An enterprise is a firm or a combination of firms that are classified into multiple industries under one or more EINs. See Sadeghi et al. (2016) for a detailed comparison of establishment-, firm-, and enterprise-level data.

5.1 Empirical Approach and Average Effects

Our sample consists of establishments that ever received a defense prime or subcontract between 2011 and 2024. We observe their employment, sales, credit ratings and other information at the annual frequency between 2011 and 2022.[24] To study the cumulative effects of receiving a prime or subcontract, we use a local-projection panel regression specification:

$$\frac{y_{j,t+h} - y_{j,t-1}}{y_{j,t-1}} = \beta^h \mathbb{I}^P_{j,t} + \gamma^h \mathbb{I}^S_{j,t} + \omega \mathbf{x}_{j,t-1} + \alpha_j + \delta_{st} + \nu_{j,t+h}, \tag{6}$$

where the LHS is the cumulative percent change of an outcome variable at horizon $h = 1, ..., H$. $\mathbb{I}^P_{j,t}$ is an indicator that takes the value of 1 if firm j receives a prime contract in year t. $\mathbb{I}^S_{j,t}$ is similarly defined for a firm that receives a subcontract in t. β^h and γ^h are key parameters of interest. $\mathbf{x}_{j,t}$ is a vector of controls. For employment regressions, we include lagged employment (in log) as a control; for sales and credit rating regressions, we further include the corresponding lagged variable (in log) as a control. All regressions include firm fixed effects to account for unobserved heterogeneity, as well as NAICS-2-digit-by-year fixed effects, which control for sector specific time trends. The standard errors are clustered at the establishment level. A similar specification is used by di Giovanni et al. (2023) to study Spanish firms' behavior in response to government procurement.

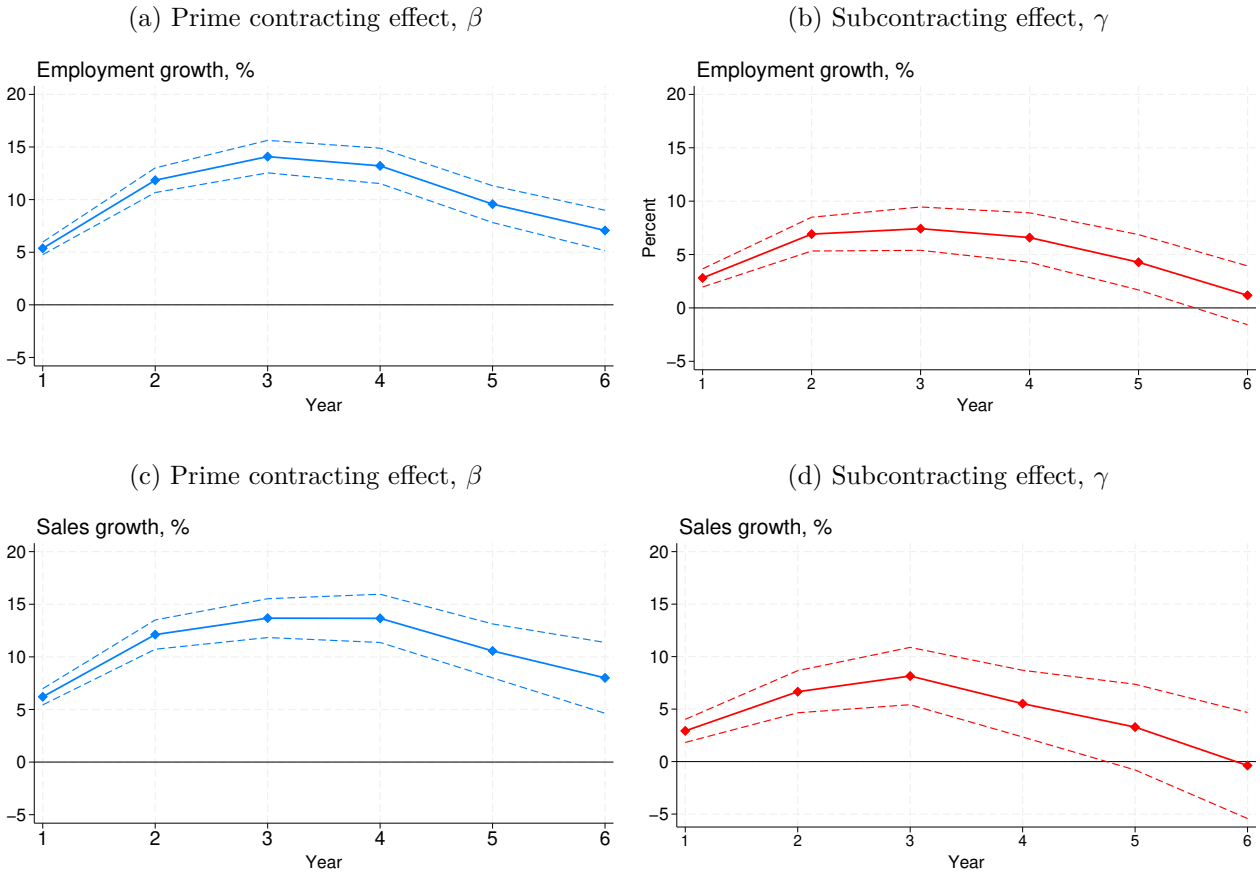
By including firm fixed effects, our empirical strategy exploits within-firm variation, as having a prime or subcontract is relatively rare at the establishment-year level. Our sample restricts to firms that ever participated in defense contracts, which helps mitigate the concern of selection bias, because firms that never participated may have done so for some reason which may be correlated with their employment and sales growth.[25] In other words, including firms that have never participated in defense contracts may accidentally introduce a selection problem that biases our estimates, a pitfall we avoid using our defense contractor sample.

Figure 9 shows the effects of prime contracting (left column) and subcontracting (right column), for employment growth (upper panels) and sales growth (lower panels). Employment and sales increase in response to both types of contracting activity. More importantly, consistent with our county-level evidence, the effects of prime contracting tend to be larger at all horizons (significant at the 1% level) and more persistent than those

[24] The credit ratings are measured by D&B's Paydex score, which accesses a firm's payment reliability based on its payment history with suppliers and vendors, just like the FICO score for consumers.

[25] For example, firms that have never participated in these contracts may operate under a different supply-chain system, have a different clientele base, or perform less or more efficiently than those participating in defense contracts. These unobserved characteristics may affect the economic outcomes we study, confounding the defense-contract effects.

Figure 9: Establishment-level evidence on defense contracting effects



Notes: The point estimates for the prime contracting effect (β) and the subcontracting effect (γ) and the 95% confidence intervals are obtained by estimating specification (6). All regressions include establishment and sector-by-year fixed effects and control variables as described in the text.

of subcontracting. A similar pattern is found for sales growth.[26] This firm-level evidence provides external support to our county-level result.

