ECONOMISTS FOR UKRAINE

WORKING PAPER SERIES

WORKING PAPER No. 36 JUNE 2026

FIRM PERFORMANCE UNDER MILITARY OCCUPATION: THE CASE OF UKRAINIAN FIRMS

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We are grateful to the editors and anonymous referees for their constructive comments and suggestions, which helped strengthen the paper. We are also very grateful to Serhiy Stepanchuk for his discussion of this paper and to conference participants at Trinity College Dublin and seminar participants at the National Bank of Ukraine for helpful feedback.

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ABSTRACT

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JEL CLASSIFICATION: D22, F51, L25, P48

KEYWORDS: military occupation, firm performance, local economic activity, event study, war, Ukraine

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May 17, 2026

Abstract

This paper examines the effect of military occupation on firm performance during Russia's full-scale invasion of Ukraine. Combining official data on territorial control with firm-level balance-sheet data from Orbis, we exploit quasi-random variation in occupation status across postal areas in 2022–2023 using an event-study design. We document strongly asymmetric effects by occupation duration: firms in short-term occupied areas experienced a temporary and largely insignificant decline in sales and employment followed by recovery after liberation, whereas firms under prolonged occupation suffered large, persistent losses in sales and employment. Capital dynamics do not differ significantly between occupied and never-occupied firms, suggesting that occupation operates primarily through channels other than direct capital destruction. Heterogeneity across sectors and firm characteristics is consistent with local demand shortages, supply-chain disruptions, and institutional uncertainty as the main transmission channels. Overall, these findings highlight that prolonged military occupation entails lasting and sizable economic losses that compound over time, with little evidence of recovery until liberation.

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1 Introduction

Military occupation, or the temporary seizure of governance and territorial control by a hostile force, is one of the main objectives of an invading army during wartime. The costs of resisting occupation are relatively straightforward and include human suffering, loss of life, material destruction, and economic disruption. The benefits of resistance, however, are less tangible and more difficult to measure. Why do countries and local communities resist occupation despite its high immediate costs? Compliance with an aggressor may also entail costs, not only ideological but also institutional and economic. Although there is some aggregate evidence on the long-term consequences of occupation, little is known about its near-real-time effects on economic activity. This paper contributes to filling this gap by examining how military occupation affects firm performance during Russia's full-scale invasion of Ukraine.

Russia's war in Ukraine is widely considered the largest and deadliest war of aggression in Europe since World War II. After the annexation of Crimea in 2014 and eight years of localized fighting in eastern Ukraine, Russia launched a full-scale offensive on February 24, 2022, making rapid territorial advances in the south and east. By late February, Russian forces controlled almost 20% of Ukraine's territory, and by the end of March, territorial control peaked at about 27% (CNN, 2022). Through a series of successful counteroffensives, Ukraine recaptured a significant share of these areas, leaving roughly 18% of the country under temporary occupation by late 2022. These rapid and uneven developments created quasi-random changes in occupation status across more than 5,000 administrative units: some territories were liberated within months, while others remained occupied for much longer. We exploit this variation to study the effects of occupation on firm performance, a key driver of aggregate economic activity. Occupation status in this case is plausibly exogenous to firm characteristics, as the Russian army's route was primarily determined by logistical considerations such as road access rather than by the economic structure of individual areas.

Micro-level evidence on the costs of military occupation during the Russo-Ukrainian war is particularly important for several reasons. First, most existing studies on the economic costs of conflict focus on countries in Africa and Latin America, with lower income levels and weaker institutions than Ukraine. Because military occupation disrupts institutions, initial institutional strength may alter both the dynamics and consequences of conflict. Second, Ukraine's relatively advanced institutions and technological capacity create a unique opportunity to assess the near-real-time effects of conflict using granular firm-level data, a dimension that has often been unavailable in previous work (Brück et al., 2013). Third, since losses in the productive sector constitute over 80% of aggregate war-induced economic losses in Ukraine, providing micro-level ev-

idence on the consequences of occupation will help better understand the causes of these losses.[1] Lastly, military occupation represents a more complex and multifaceted type of war-related shock than direct combat or missile attacks, which have received more attention in the literature. Occupation typically combines institutional, economic, and sometimes physical disruptions and is often endogenous to pre-war conditions, which makes it particularly difficult to study without detailed micro-level data and strong identification.

We combine official information on the occupation status of Ukrainian territories in 2022–2023 with firm-level balance-sheet data from the Orbis database, compiled by Bureau van Dijk, for firms operating in Ukraine between 2017 and 2023. We apply the event-study design proposed by Borusyak et al. (2024) to estimate the dynamic effect of military occupation on firm performance. We compare changes in performance, measured by sales, between firms located in affected and unaffected areas and exploit variation in liberation timing to distinguish between the effects of short-term and long-term exposure to military occupation.

Our results show that firms in areas occupied in 2022 but liberated within months experienced a modest and statistically insignificant decline in sales in the year of occupation, followed by recovery the next year. In contrast, firms that remained under occupation through 2023 suffered large and persistent sales losses relative to those never occupied. Because sales capture both production and demand-side dynamics, they may not perfectly reflect changes in output. Nevertheless, if the occupation-induced decline in sales primarily reflects reduced production, similar patterns should also be reflected in employment and capital dynamics.

We find that employment dynamics under occupation mirror those of sales, with persistent declines under long-term occupation and evidence suggestive of recovery following liberation from short-term occupation. By contrast, capital dynamics differ little from those of never-occupied firms. Importantly, similar patterns emerge even in occupied areas without active combat or direct exposure to war-related damage, suggesting that occupation affects firm performance primarily through channels other than physical destruction. To shed further light on the mechanisms underlying firms' responses in sales, employment, and capital, we next examine heterogeneity in occupation effects across sectors, firm size, and use of debt finance.

The heterogeneity of occupation effects by sector provides insight into both demand- and supply-side channels. Manufacturing firms, which rely heavily on complex supply networks, are most severely affected by prolonged occupation, consistent with disruptions to input supply and distribution networks. Firms in the services sector experience particularly persistent sales losses under long-term occupation, despite little effect of short-term occupation on sales, pointing to the importance of local demand shortages. By contrast, the

1. According to Andrienko et al. (2024), Ukraine incurred $1.164 trillion war-induced economic losses in revenues and value added as of July 2024, most in productive sectors ($450.5 billion in trade, $409.9 billion in industry, including construction and services, and $83.1 billion in agriculture).

resilience of the trade sector, even under prolonged occupation, is consistent with precautionary consumption behavior under heightened uncertainty, while patterns in the construction sector align with institutional and geopolitical uncertainty reducing investment incentives.

Beyond sectoral differences, the effects of occupation also vary systematically with firm characteristics. By firm size, medium-sized firms emerge as the most resilient to occupation, suggesting that balancing operational flexibility with sufficient financial and relational buffers provides better conditions for absorbing shocks. Heterogeneity by financial structure further suggests that while short-term occupation may partly operate through financial disruptions, under long-term occupation these channels appear secondary to broader institutional disruptions.

Overall, these findings suggest that while firms can recover relatively quickly from short-term occupation, prolonged occupation has severe and persistent effects that operate not only through demand and supply disruptions, but also through institutional and geopolitical uncertainty. These findings are particularly policy-relevant in light of ongoing discussions about potential territorial concessions as part of a peace settlement. Our results suggest that prolonged occupation resulting from such concessions would entail substantial and lasting economic costs.

Related Literature This paper contributes to several strands of literature. First, it contributes to the growing research on micro-foundations of the costs of conflict. While a substantial body of work examines the aggregate costs of conflict (e.g., Alesina et al., 1996; Cerra and Saxena, 2008; Chupilkin and Koczan, 2022), micro-level evidence remains scarce. Existing micro-level studies mostly examine the impact of conflict on individuals, households, and communities, whereas firms have received far less attention (Brück et al., 2013). This scarcity largely reflects the difficulty of collecting firm-level data during active conflict. Using post-conflict survey data from Sierra Leone, Collier and Duponchel (2013) document persistent declines in firm employment four years after conflict resolution, which they attribute primarily to technological regress and human-capital deterioration rather than physical destruction.

