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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. Using newly available data on defense subcontract awards linked to establishment-level data from NETS, we examine prime–subcontractor relationships across regions, industries, and over time. We document three key facts. First, subcontracting reallocates a substantial share of federal dollars across geographic areas, weakening the link between the location of prime contracts and where spending ultimately occurs. Second, subcontracting shifts spending across industries, notably from service-sector primes to manufacturing subcontractors. Third, large firms dominate subcontracting networks, including by receiving subcontracts from smaller primes. Accounting for geographic reallocation implies that conventional estimates understate local fiscal multipliers by about 20%. Furthermore, local multipliers are smaller for subcontracting than for prime contracting, partly because subcontracted spending is concentrated among large manufacturing firms that exhibit more muted employment responses. Establishment-level evidence further shows that subcontracting generates weaker employment effects, even conditional on firm size and industry, reflecting the less stable nature of subcontracting relationships. Overall, our findings show that subcontracting fundamentally reshapes the transmission of procurement spending through the private sector, with important implications for the local and aggregate effects of federal spending.

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1 Introduction

Government procurement spending, particularly defense contracting, plays a central role in U.S. fiscal policy and has 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 are often located in different 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 systematically quantify how *subcontracting* reshapes the geographic, sectoral, and firm-level distribution of federal funds and to examine the resulting micro- and macroeconomic implications. We use a newly available dataset on defense subcontracting, reported continuously since 2011 under the Federal Funding Accountability and Transparency Act, which provides detailed information on subcontract amounts, the place of performance, and contractual linkages to prime contracts. This dataset, previously unused in the fiscal-multiplier literature, allows us to document new facts about subcontracting and to revisit longstanding conclusions about the local effects of federal spending. In addition, by merging these data with the National Establishment Time Series (NETS), we further link prime and subcontracting firms to establishment-level outcomes such as employment and sales, enabling us to assess the direct microeconomic effects on firms.

Our analysis yields several key findings. First, subcontracting significantly alters the geography of defense spending. More than 70 percent of subcontract dollars cross state lines, and about 90 percent cross county lines. This pervasive reallocation means that

[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.

the conventional approach—assigning all spending flowing to the location of the prime contractor—misidentifies where funds actually flow. To assess the implications of this mismeasurement, we estimate local fiscal multipliers using county-level quarterly data from 2011-2024 with the commonly employed shift-share instrument (Nakamura and Steinsson, 2014; Auerbach et al., 2020). The key innovation is to correct the conventional measure of local defense spending by netting out subcontracting outflows from each county and adding inflows from other counties. Our estimates show that the corrected multipliers are about 20 percent higher than those based only on the prime contract location. The implied cost per job decreases from slightly over $400,000 to $330,000 (in 2019 dollars). These results suggest that previous studies likely understated the overall effect of federal procurement on the local economy, as they inadvertently omitted the spatial redistribution of funds through subcontracting.

Second, although incorporating subcontracts enables a more precise measurement of overall government spending effects, it raises the question of whether subcontract and prime contract spending have similar impacts. To answer this question, we use county-level data and shift-share instruments to separately identify the two effects. Identification relies on three sources of exogenous variation: (i) the change in aggregate defense prime contract spending that is driven by geopolitical and national strategic considerations (i.e., the shift in aggregate prime contracts), (ii) the change in aggregate subcontracting driven by regulation and policies that are intended to promote subcontracting business networks (i.e., the shift in aggregate subcontracts), and (iii) county-level initial shares of prime and subcontract spending (i.e., the exposure of individual counties to aggregate spending shocks). Our county-level estimates show that subcontracting generates weaker local multipliers than prime contracting. Specifically, counties that receive spending through subcontracts display smaller and less persistent employment and earnings gains than those receiving prime contracts of the same size.

To understand this difference, we turn to establishment-level micro data. These data capture the direct employment effects for firms receiving prime contracts, subcontracts, or both, and allow us to examine the underlying mechanisms through firm-level dynamics and heterogeneity. We are able to match almost all firms in the defense spending database to NETS establishment-level data. We find that, while employment and sales rise following both prime and subcontract awards, the responses of subcontractors are smaller and relatively short-lived. This pattern persists when industry-by-time and firm fixed effects are included, suggesting that the differential response is not simply due to the composition of subcontractors. We provide evidence that this difference may be explained by the structure of contracting relationships: prime contracts with the DoD tend to be more stable, generating multi-year expansions in prime contracting firms' activity, whereas subcontracting relationships are typically shorter in duration, less stable, and characterized by greater uncertainty over renewal, limiting their cumulative impact on firm employment.

Third, the composition of subcontractors further contributes to the smaller multiplier effects of subcontracts on local labor markets. Consistent with the previous literature, we find that large manufacturing firms tend to be less responsive to new contracts in terms of employment. In contrast, small firms in service industries display stronger and more persistent employment gains when receiving government contracts. We present evidence based on firm-to-firm flows of funds that subcontracts disproportionately flow to large manufacturing firms. In addition, text analysis on prime-subcontract linkages suggests that most subcontracts are concentrated in goods production—computers, electronics, special equipment and industrial products—where the direct labor intensity tends to be lower. This skewness in funds allocation provides another channel through which the multipliers associated with subcontracting are smaller: subcontracting tends to be concentrated in firms and sectors where the incremental effect on employment is limited and short-lived.

Taken together, our results highlight two key points. Ignoring the redistribution of federal funds through subcontracting leads to understating the true local reach of federal spending. Yet at the same time, the rise of subcontracting, especially its concentration in large, capital-intensive manufacturing firms, has reduced the overall labor market sensitivity to defense procurement. The pervasive reallocation of funds through subcontracting helps reconcile why defense spending has reached far more places and has diffused across many more industries than the prime contract data suggests, yet generates a relatively modest aggregate employment response.

From a macroeconomic perspective, our findings suggest that subcontracting has become an important determinant of fiscal transmission. By redistributing funds toward larger, less labor-intensive firms, subcontracting may reduce the responsiveness of the labor market to government spending shocks. In the last part of the paper, we explore the aggregate labor market implications through a fixed-policy counterfactual that combines our cross-sectional multiplier estimates with observed changes in defense procurement spending. We show that, despite a run-up in national defense spending during 2015-2019, it did not spur more job creation than in earlier years, because a large share of prime contracts were subcontracted, generating fewer jobs than would have resulted had the funds been directed to prime contractors. Our analysis has clear policy implications: measures designed to promote subcontracting broadly may unintentionally dampen the short-run employment effects of government spending. At the same time, the stronger and more persistent responses of small and service-sector firms suggest that subcontracting policies targeted toward these firms could serve as a powerful lever for amplifying employment gains.

Relation to the Literature

A growing body of empirical work uses Department of Defense (DoD) contracts to study the economic impact of government spending since the seminal contribution of Nakamura and Steinsson (2014), which leverages state-level variation in DoD prime contract obligations to estimate local fiscal multipliers.[2]

Building on this, subsequent research has employed finer geographic units and examined the aggregate implications of local fiscal multipliers.[3] Dupor and Guerrero (2017) map local to aggregate multipliers using state-level data, while Demyanyk et al. (2019) show that county-level multipliers are larger in areas with higher pre-recession household debt, consistent with stronger demand-side channels. Basso and Rachedi (2021) find that state-level local multipliers vary with local age composition, and Jo and Zubairy (2025) demonstrate that local multiplier size depends on the phase of business cycles, being larger in demand-driven recessions. At the city level, Auerbach et al. (2020) document sizable GDP responses and significant cross-regional spillovers. Our analysis points to subcontracting as a concrete mechanism underlying such spillovers.

Other studies exploit industry- and firm-level variation. Hebous and Zimmermann (2021) find that each dollar of federal procurement raises capital investment only among financially constrained firms, consistent with financial accelerator effects, while Barattieri et al. (2023) show that upstream suppliers gain through higher employment and producer prices.

More recent contributions have expanded beyond aggregate effects and emphasize heterogeneity across contract types and firms. Cox et al. (2024) explore the universe of prime contracts in detail and highlight distinctions between one-time and repeat contracts, their compositional differences and implications for aggregate dynamics. Muratori et al. (2023) show that service-based defense contracts generate larger employment multipliers than those for goods. Briganti et al. (2025) match defense contract data with detailed microdata to decompose employment effects across firms, and find that job creation is

[2]In their influential paper, Nakamura and Steinsson (2014) note that subcontracting may be a concern, but they abstract from formally assessing its quantitative importance for two reasons. First, there is no subcontracting data available for the sample period they consider (1966-2006). Second, they show that prime defense 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.

heavily concentrated in large, high-wage contractors, and that only a small share of jobs arise at direct recipients, with most gains diffusing gradually through supply-chain linkages. Findings across these papers underscore that procurement's employment impact depends critically on firm structure and production networks, issues that resonate with our analysis of subcontracting, where differences in firm composition and inter-firm linkages similarly shape the magnitude and persistence of local multipliers.

Cross-country evidence likewise shows that government procurement affects firm outcomes in a variety of settings: in Austria (Gugler et al., 2020), Brazil (Ferraz et al., 2021), Portugal (Gabriel, 2024), Korea (Lee, 2024), Spain (di Giovanni et al., 2023), and Germany (Hager and Huber, 2025).

Together, these papers demonstrate the usefulness of federal 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 reallocation 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 for our county-level analysis and uncovers possible transmission mechanisms at the micro level. Section 6 explores the aggregate implications of subcontracting in a fixed-policy counterfactual using our cross-sectional estimates, and finally Section 7 concludes.

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.

[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.

2.1 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 widely exploited in the literature 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 recovery started in 2014-2015, which may be explained by several factors including the end of budget sequestration that allowed 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 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]

[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.

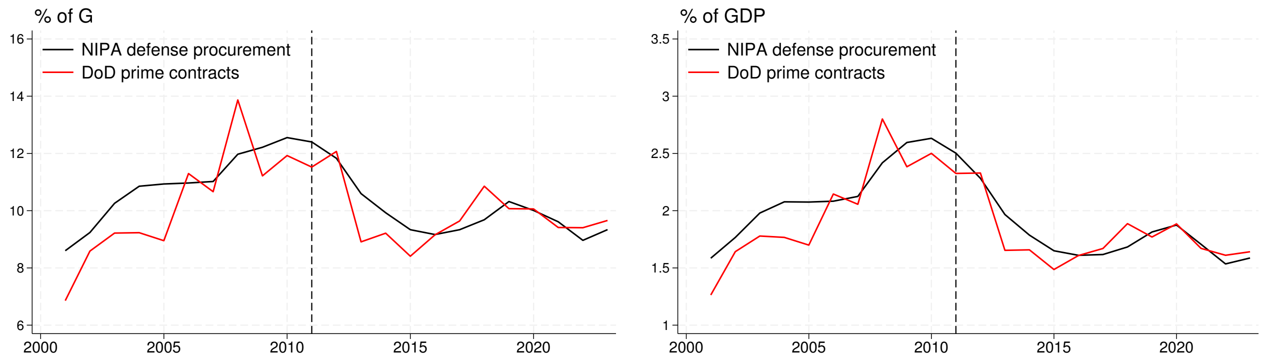
[6] See U.S. Department of Defense, Office of Industrial Policy (2021) and U.S. Department of Defense, Office of Industrial Base Policy (2023)

[7] This pattern is in line with Cox et al. (2024), who document that while the majority of government contracts (87%) constitute a single transaction, they account for only 17% of total contracted dollars.

Figure 1: Defense procurement spending shares

(a) Share of government 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.

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.

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. 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 support, interiors, and common aerospace commodities, demonstrating the supportive nature of subcontracting.[9]

2.2.2 Subcontracting Data and Summary Statistics

The federal procurement contract database 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,

[8]These thresholds have been revised over time. More institutional details and regulatory requirements are provided in Appendix D. These plans must outline specific goals for engagement with small businesses, disadvantaged business enterprises (DBEs), 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. Additional examples of subcontracting are provided in Appendix E.

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.

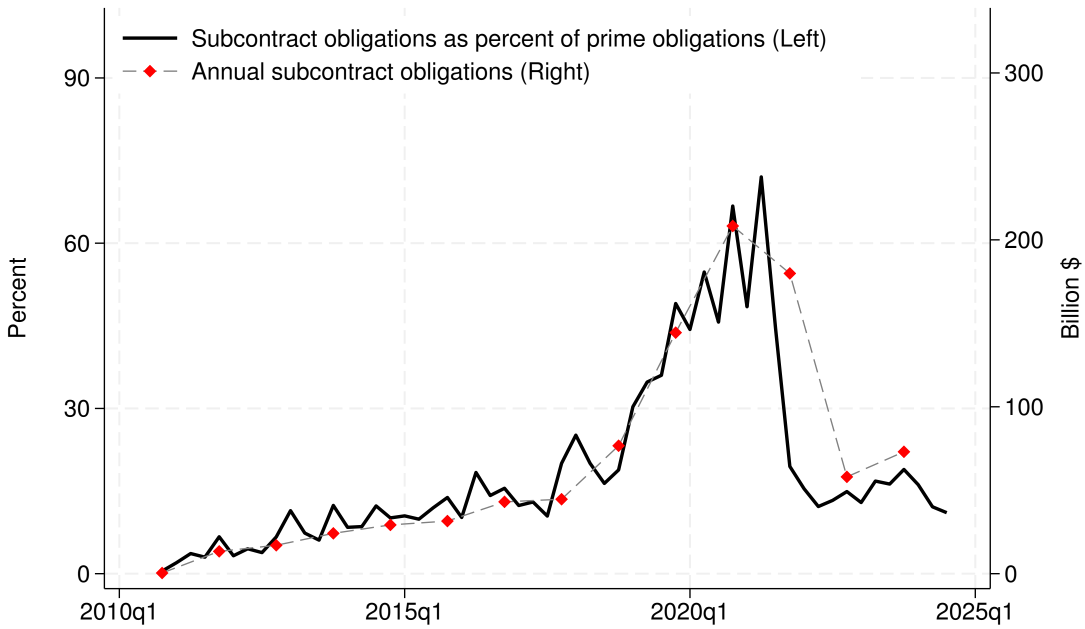
allowing us to construct a comprehensive dataset that includes all prime contracts merged with their subcontracts, if any.[10]

Subcontracting has become an increasingly important component of federal defense procurement in recent years. Figure 2 shows that subcontracting grew steadily from 2011 to 2018, reaching about 20% of prime obligations. Between 2019 and 2021, subcontracting expenditures accelerated sharply, peaking at roughly 60% of prime obligations, before declining 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 (left panel), 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 (right panel). This emphasizes the role of high-value contracts rather than broad diffusion during this period.[11]

[10]Subcontracts that occurred before October 2007 were not captured in the federal procurement data. Although subcontracting records exist for FY2008-FY2010, they are much sparser than those reported after 2011, when reporting became mandatory. This discontinuity suggests that the number of subcontracts prior to 2011 is likely underreported. That said, even in 2011, the aggregate count and value of subcontracts were small and quantitatively insignificant relative to subsequent years.

[11]DoD publications attribute the post-2021 increase in subcontracting to several factors, including urgent

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).

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 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.[12] 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 timing information is useful for our later analysis, which explicitly accounts for the geographic reallocation of spending through subcontracting.

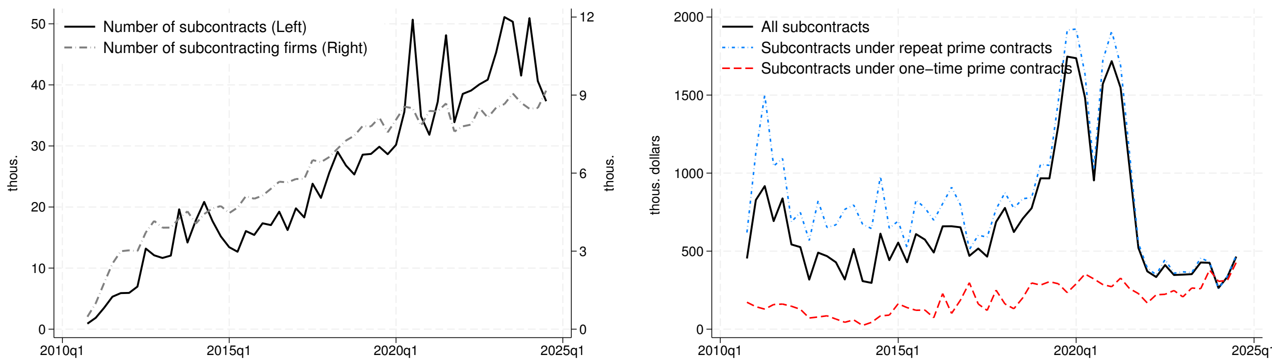
As noted above, the subcontracting data include a short textual description for each subaward. These descriptors provide a window into the types of activities subcontractors

pandemic-related catch-up efforts that pushed DoD to rely more heavily on subcontracts to offset delays, as well as new initiatives such as the strategic shipbuilding surge under the FY2021–2022 budget and broader industrial-base revitalization efforts implemented through 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.