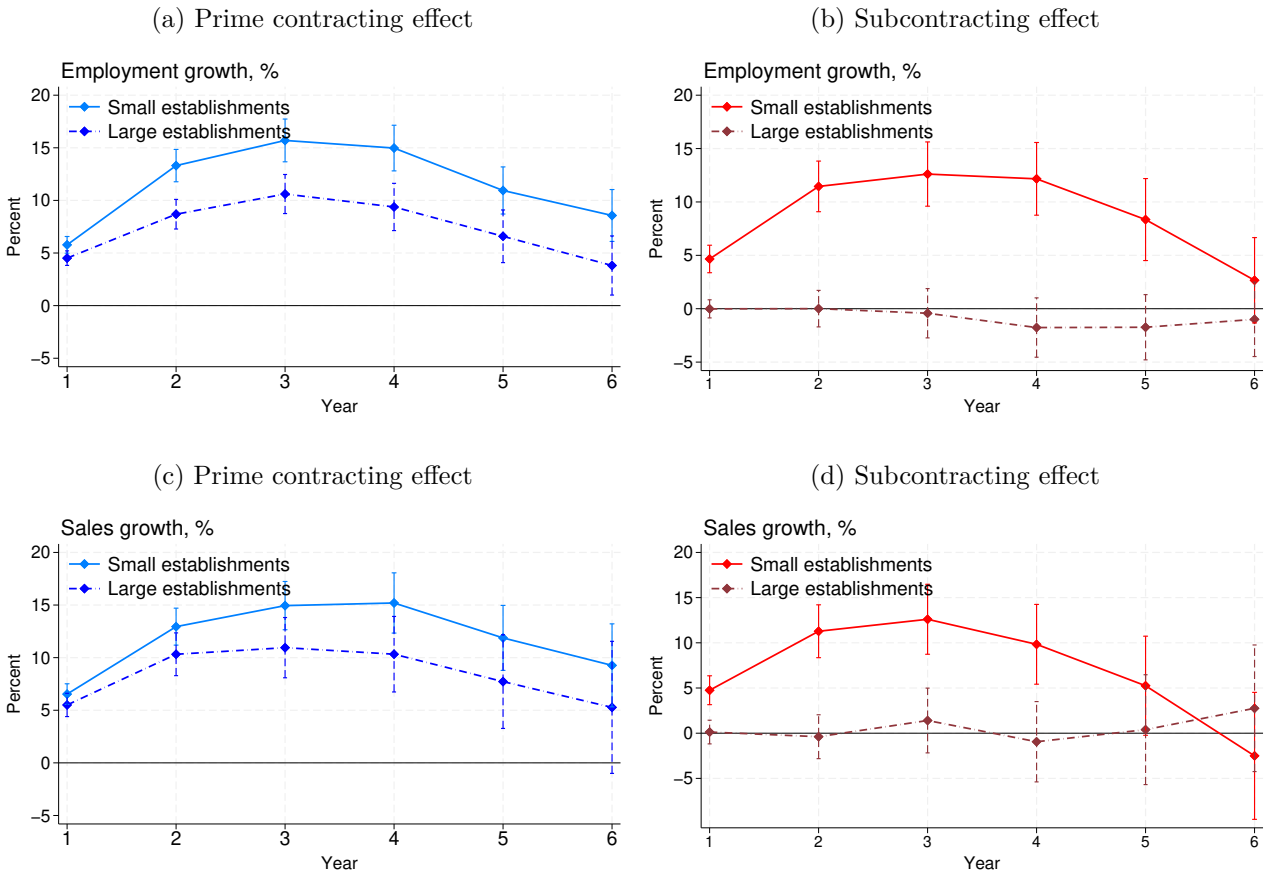
5.2 Heterogeneity across Establishments

To understand which firms drive the differential effects of subcontracting, we examine heterogeneity in two dimensions. First, we analyze the response by firm size, contrasting small firms (less than 50 employees) with large firms (50 or more employees). Second, we examine heterogeneity by industry, focusing on the comparison between firms in services sectors and those in goods sectors. We estimate a specification that interacts the prime and subcontracting indicators in equation (6) with a firm characteristic, Z_j,

[26] We also considered the responses of credit rating. We find that it increases in response to both prime and subcontracting shocks, consistent with the view that firms experience improved financial health after participating in federal purchase programs. The difference, however, is small.

$$\frac{y_{j,t+h} - y_{j,t-1}}{y_{j,t-1}} = \beta_1^h \mathbb{I}_{j,t}^P + \gamma_1^h \mathbb{I}_{j,t}^S + \beta_2^h \mathbb{I}_{j,t}^P \times Z_j + \gamma_2^h \mathbb{I}_{j,t}^S \times Z_j + \mathbf{x}_{j,t-1}\omega + \alpha_j + \delta_{st} + \nu_{j,t+h}. \quad (7)$$

Figure 10: Establishment-level effects by size



Notes: The point estimates for the prime contracting effects on small establishments (β_1) and on large establishments ($\beta_1 + \beta_2$) and the subcontracting effects on small establishments (γ_1) and on large establishments ($\gamma_1 + \gamma_2$), as well as the 95% confidence intervals are obtained by estimating specification (7). All regressions include establishment and sector-by-year fixed effects and control variables as described in the text.

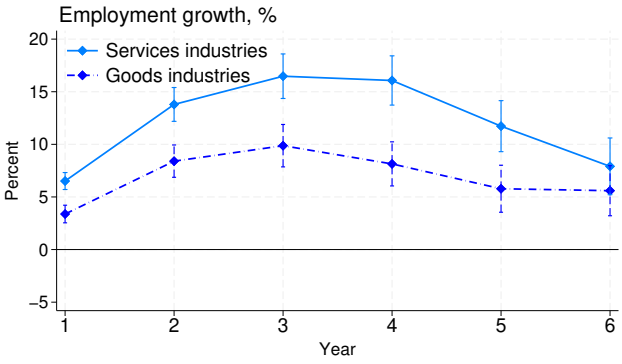
Figure 10 reveals two patterns. First, large firms tend to have smaller responses in terms of employment and sales growth, regardless of the contract type. This is consistent with the previous literature finding that small firms contribute disproportionately to net job growth than large firms (e.g., Neumark et al. (2011); Haltiwanger et al. (2013)). Second, large firms respond the least to subcontracting activity. In fact, small firms respond in a similar way to prime and subcontracting, experiencing higher employment and sales growth. It is the differential response of large firms that explains the lower average effect of subcontracting in

Figure 9.[27]

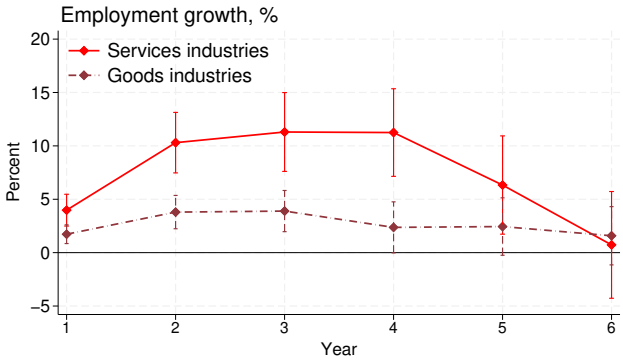
Breaking down the effect by industry, Figure 11 shows that the responses of firms in goods industries are smaller than those in services industries. Part of the reason is that firms in services industries tend to be smaller, as shown in Table 2. Together, Figures 10 and 11 suggest that subcontracting has the least effect on large firms in goods-producing industries. Our results about service and good industries are also consistent with Muratori et al. (2023), who use defense prime contracts in a longer sample, establishing that service-based multipliers are larger than goods spending multipliers.

Figure 11: Establishment-level effects by industry

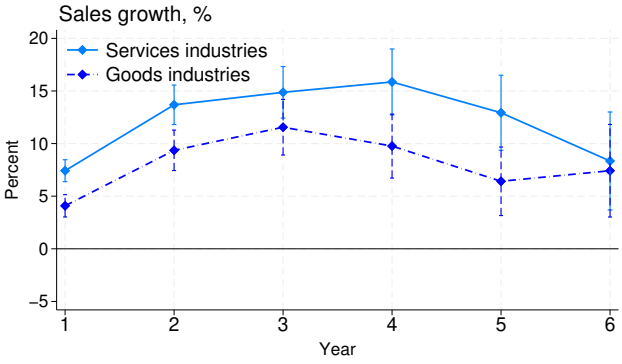
(a) Prime contracting effect



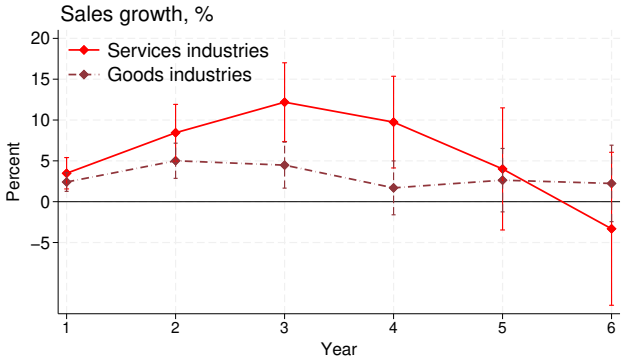
(b) Subcontracting effect



(c) Prime contracting effect



(d) Subcontracting effect



Notes: The point estimates for the prime contracting effects on goods-producing establishments (β_1) and on service-producing establishments ($\beta_1+\beta_2$) and the subcontracting effects on goods-producing establishments (γ_1) and on service-producing establishments ($\gamma_1+\gamma_2$), as well as the 95% confidence intervals are obtained by estimating specification (7). All regressions include establishment and sector-by-year fixed effects and control variables as described in the text.