Several papers have addressed data challenges by utilizing novel sources to capture firm performance during conflict. Abadie and Gardeazabal (2003) show that a temporary truce in the Basque Country improves the stock market performance of affected firms. Camacho and Rodriguez (2013) find that conflict intensity increases the probability of firm exit in Colombia, with small and young firms particularly strongly affected. Custodio et al. (2025) show that political violence in Mozambique has a negative, though short-lived, effect on inventory purchases among customers of a multinational beverage supplier, with small firms

disproportionately affected. Using export data from Kenya's flower industry, Ksoll et al. (2023) document that electoral violence disrupts firm performance through increased worker absence, with larger firms and those with direct contractual agreements less negatively affected. Based on survey data from the Second Libyan Civil War, Del Prete et al. (2023) document that conflict reduces firm revenues and increases firm exit, attributing these outcomes to restricted input access and weaker competition. Similar to our paper, Klapper et al. (2013) use balance-sheet data for firms in Côte d'Ivoire and find that conflict reduces firms' total factor productivity, with larger effects for firms owned by or employing foreigners.

Our paper contributes to the literature on the contemporaneous impact of conflict on firm performance in several ways. First, instead of examining conflict intensity, which is typically measured by the number of conflict events or casualties, we focus on military occupation. We estimate its effect on firms using an event-study design that leverages the quasi-random timing of occupation and liberation events. Second, we assess firm performance in conflict-affected areas using balance-sheet data from the internationally recognized Orbis database. Third, while most existing studies focus on conflict in developing countries with weaker institutions, we provide evidence from a middle-income country with stronger institutions that have contributed to its war resilience (Rabinovych et al., 2024). This context enables us to challenge the common misconception that "war stops markets and governance" (Verwimp et al., 2019).

Second, we contribute to the nascent literature on the effects of military occupation, which represents a distinct shock that can persist through channels different from those associated with other forms of conflict. Vishwasrao et al. (2019) examine country-level economic growth following the end of conflict and distinguish between transformative occupations, which aim to establish institutions that promote post-occupation stability, and subdual occupations, which seek to impose authoritarian rule or extract resources. They find that the end of occupation generally has a positive effect on growth, particularly for transformative occupations. Tkaleca (2022) shows that military occupation in Croatia led to increased firm exit in the post-occupation period. Krumins and Zhukov (2026), exploiting the quasi-exogenous closure of Soviet military bases in the Baltic states following decades of Soviet occupation, find that de-occupation led to local economic disruption, including employment declines and population outflows, and was accompanied by increased support for parties associated with the former occupying power. Our paper extends this line of research by providing micro-level identified evidence on the effects of both short-term and long-term occupation on firm performance, using granular balance-sheet data.

Our analysis also provides a deeper understanding of the mechanisms through which occupation affects firms. Existing literature documents multiple channels through which conflict may affect firm performance:

migration (Ibáñez and Vélez, 2008), reduced consumer demand (Verwimp, Bundervoet, et al., 2008), labor market disruptions (Anastasia et al., 2026), human capital deterioration (Collier and Duponchel, 2013), financial constraints (Glick and Taylor, 2010; Shpak et al., 2023), supply chain disruptions (Ksoll et al., 2023; Ayele and Edjigu, 2025), reduced competition (Del Prete et al., 2023), and macroeconomic and geopolitical uncertainty (Caldara and Iacoviello, 2022; Fiori and Scoccianti, 2023; Kumar et al., 2023). Our findings point to local demand shortages, supply chain disruptions, and institutional uncertainty as the primary channels through which occupation affects firm performance. Labor supply constraints associated with population displacement may also contribute, though our results are more consistent with firms adjusting labor demand in response to broader demand and supply shocks. Financial constraints appear to play a more limited role, particularly under long-term occupation where institutional disruptions take precedence.

Finally, we contribute to the literature on the economic consequences of Russia's ongoing war in Ukraine. Bluszcz and Valente (2022) and Romhányi and Bilko (2025) provide aggregate estimates of the effect of Russian aggression on Ukraine's GDP since its beginning in 2014 using the synthetic controls method. Zhukov (2023) documents an immediate decline in economic activity in Ukraine using spatially disaggregated evidence on destructive war events and night-time light intensity as a proxy for local economic activity, with areas under Russian occupation less affected. Using high-frequency supervisory bank data, Shpak et al. (2023) offer insight into the financial mechanisms through which war affects firms, showing that the destruction of collateral assets leads to a severe contraction in firms' access to new credit. Anastasia et al. (2026) study how the labor market in Ukraine-controlled territory operates during the ongoing Russian invasion outside areas under long-term occupation, documenting that war-induced disruptions reduced worker-vacancy matching, but that firms' adaptation of hiring practices helped mitigate these effects. Andrienko et al. (2024) present detailed descriptive analysis of the impact of war on Ukrainian firms based on survey data, with particular attention to multiple channels through which conflict may affect firm outcomes. Our paper is complementary to this body of work by providing an in-depth analysis of the consequences of occupation and de-occupation using firm balance-sheet data. It further extends this literature by showing that military occupation leads to substantial economic losses even in the absence of direct physical destruction.

Structure The rest of the paper is organized as follows. Section 2 describes data on military occupation and firm performance. Section 3 summarizes event-study methodology and Section 4 presents the results. Section 5 discusses the main findings and concludes.

2 Data

This paper studies the effect of military occupation on firm performance. To do so, we combine balance-sheet data from Orbis with information on firms' exposure to war events during the full-scale invasion of Ukraine in 2022–2023. This section provides information about data sources used in the analysis.

2.1 Exposure to Military Occupation

To identify exposure to military occupation, we use official information on occupation, de-occupation, and combat from Decree No. 910 of the Ministry of Communities and Territories Development, which provides the official classification of territories affected by combat and occupation as of May 2025 (MinRegion, 2025). Since this information is not available in geocoded format, we match exposure to war-related events to a universe of 28,038 postal areas using administrative classification codes (KOATUU).

Figure 1 shows the occupation status for the universe of postal areas in Ukraine.[2] Of 28,038 postal areas, 5,288 close to the country's border in the south, east, and north were occupied by the Russian forces in 2022–2023. Among them, 3,202 were occupied for less than a year, with both occupation and liberation occurring in 2022. Since the average duration of occupation in these areas was 83.2 days and the median duration was 39 days (Table 1), we refer to this type of occupation as short-term occupation in the analysis. These areas define our treated group for the analysis of the effects of short-term occupation. They are located in Zhytomyr, Kyiv, Chernihiv, Sumy, Kharkiv, Mykolayiv, and Kherson regions and are denoted by bright green color in Figure 1.

An additional 1,923 postal areas experienced long-term occupation: they were initially occupied in 2022 and remained occupied throughout 2023. The average duration of occupation in these areas was 658 days, with a median of 674 days. Located primarily in Donetsk, Luhansk, Kharkiv, Kherson, and Zaporizhzhia regions (denoted in yellow in Figure 1), these areas define the treated group for the analysis of long-term occupation effects. There are also 40 postal areas in Donetsk and Luhansk regions that were occupied in 2022 and liberated in 2023. Because these areas experienced substantially different occupation durations (average 404 days; median 459 days) and represent a relatively small category, we exclude them from the analysis. Finally, 123 postal areas in Donetsk and Luhansk regions, as well as the entire Crimea were occupied

2. We use the GfK postcode area dataset for mapping and spatial analysis. A postal area generally corresponds to a level-4 administrative division in Ukraine prior to the creation of hromadas. However, for the largest Ukrainian cities (Kyiv, Kharkiv, Odesa, Lviv, Dnipro, and Zaporizhzhia), multiple postal areas correspond to districts within a city identified by postal code. As a result, postal-area-level war events can be interpreted as shocks affecting the territory of a specific village, city, or city district.

in 2014–2015 and remained under occupation throughout the analysis period. Because occupation during the early stages of the Russian invasion likely has a different effect from occupation during the full-scale invasion, these areas are also excluded from the analysis. The duration of occupation on the postal area level is summarized in Appendix Figure F.1.