[12]This extended lag 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 generated the subcontract. In addition, unlike prime contract data, subcontracting data do not have information on project duration.

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 (dashed 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.

perform. Here we focus on the nature of subcontracts alone. In Section 3, we explore prime-subcontract linkages by applying machine learning techniques on these descriptions. To characterize the nature of subcontracting, we parse these descriptions and focus on the most common terms. Appendix Figure A5 shows a word cloud of the top descriptors with the font size indicating usage frequency. The most prominent terms—such as "service," "equipment," "support," "assembly," "system," "aircraft" and "software"—indicate that subcontracting is concentrated in technical, engineering, and manufacturing activities that support the prime contract's production process and provide intermediate support.[13]

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 better understand their responses to defense procurement, we employ establishment-level data from the National Establishment Time Series (NETS), 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

[13]Some descriptors are abbreviated (e.g., "assy" for assembly) or concatenated (e.g., "medicalsurgical"). The word cloud is based on cleaned text (lowercased, lemmatized, and stripped of punctuation and stopwords), but such original abbreviations and compound words remain as in the source 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 ends in 2022, 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 are able to conduct an exact merge using this variable as the identifier. Appendix Table A1 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.

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] These firms together account for 53% of total prime obligations and 70% of total subcontract obligations over our sample period.

Appendix Figure A6 shows average establishment-level employment, sales and annual growth rates from 2011 to 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 A7). The annual growth rates of employment and sales have been trending down and are 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-universal coverage of wage-and-salary jobs, which is also consistent across localities. The data report employment, total wage income and the number of establishments by county and NAICS industry at the quarterly frequency, which we use for estimating cross-sectional

[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 and the Quarterly Census of Employment and Wages with appropriate sample restrictions (Barnatchez et al., 2017).

[15] See details in Appendix Table A1. When we conduct analysis employing these data in later sections, the main results are robust to further restrictions, such as dropping observations with imputed employment.

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 reveals the geographic reallocation of prime contract spending through subcontracting. The second and third facts focus on the industry and firm-size linkages between prime and subcontractors. The first fact has implications for cross-sectional fiscal multipliers, which we explore in Section 4. The second and third facts have implications for the relative effectiveness of prime and subcontract spending, which guide us in conducting the firm-level analysis in Section 5.

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

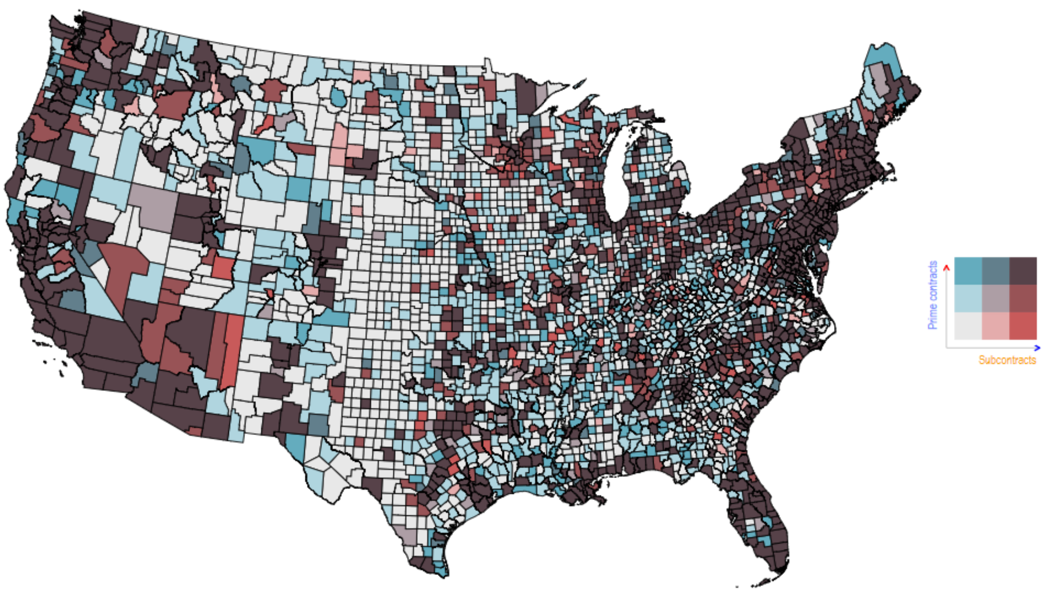
Figure 4 presents an initial view of the geographic distribution of prime and subcontract awards. It shows that coastal areas and major population centers generally receive larger amounts of both prime and subcontract obligations than other regions. In contrast, the Mountain and Central regions (teal-colored areas such as NM, CO, WY and ID) primarily receive prime contracts, which are likely redistributed to other parts of the country through subcontracting.

Next, we focus on the prevalence of cross-county and cross-state subcontracting using linked prime-subcontract data. Table 2 shows that 90% of subcontracting occurs between firms that are not in the same county and 70% occur between firms not in the same state, based on firm location. When considering the location of work performed, these shares are lower, but still notable. Over 80% of subcontracts are performed in a different county from the prime contract workplace, and near two-thirds are performed in a different state. Separating prime contracts into one-time and repeat categories shows that subcontracts linked to one-time prime contracts are even less likely to occur in the same location, although they account for a much smaller share of prime–subcontract pairs.[16]

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 spillover effects of defense spending across regions based on distance in the earlier literature (e.g., Auerbach et al. (2020)), with subcontracting being

[16]We show in Appendix Table A2 that when the shares in Table 2 are computed based on dollar amounts rather than subcontract counts, cross-region subcontracting is even more pronounced: only 6% of dollars flow to subcontractors within the same county, and only 22% remain within the same state.

Figure 4: Geographic distribution of prime and subcontract obligations



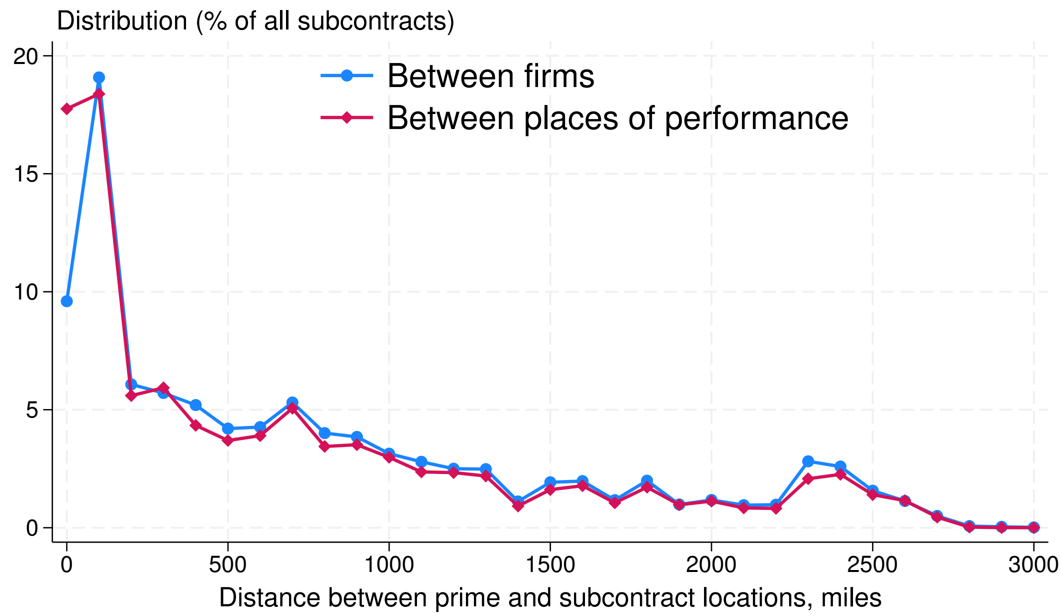
Notes: This map displays county-level prime and subcontract obligations in 2019, summarizing variation along two dimensions. Counties are categorized as having high, medium, or low prime contract obligations based on their 2019 prime awards. Similarly, counties are grouped into three categories according to their 2019 subcontract obligations. This classification yields nine county groups, as indicated in the legend, with darker colors representing higher intensity along both dimensions.

Table 2: Prime and subcontractor location patterns

	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.	1,393,150	259,587	1,133,563
Places of work performed:			
Same county	18%	13%	19%
Same state	36%	21%	39%
Same region	56%	43%	59%
# Obs.	1,384,016	258,474	1,125,542

Notes: This table examines prime–subcontract pairs, reporting the frequency with which the prime and subcontracting firms are located in the same place (top panel) and the frequency with which their places of performance coincide (bottom panel).

Figure 5: Distance between prime and subcontractor locations



Notes: This figure, using prime-subcontract pairs, shows the distribution of distances between prime and subcontractors (blue line) and between their respective places of performance (red line) in 100-mile bins.

a concrete transmission channel. However, we also note that the dispersion is large, with the long tail indicating a non-negligible share of prime–subcontractor pairs located more than 2,000 miles apart.

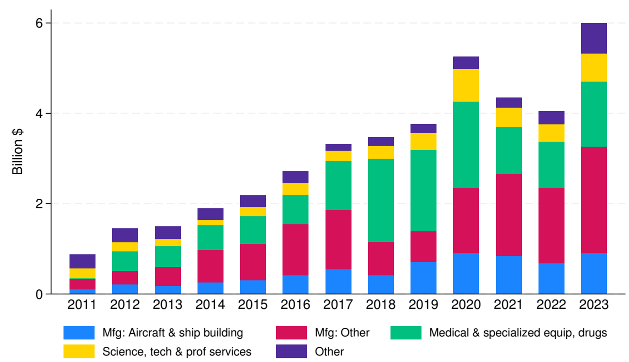
Fact 2: Sectoral reallocation of federal spending through subcontracting is substantial, especially from service to goods sectors.

We now explore industry- and product-level linkages between prime and subcontractors. Figure 6 shows the industry composition of matched prime and subcontractors. The upper panels focus on the prime contractor's industry. Conditional on prime contracts with shorter durations and smaller amounts (i.e., one-time contracts), medical and specialized equipment wholesale industries and manufacturing industries other than aircraft and shipbuilding generate the largest fractions of subcontracts (panel a). In contrast, among large, repeat prime contracts, aircraft and shipbuilding industries and science and professional service industries generate the most subcontracts (panel b).

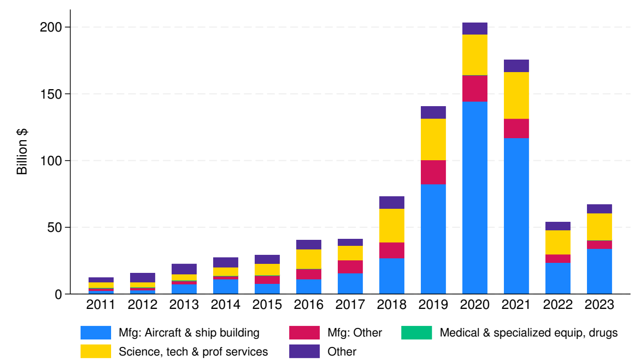
There is substantial reallocation of prime contract spending across industries through subcontracting, as shown in the lower panels of Figure 6. Most subcontracts flow to manufacturing industries other than aircraft and ship building and to "other" industries, which include construction and a wide range of services. This suggests that, while capital-

Figure 6: Industry composition of subcontract obligations

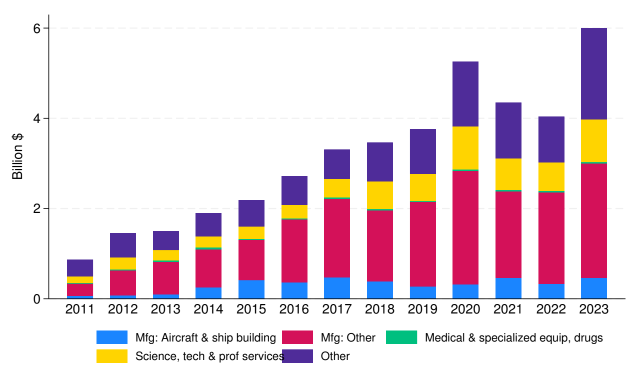
(a) Prime contractor's industry:
subcontracts under one-time prime contracts



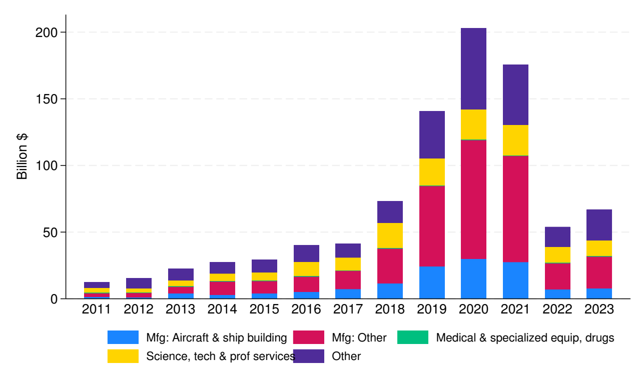
(b) Prime contractor's industry:
subcontracts under repeat prime contracts



(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. Notes: This figure shows subcontract obligations (in billions of dollars) by prime contractor's industry (panels a and b), by subcontractor's industry based (panels c and d), and by prime contract type (left vs right columns).

and scale-intensive industries contribute the most to generating subcontracts (in terms of value), these subcontracts are diffused broadly across industries.

Table A3 provides a more complete view of the cross-industry linkages between prime and subcontractors at the NAICS 2-digit level, with the first column (row) indicating the prime (sub-) contractor's industry. Each cell reports the flow of prime contracts from an industry to subcontractors in a given industry. The table shows that goods industries tend to form subcontracting relationships primarily within the sector, whereas service industries tend to extend the relationships more broadly, especially with manufacturing and high-valued service industries, which include information, professional, business and technical services, and education and health.

The industry-level linkages suggest that, despite the diffusion of federal spending across

Table 3: Product-type linkages between prime and subcontracts

Subcontractors → Prime contractors ↓	Products	Non-R&D Services	R&D Services
Products	**74%**	17%	9%
Non-R&D Services	32%	**60%**	9%
R&D Services	44%	39%	**18%**

Notes: This table shows the share of subcontract obligations (in 2019 dollars) flowing from prime contracts in each product category to subcontracts in a given category. Shares corresponding to within-category subcontracting are highlighted in bold.