[27] Hebous and Zimmermann (2021) link federal contracts won through auctions with Compustat (dominated by large firms) and find that winning a contract allows financially constrained firms to raise their capital investment. They define constrained firms as small firms (asset based) and also based on corporate bond ratings. We have consistent results that small firms respond more.

In Appendix Figure C1, we also explore employment and sales responses for high and low credit-rating firms. There are no differential responses among prime contractors. Among subcontractors, however, there is some evidence that high-rating firms tend to have a larger employment response.

5.3 Why Does Subcontract Spending Have Smaller Effects?

Our firm-level heterogeneity exercise shows that firms are less responsive to subcontracts compared to prime contracts, and that large and goods-producing firms are particularly unresponsive to subcontracting. In the aggregate, we already established that subcontracts disproportionately flow to large and goods-producing firms (Figure 7). This means that the multiplier effects of subcontracting on the local economy is weaker than prime contracting, exactly as our county-level evidence shows (Table 8).

An interesting question is why firms are less responsive to subcontracts, especially large firms, which also tend to be goods-producing firms. While there may be different explanations from a behavioral point of view, we offer one with supporting evidence: the difference in the persistence of the contracting relationship. The idea is that, if the contracting relationship is more persistent, firms may expect higher future revenue and hence are more willing to hire workers. Using NETS data, we present two pieces of evidence: (i) prime contracting relationship is more persistent than subcontracting relationship, and (ii) conditional on the sample of subcontractors, the relationship with the main prime contractor is more stable for smaller subcontractors. This evidence seems to support the expectation channel, particularly with respect to firms' hiring decisions.[28]

In column (1) of Table 9, we regress the indicator of having a prime contract ($\mathbb{I}^P_{j,t}$) on its lag ($\mathbb{I}^P_{j,t-1}$). The estimate shows that having a prime contract in the previous year increases the probability of having one in the current year by 0.2 pp (a 51% increase relative to the sample mean). In column (2), we find somewhat higher persistence for large firms, but the magnitude of this difference is small. Columns (3) and (4) focus on the persistence of having subcontracts. We find that this relationship is much less persistent than the prime contracting relationship, with the AR(1) coefficient being about 0.1. Large firms are slightly more likely to continue having a subcontracting relationship.

However, unlike prime contractors who always receive contracts from the DoD,

[28] An alternative explanation is that large, goods-producing firms respond to subcontracts by investing in capital (machinery, equipment, etc.) rather than expanding employment. While our data lack investment measures to directly test this channel, our firm-level results show that sales growth mirrors employment growth, suggesting similar dynamics across outcomes. In addition, our county-level analysis, which captures local general-equilibrium effects across all channels, indicates smaller subcontracting multipliers for both earnings and employment. Taken together, these findings suggest that capital investment, though potentially relevant, does not help to explain the differential multiplier effect of subcontracting.

Table 9: Persistence of defense contracting relationship

	Prime contracting		Subcontracting		Same Prime firm	
	$\mathbb{I}^P_{j,t}$	$\mathbb{I}^P_{j,t}$	$\mathbb{I}^S_{j,t}$	$\mathbb{I}^S_{j,t}$	$SameFirm_{j,t}$	$SameFirm_{j,t}$
$\mathbb{I}^P_{j,t-1}$	0.210***	0.200***		0.044***		
	(0.002)	(0.002)		(0.003)		
$\mathbb{I}^P_{j,t-1}$×Large		0.021***				
		(0.003)				
$\mathbb{I}^S_{j,t-1}$		0.041***	0.116***	0.108***		
		(0.002)	(0.002)	(0.003)		
$\mathbb{I}^S_{j,t-1}$×Large				0.021***		
				(0.005)		
$SameFirm_{j,t-1}$					0.200***	0.223***
					(0.005)	(0.007)
$SameFirm_{j,t-1}$×Large						-0.042***
						(0.009)
Ctrls	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Sector × year FE	Y	Y	Y	Y	Y	Y
Sample	Prime firms	Prime firms	Sub firms	Sub firms	Sub firms	Sub firms
# Obs.	704,076	704,076	307,861	307,861	82,113	82,113

Notes: The table shows the estimated persistence (captured by the AR(1) coefficients) of the prime- and sub-contracting relationship, respectively, and heterogeneity by establishment-size. The dependent variable is shown in each column header. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

subcontractors face an additional layer of uncertainty—from whom they will receive the subcontract. This motivates the analysis in the last two columns of Table 9. We restrict the sample to subcontractors and examine the probability that the main prime contractor remains the same as in the previous year (i.e., $SameFirm_{j,t} = 1$). We regress this indicator on its lag to evaluate the persistence of the relationship with a specific prime contractor. Our estimates show that this probability increases if, in the previous year, the subcontractor had the same main prime contractor as in the year before (column 5). However, as shown in the last column, this persistence declines for large firms.

These results suggest that while subcontracting appears to be less persistent and less predictable than prime contracts for all firms, this is particularly true for large firms (who are also more likely to be goods producers). These differences may affect firms' revenue expectations and hence impact their employment decisions.

5.4 Robustness

We consider two robustness checks. First, although imputation occurs most frequently in the small-size-firm bin, which we already dropped, there is still a non-trivial fraction of employment observations that are imputed (about 20%). We conduct a robustness check that drops all observations with imputed employment (Figure C2, upper panel).

Second, one may be concerned that the smaller responses to subcontracting simply reflect the smaller amount of subcontracts, so the treatment intensity is different. To address this concern, we estimate a specification that accounts for the amounts of the prime and subcontracts received. Specifically, the indicator variables, $\mathbb{I}^P_{j,t}$ and $\mathbb{I}^S_{j,t}$, are replaced with log of prime contract obligation (adjusted for subcontracting) and log of subcontract obligation (Figure C2, lower panel).

Figure C2 shows the responses of employment growth (with similar patterns found in sales growth). Our baseline estimates are robust. Removing imputed employment observations does not change the results from the baseline sample. In addition, accounting for the treatment intensity based on the dollar amount of contracts does not alter the pattern that prime contracting has larger effects on firm employment than subcontracting.

6 Conclusion

This paper highlights the critical but underexplored role of subcontracting in shaping the economic incidence of federal defense procurement. Using newly available data on subcontract awards since 2011, matched with detailed establishment-level data from NETS, we document three key facts: subcontracting facilitates widespread geographic and sectoral reallocation of federal dollars; subcontracting relationships disproportionately flow to large firms; and prime–subcontractor linkages vary significantly in their persistence and responsiveness. These patterns have important implications for estimating the local fiscal multipliers typically associated with defense spending.

First, conventional measures that attribute contract dollars solely to the location of the prime contractor underestimate the true economic effects of federal procurement. Accounting for subcontracting raises estimated local multipliers by about 20% and reveals substantial cross-county and cross-industry spillovers. Second, while subcontracting broadens the footprint of federal spending, its average local effects are smaller and less persistent than those of prime contracting. Our establishment-level analysis shows that subcontractors respond positively to awards, but with muted and shorter-lived gains relative to prime contractors, likely reflecting the less durable nature of subcontract relationships.

Finally, the aggregate stimulative effect of subcontracting is further dampened by

its concentration in large, manufacturing-intensive firms, which exhibit limited marginal responsiveness. In contrast, smaller and service-sector firms respond more strongly but are underrepresented in subcontract allocations. These findings underscore the need to look beyond prime contracts to fully understand how public procurement diffuses through the economy and suggest that policy design and contract structuring could play a role in enhancing the effectiveness of fiscal spending.