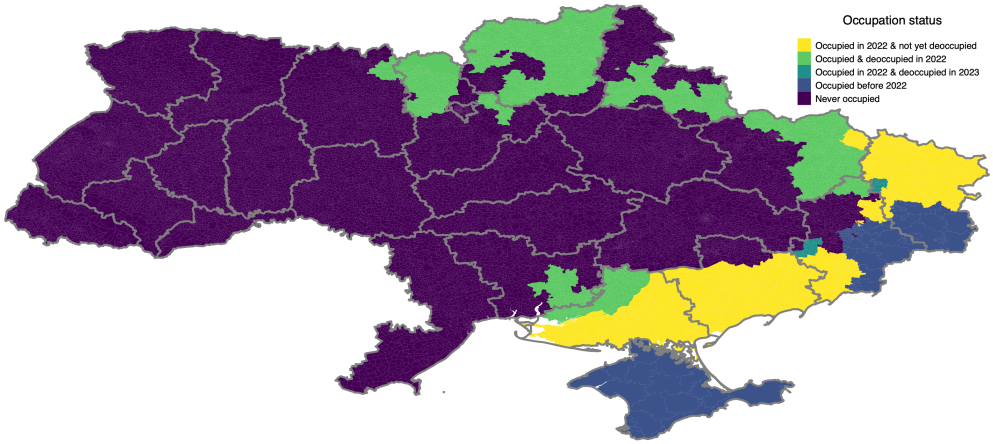


Figure 1: Military occupation status by postal area

Notes: The map shows the universe of 28,038 postal areas in Ukraine, color-coded by occupation status during 2022–2023 based on Decree No. 910 of the Ministry of Communities and Territories Development. Bright green denotes short-term occupied areas (occupied and de-occupied within 2022); yellow denotes long-term occupied areas (occupied in 2022 and still under occupation at the end of 2023); other categories include areas occupied before 2022 (Crimea and parts of Donbas) and areas occupied in 2022 and de-occupied in 2023.

Table 1: Duration of occupation (in days) in 2022–2023 by occupation status on the postal area level

Occupation status	N	Mean	SD	Median	Min	Max
Never occupied	22750	0	0	0	0	0
Occupied before 2022	123	730	0	730	730	730
Occupied in 2022 & de-occupied in 2023	40	404	90	459	259	459
Occupied & de-occupied in 2022	3202	83	80	39	3	262
Occupied in 2022 & not yet de-occupied	1923	658	53	674	370	676
Total	28038	58	175	0	0	730

Notes: Unit of observation is the postal area. Values are duration of occupation in days during 2022–2023, based on Decree No. 910 of the Ministry of Communities and Territories Development. "Occupied before 2022" refers to postal areas in Donetsk, Luhansk, and Crimea occupied since 2014–2015, with duration capped at 730 days for the analysis window. "Occupied in 2022 & not yet de-occupied" refers to postal areas occupied in 2022 and still under occupation at the end of 2023. The Total row aggregates across all categories including never-occupied postal areas.

We study the effect of occupation on firm performance by comparing firms located in areas exposed to either short-term or long-term occupation after 2022 to firms in areas that were never occupied. We infer a firm's occupation status from the occupation status of its postal area under the assumption that all firms located in occupied postal areas were affected by occupation. Violations of this assumption would introduce attenuation bias, as some firms unaffected by occupation would be classified as affected.

Figure 2 visualizes the spatial distribution of firms in the main analysis sample, with larger circles indicating a larger number of firms per postal area.[3] Panel A visualizes the spatial variation used in the analysis of short-term occupation effects. The baseline sample includes 1,098 firms in 227 postal areas exposed to short-term occupation and 50,087 firms in 2,992 postal areas that were never occupied. Short-term occupied postal areas contain an average of 4 firms (median 2) operating in 2022, compared to an average of 17 firms (median 2) in the control group.

Panel B of Figure 2 visualizes the spatial variation used in the analysis of long-term occupation. The treated group in the baseline sample consists of 147 firms in 38 postal areas exposed to long-term occupation since 2022, while the control group remains unchanged (50,087 firms that were never occupied). Long-term occupied postal areas contain an average of 5 firms (median 1) operating in 2022. In robustness checks, we show that the main results remain similar when restricting the control group to regions that experienced a particular type of occupation in 2022–2023 or bordered such regions, as well as when excluding locations with the largest number of firms from the analysis.

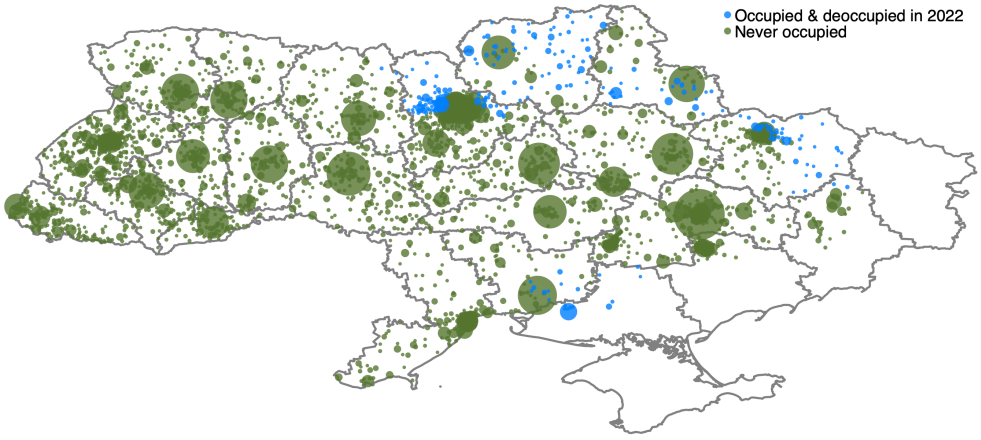
2.2 Firm-Level Data

To characterize firm performance under military occupation, we use data from the Orbis database, compiled by Bureau van Dijk (BvD), spanning 2017–2023. Orbis provides detailed financial information for a broad cross-section of firms, including balance sheet and income statement variables such as total assets, employment, sales, tangible and intangible fixed assets, and long-term debt. The data are collected at annual frequency based on firms' financial reporting. After data cleaning, our core sample consists of over 50,000 unique firms active between 2017 and 2023.

Orbis offers several key advantages for analyzing Ukrainian firms and their exposure to occupation and de-occupation. First, it provides near-comprehensive coverage of the Ukrainian corporate sector across all industries, including both large and very small firms, which is crucial for capturing the full economic impact of conflict events. Second, and critically for our analysis, Orbis aggregates data from multiple registries

3. To minimize matching errors, we use all spatial information available in Orbis, including postal code, city name, region, and street address.