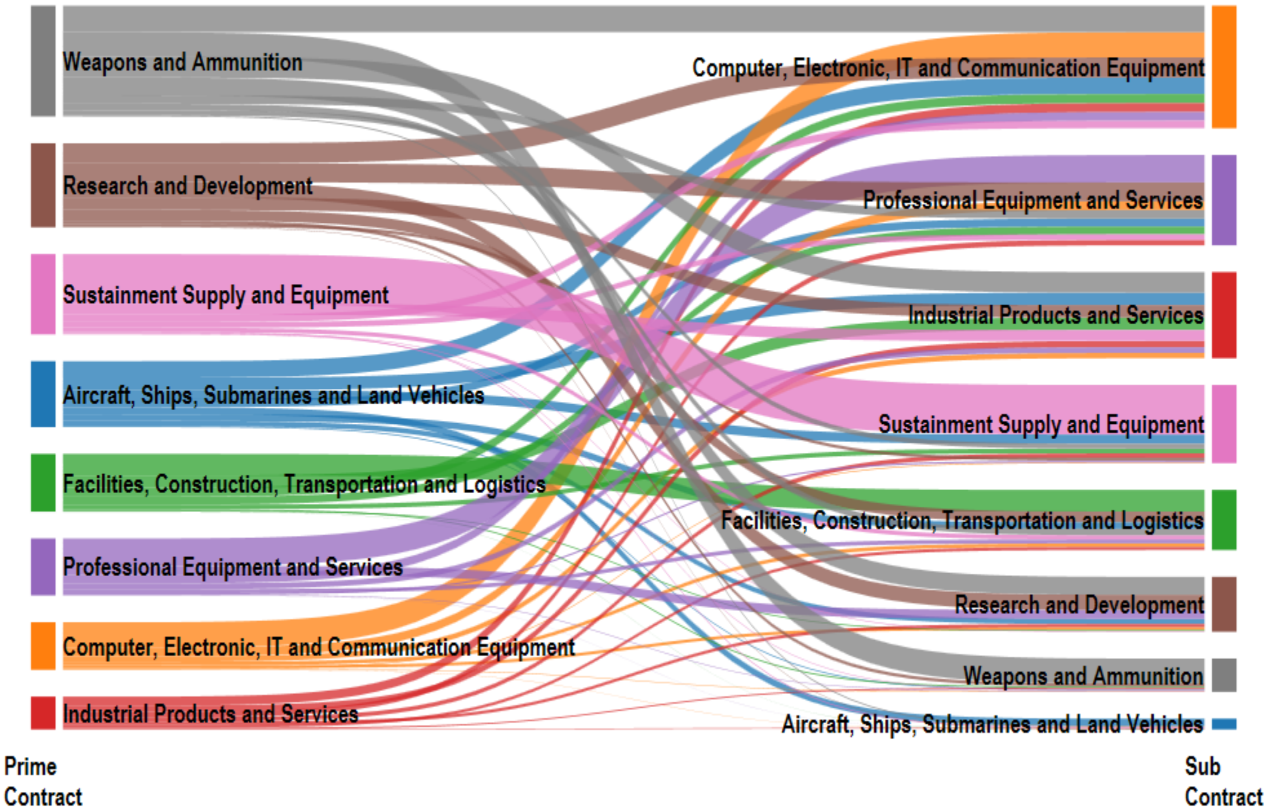
industries through subcontracting, goods-producing sectors receive a disproportionately large share of subcontracts relative to service sectors. To corroborate this finding at a more disaggregated level, we examine granular product-level linkages embedded in each prime-subcontract pair. Each prime contract in our data is associated with a product and service code (PSC) that indicates the predominant product or service purchased by the DoD (such as weapons and engineering services).[17] Subcontracts in our data do not have such information, but a short description is available in most cases (e.g., "Countering weapons of mass destruction...", "Data visualization support...", "Education and training of airmen including..."). Machine-learning techniques can be applied to predict the most likely PSC for each subcontract. Appendix F provides the details of our prediction algorithm.

We analyze the relationship between the predicted subcontract PSC and the PSC of the associated prime contract. Two pieces of evidence support the central role of goods production in subcontracting. First, Table 3 shows that prime contracts for products are mostly linked to subcontracts that also deliver products, while a large share of service-oriented prime contracts are also associated with subcontracts delivering products, consistent with our cross-industry evidence.

Second, Figure 7 shows the flow from prime-contract products to subcontract products, with each arrow indicating subcontract obligations in dollars. Consistent with earlier results, prime contracts (left panel) delivering defense products and R&D services generate the most subcontracts. On the subcontract side (right panel), computers, electronics, IT and communication equipment are the largest recipients. This is not surprising, as the U.S. defense system relies heavily on computing technology. Moreover, in recent years,

[17]The PSC is consistent across the Federal Procurement Data System. Codes starting with a number indicate products, while those starting with a letter indicate services. In the latest version of PSC (April 2025), there are about 3,600 categories at the 4-digit level and 183 categories at the 2-digit level. See https://www.acquisition.gov/psc-manual.

Figure 7: Product linkages between prime and subcontracts



Notes: This figure visualizes flows from prime contracts to subcontracts using prime-subcontract pairs, with arrow widths proportional to subcontract obligations (in 2019 dollars). The left panel categorizes prime contracts by product service code, while the right panel categorizes subcontracts using product service codes predicted from subcontract description texts.

the DoD has undertaken initiatives investing in rapidly growing technologies—such as big data and artificial intelligence—that require substantial computing resources (Sayler, 2024). Professional equipment and supplies, as well as industrial products, which are in high demand by the DoD, are also concentrated in goods sectors.

Fact 3: Large firms primarily subcontract to other large firms, whereas small and mid-sized firms also direct a substantial share of subcontracts to large firms.

Next we examine the linkages between prime contractors and subcontractors based on firm size. Table 4 presents the distribution of subcontracting relationships by employment count. Each cell shows the percentage of prime obligations in a given firm-size category (first column) that are subcontracted to firms in the corresponding size bracket (first row). At both extremes, prime contractors are more likely to form subcontracting relationships with firms of similar size. For example, 27% of prime contracts awarded to the smallest primes

Table 4: 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	**27%**	20%	16%	21%	17%	54%
20-49	26%	**23%**	14%	27%	11%	51%
50-99	28%	23%	**18%**	20%	11%	49%
100-299	25%	20%	14%	**21%**	20%	55%
More than 300	18%	15%	11%	22%	**33%**	67%

Notes: This table shows the share of subcontract obligations (in 2019 dollars) flowing from prime contractors in each firm-size category to subcontractors in a given category. Within-category shares are highlighted in bold. Firm-size information is drawn from NETS.

(fewer than 19 employees) are subcontracted to similarly small firms, while 33% of contracts awarded to the largest firms (over 300 employees) go to firms in the same size category.

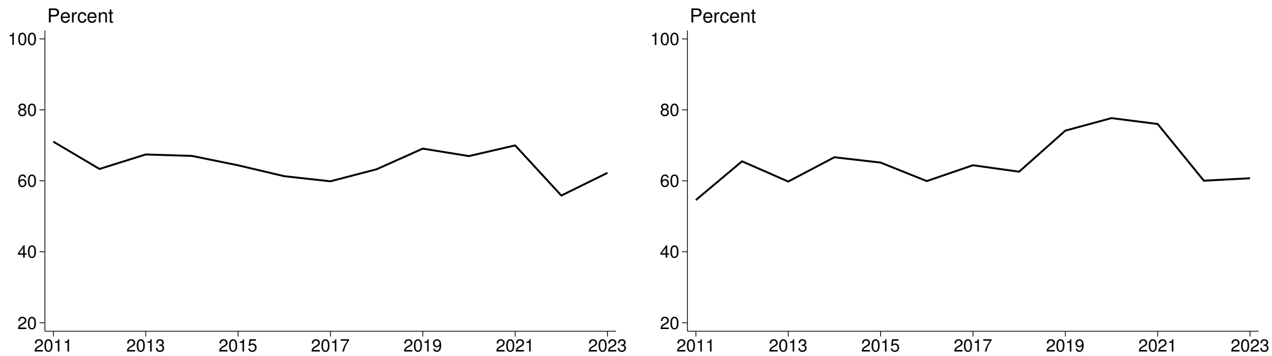
Table 4 also reveals a striking pattern in subcontracting relationships: a disproportionate share of subcontracts flow to large firms, defined as having more than 49 employees (see the last column). This is notable given the conventional view that subcontracting is a channel through which smaller, more 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, indicating that scale advantages, capacity, or strong embeddedness in federal procurement networks likely make them attractive upstream partners as well.

Discussion:

We have shown that subcontracting leads to substantial reallocation of federal defense spending across regions, industries, and firms of varying sizes. We conclude this section by highlighting a key pattern: despite policies aimed at supporting small businesses and service providers in subcontracting, most subcontract dollars ultimately accrue to large firms and goods-producing industries (see Figure 8). This composition pattern may have important implications for both local and aggregate economic outcomes, which we examine in subsequent sections.

Figure 8: The composition of subcontract obligations

(a) Share accounted for by large firms (b) Share accounted for by goods-sector firms



Source: USAspending.gov; NETS annual establishment-level panel data. Note: Panel (a) shows the share of subcontract obligations (in 2019 dollars) accounted for by large firms (more than 49 employees); panel (b) shows the share accounted for by firms in goods-producing sectors.

4 Subcontracting and Cross-Sectional Fiscal Multipliers

In the previous section, we showed that a large share of subcontracts 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 spending measure. We then illustrate the potential bias embedded in conventional estimates. Our results show that corrected fiscal multipliers are larger than those estimated using the conventional approach, and that their magnitudes vary over time and across industries. To close this section, we show that subcontract spending has smaller effects than prime spending, a novel and interesting result motivating 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 Dupor and Guerrero (2017) and 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 denotes location (county), t denotes time and h denotes the horizon. $Y_{i,t}$ is a local economic outcome, and $G_{i,t}$ is the total military spending directed to location i at time t, measured by defense contract obligations.[18] The LHS and key RHS terms sum over h, so that the 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. Standard errors are clustered at the commuting-zone-by-year level to allow for spatial correlation of shocks within local labor markets in each year.[19]

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.[20] As we show in Section 4.2, conventional approaches that do not account for the reallocation of funds through subcontracting yield biased estimates of the local multiplier at a given horizon, with the magnitude of the bias depending on the true multiplier.

Even after accounting for the reallocation of funds through subcontracting, the OLS estimate is likely to be biased due to potential reverse causality, anticipation effects and other unobserved confounding factors. To address this concern, we use an instrumental-variable (IV) approach with shift-share instruments (Bartik, 1991; Goldsmith-Pinkham et al., 2020).

[18] We follow Auerbach et al. (2020) in constructing a flow spending measure by allocating each contract's value evenly over its duration, which helps capture the component of defense contracts that affects output contemporaneously. For prime contracts, duration information is available in DoD procurement data. For subcontracts, however, no such information exists. We therefore approximate a subcontract's duration using the duration of the prime contract whose obligation date is closest to the subcontract's obligation date.

[19] Because counties within the same commuting zone form an integrated local labor market, shocks may be correlated across counties within a commuting zone. Clustering at the commuting-zone–by-year level allows for arbitrary correlation of errors across all counties in the same commuting-zone–year cell, while treating correlations across years as absorbed by the model's fixed effects. This approach accounts for spatial dependence while maintaining a sufficiently large number of clusters for reliable inference.

[20] In constructing the corrected local spending measure, we adjust the timing of subcontracts to align with that of prime contracts, which helps mitigate the concern that subcontracting may be anticipated when the prime contract is awarded. Specifically, we assign each subcontract the obligation date of its associated prime contract (or the prime contract with the closest action date, as described in footnote 18). As Appendix Figure A4 (panels b and d) shows, this adjustment has minimal impact, as subcontract obligations typically occur very close to the corresponding prime contract's obligation.

We estimate the following first-stage regression for the key RHS term of equation (1),

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

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 location 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 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 each 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

Since the conventional approach uses only prime contract data to construct the local spending measure, i.e., $G_{i,t} = G_{i,t}^{prime}$, the reallocation through subcontracting introduces both measurement error and an omitted-variable problem, leading 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 the correction 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, i.e., $x_i^s \equiv x_i^{sub,in} - x_i^{sub,out}$. $\beta > 0$ is the true multiplier effect.

Bias in 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. We do not know the sign of $\rho(x^p, x^s)$ a priori, but in the data, $\hat{\rho}(x^p, x^s) < 0$, meaning that regions receiving relatively more prime contracts receive relatively fewer subcontracts on net.[21] According to the DGP, $\hat{\rho}(x^p, x^s)$ converges asymptotically to $\rho(x^p, x^s)$, and $\hat{\beta}$ is downward biased. Given that $\rho(x^p, x^s) < 0$, 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, regardless of whether the shock arises from prime contracts 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 within and outside location i. β and γ are the true multiplier effects of prime and subcontract spending, respectively.

In this case, if the researcher uses the conventional misspecified model to estimate β, the

[21] This is visually apparent in Figure 4 where many regions receive high volumes of prime contracts but few subcontracts (teal-colored regions).

bias is given by

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

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 again 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 local fiscal multipliers and illustrate how accounting for subcontracting alters the effects of federal defense spending. The central comparison is between the conventional multiplier estimates, which do not account for the reallocation of funds through subcontracting, and the corrected estimates. We study a set of labor market outcomes that characterize the local economy and examine heterogeneity across industries and over time.

Labor market effects: Table 5 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, an increase in defense spending by one percent of local earnings 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 previous studies.[22] However, once accounting for the reallocation of funds through subcontracting, our corrected multiplier estimates are larger at all horizons: 0.13% at the 2-year horizon 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 6 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. The table also

[22]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.

Table 5: 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***
	(0.009)	(0.011)	(0.012)	(0.013)	(0.014)
IV estimate	0.094***	0.104***	0.179***	0.230***	0.259***
	(0.034)	(0.041)	(0.054)	(0.065)	(0.070)
1st-stage F	4,097	3,594	2,782	2,414	2,299
# Obs.	96,491	84,805	74,892	66,095	57,912
Corrected (Accounting for subcontract reallocation)					
OLS estimate	0.002	0.002	0.002	0.004	0.007**
	(0.002)	(0.001)	(0.002)	(0.003)	(0.004)
IV estimate	0.109**	0.126**	0.210***	0.253***	0.287***
	(0.043)	(0.057)	(0.075)	(0.082)	(0.091)
1st-stage F	249	117	119	166	171
# Obs.	96,491	84,805	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 an instrumental variable (IV) approach. For the IV estimates, the robust F-statistics of the first stage regression are 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 reallocation of subcontract amounts. The unit of observations is county-quarter. *, **, and *** indicate significance at the 10%, 5%, and 1% levels. Standard errors clustered at the commuting-zone-by-year level are in parentheses below each estimate. The sample in each regression spans 2011q1-2024q3.

shows 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 both employment and wage 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 count, 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.

In the literature, the cost per job-year——a metric closely related to fiscal multipliers——is of particular interest from a policy perspective.[23] We show in Appendix Figure B1 that conventional multiplier estimates imply a cost per job-year exceeding \$400K (in 2019 dollars) at a two-year horizon, whereas the corrected multipliers suggest a lower cost per job-year of approximately \$330K. Thus, the downward bias in the conventional employment multiplier translates into an upward bias in the cost per job-year number, which is important for policy design and evaluation.[24]

Time variation: To further investigate the role of subcontracting in fiscal multipliers, we compare conventional and corrected multipliers across subsamples. Since subcontracting has risen over time (except for the last two years of our sample), the downward bias of 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 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: A related and important question is how defense spending affects different industries. To address this question, we estimate equation (1) using the corrected spending measure and IV approach, but replace the total employment growth on the LHS with the employment growth of a specific industry. Appendix Figure B2 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, as well as professional and business services. This supports the view of "spillovers" and "general-equilibrium multiplier effects" across industries beyond those directly impacted by defense contracts.

[23] This is computed as the reciprocal of the job-year estimate using the formula consistent with Briganti et al. (2025) and Chodorow-Reich (2019):

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

where β_h is the horizon h employment multiplier.

[24] Our cost-per–job-year estimates exceed those surveyed in Chodorow-Reich (2019) for the 2009 American Recovery and Reinvestment Act (ARRA), which range from \$25K- \$125K in 2008 dollars. By comparison, our conventional estimate for 2011-2024 is \$344K, and the corrected estimate is \$282K, both in 2008 dollars. This difference may reflect the unique economic conditions during the ARRA period(i.e., the Great Recession). Our estimates are in line with Briganti et al. (2025), who use MSA-level data from 2006-2019 and find a cost per job-year of \$305K in 2008 dollars.

Table 6: Conventional vs corrected local multipliers: additional outcomes

Outcome	4-Quarter	8-Quarter	12-Quarter	16-Quarter	20-Quarter
Earnings					
Conventional	0.094***	0.104***	0.179***	0.230***	0.259***
	(0.034)	(0.041)	(0.054)	(0.065)	(0.070)
Corrected	0.109**	0.126**	0.210***	0.253***	0.287***
	(0.043)	(0.057)	(0.075)	(0.082)	(0.091)
Employment					
Conventional	0.063*	0.078*	0.138***	0.174***	0.204***
	(0.037)	(0.041)	(0.053)	(0.061)	(0.067)
Corrected	0.074	0.095*	0.162**	0.192**	0.225***
	(0.045)	(0.057)	(0.072)	(0.075)	(0.085)
Average weekly wage					
Conventional	0.037**	0.031*	0.042**	0.049**	0.044*
	(0.017)	(0.018)	(0.021)	(0.024)	(0.025)
Corrected	0.042**	0.038*	0.049**	0.054**	0.049*
	(0.020)	(0.022)	(0.025)	(0.027)	(0.027)
Establishment counts					
Conventional	0.013	0.014	0.004	0.004	0.010
	(0.010)	(0.013)	(0.017)	(0.020)	(0.021)
Corrected	0.016	0.017	0.005	0.004	0.011
	(0.012)	(0.016)	(0.020)	(0.022)	(0.024)

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 QCEW for 2011q1- 2024q3. See notes for Table 5.