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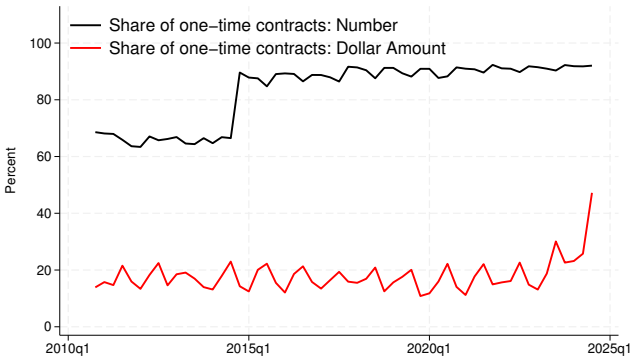
Appendix

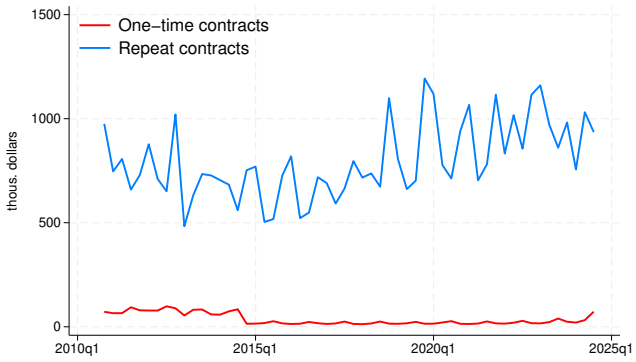
A Data and Summary Statistics: Additional Figures and Tables

Figure A1: One-time vs repeat prime contracts

(a) Number and total amount



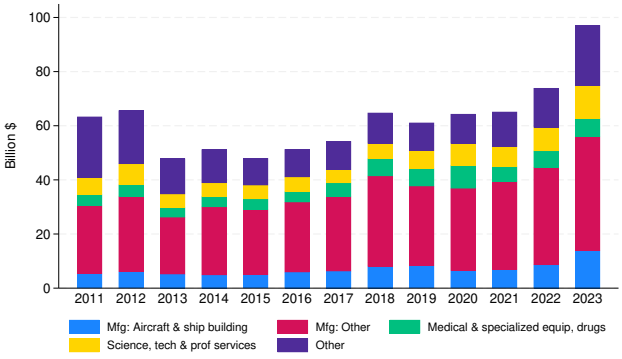
(b) Average contract amount



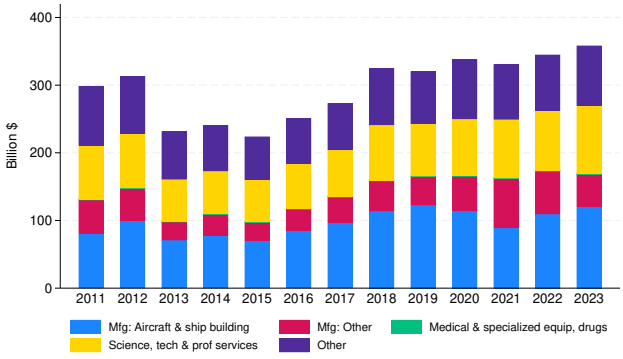
Source: USAspending.gov. Notes: The left panel shows the shares of one-time prime contracts in all prime contracts in terms of the number (black line) and the obligation amount (red). The right panel compares the average amount of one-time prime contracts with that of repeat prime contracts.

Figure A2: Prime contract amount by industry

(a) One-time contract

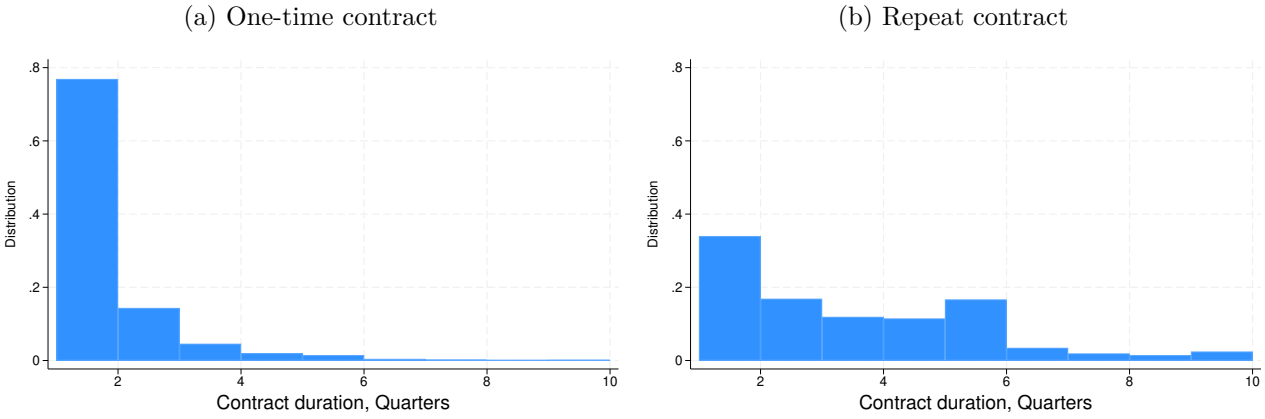


(b) Repeat contract



Source: USAspending.gov. Notes: The figure shows the prime contract amount by industry and contract type: one-time (left panel) and repeat (right panel).

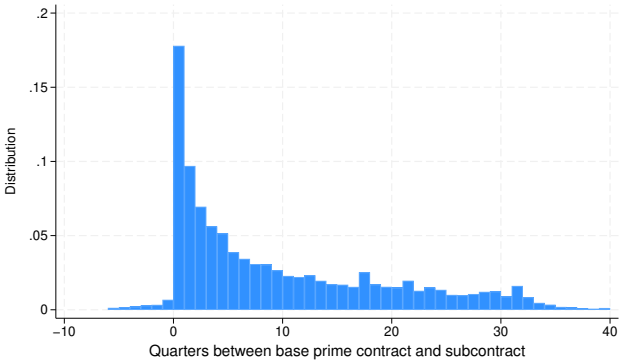
Figure A3: Duration of prime contracts



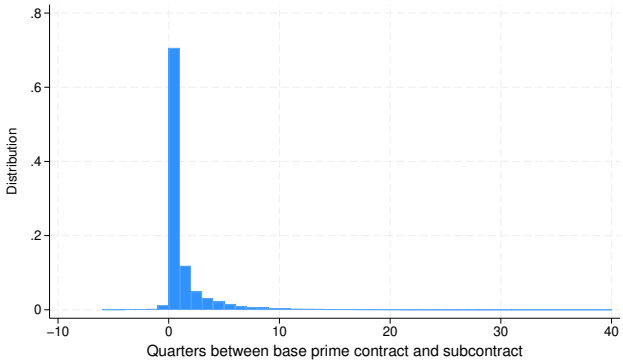
Source: USAspending.gov. Notes: The figure shows the distribution of the duration of prime contracts by contract type: one-time (left panel) and repeat (right panel).

Figure A4: Time lag between prime and subcontracts

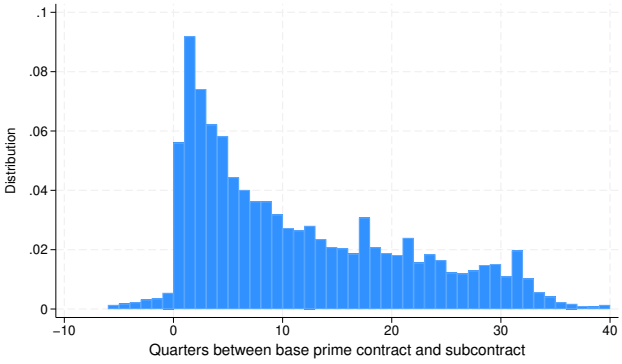
(a) All subcontracts



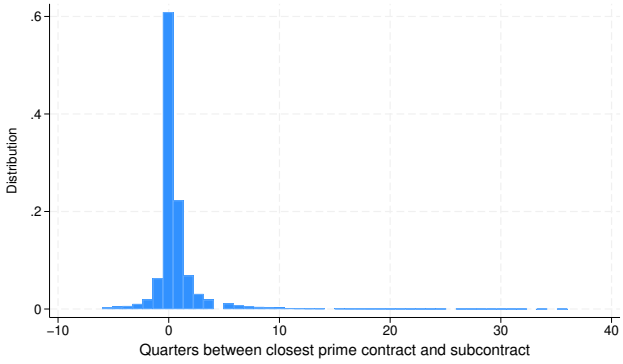
(b) Subcontracts under one-time prime contracts