Panel A: Postal areas subject to short-term occupation



Panel B: Postal areas subject to long-term occupation

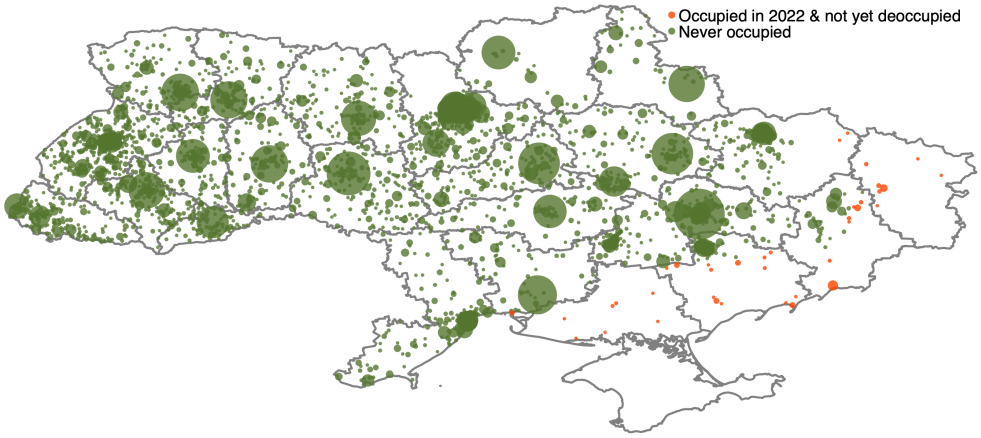


Figure 2: Analysis sample

Notes: The map presents postal areas with firms for which consistent coverage is available in our sample (Orbis) for 2017–2023. Larger circles indicate a larger number of firms per postal area.

that cover both occupied and non-occupied territories of Ukraine. The database draws on information from Creditreform Ukraine for firms in Ukraine-controlled territory, as well as from CredInform, which collects data on firms in occupied territories. In occupied areas, Russian authorities compel companies to register with EGRUL (the Russian registry), and this information is subsequently captured through CredInform. This dual coverage allows us to track firms across changing territorial control, including those forcibly re-registered under occupation, and analyze the effects of occupation and de-occupation on firm outcomes. Without access to both registry systems, firms in occupied territories would be systematically excluded from the analysis. Third, Orbis provides firm-level geographic information, including the address of operational

activities. This allows us to geocode firm locations and match them to administrative units and postal codes, which we then link to the timing of occupation and liberation events in each locality.

An important feature of the data is that certain firm characteristics, including industry classification and geographic location, are recorded as snapshots rather than tracked annually, similar to the structure of Compustat.[4] Specifically, we observe the most recent address and industry code for each firm in each year's vintage, but not necessarily a complete year-by-year history of changes. As a result, firm addresses sometimes disappear and reappear across vintages, which could reflect relocations, temporary data gaps, or reporting disruptions due to conflict. For this reason, we cannot reliably study occupation-induced sample attrition.

To ensure reliable geographic assignment, we assume firms retained their 2021 (pre-invasion) address unless a new address is explicitly recorded after 2021, and restrict the analysis to firms without recorded relocations.[5] This approach minimizes measurement error in treatment status, *i.e.*, exposure to military occupation, which is essential for our identification strategy. However, it may also exclude some genuinely affected firms that relocated due to conflict.

We restrict our analysis to non-financial corporations, excluding sectors with atypical dynamics or substantial state ownership, such as agriculture, mining, and public administration. We retain firms in the following industries, based on NACE Rev. 2 classifications: Manufacturing (C), Construction (F), Wholesale and Retail Trade (G), Transportation and Storage (H), Accommodation and Food Services (I), Information and Communication (J), Professional, Scientific and Technical Activities (M), and Administrative and Support Services (N).

To ensure data quality and national representativeness, we follow the cleaning procedures outlined in Kalemli-Ozcan et al. (2015), with full details provided in Appendix A.1. We exclude firms with clearly erroneous values such as negative total assets, employment, sales, or tangible fixed assets. Firm-year observations are dropped if total assets are zero, firm age is negative, or if fixed, tangible, or intangible assets are missing or implausible. We also remove observations violating basic accounting identities. To support panel analyses, we retain only firms present throughout the sample period of 2017–2023 and with continuous information about sales, employment, and fixed capital.[6]

4. Compustat is a widely used database of firm-level financial statements for publicly traded companies maintained by S&P Global Market Intelligence. It similarly records certain firm characteristics (such as industry codes and headquarters location) as snapshots rather than maintaining complete historical records of changes.

5. If a firm's address changes, Orbis records the new address but not the date of the move, making it impossible to determine whether relocation occurred before or after a given event.

6. To maximize the sample size, we apply an imputation procedure for missing values in sales, employment, or capital for any year between 2018 and 2021. Specifically, when a firm-year observation is missing, we replace it with the average of the firm's values in the preceding and following years. This procedure yields 4,354 imputations in total, including 25 firms located

Table 2 presents summary statistics for the main firm-level variables, disaggregated by occupation status. The final sample includes 51,332 unique firms: 147 (0.3%) under long-term occupation, 1,098 (2.1%) under short-term occupation, and 50,087 (97.6%) never occupied. The firm size distribution reflects strong coverage of small firms in Orbis: the average firm reports total assets of $2,797,117 (in 2017 dollars), while the median firm holds only $173,451, indicating a highly right-skewed distribution. Similarly, the average firm employs 50 workers, whereas the median employs just 9. Mean sales ($3,287,657) substantially exceed median sales ($233,780). This pronounced right-skewness across all firm-level variables motivates the use of logarithmic transformations for the main outcome variables — sales, employment, and capital — in all regression analyses.

Table 2: Firm-level descriptive statistics

	Long-term occupation	Short-term occupation	Never occupied	Total
Number of firms	147	1,098	50,087	51,332
Sales, in 2017 $				
Mean	4,061,422.98	2,519,710.28	3,302,221.33	3,287,657.42
SD	(12,869,774.02)	(12,142,631.90)	(41,383,500.40)	(40,923,012.09)
Median	313,897.53	244,064.32	233,580.92	233,779.80
Fixed capital, in 2017 $				
Mean	723,436.08	504,573.52	939,156.86	929,243.29
SD	(3,011,263.55)	(2,725,930.07)	(33,330,788.46)	(32,926,964.11)
Median	30,250.12	26,040.54	16,652.19	16,889.72
Number of Employees				
Mean	107	37	50	50
SD	(613)	(98)	(1,145)	(1,132)
Median	8	11	8	9
Total Assets, in 2017 $				
Mean	3,400,607.89	1,680,575.40	2,819,822.81	2,797,117.32
SD	(11,852,241.38)	(7,265,984.51)	(51,028,996.49)	(50,421,792.98)
Median	295,747.44	179,228.64	172,896.33	173,451.16
Current Assets, in 2017 $				
Mean	2,502,128.85	1,135,000.57	1,692,751.89	1,683,139.32
SD	(9,989,172.41)	(4,848,545.17)	(19,142,893.33)	(18,930,319.62)
Median	214,634.94	104,294.23	118,705.80	118,663.70
Current Liabilities, in 2017 $				
Mean	1,931,789.59	969,768.52	1,550,645.44	1,539,311.87
SD	(9,815,967.47)	(4,627,157.96)	(18,747,873.91)	(18,539,064.68)
Median	123,784.41	64,863.60	67,911.66	67,933.81
Cash & Cash Equivalent, in 2017 $				
Mean	202,099.51	114,789.96	164,607.90	163,649.65
SD	(807,404.81)	(689,871.76)	(2,224,160.67)	(2,199,770.10)
Median	12,856.97	4,121.83	5,527.10	5,510.25
EBITDA, in 2017 $				
Mean	2,995,063.68	1,270,678.46	2,177,276.59	2,158,597.23
SD	(5,590,438.40)	(3,664,188.50)	(20,614,486.10)	(20,326,895.67)
Median	476,851.09	218,475.44	228,645.89	228,759.34
Leverage, ratio				
Mean	0.0233	0.0463	0.0508	0.0506
SD	(0.0745)	(0.4694)	(0.8471)	(0.8396)
Median	0.0000	0.0000	0.0000	0.0000

Notes: This table presents summary statistics for key firm-level variables in 2021, the last year before the full-scale invasion, broken down by territorial occupation status. The full sample covers Ukrainian firms from 2017–2023.

Descriptive comparisons across locations with different occupation statuses indicate substantial hetero-

in long-term occupied areas and 18 firms in short-term occupied areas.