Higher geographic aggregation: Our results are robust to exploring variation at higher geographic levels. Table B2 presents earnings and employment multiplier estimates at the commuting-zone (CZ) level—geographic units that more closely reflect local labor markets. The earnings multiplier increases from 0.17 at the one-year horizon to 0.5 at the four-year horizon, while the employment multiplier rises from 0.14 to 0.3 over the same horizons. These estimates are in line with the previous studies using comparable geographic units such as CBSAs (Auerbach et al., 2020).[25] In terms of the magnitude, our CZ-level

[25]We do not conduct a CBSA-level analysis, because CBSAs do not cover the entire United States;

estimates are slightly larger than county-level estimates, which may be explained by the presence of cross-county spillovers (Dupor and McCrory, 2017). Comparing the conventional with the corrected multipliers, we find that the conventional multipliers for earnings and employment are biased downwards by 7-15%. Overall, these estimates corroborate the patterns established by our county-level analysis.

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 estimate the following specification,

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

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 (see Section 2.1), (ii) the change in aggregate subcontract spending, driven by regulation and policies intended to promote subcontracting and business networks (see Section 2.2.1 and Appendix D), and

approximately 1,300 counties fall outside the CBSA classification. This is problematic, as our empirical approach requires accounting for both the outflow of funds to and the inflow of funds from all other geographic units. The incomplete CBSA coverage thus poses both conceptual and econometric challenges for estimating the multipliers.

(iii) county-level initial shares of prime and subcontract spending. These aggregate shifts interacted with county-specific shares create plausible exogenous variation, especially at fine geographic levels such as counties.

Table 7 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 6.[26] Importantly, subcontracting multipliers in general are *smaller* than prime contract multipliers. At longer horizons, for example, prime contract multipliers are approximately twice as large as subcontracting multipliers. These results imply that subcontracting exerts weaker local economic effects than prime contracting. 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 underestimated local fiscal multipliers and obscures meaningful variation in the incidence and transmission of government spending shocks across regions, industries and over 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 assessing aggregate implications, county-level evidence provides limited insight into 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.[27] First, DoD contracts are performed in specific locations by 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,

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

[27] 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 data at the establishment, firm, and enterprise levels.

Table 7: 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***
	(0.044)	(0.057)	(0.080)	(0.088)	(0.098)
$\hat{\gamma}$ (Sub effect)	0.039	0.029	0.061	0.119**	0.198***
	(0.038)	(0.029)	(0.044)	(0.052)	(0.072)
1st-stage F	135	162	274	320	242
# Obs.	96,491	84,805	74,892	66,095	57,912
Employment					
$\hat{\beta}$ (Prime effect)	0.075	0.095*	0.168**	0.200**	0.234**
	(0.046)	(0.057)	(0.076)	(0.081)	(0.092)
$\hat{\gamma}$ (Sub effect)	0.023	0.019	0.039	0.069**	0.119***
	(0.023)	(0.019)	(0.029)	(0.030)	(0.043)
1st-stage F	135	162	274	320	242
# Obs.	96,491	84,805	74,892	66,095	57,912
Average weekly wage					
$\hat{\beta}$ (Prime effect)	0.043**	0.038*	0.051*	0.055*	0.048*
	(0.021)	(0.022)	(0.026)	(0.028)	(0.029)
$\hat{\gamma}$ (Sub effect)	0.020	0.012	0.022	0.044**	0.065*
	(0.018)	(0.012)	(0.016)	(0.021)	(0.027)
1st-stage F	135	162	274	320	242
# Obs.	96,491	84,805	74,892	66,095	57,912
Establishment counts					
$\hat{\beta}$ (Prime effect)	0.016	0.017	0.005	0.004	0.011
	(0.012)	(0.016)	(0.021)	(0.023)	(0.025)
$\hat{\gamma}$ (Sub effect)	-0.004	-0.004	-0.002	0.011	0.014
	(0.011)	(0.011)	(0.011)	(0.011)	(0.014)
1st-stage F	135	162	274	320	242
# Obs.	96,491	84,805	74,892	66,095	57,912

Notes: The table reports cumulative multipliers for different outcome variables at various horizons, estimated using specification (5) with instruments. See notes for Table 5.

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. In our analysis, we use the terms *establishment* and *firm* interchangeably to mean establishment.

5.1 Empirical Approach and Average Effects

Our sample consists of all establishments that ever received a defense prime contract or subcontract at any point between 2011 and 2024. We observe their employment, sales, credit rating and other information at the annual frequency between 2011 and 2022.[28] 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.[29]

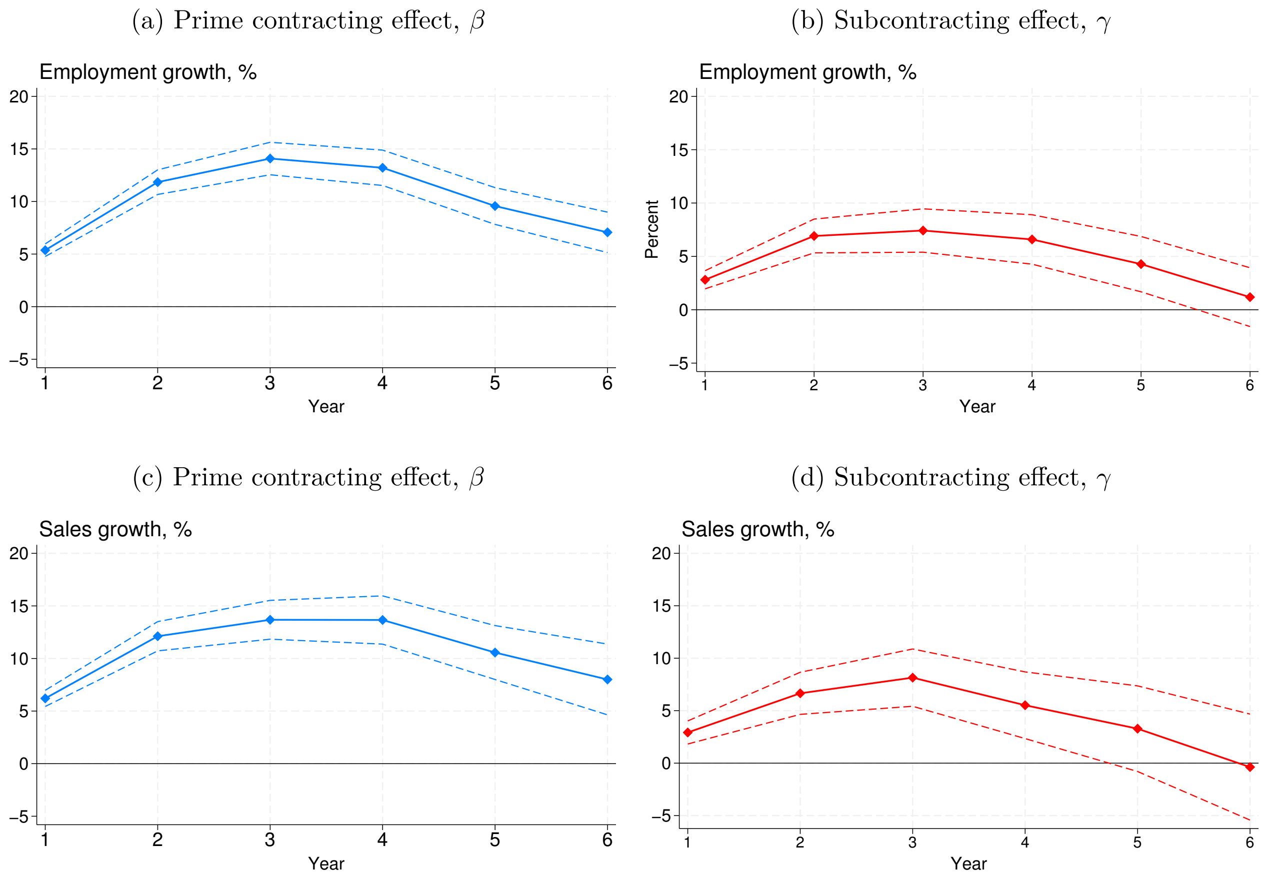
By including firm fixed effects, our empirical strategy exploits within-firm variation, as having a prime or subcontract is relatively rare at the establishment-year level. Our sample is restricted to firms that have ever participated in defense contracts, which helps mitigate concerns of selection bias, since firms that never participated may have done so for reasons correlated with their employment and sales growth.[30] In other words, including firms that

[28] 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.

[29] This is similar to the specification used by di Giovanni et al. (2023) to study Spanish firms' behavior in response to government procurement.

[30] For example, firms that have never participated in defense contracts may operate under different supply-chain systems, serve different clientele bases, or perform more or less efficiently than participating

Figure 9: Establishment-level evidence on defense contracting effects



Notes: The point estimates for the prime contracting effect (β) and the subcontracting effect (γ), along with their 95% confidence intervals, are obtained from estimating specification (6). All regressions include establishment and NAICS 2-digit-industry-by-year fixed effects, as well as the control variables described in the text.

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

firms. These unobserved characteristics could affect the economic outcomes we study, potentially confounding the estimated effects of defense contracts.

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 (on average less than 50 employees) with large firms (on average 50 or more employees). Second, we examine heterogeneity by industry, focusing on the comparison between firms in service 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,

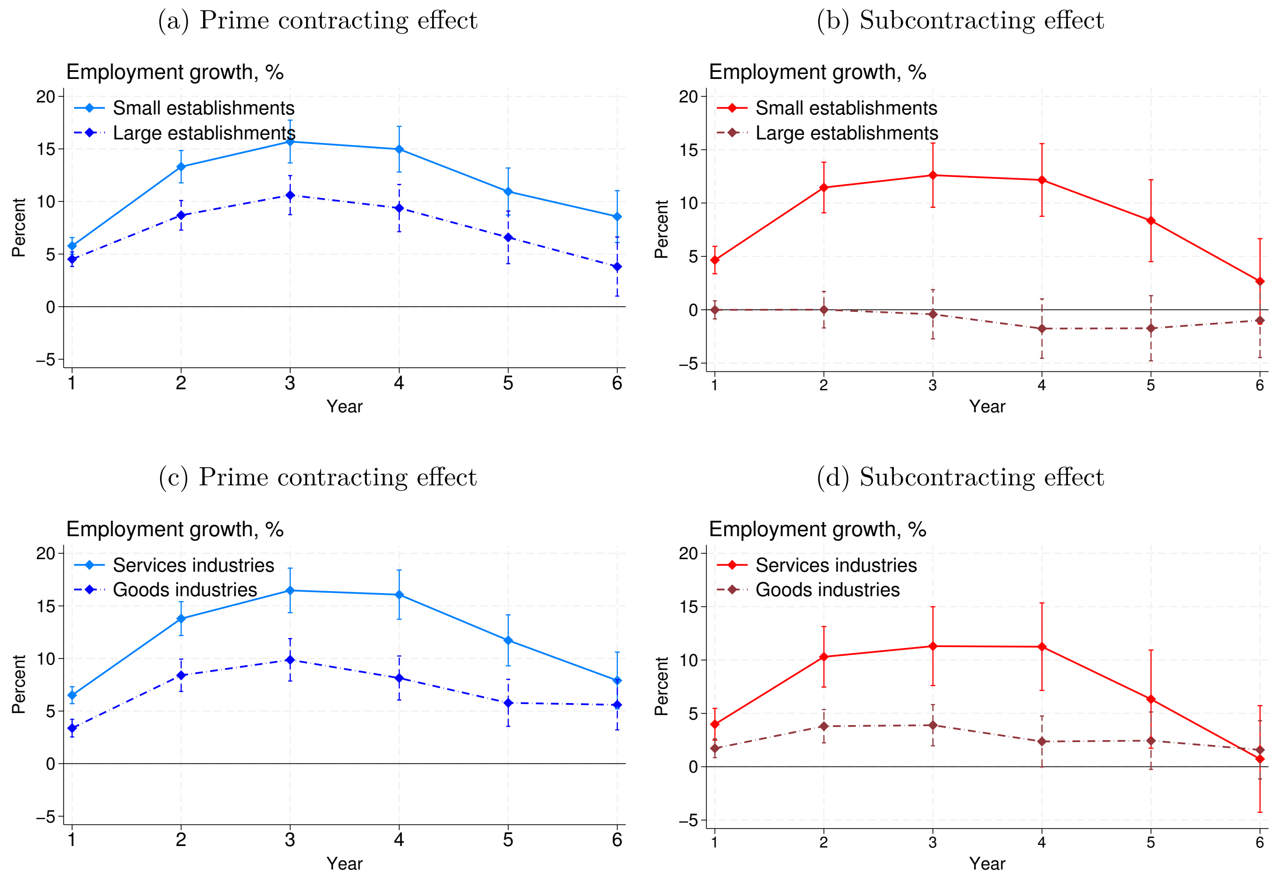
$$\frac{y_{j,t+h} - y_{j,t-1}}{y_{j,t-1}} = \beta_1^h \mathbb{I}_{j,t}^P + \gamma_1^h \mathbb{I}_{j,t}^S + \beta_2^h \mathbb{I}_{j,t}^P \times Z_j + \gamma_2^h \mathbb{I}_{j,t}^S \times Z_j + \mathbf{x}_{j,t-1}\omega + \alpha_j + \delta_{st} + \nu_{j,t+h}. \quad (7)$$

The upper panels of Figure 10 reveal two patterns. First, large firms tend to have smaller employment responses, 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 significantly higher employment growth. It is the differential response of large firms that explains the lower average effect of subcontracting in panel (b) of Figure 9.

Breaking down the effect by industry, the bottom panels of Figure 10 show that the employment responses of firms in goods industries are smaller than those in services industries. Together, Figure 10 suggests that subcontracting has the least employment effect on large firms in goods-producing industries. In Appendix Figure C1, we find a very similar pattern for the responses of sales growth. Our results about services and goods industries are consistent with Muratori et al. (2023), who use defense prime contracts in a longer sample and establish that service-based multipliers are larger than goods spending multipliers.

In Appendix Figure C2, we also explore the effects on firms' credit rating (measured by D&B's Paydex score) and their heterogeneity. We find that credit rating 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, although the difference between receiving prime and subcontracts is insignificant. In addition, we find some evidence that the credit-rating increase is more pronounced for small firms in the case of receiving subcontracts. These results are consistent with Hebous and Zimmermann (2021), who find that demand shocks arising from federal contracts reduce firms' external financing

Figure 10: Heterogeneity in employment responses



Notes: The upper panels show point estimates of prime contracting effects on small (β_1) and large ($\beta_1 + \beta_2$) establishments, and subcontracting effects on small (γ_1) and large ($\gamma_1 + \gamma_2$) establishments, along with 95% confidence intervals, obtained from estimating specification (7). The lower panels similarly show prime contracting effects on goods-producing (β_1) and service-producing ($\beta_1 + \beta_2$) establishments, and subcontracting effects on goods-producing (γ_1) and service-producing ($\gamma_1+\gamma_2$) establishments. All regressions include establishment and NAICS 2-digit-industry-by-year fixed effects, as well as the control variables described in the text.

premium, especially for financially constrained firms such as small firms.

5.3 Why Does Subcontract Spending Have Smaller Effects?

Our firm-level heterogeneity exercise shows 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 8). This smaller direct effect helps explain the weaker multiplier effects of subcontracting on the local economy than prime contracting, consistent with our county-level evidence (Table 7).

An interesting question is why firms are less responsive to subcontracts even after conditioning on firm and industry-by-year fixed effects. Moreover, large firms appear to be particularly unresponsive to subcontracting. While several behavioral explanations are possible, we focus on one mechanism for which we provide supporting evidence: differences in the persistence of contracting relationships. 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 than for large subcontractors. This evidence seems to support the expectation channel, particularly with respect to firms' hiring decisions.[31]

In column (1) of Table 8, 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 differential effect 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, 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 8. 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. The estimates show that this probability increases if the subcontractor had the same main prime contractor 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.