(c) Subcontracts under repeat prime contracts

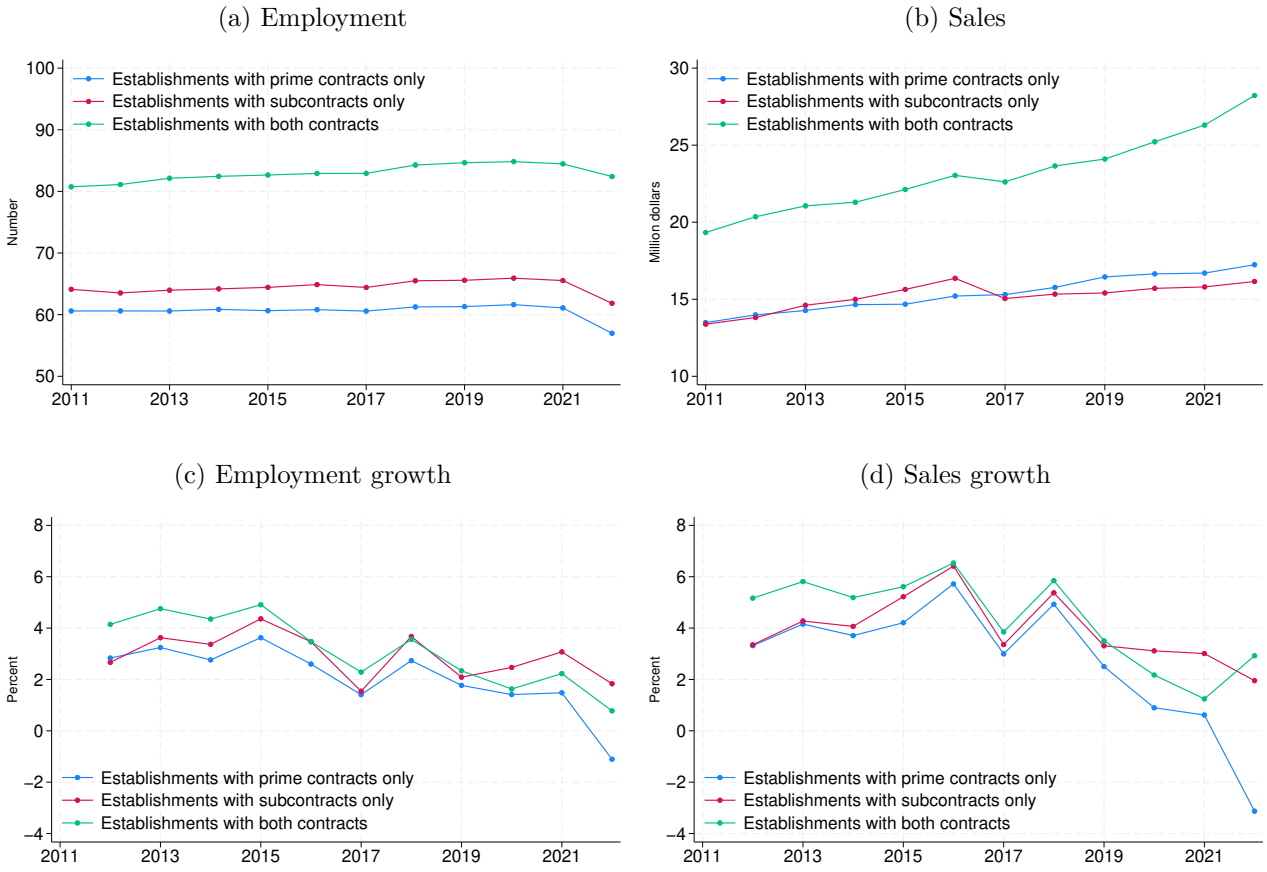


(d) Subcontracts under repeat prime contracts



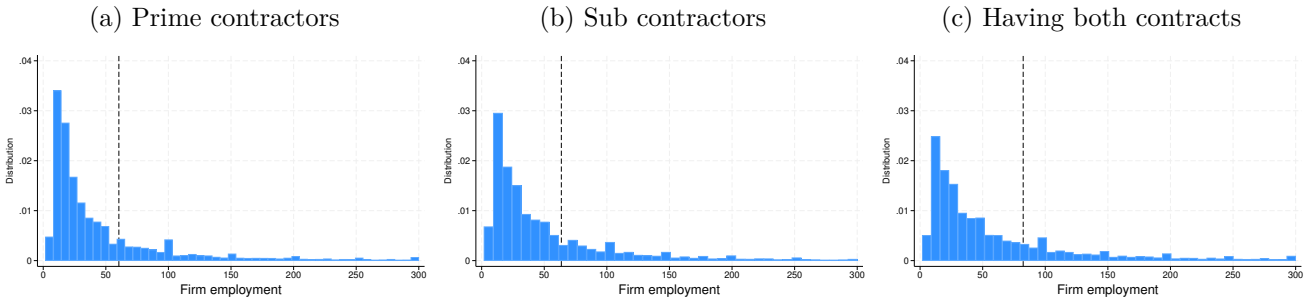
Source: USAspending.gov. Notes: The figure uses prime-subcontract pairs and shows the distribution of the difference between the prime contract obligation timing and the subcontract obligation timing. Panel (a) shows the distribution for all contract pairs. Panel (b) shows the distribution for pairs with the prime contracts being one-time, and panel (c) shows the distribution for pairs with the prime contracts being repeat. Panel (d) shows the distribution for prime-subcontract pairs where the obligation date of the prime contract (among a sequence of prime contracts with the same identifier) is the closest to the subcontract obligation date.

Figure A5: NETS establishment characteristics



Source: NETS annual establishment-level panel data from 2011-2022. Notes: Each panel shows the average across establishments in a given year and category: (1) having only prime contracts, (2) having only subcontracts, and (3) having both types of contracts.

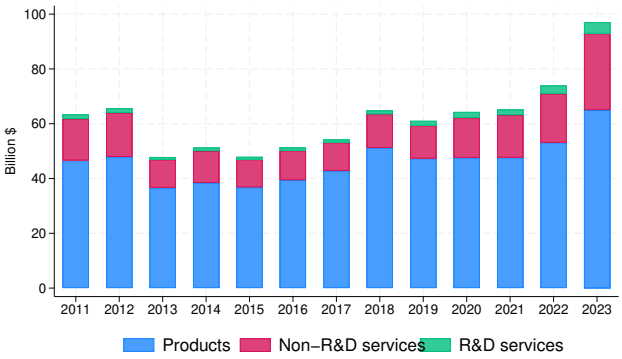
Figure A6: NETS establishment size distribution



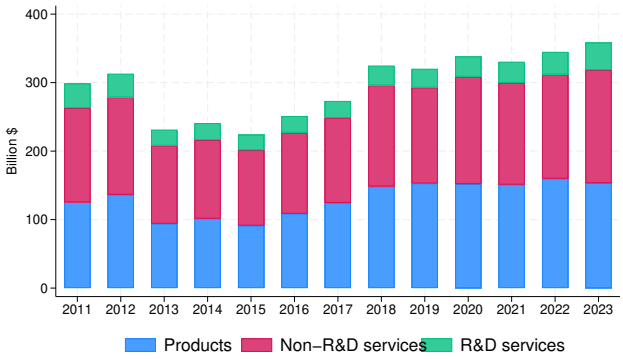
Source: NETS annual establishment-level panel data merged with the USAspending.gov data. Notes: The figure shows the distribution of the average employment at the establishment level from 2011-2022. The left panel shows the distribution for establishments that only received prime contracts, the middle panel shows the distribution for establishments that only received subcontracts, and the right panel shows the distribution for firms receiving both prime and subcontracts. The vertical line in each panel indicates the mean of the distribution.