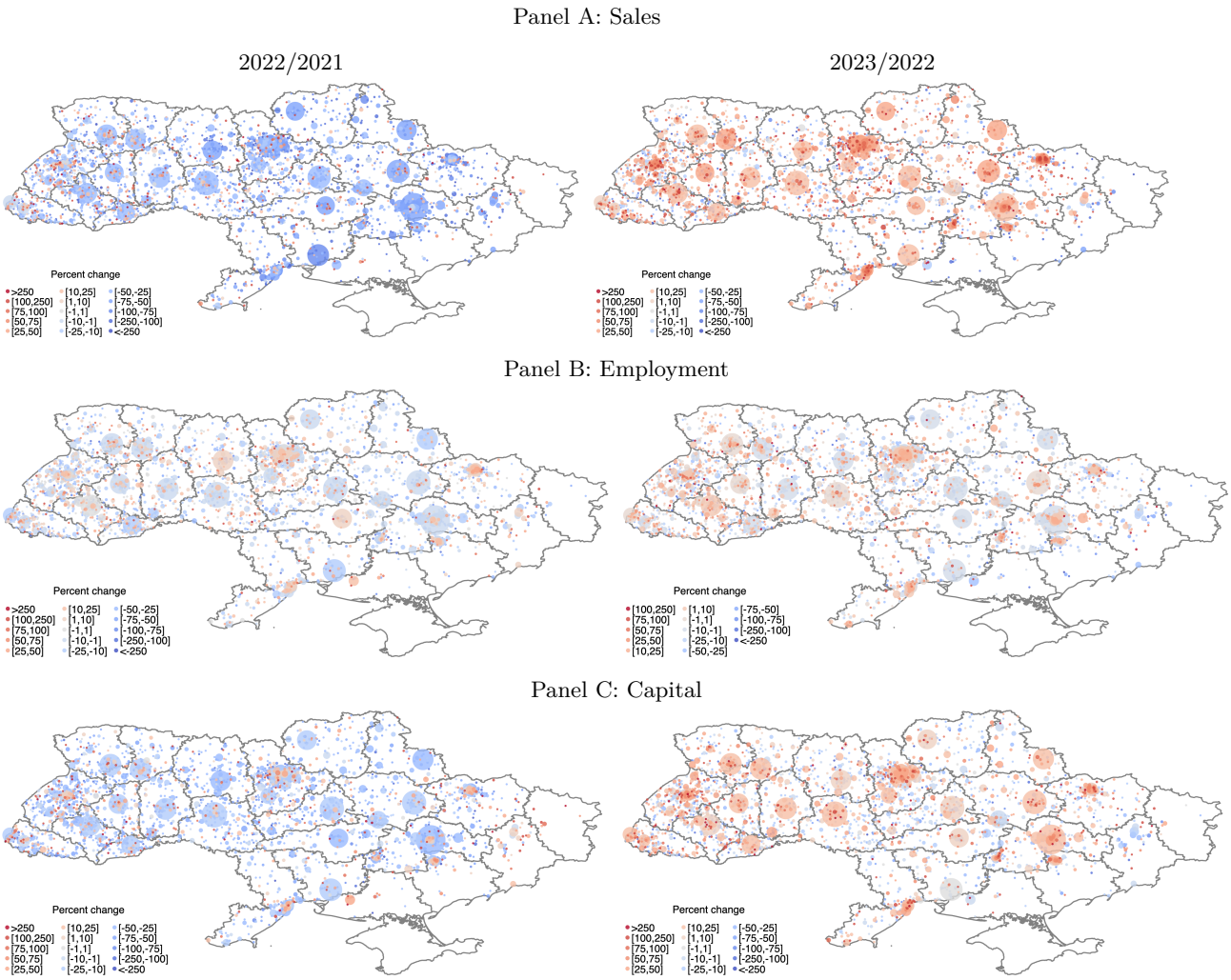


Figure 3: Percent change in firm outcomes by postal area

Notes: This figure shows the average percentage changes in firm-level outcomes at the postal area level in the analysis sample (Orbis). The values correspond to mean changes, calculated as $\Delta \log y_{\ell,t} \times 100$, in 2022 relative to the pre-war baseline in 2021 and in 2023 relative to 2022. More intense shades of blue indicate a larger decline, and more intense shades of red indicate a larger increase. Larger circle area indicates a larger number of firms per postal area.

geneity in firm characteristics. Firms in long-term occupation zones have higher mean total assets ($3.4 million vs. $2.8 million) and employment (107 vs. 50 workers) compared to those in never-occupied areas. These disparities likely reflect regional differences in economic structure, which are addressed by including region-by-year and industry-by-year fixed effects in the analysis. According to pairwise t-tests (Table A.1), these differences are not statistically significant for sales, fixed capital, and leverage. The average leverage ratio, defined as long-term debt to total assets, is approximately 5%, with substantial cross-sectional variation (standard deviation of 84%). Notably, the median firm holds no long-term debt, indicating that long-term debt financing is uncommon among Ukrainian firms.

Figure 3 shows that the deterioration in firm outcomes in 2022 extended well beyond frontline areas, with sharp declines in sales and capital (fixed assets) observed across Ukraine. Employment patterns are more heterogeneous, with many firms showing growth, possibly due to relocation to safer regions. Notably, firms in areas that later remained under long-term occupation were more likely to experience increases in sales, employment, and capital in 2022; however, this pattern reversed in 2023. The fact that most postal areas in never-occupied territory display improvements in 2023 suggests a partial recovery from the initial war shock. In contrast, the asymmetric pattern for firms in long-term occupied territories indicates that prolonged restrictions and institutional disruptions associated with military occupation are particularly harmful to firm performance.

3 Empirical Strategy

Our empirical analysis aims to estimate the causal effect of military occupation on firm performance and explore the mechanisms behind it.

3.1 Event Study

To estimate the effects of occupation on firm outcomes, we employ an event-study design following Borusyak et al. (2024), defining the event as a firm experiencing military occupation in a particular year. We conduct two separate analyses: the first examines firms in areas subjected to long-term occupation (occupied in 2022 and remaining occupied through 2023), while the second focuses on firms in areas that were occupied and subsequently de-occupied within 2022. In both event studies, the control group comprises firms in never-occupied areas. For each analysis, we regress the logarithm of outcome $y_{i\ell t}$ of firm i in industry j and postal area ℓ in year t on event-time treatment indicators:

$$\log y_{i\ell t} = \alpha_i + \lambda_{jt} + \theta_{rt} + \sum_{k \neq -1} \beta_k D^k_{i\ell t} + \epsilon_{i\ell t} \tag{1}$$

The specification includes firm fixed effects α_i to capture time-invariant unobserved heterogeneity, industry-year fixed effects λ_{jt} to control for sector-specific shocks, and region-year fixed effects θ_{rt}, where r denotes the region (oblast) containing postal area ℓ, to account for time-varying factors at the oblast level.[7] Event-time indicators $D^k_{i\ell t}$ equal one if firm i is k years from the 2022 occupation event, with $k \in \{-5, \ldots, 1\}$ and occupation defined at the postal area level. These indicators are normalized so that $k = -1$ (2021) serves as the reference period. The coefficients β_k capture the dynamic effects of occupation or de-occupation relative to this pre-2022 baseline. Standard errors are clustered at both the firm and postal area levels.

Analyzing long-term occupied and de-occupied areas separately avoids confounding fundamentally distinct treatment dynamics. Brada et al. (2023) show that post-conflict recovery depends critically on whether territorial stability is restored.[8] In Ukraine, firms in liberated and occupied territories face systematically different conditions. First, liberated areas reinstate Ukrainian legal frameworks and property rights, whereas occupied territories experience regulatory collapse. Second, de-occupied firms regain access to Ukrainian and international markets, while occupied firms remain disconnected from these networks.[9] Third, liberated territories attract returning populations, whereas many occupied areas experience demographic decline due to deportation and resettlement, which erodes local demand and labor supply. Fourth, international reconstruction support, including $524 billion in planned financing, is accessible only to liberated territories (World Bank, 2023). These differences result in divergent trajectories: de-occupied firms experience an initial shock followed by recovery, while continuously occupied firms face persistent decline. The effects likely vary depending on firm characteristics such as size, leverage, and sector, as well as on exposure to combat. We examine this heterogeneity to determine which firms are most vulnerable to occupation and which are best positioned to recover after liberation.