[31] 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 investigate 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 8: Persistence of defense contract relationships

	Prime contracting		Subcontracting		Same Prime firm	
	$\mathbb{I}^P_{j,t}$	$\mathbb{I}^P_{j,t}$	$\mathbb{I}^S_{j,t}$	$\mathbb{I}^S_{j,t}$	$SameFirm_{j,t}$	$SameFirm_{j,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{I}^P_{j,t-1}$	0.210***	0.200***		0.044***		
	(0.002)	(0.002)		(0.003)		
$\mathbb{I}^P_{j,t-1}\times$Large		0.021***				
		(0.003)				
$\mathbb{I}^S_{j,t-1}$		0.041***	0.116***	0.108***		
		(0.002)	(0.002)	(0.003)		
$\mathbb{I}^S_{j,t-1}\times$Large				0.021***		
				(0.005)		
$SameFirm_{j,t-1}$					0.200***	0.223***
					(0.005)	(0.007)
$SameFirm_{j,t-1}\times$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 reports the estimated persistence of prime- and subcontracting relationships, measured by AR(1) coefficients, along with heterogeneity by establishment size. The dependent variable is indicated in the header of each column. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Our analysis also addresses whether being a subcontractor increases the likelihood of becoming a prime contractor——a stated motivation for the government's encouragement of subcontracting. Column (2) of Table 8 shows that having a subcontract in the previous year raises the probability of having one in the current year by 0.04 pp (a 10% increase relative to the sample mean), indicating the role of prior participation in the government contracting network. Likewise, column (3) shows that being a prime contractor increases the likelihood of being a subcontractor. Nevertheless, the strongest relationships remain within the same segment: being a prime (subcontractor) in the past makes it more likely to be a prime (subcontractor).

5.4 Robustness

The baseline estimates in Sections 5.1 and 5.2 are robust to alternative specifications and sample restrictions that further address potential concerns about estimation bias and data quality. We present three key robustness checks.

Accounting for treatment intensity: One concern is that the smaller responses to subcontracting simply reflect the smaller dollar amounts of subcontracts, implying differences in treatment intensity. To address this concern, we estimate a specification that accounts for the amount of prime and subcontracts received. Specifically, the indicator variables, $\mathbb{I}^P_{j,t}$ and $\mathbb{I}^S_{j,t}$, are replaced with prime contract obligations (adjusted for subcontracting) and subcontract obligations. Figure C3 shows the average effects on employment growth and heterogeneity across firms. Accounting for the treatment intensity does not alter the pattern that prime contracting has larger effects on firm employment than subcontracting. Using within-firm variation, the results show that a \$1 million increase in prime contracts is associated with 0.2% employment growth, while the same size increase in subcontracts lead to no employment growth. In addition, the heterogeneity patterns are also consistent with those in Figure 10.

Restricting to firms receiving both contract types: To further mitigate concerns that firms receiving prime contracts differ systematically from those receiving subcontracts, potentially biasing our estimates due to unobserved heterogeneity, we restrict the baseline sample to firms that receive both prime and subcontracts. These firms account for approximately 22% of observations in the baseline sample. Figure C4 reports the average effects on employment growth, along with heterogeneity across firms. The estimated effects are fully consistent with our baseline results, indicating that differential selection into prime versus subcontracting relationships is unlikely to drive our findings. Results based on contract dollar amounts are also similar to those reported in Figure C3.

Excluding imputed employment observations: Although imputation occurs most frequently in the smallest firm-size bin (1-10 employees), which we already exclude from the baseline sample, there is still a nontrivial fraction of NETS employment observations that are imputed (about 20%). We conduct a robustness check that drops all observations with imputed employment. As shown in Figure C5, our baseline estimates are almost unaffected,

6 Aggregate Implications of Subcontracting

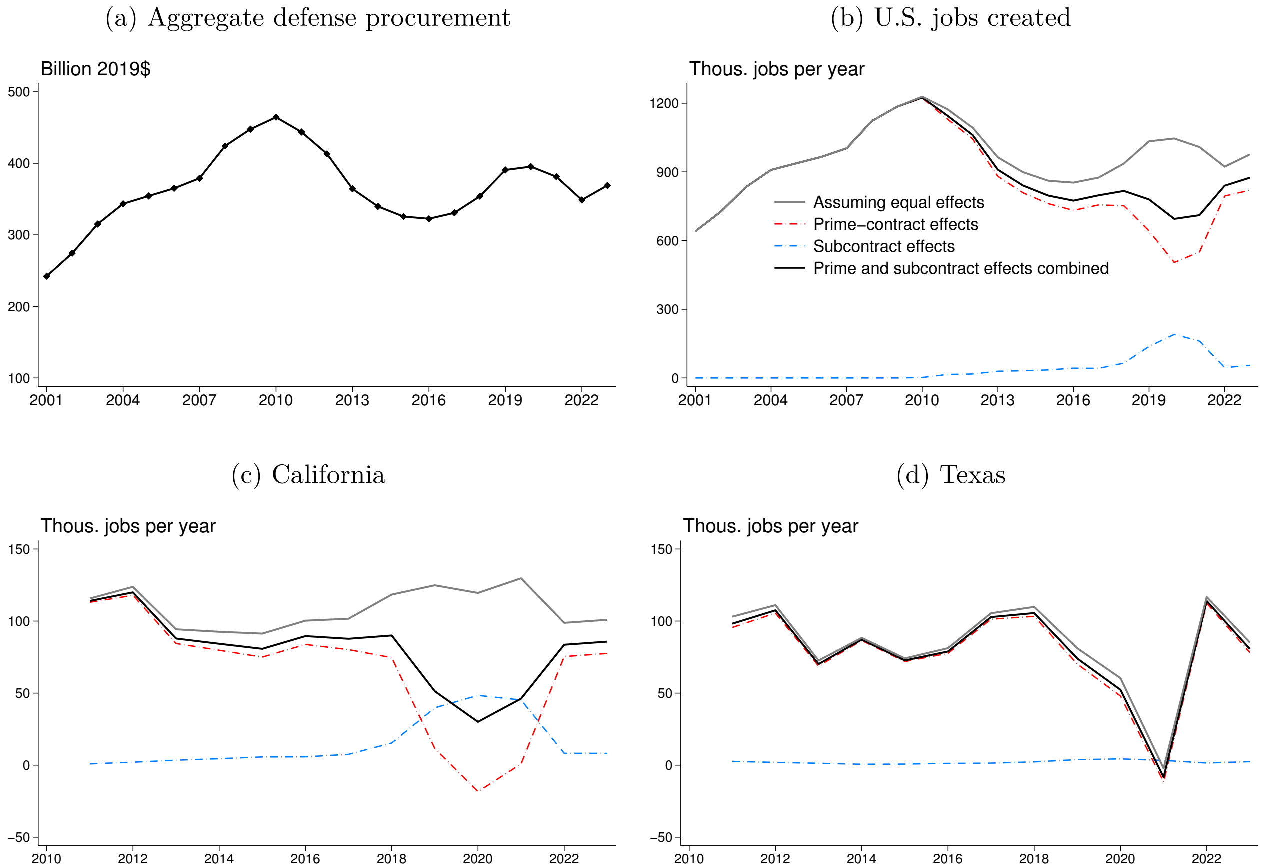
Our analysis thus far shows that defense subcontracts have smaller real effects than prime contracts, both in regional-level and firm-level data. Accordingly, we expect the rise of subcontracting to weaken the aggregate effects of military spending. The mapping between cross-sectional fiscal multipliers and national multipliers, however, is not straightforward. As extensively discussed in the literature, potential spillovers across regions and monetary and tax policy responses can create a gap between local and aggregate multipliers, which may be quantified by a structural open-economy model with a monetary and fiscal union (Nakamura and Steinsson, 2014).

Nevertheless, empirical studies have found that local multipliers provide informative indicators of the aggregate effects of federal spending (Dupor and Guerrero, 2017; Chodorow-Reich, 2019; Nakamura and Steinsson, 2018). In this section, we illustrate the role of subcontracting through a back-of-the-envelope calculation of the number of jobs created by defense procurement spending since 2011. When extrapolating our local employment multipliers to the aggregate level, we interpret the resulting job estimates as a fixed-policy counterfactual, holding constant the stance of monetary and tax policy and abstracting from potential general-equilibrium feedback. This interpretation follows the distinction emphasized by Chodorow-Reich (2019), whereby local multipliers capture partial-equilibrium responses that are informative about aggregate effects under an unchanged national policy environment. The purpose of the exercise is to highlight the role of the rise in subcontracting relative to the counterfactual absent this trend.

The upper left panel of Figure 11 displays real aggregate defense procurement since 2001. Spending rose from 2001 to 2010, declined gradually over the next couple of years, and began to rise again around 2015. If the post-2015 increase was exogenous to prevailing economic conditions, one would expect it to provide some stimulus to the labor market. The right panel supports this view, but only under the assumption that defense spending flows exclusively to prime contractors (gray line). Specifically, we divide real defense spending by the real cost per job-year implied by our estimated prime-contract effect in Table 7 (see footnote 23 for details on the cost per job-year calculation).

However, the rise of subcontracting—coupled with the fact that subcontracting, on average, has smaller multiplier effects than prime contracting—implies that defense spending has created fewer jobs than it would have in the absence of subcontracting. Splitting the post-2010 defense procurement series into prime and subcontract components and applying the corresponding multiplier estimates from Table 7 shows that the increase in spending after 2015 did not translate into a boost to the labor market. If anything, job creation was lower than in earlier years, as the subcontracting boom generated fewer jobs than would have resulted had the funds been directed solely to prime contractors. While the level of jobs created are subject to the caveats discussed above, the main point is that assuming equal effects across contract types overstates employment effects, by about 33% in 2020 and

Figure 11: Defense procurement and job creation



Sources: BEA NIPA table; USAspending.gov. See notes in Figure 1 for the NIPA defense procurement definition. Panels (b)-(d) show the number of jobs created by defense procurement using different cost-per-job-year estimates implied by our 4-quarter multiplier estimates in Table 7. The gray line applies the prime contract multiplier to total defense procurement, without distinguishing between prime and subcontracts. The black line separates subcontracts from prime contracts, calculates their effects using the corresponding multipliers, and sums these effects. The red and blue lines show the individual contributions of prime and subcontracts, which together correspond to the black line.

by about 22% cumulatively over 2018-2022.

The aggregate job-creation picture masks substantial heterogeneity across regions, as the rise of subtracting has been uneven. In panels (c) and (d) of Figure 11, we apply our cost per job-year estimates to the two largest states that historically received the most defense prime contracts—California and Texas. We first obtain the corrected prime contract obligations by subtracting subcontract outflows, which allows us to estimate the prime-contract effect (red line). We then obtain subcontract obligations received by the state and the resulting employment effect (blue line).

In the case of California, the combined effect (black line) is much smaller than that under the assumption that all defense contracts have the same prime-contract effect (gray line), especially during 2018-2022. This is because California subcontracted much of its prime obligations during this period, while also receiving a substantial amount of subcontracts. Since subcontracts have smaller employment multipliers, the combined effects are smaller. In contrast, Texas subcontracted much of its prime obligations during this period, but the state received little subcontract inflows. Therefore, applying the prime-contract multiplier to the corrected prime obligations captures the combined employment effect reasonably well.

In sum, this back-of-the-envelope aggregation exercise, which extends local multipliers to a fixed-policy aggregate counterfactual, underscores that subcontracting is not merely a distributional detail but a quantitatively important determinant of the national employment impact of defense spending. The rise of subcontracting has dampened aggregate job creation associated with recent procurement expansions, suggesting that changes in contracting structure can meaningfully reshape the macroeconomic footprint of federal defense outlays.

7 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 reallocation of federal dollars; subcontracts disproportionately flow to goods-producing industries; most subcontracting dollars ultimately accrue to large firms. 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 in employment relative to prime contractors, likely reflecting the less durable nature of subcontract relationships. Finally, the aggregate employment 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.

Our analysis has two important policy implications. First, the rise of subcontracting has dampened the job creation effects of federal spending. Second, policies that encourage subcontracting may have unintended consequences, as sub-awards often flow to firms and sectors with limited employment responses. These findings highlight the importance of looking beyond prime contracts to fully understand how public procurement diffuses through the economy and suggest that policy design and contract structure can meaningfully shape the local economic impact of federal spending.

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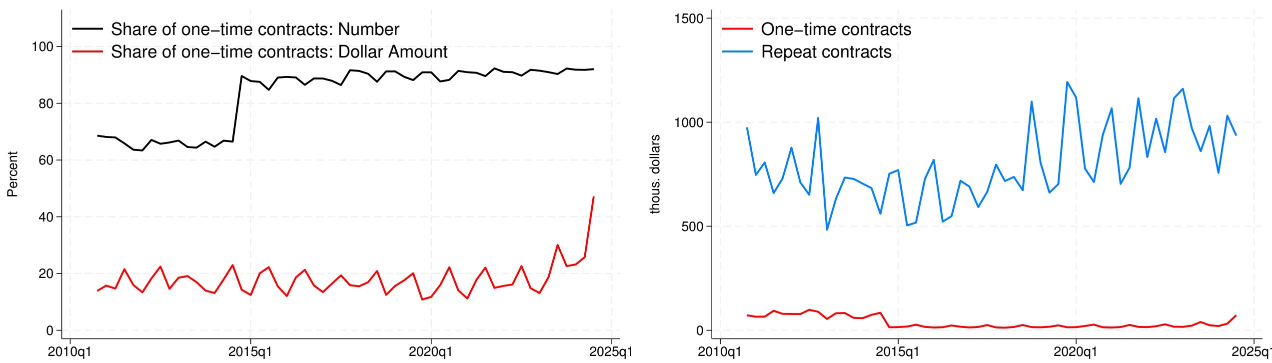
Online Appendix

A Data and Stylized Facts : Additional Figures and Tables

Figure A1: One-time vs repeat prime contracts

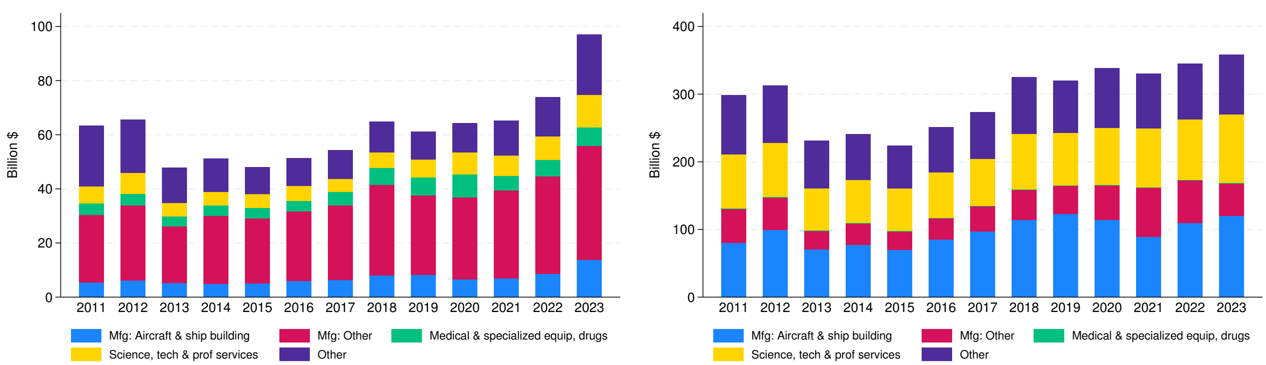
(a) Number and total amount (b) Average contract amount



Source: USAspending.gov. Notes: The left panel shows the share of one-time prime contracts among all prime contracts, measured by count (black line) and obligation amount (red line). The right panel compares the average obligation of one-time prime contracts with that of repeat prime contracts.