Figure A7: Composition by the product type of prime contracts

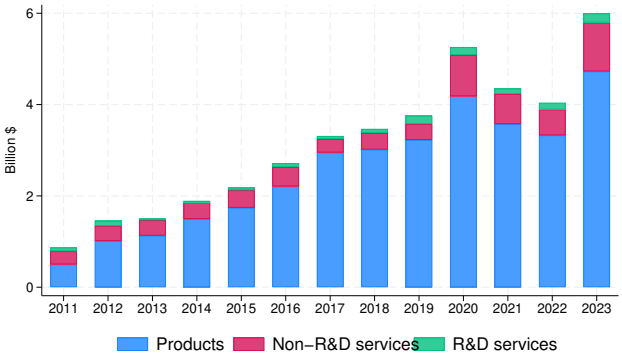
(a) Prime contract composition: one-time prime contracts



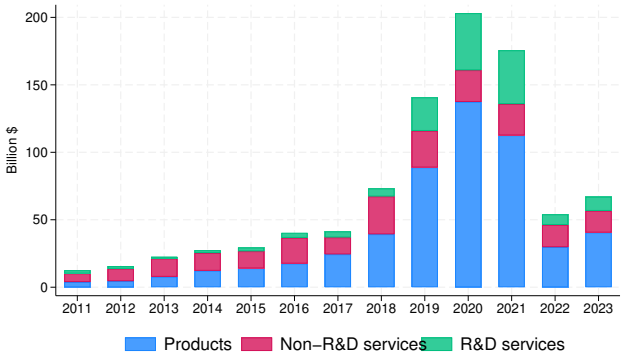
(b) Prime contract composition: repeat prime contracts



(c) Subcontract composition: under one-time prime contracts



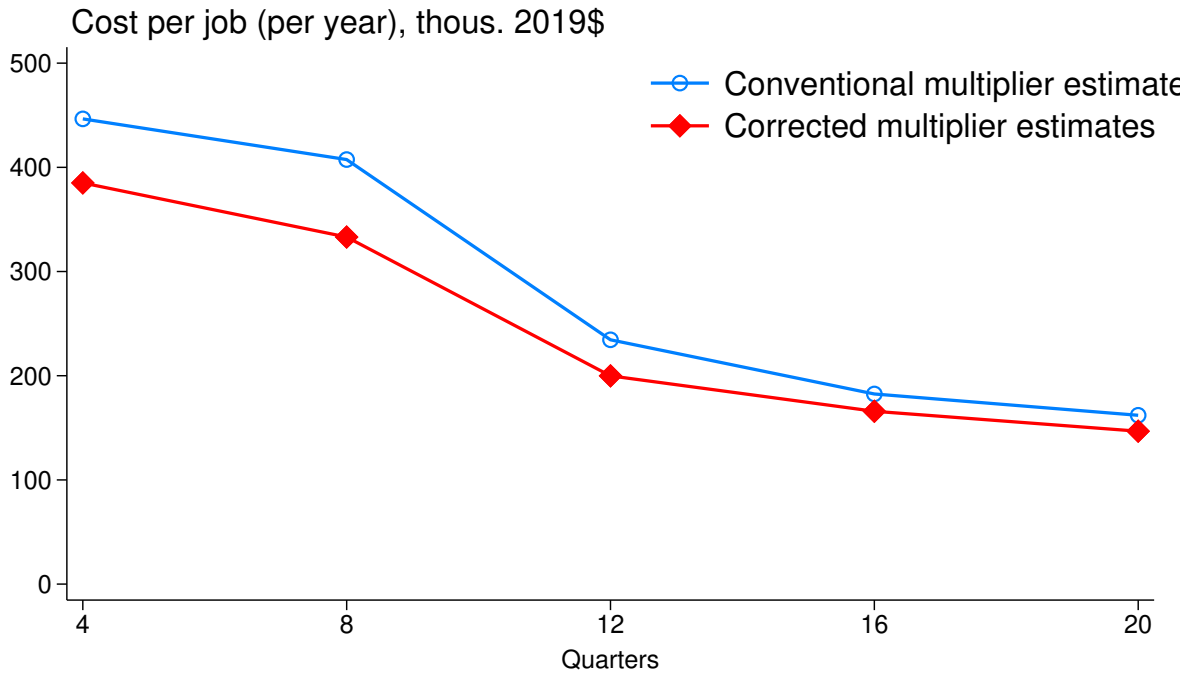
(d) Subcontract composition: under repeat prime contracts



Source: USAspending.gov. Note: The figure shows the composition of prime contracts by the product/service type (panels a and b) and the composition of subcontracts by the product/service type of prime contracts (panels c and d). The left column shows for one-time prime contracts or subcontracts associated with one-time prime contracts. The right column shows for repeat contracts or subcontracts associated with repeat prime contracts.

B Conventional and Corrected Multipliers: Additional Results

Figure B1: Cost per job estimates



Notes: See footnote 20 for how cost per job (per year) is computed. The blue line uses the conventional IV multiplier estimates (Table 6, upper panel). The red line uses our corrected IV multiplier estimates (Table 6, lower panel).

Table B1: Time-varying multiplier effects: IV estimates

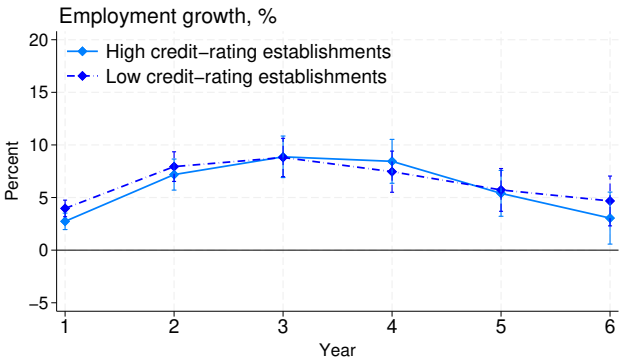
	Outcome variable: Earnings				
	4-Quarter	8-Quarter	12-Quarter	16-Quarter	20-Quarter
2011Q1-2016Q4					
Conventional	0.061***	0.059***	0.087***	0.119***	0.159***
	(0.016)	(0.017)	(0.019)	(0.020)	(0.022)
Corrected	0.061***	0.058***	0.089***	0.125***	0.166***
	(0.016)	(0.016)	(0.020)	(0.021)	(0.024)
2011Q1-2019Q4					
Conventional	0.085***	0.099***	0.146***	0.203***	0.259***
	(0.016)	(0.017)	(0.020)	(0.022)	(0.025)
Corrected	0.095***	0.110***	0.162***	0.219***	0.286***
	(0.018)	(0.019)	(0.024)	(0.029)	(0.034)
2011Q1-2022Q4					
Conventional	0.092***	0.103***	0.179***	0.230***	0.259***
	(0.017)	(0.018)	(0.021)	(0.023)	(0.025)
Corrected	0.107***	0.126***	0.210***	0.253***	0.286***
	(0.021)	(0.025)	(0.031)	(0.032)	(0.034)

Notes: The table reports cumulative multipliers for local earnings at various horizons and different sample periods. The estimates are for specification (1) estimated using an instrumental variable approach. In each panel, the first row shows the conventional multipliers which allocate the entire prime contract amount to place of performance reported by the prime contractor. The second row shows the corrected multipliers that incorporate the relocation of subcontract amounts. The unit of observations is county-quarter. *, **, and *** indicate significance at the 10%, 5%, and 1% levels. The sample in each regression spans 2011q1-2024q3.