Balanced Panel Approach We first estimate treatment effects using balanced panels of firms with complete outcome data throughout the analysis period. This approach maintains a constant sample composition within each specification, enabling firm fixed effects to absorb time-invariant heterogeneity and facilitating clear interpretation of event study coefficients. Each β_k reflects outcomes for the same set of firms, measured relative to 2021.

7. Regions are defined at the ADM1 (oblast) level.

8. Brada et al. (2023) find that in almost half of post-conflict cases GDP remains below trend even 25 years after conflict, with sustained peace being a prerequisite for recovery.

9. 75% of businesses in occupied areas ceased operations in early 2022, whereas liberated firms gradually recovered (OECD, 2025).

However, non-random selection may arise in the balanced sample because firms may exit the Orbis dataset or cease operations entirely due to occupation-related factors such as physical destruction, management displacement, or loss of reporting capacity. Since we cannot observe why firms discontinue reporting, if occupation increases exit rates, our estimates reflect effects conditional on survival rather than average effects across all treated firms. This likely understates the total economic impact, as the most severely affected firms are disproportionately excluded. Therefore, we extend the analysis by relaxing the balanced panel requirement in 2023.

The full balanced panel requires continuous reporting from 2017 through 2023, resulting in 147 firms in long-term occupied areas and 1,098 in short-term occupied areas. The unbalanced panel requires reporting only through 2022, yielding 278 long-term and 1,308 short-term occupied firms, with an additional 131 long-term and 210 short-term occupied firms that exited between 2022 and 2023. The two specifications produce identical pre-treatment estimates but diverge in post-invasion years. We exclude from the analysis firms that stopped reporting to Orbis in 2022, as the reason for disappearance from the dataset is unobservable and may reflect factors other than firm closure.

For 2022, the unbalanced panel includes firms that subsequently exited, thereby capturing effects on a broader population during the initial invasion year. If the unbalanced panel reveals larger effects for 2022, this indicates that firms exiting after 2022 were less resilient to the initial shock, although it is not possible to distinguish whether this is due to pre-existing firm characteristics or differential treatment intensity. Overall, conditional on the parallel trends assumption, our estimates provide credible causal evidence on the effects of occupation among firms that survived at least through the initial invasion year. If firms exiting earlier experienced more severe impacts, our estimates likely represent lower bounds on the total economic effect of occupation.

Identifying Assumptions Causal interpretation of our event study estimates depends on two key assumptions. First, the parallel trends assumption requires that, absent occupation and conditional on controls, treated and control firms would have exhibited similar outcome trajectories. This assumption could be violated if occupation disproportionately affected areas with specific regional or industrial structures. Our specification mitigates these risks by including firm fixed effects (absorbing time-invariant differences), industry-year fixed effects (controlling for sector-specific shocks), and region-year fixed effects (accounting for oblast-level trends in regions where occupation was concentrated). Although counterfactual outcomes are unobservable, pre-treatment coefficients (β_k for $k < -1$) provide evidence regarding the plausibility of

this assumption. Statistically insignificant coefficients fluctuating around zero support the parallel trends assumption.

Second, the no anticipation assumption posits that firms did not adjust their behavior in anticipation of occupation prior to the February 2022 invasion. This assumption is plausible given the speed and unpredictability of the invasion. Although Russia amassed troops in late 2021, the timing, scale, and geographic scope remained uncertain until the invasion occurred, which limited firms' ability to relocate assets or strategically adjust operations based on anticipation of occupation.

Violation of either assumption would bias our estimates. If firms anticipated and adjusted to occupation, the estimated effects would understate the true impact. We present pre-treatment event study coefficients alongside our main results to facilitate assessment of these assumptions.

3.2 Comparative Analysis: Long-Term Occupation vs. De-Occupation

To directly compare the differential impacts of sustained occupation versus liberation, we estimate a difference-in-differences specification restricted to the sample of ever-occupied firms:

$$\log y_{i\ell t} = \alpha_i + \lambda_{jt} + \sum_{\tau=2022}^{2023} \delta_\tau (\text{LongTerm}_{i\ell} \times \mathbb{1}[\tau = t]) + \epsilon_{i\ell t} \tag{2}$$

where $\text{LongTerm}_{i\ell} = 1$ if firm i's postal area ℓ remained occupied through 2023 and 0 if it was liberated by the end of 2022, and the coefficients δ_τ (for $\tau = 2022, 2023$) capture the differential outcomes between long-term occupied and de-occupied firms in each post-invasion year relative to 2021.[10] While this specification follows a difference-in-differences format, it serves primarily as a descriptive comparison rather than causal identification.[11] The treatment group consists of firms in long-term occupied areas, while the control group consists of firms in de-occupied areas.

This specification differs from our main event study in three ways. First, the sample includes only firms in ever-occupied territories, comparing outcomes between those that remained occupied and those that were liberated. Second, rather than using never-occupied firms as the control group, we compare two different occupation experiences within conflict-affected areas. Third, we estimate year-specific coefficients for 2022 and 2023 rather than a full event study, as the limited post-treatment window provides only two

10. Region-year fixed effects are omitted from this specification because long-term and de-occupied areas are concentrated in a small number of oblasts, leaving insufficient within-oblast variation to identify the differential effect.

11. Unlike our main event study which identifies causal effects through parallel pre-trends between occupied and never-occupied firms, this specification compares two endogenous treatments. Occupation duration and liberation timing are both likely correlated with unobserved regional characteristics (strategic importance, industrial composition, military dynamics) that independently affect firm outcomes.

data points per firm.[12] We interpret the coefficients δ_{2022} and δ_{2023} as descriptive measures of outcome differences between long-term occupied and de-occupied firms, conditional on our fixed effects structure. These estimates complement our main event study results by providing statistical evidence on whether firms facing sustained occupation experienced systematically different outcomes from firms in liberated territories.

4 Results

This section presents the main results on the effect of short-term and long-term military occupation on firm performance. First, we document the effect of occupation on sales following the event study methodology (Borusyak et al., 2024). Then, to understand what drives the effects on sales, we explore the effect of occupation on firms' employment, capital, and labor productivity. Finally, we zoom into the analysis of channels for these effects. Throughout the analysis, estimated effects should be interpreted relative to the control group of never-occupied firms, which also experienced significant wartime disruptions. The estimated coefficients therefore capture the differential impact of occupation rather than its absolute effect on firm performance.

4.1 Effects of Occupation on Sales

We focus on firm sales as the primary measure of firm performance for several reasons. First, when production data are unavailable, sales are commonly used as a proxy for output (e.g., Del Prete et al., 2023; De Loecker and Warzynski, 2012; Kumar and Rabindran, 2019). The accuracy of this approximation relies on several strong assumptions, including stable prices, production mix, and inventory levels. To mitigate deviations of sales from output due to price changes, our specification includes industry-by-year fixed effects, which absorb common price dynamics within industries. Nevertheless, sales may still deviate from output due to demand shocks that prevent firms from selling all production, resulting in inventory accumulation. Sales may also fall short of output if inventories are destroyed. Even in the presence of such shocks, sales remain a valuable measure of firm performance as they capture both production decisions and demand for firms' products. This dual perspective motivates our discussion of the channels through which military occupation affects firm performance.