Figure A2: Prime contract obligations by industry

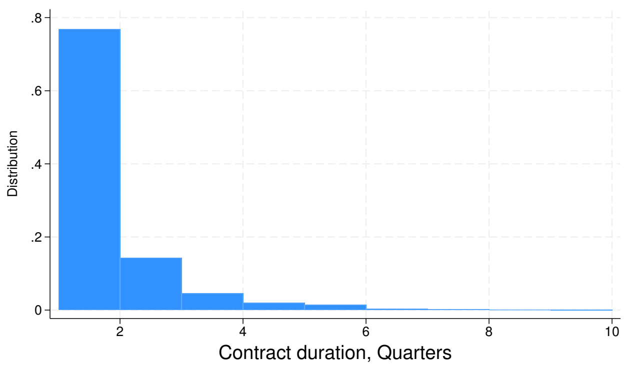
(a) One-time contract (b) Repeat contract



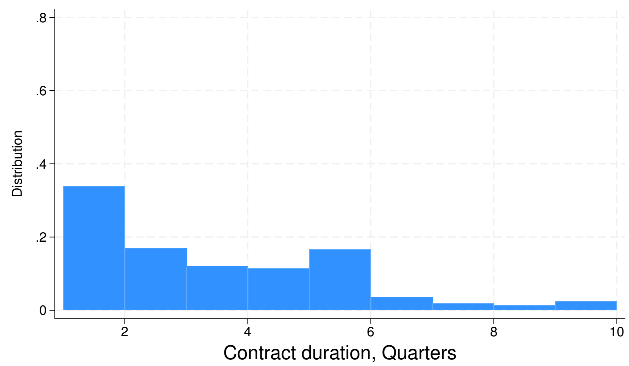
Source: USAspending.gov. Notes: The figure shows prime contract obligations (in billions of dollars) by industry and contract type.

Figure A3: Duration of prime contracts

(a) One-time contract

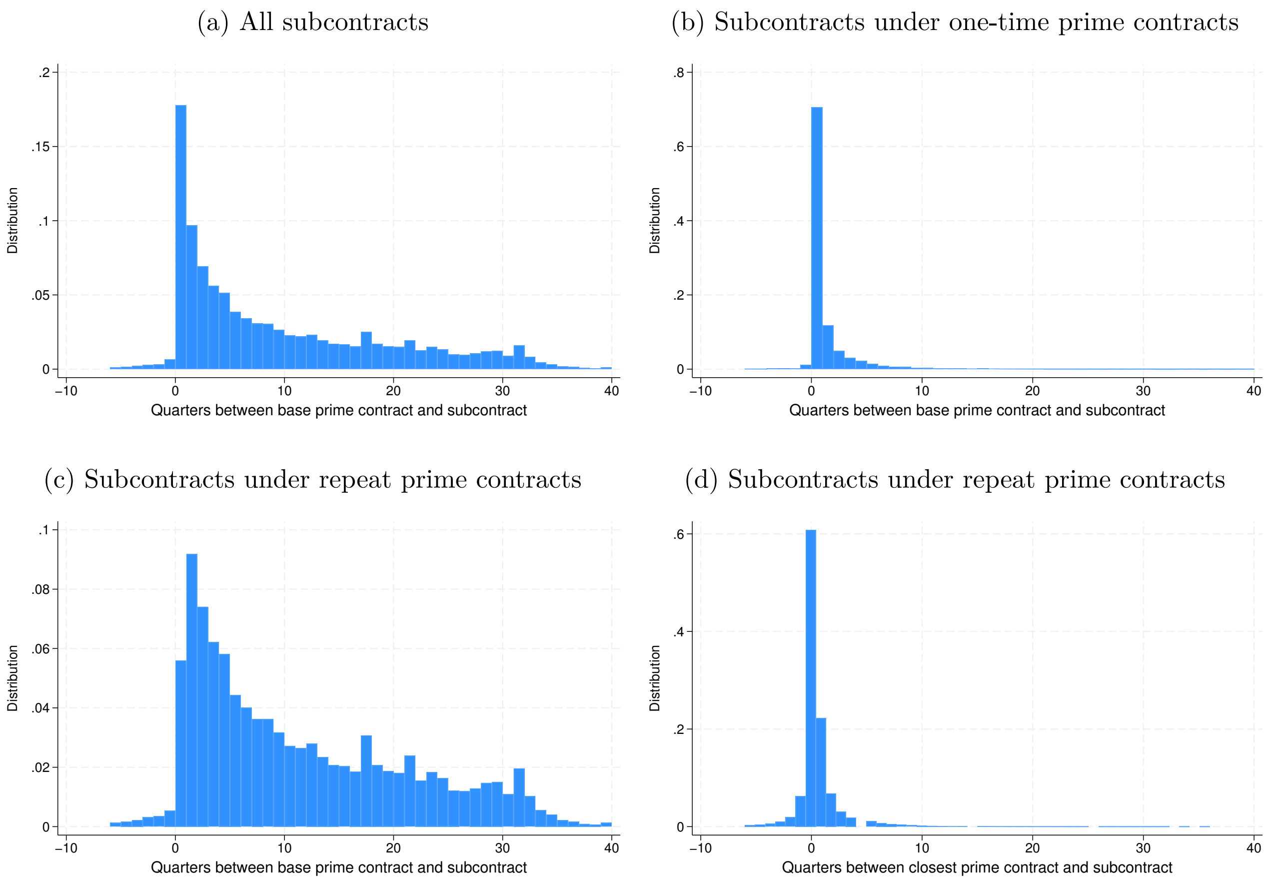


(b) Repeat contract



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

Figure A4: Time lag between prime and subcontract awards



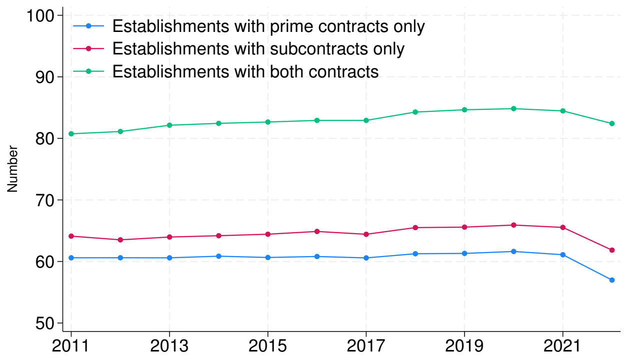
Source: USAspending.gov. Notes: The figure uses prime–subcontract pairs to show the distribution of differences between prime contract and subcontract obligation dates. Panel (a) presents the distribution for all contract pairs. Panel (b) focuses on pairs with one-time prime contracts, while panel (c) shows pairs with repeat prime contracts. Panel (d) displays the distribution for pairs in which the prime contract obligation date (among a sequence of contracts with the same identifier) is closest to the subcontract obligation date.

Figure A5: Subcontract descriptors

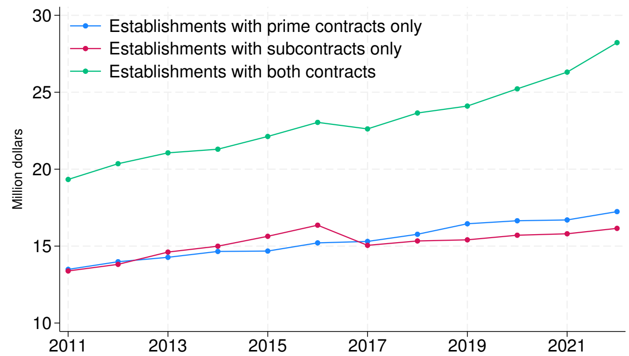
Source: USAspending.gov. Note: The figure shows a word cloud of the top 200 words in the subcontract descriptors, with the font size reflecting the frequency of usage.

Figure A6: NETS establishment characteristics

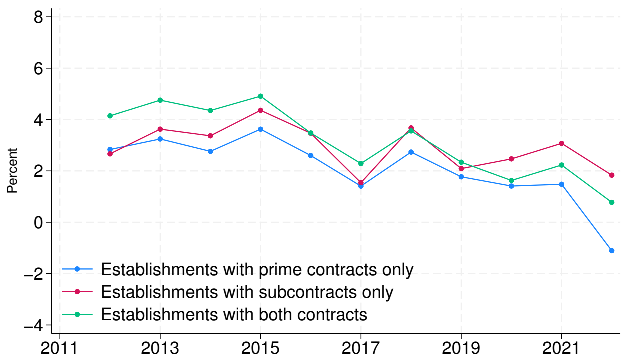
(a) Employment



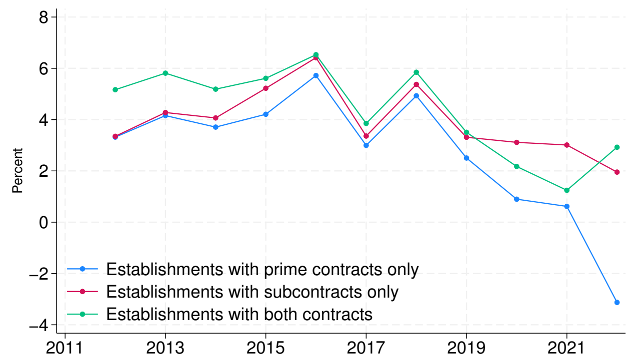
(b) Sales



(c) Employment growth



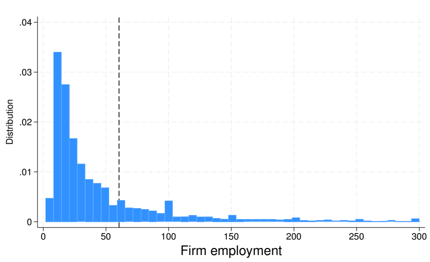
(d) Sales growth



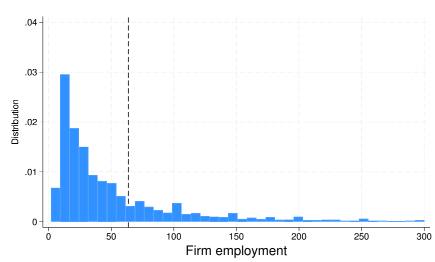
Source: NETS annual establishment-level panel data from 2011-2022. Notes: Each panel shows the average across establishments in a given year and category: (1) having only prime contracts, (2) having only subcontracts, and (3) having both types of contracts.

Figure A7: NETS establishment size distribution

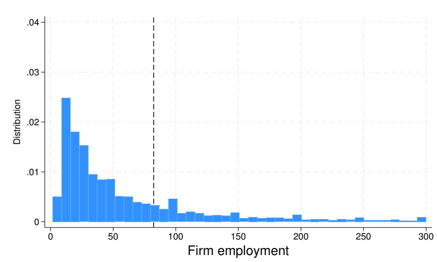
(a) Prime contractors



(b) Sub contractors



(c) Having both contracts



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

Table A1: NETS data summary statistics

	Total	Establishments that receive		
		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.

Table A2: Prime and subcontractor location patterns (based on subcontract amount)

	All subcontracts	Subcontracts under	
		One-time prime	Repeat prime
Firm locations:			
Same county	6%	6%	6%
Same state	22%	19%	22%
Same region	43%	43%	43%
# Obs.	1,393,150	259,587	1,133,563
Places of work performed:			
Same county	8%	8%	8%
Same state	23%	21%	23%
Same region	45%	45%	45%
# Obs.	1,384,016	258,474	1,125,542

Notes: This table examines prime–subcontract pairs, reporting the share of subcontract obligations (in 2019 dollars) for which the prime and subcontracting firms are located in the same place (top panel) and the share for which their places of performance coincide (bottom panel).

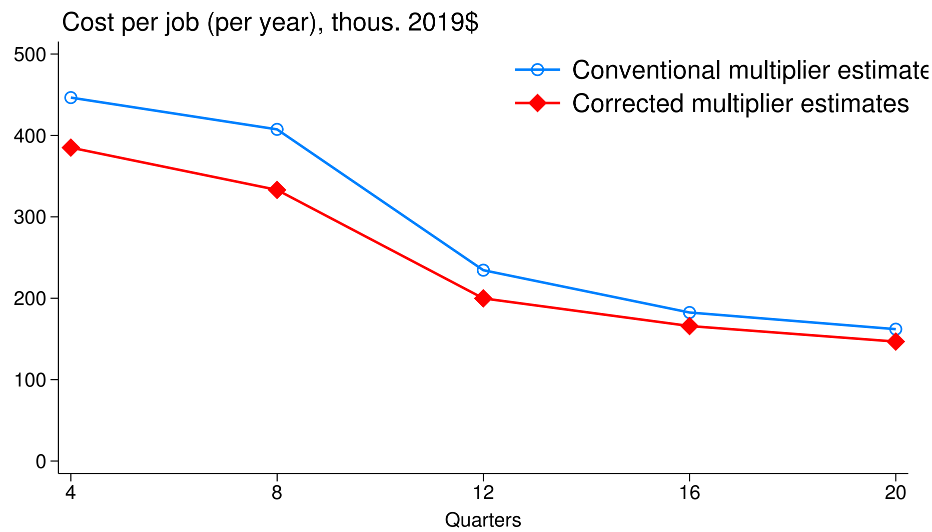
Table A3: Industry linkages between prime and subcontractors

Sub industry → Prime industry ↓	Construction	Manufacturing	Wholesale & Retail	High-Valued Services	Other Services	Goods
Goods						
Construction	**69%**	9%	10%	7%	4%	78%
Manufacturing	2%	**81%**	6%	9%	3%	82%
Services						
Wholesale & Retail	1%	65%	**15%**	16%	4%	66%
High-Valued services	4%	18%	5%	**66%**	7%	22%
Other services	17%	19%	9%	36%	**20%**	35%
Product type						
Product	1%	82%	6%	8%	2%	68%
Non-R&D service	20%	19%	6%	45%	10%	39%
R&D service	1%	66%	2%	29%	2%	67%

Notes: The table shows the share of subcontract obligations (in 2019 dollars) flowing from prime contracts in each industry or product service category to subcontractors in a given industry. High-valued service industries include information, professional, business and technical services, and education and health. Within-industry subcontracting shares are highlighted in bold. Prime contractor industry and product information are obtained from USAspending.gov, while subcontractor industry information comes from NETS.

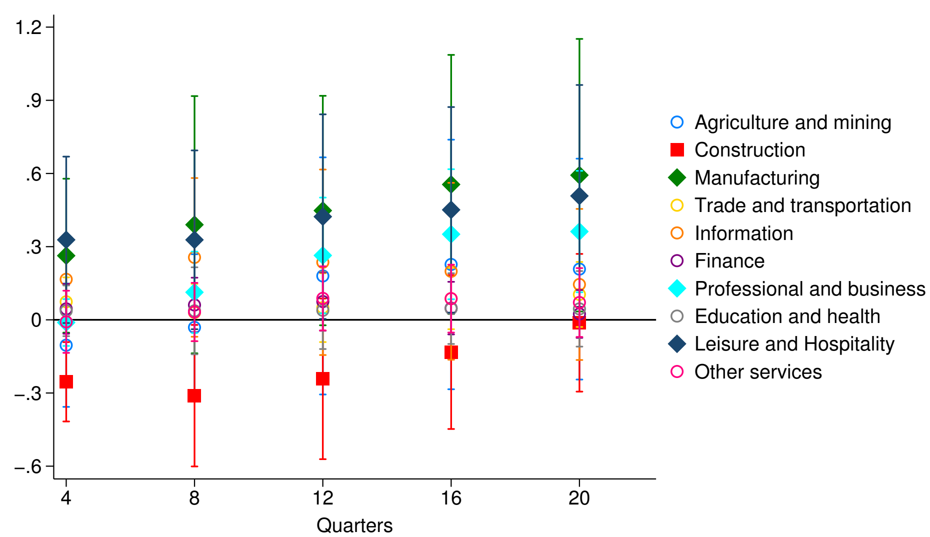
B Conventional and Corrected Multipliers: Additional Results

Figure B1: Cost-per-job-year estimates



Notes: See footnote 23 for the calculation of cost-per-job-year estimates. The blue line uses conventional IV multiplier estimates (Table 5, upper panel), while the red line uses corrected IV multiplier estimates (Table 5, lower panel).

Figure B2: Employment effects by industry



Notes: The figure reports cumulative employment effects by industry, estimated using specification (1), with the cumulative employment change of an industry on the RHS and the corrected spending measure on the LHS. Diamonds indicate significant positive effects, squares indicate significant negative effects, and circles indicate effects that are statistically or economically insignificant.