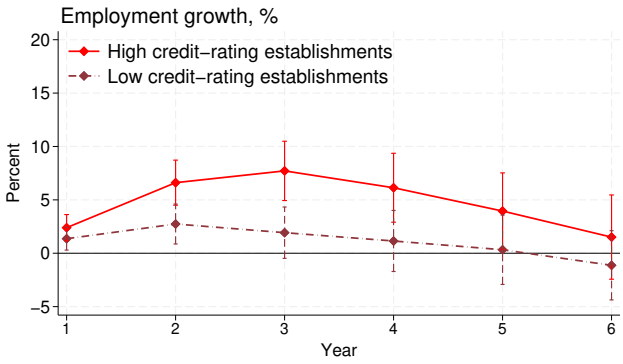
C Establishment-Level Analysis: Robustness

Figure C1: Establishment-level effects by credit ratings

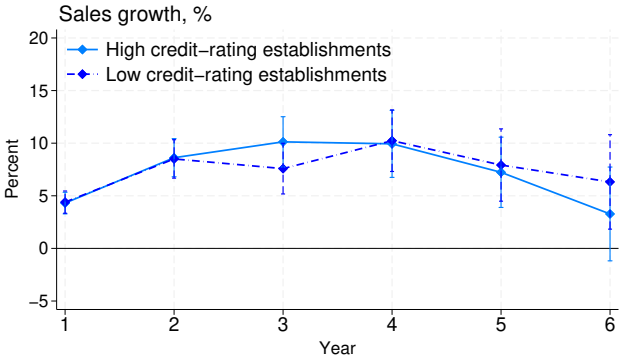
(a) Prime contracting effect



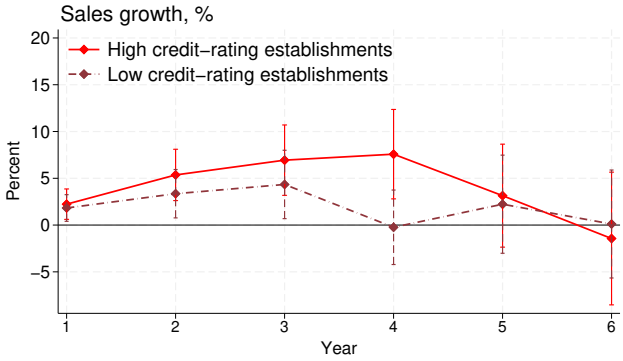
(b) Subcontracting effect



(c) Prime contracting effect



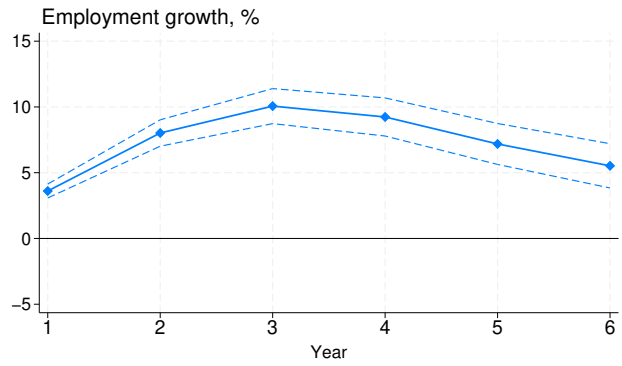
(d) Subcontracting effect



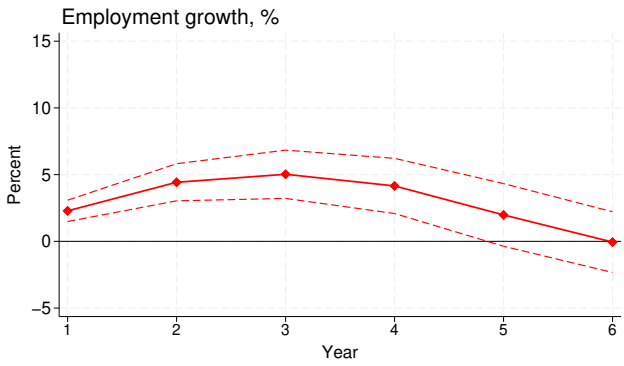
Notes: The point estimates for the prime contracting effects on low credit-rating establishments (β_1) and on high credit-rating establishments ($\beta_1+\beta_2$) and the subcontracting effects on low credit-rating establishments (γ_1) and on high credit-rating establishments ($\gamma_1+\gamma_2$), as well as the 95% confidence intervals are obtained by estimating specification (7). All regressions include establishment and sector-by-year fixed effects and control variables as described in the text.

Figure C2: Robustness of establishment-level evidence

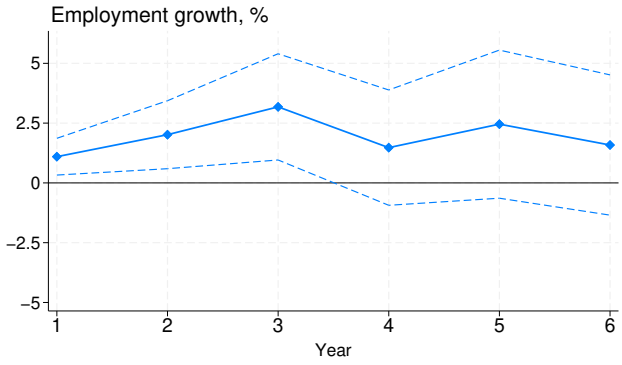
(a) Prime contracting effect



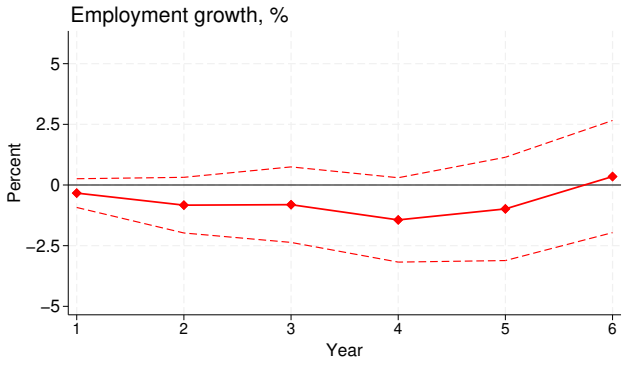
(b) Subcontracting effect



(c) Prime contracting effect



(d) Subcontracting effect



Notes: The figure shows the robustness of our baseline establishment-level employment effects. Panels (a) and (b) use a restricted sample that does not have imputed employment observations. Panels (c) and (d) estimate the specification with log dollar amounts of prime contracts (adjusted for subcontracting) and subcontracts replacing the corresponding indicator variables in equation (6).

D Federal Regulation on Subcontracting Activity

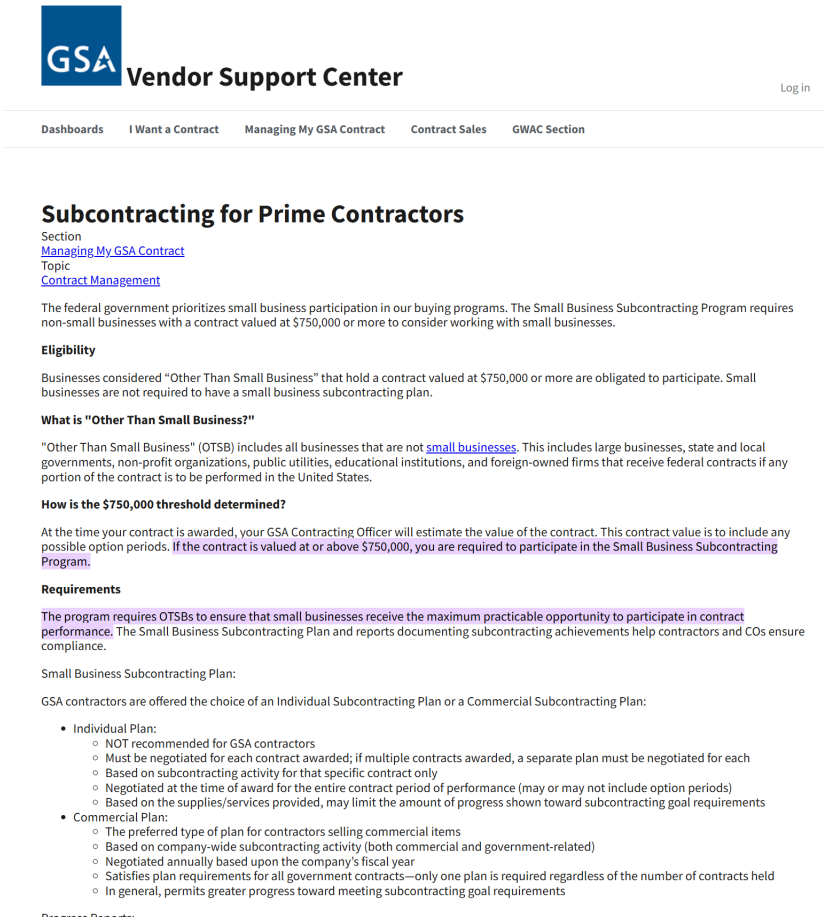
Under Section 8(d) of the Small Business Act (15 U.S.C. § 637(d)), and implemented through the Federal Acquisition Regulation (FAR) Subpart 19.7, federal prime contractors that are not classified as small businesses (i.e., "Other Than Small Businesses" or OTSBs) are required to engage in subcontracting with small businesses when certain thresholds are met.