Figure 4 presents the main event-study results for sales. We estimate equation (1) separately for firms

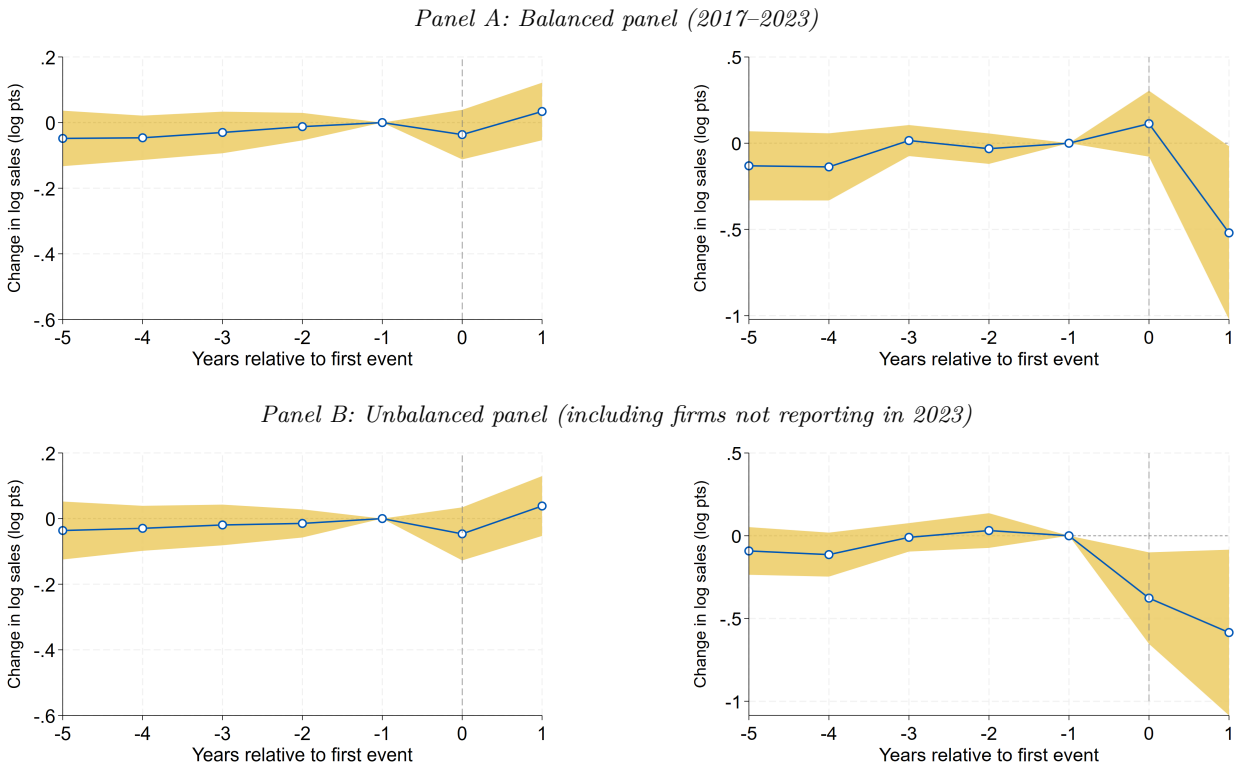
12. We cannot run a standard event study comparing these two treatment levels directly (long-term vs. short-term occupation) because few regions contain firms experiencing both types of occupation, limiting our ability to control for region-specific factors while estimating heterogeneous treatment effects. This specification trades off some causal clarity for the ability to directly test whether the magnitude of impacts differs between occupation regimes.

experiencing short-term and long-term occupation, tracking sales dynamics from five years before to one year after the initial occupation event. Panel A displays results for the balanced panel of firms continuously observed from 2017 to 2023. Panel B reports results for an unbalanced panel that includes firms present in 2022, even if they did not report in 2023, thereby capturing the effect of occupation on firm survival.

The results in Figure 4 indicate a negative immediate effect of short-term occupation on sales, followed by full recovery in the subsequent year. Firms in areas occupied and liberated within 2022 experienced an average sales decline of approximately 4% during the occupation year; however, this effect is statistically insignificant and dissipates completely by 2023. Similar results are observed in the unbalanced panel, likely because short-term occupation has little effect on firm exit. In contrast, long-term occupation results in large and persistent sales losses. Panel A shows that firms remaining under occupation through 2023 experienced sales declines of approximately 41% by the end of the second year (year +1), with the effect intensifying over time. The coefficients for the pre-treatment period are not statistically different from zero, supporting the parallel trends assumption. The unbalanced panel reveals even larger negative effects: when including firms that stopped reporting in 2023 (Panel B), long-term occupation reduces sales by approximately 31% on impact, with the cumulative decline reaching 44% by 2023. This suggests that the main estimates represent a lower bound, as the most severely affected firms exit the sample. Survival bias explains the positive, though insignificant, effect on impact in Panel A, which turns negative once non-surviving firms are included in Panel B.

Robustness to Sample Restrictions. One concern with the setup considered above is that firms operating in western Ukraine may not constitute a valid control group for areas closer to the combat zone, due to differences in the economic environment and potential spillovers from the relocation of population and businesses from more heavily affected areas. To address this, we conduct robustness checks by refining the analysis sample and restricting the control group to firms located in regions that experienced occupation in 2022–2023 or in neighboring regions, thereby excluding western Ukraine from the analysis (see Appendix Figure B.1). The resulting estimates remain qualitatively similar, with a modest on-impact decline in sales followed by recovery after short-term occupation and a persistent decline under long-term occupation (Appendix Figure B.2).

A further concern is that firms in large cities may exhibit different patterns from those in towns and rural areas, and their inclusion in the control group may bias the estimated effect of occupation. Additionally, firms relocating from occupied areas may choose Kyiv or western regional capitals for relocation, potentially



(a) Firms in short-term occupation

(b) Firms in long-term occupation

Figure 4: Dynamic effects of occupation on firm sales

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

contaminating the control group. To address this, we conduct additional robustness checks by excluding regional capitals and other cities with the largest number of firms from both treatment and control groups (see Appendix Figure B.3 and B.4). Although the resulting estimates become less statistically significant, they remain qualitatively consistent with the baseline specification.

4.2 Effects of Occupation on Employment and Capital

The results in Section 4.1 show that sales quickly recover after short-term occupation but persistently decline under long-term occupation. If the decline in sales reflects a decline in output, corresponding changes should also be observed in factors of production. This section examines the impact of occupation on fixed capital and labor, the two primary inputs in the production process.

Employment The effects of occupation on firm employment, measured by the number of employees, are summarized in Figure 5, Panel A. The employment dynamics closely mirror those for sales, with short-term occupation resulting in a modest and statistically insignificant decline in employment on impact (approximately 3%), with full recovery in the following year. In contrast, long-term occupation leads to substantial workforce reductions: employment in continuously occupied areas declined by approximately 23% in 2023, which is about half the magnitude of the corresponding sales losses. Results from the unbalanced panel are similar (Appendix Figure B.5, Panel A). This pattern suggests that the decline in employment is an important factor behind the deterioration of firm performance under occupation.

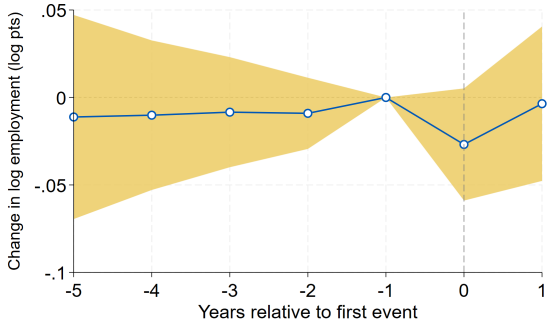
Examining the effect of occupation on productivity, defined as operating revenues per employee, allows further refinement of the role of employment in the observed sales decline (Figure 5, Panel B). Labor productivity declines less than sales on impact, which is consistent with a decline in employment that partially offsets the decrease in sales per worker. Upon liberation from short-term occupation, productivity rises as sales recover more rapidly than employment. Conversely, under long-term occupation, productivity declines, again reflecting that sales decrease more sharply than employment.

Capital Fixed capital, measured by the book value of fixed assets on firms' balance sheets, demonstrates notable resilience compared to sales and employment. As shown in Figure 6, Panel A, capital remains largely unchanged on impact for short-term occupied firms and increases by approximately 5% upon liberation relative to never-occupied firms, though the estimates are statistically insignificant. Under long-term occupation, capital declines by about 2% on impact, with a slight further decrease in the subsequent year; again, the estimates are statistically insignificant. Results from the unbalanced panel similarly suggest limited differential adjustment of capital stock between occupied and never-occupied firms (Appendix Figure B.5). During long-term occupation, the capital-to-labor ratio increases by about 25%, reflecting the relative stability of capital alongside the sharp decline in employment (Figure 6, Panel B). These findings suggest that labor, rather than capital, is the primary factor-of-production channel through which occupation depresses output.