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***
	(0.029)	(0.031)	(0.039)	(0.045)	(0.052)
Corrected	0.061**	0.058*	0.089**	0.125***	0.166***
	(0.028)	(0.030)	(0.040)	(0.048)	(0.055)
2011Q1-2019Q4					
Conventional	0.085***	0.099***	0.146***	0.203***	0.259***
	(0.031)	(0.037)	(0.048)	(0.060)	(0.070)
Corrected	0.095**	0.110**	0.162***	0.219***	0.287***
	(0.038)	(0.047)	(0.062)	(0.073)	(0.091)
2011Q1-2022Q4					
Conventional	0.093***	0.103**	0.179***	0.230***	0.259***
	(0.033)	(0.041)	(0.054)	(0.065)	(0.070)
Corrected	0.107**	0.126**	0.210***	0.253***	0.287***
	(0.042)	(0.057)	(0.075)	(0.082)	(0.091)

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 reallocation of subcontract amounts. The unit of observations is county-quarter. *, **, and *** indicate significance at the 10%, 5%, and 1% levels. Standard errors clustered at the commuting-zone-by-year level are in parentheses below each estimate.

Table B2: Commuting-zone-level multiplier effects: IV estimates

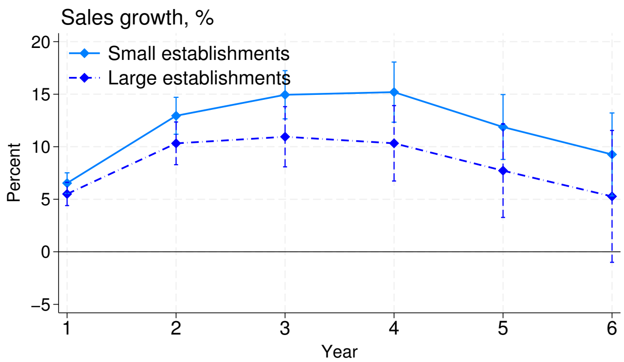
Outcome	4-Quarter	8-Quarter	12-Quarter	16-Quarter	20-Quarter
Earnings					
Conventional	0.157**	0.251***	0.459***	0.525***	0.543***
	(0.068)	(0.089)	(0.123)	(0.118)	(0.106)
Corrected	0.168**	0.284**	0.486**	0.533***	0.563***
	(0.078)	(0.132)	(0.210)	(0.178)	(0.165)
$\hat{\beta}$ (Corrected, Prime effect)	0.170**	0.280***	0.502***	0.546***	0.566***
	(0.074)	(0.100)	(0.143)	(0.145)	(0.147)
$\hat{\gamma}$ (Corrected, Sub effect)	0.046	0.027	0.116*	0.271***	0.420***
	(0.091)	(0.066)	(0.060)	(0.073)	(0.099)
Employment					
Conventional	0.128**	0.181***	0.303***	0.337***	0.341***
	(0.055)	(0.069)	(0.092)	(0.085)	(0.076)
Corrected	0.137**	0.205**	0.322**	0.342***	0.354***
	(0.063)	(0.100)	(0.146)	(0.120)	(0.110)
$\hat{\beta}$ (Corrected, Prime effect)	0.139**	0.202***	0.335***	0.354***	0.357***
	(0.060)	(0.077)	(0.103)	(0.095)	(0.091)
$\hat{\gamma}$ (Corrected, Sub effect)	0.001	-0.003	0.025	0.095**	0.193***
	(0.074)	(0.051)	(0.043)	(0.048)	(0.061)

Notes: The table reports cumulative multipliers for earnings and employment at the commuting-zone (CZ) level and various horizons. All estimates are obtained using instrumental variable approaches. 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 reallocation of subcontract amounts. The third and fourth rows show the estimates from specification (5). The unit of observations is CZ-quarter. *, **, and *** indicate significance at the 10%, 5%, and 1% levels. The sample in each regression spans 2011q1- 2024q3.

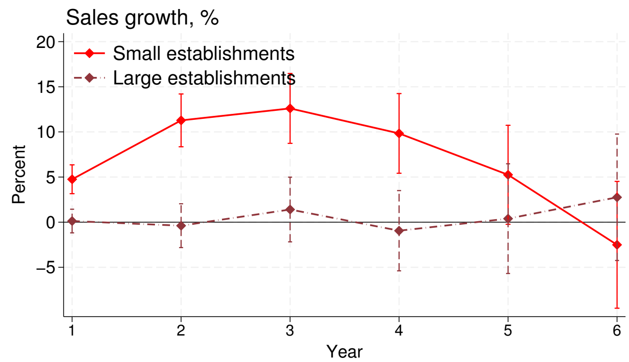
C Establishment-Level Evidence: Additional Results

Figure C1: Heterogeneity in sales responses

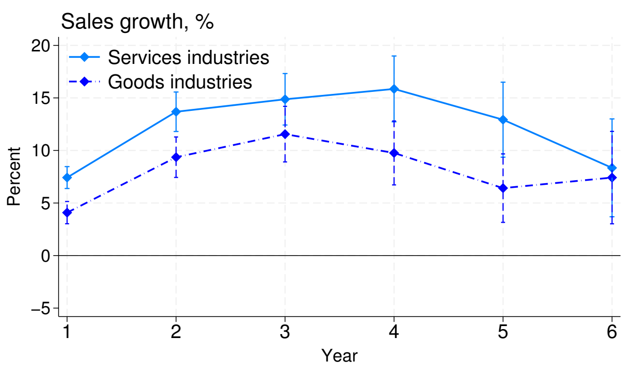
(a) Prime contracting effect



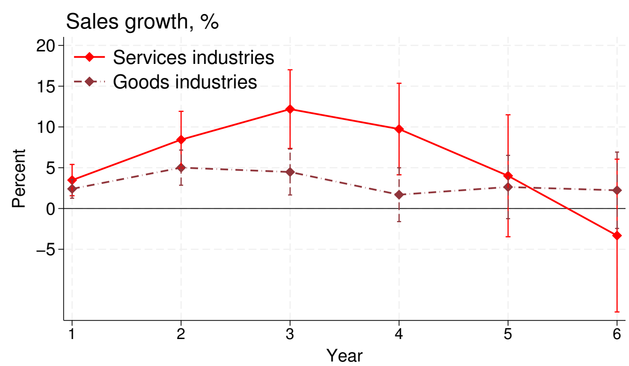
(b) Subcontracting effect



(c) Prime contracting effect



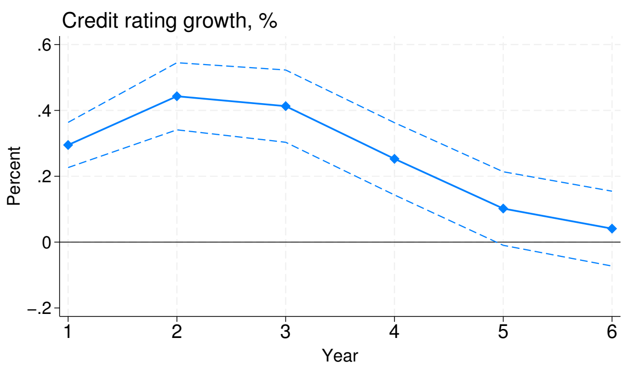
(d) Subcontracting effect



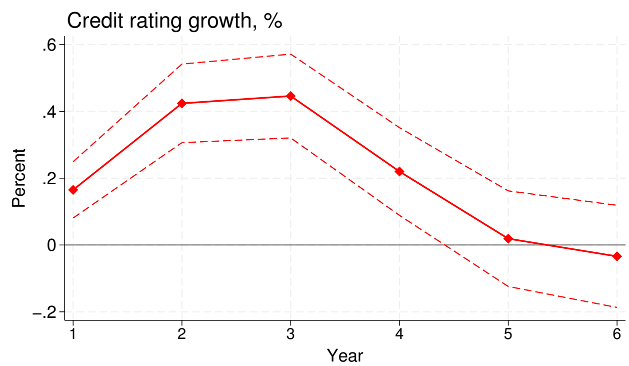
Notes: The upper panels show point estimates of prime contracting effects on small (β_1) and large ($\beta_1 + \beta_2$) establishments, and subcontracting effects on small (γ_1) and large ($\gamma_1 + \gamma_2$) establishments, along with 95% confidence intervals, obtained from estimating specification (7). The lower panels similarly show prime contracting effects on goods-producing (β_1) and service-producing ($\beta_1 + \beta_2$) establishments, and subcontracting effects on goods-producing (γ_1) and service-producing ($\gamma_1+\gamma_2$) establishments. All regressions include establishment and NAICS 2-digit-industry-by-year fixed effects, as well as the control variables described in the text.

Figure C2: Effects on firm credit rating

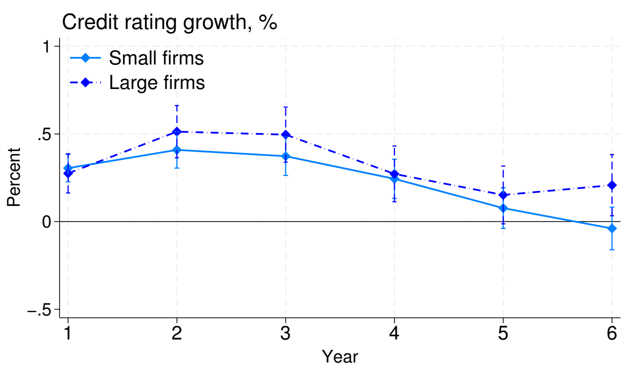
(a) Prime contracting effect



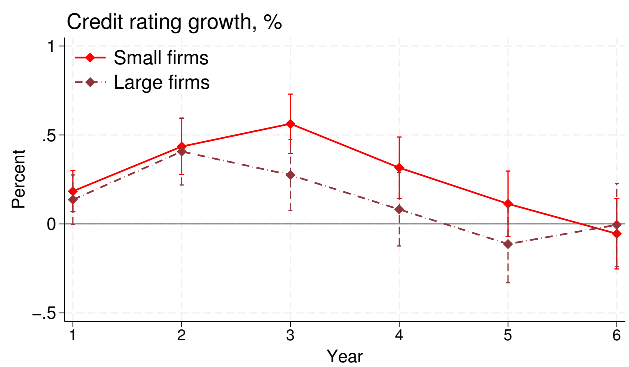
(b) Subcontracting effect



(c) Prime contracting effect



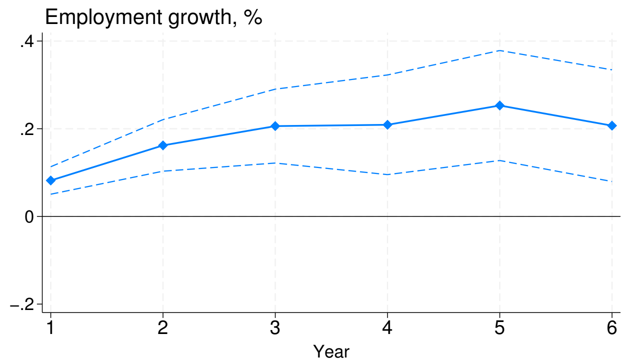
(d) Subcontracting effect



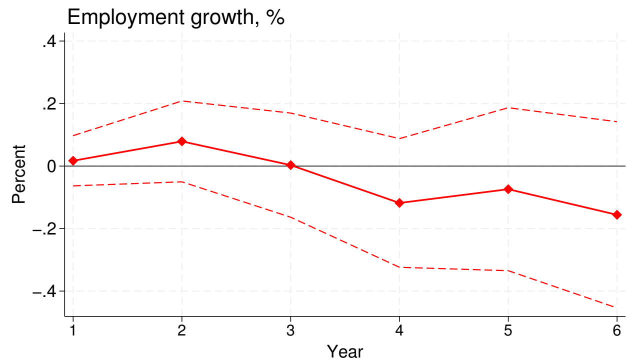
Notes: The point estimates and 95% confidence intervals are obtained from estimating specification (6) for the average effects (panels a and b) and specification (7) for heterogeneous effects by firm size (panels c and d). All regressions include establishment and NAICS 2-digit-industry-by-year fixed effects, as well as the control variables described in the text.

Figure C3: Robustness: Effects of contract dollar amount

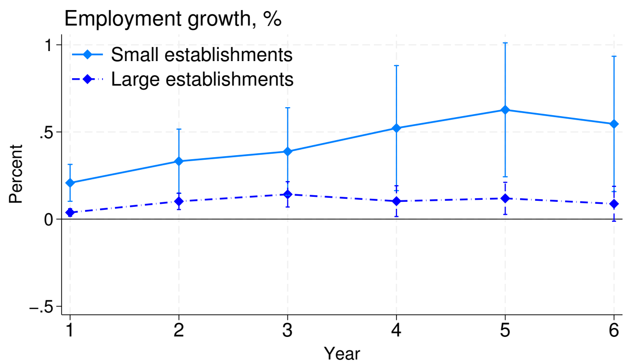
(a) Prime contracting effect



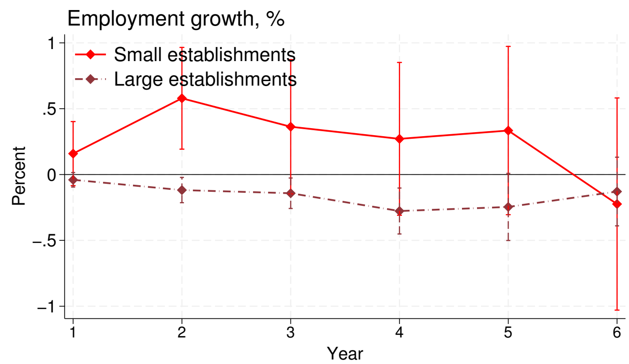
(b) Subcontracting effect



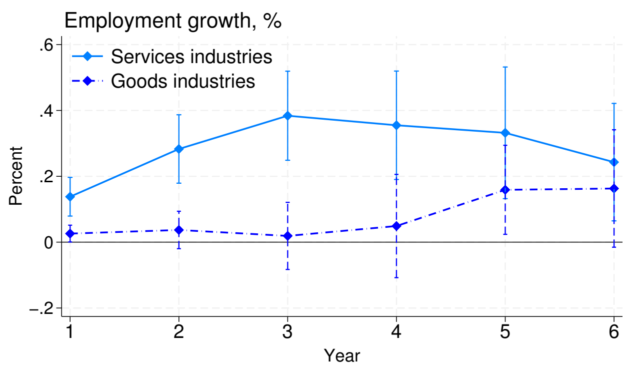
(c) Prime contracting effect



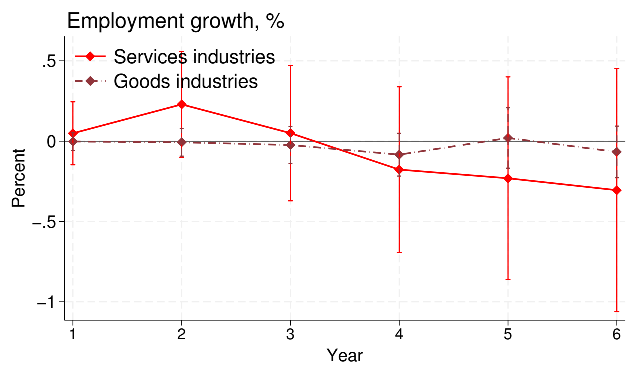
(d) Subcontracting effect



(e) Prime contracting effect



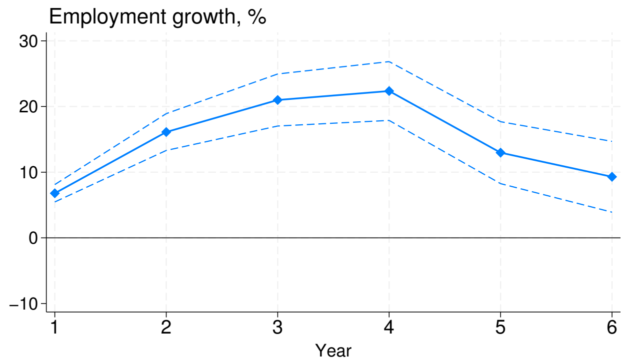
(f) Subcontracting effect



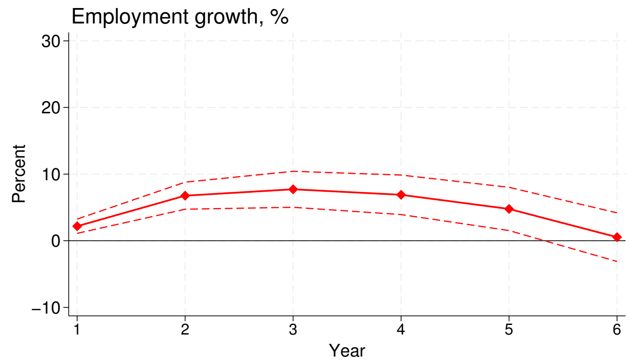
Notes: The figure shows the robustness of baseline establishment-level results in Figures 9 and 10, by estimating the specifications using the amount of prime contracts (adjusted for subcontracting) and subcontracts in millions of dollars in place of the corresponding indicator variables.