Thresholds and Applicability: A subcontracting plan is mandatory for prime contracts exceeding a value greater than the *simplified acquisition threshold* that offer subcontracting opportunities (FAR 19.702(a)(1); 15 U.S.C. § 637(d)). This threshold is recently $750,000 (or $1.5 million for construction). Before 2015Q4 if was > $650,000 and between 2015Q4-2020Q2 it was > $ 700,000.

These requirements apply both to negotiated procurements and sealed bidding acquisitions, and extend to contract modifications that raise the contract's value above the threshold.

Required Content of Subcontracting Plans: As detailed in FAR 52.219-9, an acceptable subcontracting plan must include: i) Separate goals (in dollars and percentages) for subcontracting to Small Businesses (SB), Small Disadvantaged Businesses (SDB), Women-Owned Small Businesses (WOSB), HUBZone Small Businesses, Veteran-Owned (VOSB) and Service-Disabled Veteran-Owned Small Businesses (SDVOSB); ii) Procedures to ensure the maximum practicable opportunity for these firms to participate, and iii) Mechanisms to ensure timely payments to subcontractors.

Enforcement and Compliance: Failure to comply in good faith with an accepted subcontracting plan is considered a material breach of contract. The contracting officer may impose liquidated damages for noncompliance, as authorized by 15 U.S.C. §637(d)(4)(F) and implemented in FAR 19.705-7. "Some contracting officers face challenges assessing compliance with the good faith standard" -U.S. Government Accountability Office Report



GSA Vendor Support Center

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Subcontracting for Prime Contractors

Section
Managing My GSA Contract
Topic
Contract Management

The federal government prioritizes small business participation in our buying programs. The Small Business Subcontracting Program requires non-small businesses with a contract valued at $750,000 or more to consider working with small businesses.

Eligibility

Businesses considered "Other Than Small Business" that hold a contract valued at $750,000 or more are obligated to participate. Small businesses are not required to have a small business subcontracting plan.

What is "Other Than Small Business?"

"Other Than Small Business" (OTSB) includes all businesses that are not small businesses. This includes large businesses, state and local governments, non-profit organizations, public utilities, educational institutions, and foreign-owned firms that receive federal contracts if any portion of the contract is to be performed in the United States.

How is the $750,000 threshold determined?

At the time your contract is awarded, your GSA Contracting Officer will estimate the value of the contract. This contract value is to include any possible option periods. If the contract is valued at or above $750,000, you are required to participate in the Small Business Subcontracting Program.

Requirements

The program requires OTSBs to ensure that small businesses receive the maximum practicable opportunity to participate in contract performance. The Small Business Subcontracting Plan and reports documenting subcontracting achievements help contractors and COs ensure compliance.

Small Business Subcontracting Plan:

GSA contractors are offered the choice of an Individual Subcontracting Plan or a Commercial Subcontracting Plan:

- Individual Plan:
  - NOT recommended for GSA contractors
  - Must be negotiated for each contract awarded; if multiple contracts awarded, a separate plan must be negotiated for each
  - Based on subcontracting activity for that specific contract only
  - Negotiated at the time of award for the entire contract period of performance (may or may not include option periods)
  - Based on the supplies/services provided, may limit the amount of progress shown toward subcontracting goal requirements
- Commercial Plan:
  - The preferred type of plan for contractors selling commercial items
  - Based on company-wide subcontracting activity (both commercial and government-related)
  - Negotiated annually based upon the company's fiscal year
  - Satisfies plan requirements for all government contracts—only one plan is required regardless of the number of contracts held
  - In general, permits greater progress toward meeting subcontracting goal requirements

Source: https://vsc.gsa.gov/drupal/

D.1 Federal Regulation on Subcontracting Activity Reporting and Relevant Timeline

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006. The intent is to empower every American with the ability to hold the government accountable for each spending decision. The FFATA legislation requires information on federal awards (federal financial assistance and expenditures) to be publicly available. (Source: https://www.grants.gov/learn-grants/grant-policies/ffata-act-2006.html)

The FFATA Subaward Reporting System (FSRS) is the reporting tool federal prime awardees (i.e., prime contractors and prime grants recipients) use to capture and report subaward and executive compensation data regarding their first-tier subawards to meet the FFATA reporting requirements.[29] Prime contract awardees are expected to report against

[29] As of March 8th 2025, FSRS.gov was retired, and all subaward reporting data and functionality are now on SAM.gov.

sub-contracts awarded, and prime grant awardees to report against sub-grants awarded. The sub-award information entered in FSRS is then displayed and associated with the prime award, furthering federal spending transparency.

Prime contractors awarded a federal contract or order that is subject to Federal Acquisition Regulation clause 52.204-10 (Reporting Executive Compensation and First-Tier Subcontract Awards) are required to file an FFATA sub-award report by the end of the month following the month in which the prime contractor awards any subcontract greater than $30,000.

These reporting requirements for subcontracts have been gradually phased-in following the original law passed in 2006. Plans must be submitted to the eSRS, including an individual subcontract report (ISR) semi-annually and a summary subcontract report (SSR) annually (Source: https://www.acquisition.gov/far/subpart-19.7).

- Phase 1: Reporting subcontracts under federally-awarded contracts and orders valued greater than or equal to $20,000,000; reporting starts now.
- Phase 2: Reporting subcontracts under federally-awarded contracts and orders valued greater than or equal to $550,000; reporting starts October 1, 2010.
- Phase 3: Reporting subcontracts under federally-awarded contracts and orders valued greater than or equal to $25,000; reporting starts March 1, 2011.
- Phase 4: Reporting subcontracts under federally-awarded contracts and orders valued greater than or equal to $30,000; reporting starts October 1, 2015.

The announcement also said that: "although the requirement to report subawards is being phased-in at certain dollar levels, if you would like to start reporting prior to the start date for your subcontracts, the system is available for reporting". Prime Grant Recipients awarded a new federal grant greater than or equal to $25,000 as of October 1, 2010, were subject to FFATA sub-award reporting requirements outlined in the Office of Management and Budgets guidance issued August 27, 2010. The prime awardee must file a FFATA sub-award report by the end of the month following the month in which the prime recipient awards any sub-grant greater than or equal to $25,000.

D.2 Defense Contracting and Subcontracting During Covid

Part of the sample period we consider coincides with the Covid-19 pandemic. However, unlike many industries, defense contractors and subcontractors were insulated from its effects in many ways. Gupta et al. (2021) reports that many specific actions were taken by the government which include:

1. Designation of Defense Industrial Base (DIB) as critical infrastructure: Through a March 2020 memorandum, DoD recognized the DIB as essential, giving its workforce continuity protections even amid local lockdowns

2. Financial lifelines via CARES Act and other mechanisms: CARES Act allocated substantial funds: $2.45B for DIB support, $1B under the Defense Production Act (DPA), and $1.45B to Defense Working Capital Funds. Additionally, authorities were loosened—e.g., accelerated payments, use of undefinitized contract actions (UCAs), and other transactions authority.

3. Direct DPA Title III investments: DoD leveraged DPA Title III to shore up key suppliers—ranging from aerospace and semiconductors to space and cyber—with selected firms receiving millions (e.g., GE Aviation got $20M to support over 100 specialized jobs)

4. Industry's role in stabilizing supply chains: Major primes like Lockheed Martin and Northrop Grumman accelerated payment to small-tier suppliers ($1.1B in Lockheed's case), helping to keep smaller firms afloat.

In addition Gupta et al. (2021) reports that Paycheck Protection Program (PPP), which was focused towards small businesses also affected defense contractors. They note that only $\sim$ 2% of all PPP recipients were defense contractors, but they averaged significantly larger loans ($650K–$1.5M vs. $\sim$ $380K–$920K overall). On average, each DoD contractor loan covered $\sim$ 66 jobs (vs. $\sim$ 50 jobs overall). Most PPP-funded DIB firms were in manufacturing and overwhelmingly small (fewer than 100 employees). The program especially helped lower-tier firms essential to national security supply chains.