Figure C4: Robustness: Restricting to firms receiving both prime and subcontracts

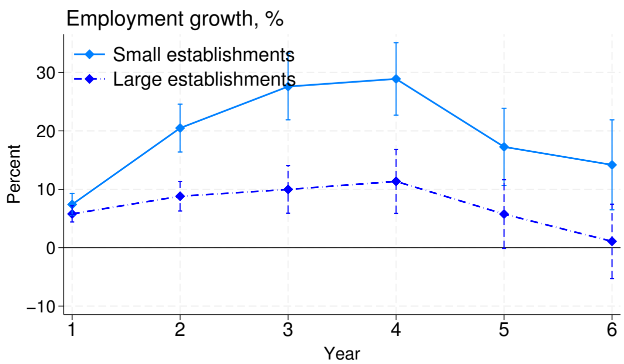
(a) Prime contracting effect



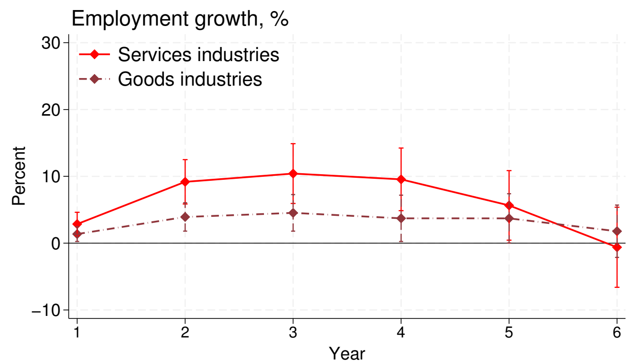
(b) Subcontracting effect



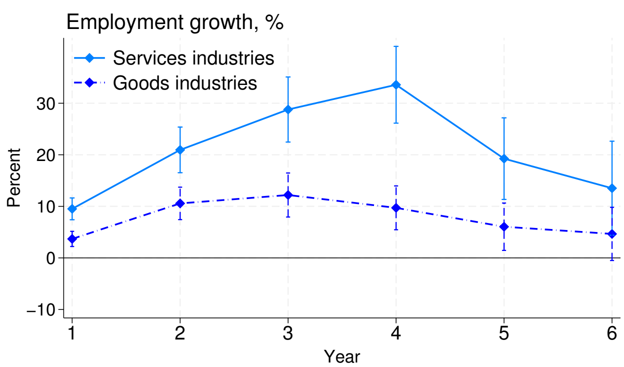
(c) Prime contracting effect



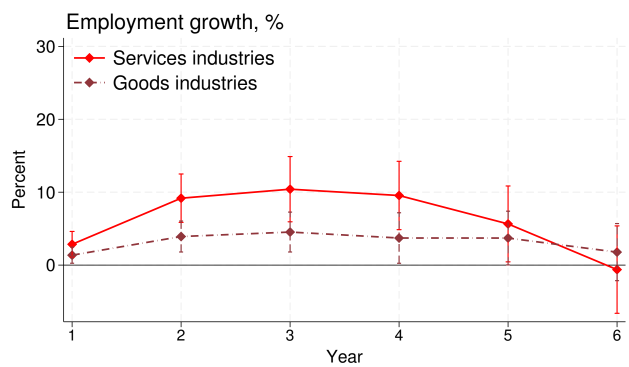
(d) Subcontracting effect



(e) Prime contracting effect



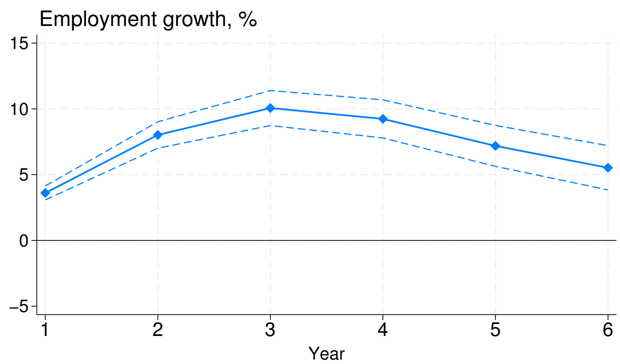
(f) Subcontracting effect



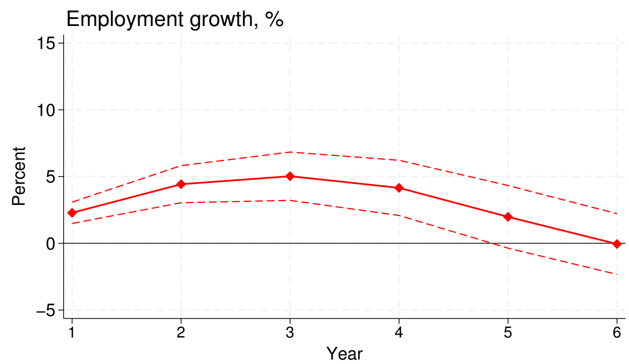
Notes: The figure shows the robustness of baseline establishment-level results in Figures 9 and 10, using a restricted sample that only includes firms that have received both prime and subcontracts.

Figure C5: Robustness: Excluding imputed employment observations

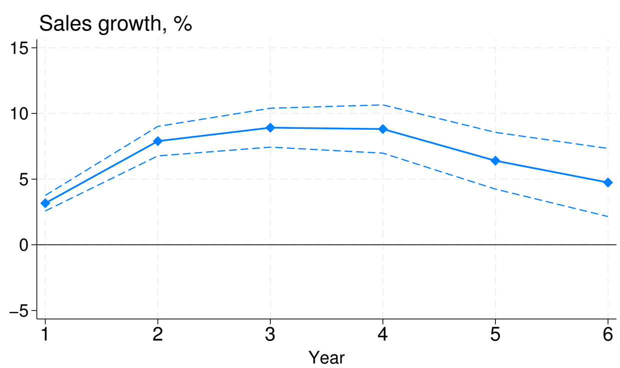
(a) Prime contracting effect



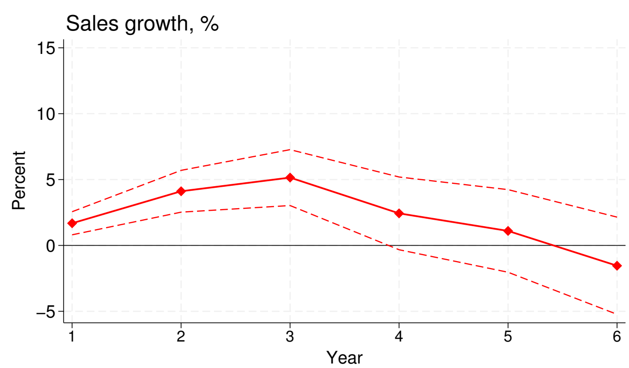
(b) Subcontracting effect



(c) Prime contracting effect



(d) Subcontracting effect



Notes: The figure shows the robustness of baseline establishment-level employment effects, using a restricted sample that excludes observations with imputed employment. See notes for Figure 9.

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 it 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

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.[32] Prime contract awardees are expected to report against 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.

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

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".

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.

E Additional Subcontracting Examples

This section provides examples of subcontracts from the DoD contract database. Subcontracting is not limited to large prime awards (see Section 2.2.1) but also occurs in small- to mid-sized contracts. For example, BAE Systems, Inc. (Nashua, NH) received a contract of approximately $3.6 million, of which about 34% ($1.22 million) was allocated to sub-awards (Table E1). These subcontracts span multiple locations and comprise highly technical hardware inputs used in the assembly of electronic equipment.

Table E1: Subcontract Example

Company	Location	Product description	Obligation
Prime contractor			
BAE Systems, Inc.	Nashua, NH	Electronics and Communication Equipment	3,585,825
Subcontractors			
Rodelco Electronics Corp.	Ronkonkoma, NY	Product input; repair product	439,198
Pentek, Inc.	Upper Saddle River, NJ	Product input	231,540
Vishay HIREL Systems	Dover, NH	Product input	140,242
TRAK Microwave Corp	Thousand Oaks, CA	Product input	118,430
Tech Resources, Inc.	Milford, NH	Product input	92,680
Abrams Airborne Manufacturing Inc.	Tucson, AZ	Product input	33,386
Russell Plastics Technology Co., Inc.	Lindenhurst, NY	Product input	53,950
FEI-Elcom Tech, Inc.	Northvale, NJ	Product input	36,060
Spirit America Corp	Phoenix, AZ	Product input	46,990
C&D Electronics	Holyoke, MA	Product input	30,590
Total			
Total subcontract obligation			1,223,066
% of prime contract obligation			34.1%

Source: USAspending.gov. Note: Obligation amounts are shown in dollars. In this table, any subcontract description that names a specific product or part number is coded as “Product input”.

Table E2 shows that subcontracting extends beyond major defense contracts, as prime contractors rely on a wide network of regional suppliers, even for smaller awards.

Lastly, another large prime award—Lockheed Martin Corporation’s $2.22 billion guided-missiles contract (Grand Prairie, TX)—channels about 10% ($216.9 million) to subcontractors across the U.S. (AR, FL, CO, NH, MA, AZ, KS). As shown in Table E3, the subcontract mix consists predominantly of production inputs for the defense system.

Table E2: Small-sized Subcontract Example

Company	Location	Product description	Obligation
Panel A.			
Prime contractor			
Oshkosh Defense, LLC	Oshkosh, WI	Packing and Gaskets Materials	192,763
Subcontractor			
Meritor Heavy Vehicle Systems	Thousand Oaks, CA	Driveline	159,167
Total			
Total subcontract obligation			159,167
% of prime contract obligation			82.6%
Panel B.			
Prime contractor			
Lynntech Inc.	College Station, TX	R&D: Other Research and Development (Basic Research)	100,000
Subcontractor			
Cornell University	Ithaca, NY	Characterization of Membrane Samples	30,000
Total			
Total subcontract obligation			30,000
% of prime contract obligation			30.0%

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

Table E3: Additional Subcontracting Example

Company	Location	Product description	Obligation
Prime contractor			
The Lockheed Martin Corporation	Grand Prairie, TX	Guided Missiles	2,220,000,000
Subcontractors			
Aerojet Rocketdyne Inc.	Camden, AR	Product input; Assembly	216,383,943
Arrow Electronics, Inc.	Lake Mary, FL	Product input	99,566
	Centennial, CO	Product input	58,753
Micross Components, LLC	Manchester, NH	Product input	34,965
Port Electronics Corporation	Lawrence, MA	Product input	100,208
Spirit America Corp	Phoenix, AZ	Product input	66,383
Leading Technology Composites, Inc.	Wichita, KS	Product input	195,520
Total			
Total subcontract obligation			216,939,339
% of prime contract obligation			9.8%

Source: USAspending.gov. Note: Obligation amounts are shown in dollars. In this table, any subcontract description that names a specific product or part number is coded as “Product input”.

F Text Analysis of Subcontract Descriptions

To understand the relationship between a defense prime contract and its subcontracts, we utilize information in the product and service code (PSC) that characterizes the primary good or service delivered by a contract. Unlike prime contract data, subcontract data do not have PSCs, but there is a text description associated with each subcontract—a cluster of words, serial codes, numbers, and abbreviations. Our goal is to transform these text descriptions to likely PSCs that underlie each of the subcontracts in our data. This serves the purpose of quantifying the flow from prime to subcontracts based on contract substances, as shown in Figure 7.[33]

The starting point of our analysis is the open source FSCPSC API, which uses a combined word-level and character-level artificial neural network to categorize text descriptions into PSCs.[34] For a user supplied text description, FSCPSC returns the top 5 candidate PSCs with a confidence score between 0 and 1 for each PSC. While convenient, the FSCPSC API has several limitations. First, the prevalence of acronyms (e.g., CMS, which could mean "Content Management Systems" or "Certified Marine Surveyor") greatly reduces information content. The FSCPSC API hence recommends the user to expand these acronyms before sending the query. Second, each query is limited to 250 characters, whereas many of our subcontract descriptions exceed this limit. These limitations motivated us to use text-processing and machine-learning techniques to gain more confidence in the algorithm.

To expand acronyms, we use external acronym dictionary for defense contracting (DAU), mining acronym-expansion pairs from the text using patterns such as Acronym (Expansion) or Expansion (Acronym), making sure that the initials of the acronym roughly match the first letters of the expansion. We then remove duplicate acronym-expansion pairs using the Jaro–Winkler similarity. Next, we estimate skip-gram Word2Vec embeddings on our subcontract descriptions, generating vector representations that capture semantic relationships among terms. Finally, we use the full acronym dictionary and the semantic word embeddings to expand acronyms in context by computing the cosine similarity between the text vector and the candidate acronym-expansion vectors. In short, we systematically clean the text, identify acronyms, score their possible expansions, and use context-aware semantic similarity to expand acronyms reliably. This makes it easier to map subcontract descriptions to PSCs.

After expanding acronyms, we clean and standardize the description text, including

[33] We thank Theresa Rincker for constructing the predicted PSC 2-digit data underlying Figure 7, including the design and implementation of the text processing and machine learning techniques descried in this appendix. The code is written in R, available upon request.

[34] https://api.fscpsc.com/

removing duplicate phrases, stripping out administrative or boilerplate add-ons, and converting all texts into individual sentences. Sentences are ranked according to four criteria: the number of verbs (+), the number of distinctive words (+), the presence of codes, dates and numbers (−), and the length (−). Sentences are ranked by score. We then add the subcontractor's name to high-ranked sentences before sending the query. The FSCPSC API then returns five most likely PSCs for each subcontract description.

To improve the precision of the algorithm, we supplement the FSCPSC API results with our own predictors based on prime contract data and text embeddings. We use PSC information in the prime contract data, as many subcontractors also served as prime contractors. We proceed as follows:

- Use the sample of prime contractors who had at least two prime contracts to predict the probability that a PSC is associated with a given contractor, i.e., $P(PSC_j|FirmID_i)$.
- Use the NAICS code in the prime contract data to predict the probability that a PSC is associated with a given industry, i.e., $P(PSC_j|NAICS_i)$.
- Compute the BM25 similarity between each PSC 2-digit extended title and the subcontract description combined with the contractor name, rescaled to be within the unit interval, i.e., $BM25_{i,j}$.
- Embed both the subcontract description and each PSC 2-digit extended title and take their cosine similarity. The PSC 2-digit categories are ranked by cosine similarity rescaled to be within the unit interval, i.e., $EMB_{i,j}$.

Finally, with the above predictors and the five PSCs from the the FSCPSC API, $API_{i,j}$, we run regression:

$$Y_{i,j} = \beta_o + \beta_1 P(PSC_j|FirmID_i) + \beta_2 P(PSC_j|NAICS_i) + \beta_3 BM25_{i,j} + \beta_4 EMB_{i,j} + \beta_5 API_{i,j} + \varepsilon_{i,j},$$

where $Y_{i,j}$ is an indicator equal to 1 if contract i truly belongs to PSC j. The coefficients provide optimal weights for aggregating the features so that the highest-scored PSC is our best prediction.

Model Validation: Using a combination of hand-coded subcontracts and prime-contract observations, we evaluate the model performance using standard classification metrics, including macro metrics and weighted metrics. The macro metrics weight each PSC equally, while weighted metrics reflect the empirical frequency distribution. The results in Table F1 indicate that the algorithm performs especially well for common PSC categories. This is expected: although text-based predictors (BM25, embeddings) help identify rarer categories, firm- and industry-based predictors favor more prevalent PSCs. Overall, the accuracy is high.

Table F1: Model validation metric

Overall Accuracy	Macro Metric			Weighted Metric			# Obs.
	Precision	Recall	F1	Precision	Recall	F1	
0.95	0.91	0.93	0.92	0.95	0.95	0.95	17,134