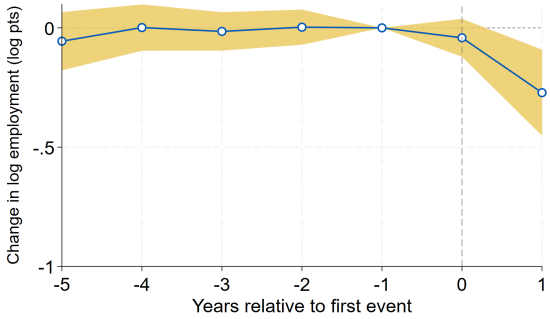
At the same time, the relative stability of capital stocks may mask important changes in firms' investment behavior. To capture these dynamics, Panel C of Figure 6 examines the growth rate of fixed capital net of depreciation, which approximates the investment rate under standard accounting assumptions.[13] Under short-term occupation, the effects are small and statistically insignificant: the capital accumulation rate

13. Formally, if capital evolves according to $K_{t+1} = K_t(1 - \delta - m_t) + I_t$, where δ is the depreciation rate, m_t is the capital-destruction rate (both expressed as fractions of K_t), and I_t denotes investment, then observed capital growth reflects both investment and destruction. The measure, therefore, does not allow distinguishing between lower investment and higher capital destruction, as neither is available in the Orbis data.

Panel A: Employment

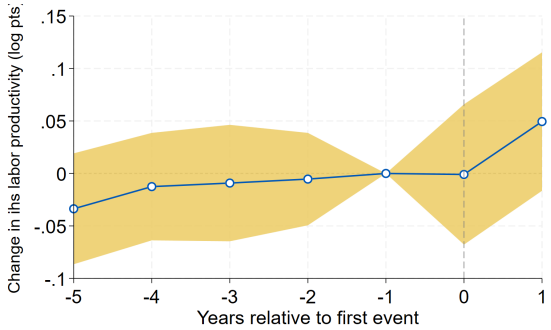


(a) Firms in short-term occupation

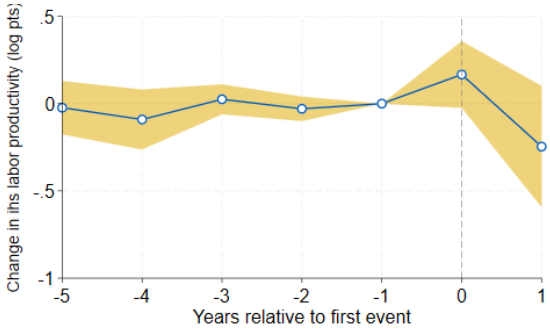


(b) Firms in long-term occupation

Panel B: Labor productivity



(c) Firms in short-term occupation



(d) Firms in long-term occupation

Figure 5: Dynamic effects of occupation on firm employment and labor productivity

Notes: Figure plots estimates from equation (1) for the balanced panel of firms continuously present in 2017–2023, where $t = 1$ is the omitted baseline period. Panel A presents results for the logarithm of firm employment. Panel B presents results for labor productivity, defined as operating revenue divided by number of employees and transformed using the inverse hyperbolic sine (IHS), $\text{IHS}(x) = \log(x + \sqrt{x^2 + 1})$. The IHS transformation is preferred over the natural logarithm because it retains observations with zero or very low productivity values while yielding coefficients that are approximately interpretable as log-point changes for moderate to large values of the variable. See Bellemare and Wichman (2020) and Chen and Roth (2024) for recent discussion of the limitations of the IHS transformation. Y-axis units are log points in both panels; x-axis plots years relative to the year of first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

declines during occupation and recovers after liberation relative to never-occupied firms. This pattern is consistent with firms postponing investment due to uncertainty and resuming it upon liberation. In contrast, under long-term occupation, the capital accumulation rate shows little change relative to never-occupied firms on impact but declines persistently in the second year, consistent with a sustained reduction in investment. This outcome aligns with the considerable uncertainty firms in occupied territories face regarding both the institutional environment and the security of property rights (Talanova et al., 2023).

Overall, the lack of a strong differential capital response aligns with existing evidence that conflict primar-

ily affects firms through channels other than direct capital destruction (e.g., Collier and Duponchel, 2013). Importantly, the absence of statistically significant effects does not imply that capital stocks remained unchanged in occupied firms; rather, capital evolved similarly to firms in never-occupied areas, which also experienced substantial wartime disruptions (see Figure 3). However, two caveats regarding the magnitude of the effect should be noted. First, for short-term occupation, although pre-treatment coefficients are not statistically different from zero, point estimates show a mild upward trend prior to occupation. This pattern may indicate a potential pre-trend that is not detected due to wide confidence intervals. If firms in areas later occupied were already experiencing faster growth, this would suggest negative selection into occupation and could bias the estimates downward, understating the true effect. Second, for both occupation types, severe capital damage would likely result in firm exit from both the 2023 and 2022 samples. Consequently, these results should be interpreted as a lower bound on the true effect. Additional evidence on the role of war-related damages is discussed in Section 4.3.

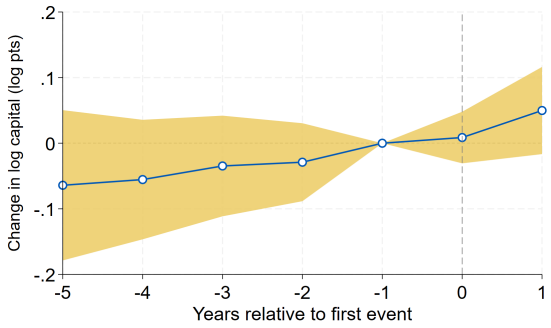
4.3 Role of Exposure to Combat and Military Damages

Destructive conflict events are generally associated with severe economic disruption through casualties, infrastructure destruction, and property damage (Collier and Duponchel, 2013; Camacho and Rodriguez, 2013; Custodio et al., 2025). However, some Ukrainian territories experienced occupation with limited exposure to direct combat. We therefore examine whether the effects of occupation differ by exposure to combat activity and military damage events, exploiting spatial variation in wartime exposure.

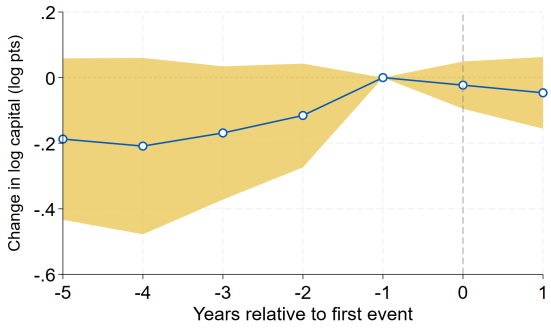
We first examine heterogeneity in occupation effects by exposure to active combat in 2022 according to Decree No. 910.[14] Figure 7 shows that firms affected by short-term occupation accompanied by active combat experienced a statistically significant decline in sales by approximately 12%, followed by recovery after liberation. By contrast, firms affected by short-term occupation without combat experienced a modest increase in sales upon liberation. These patterns suggest that occupation without direct combat disruption may have temporarily increased local demand, potentially due to reduced competition from outside the occupied territory, demand from occupying forces and military personnel, or precautionary purchasing by local households. For long-term occupation, the results in the balanced panel (Panel A) indicate no statistically significant effect on sales on impact, both in areas with and without active combat, but a negative effect

14. About 12% of all postal areas in Ukraine experienced combat in 2022. In our analysis sample, this share is slightly higher (13.6%). Of 227 short-term occupied locations with 1,098 firms, 97 locations with 493 firms were exposed to combat in 2022. Of 38 long-term occupied locations with 147 firms, 21 locations with 107 firms were exposed to combat in 2022. Of 2,992 never occupied locations with 50,087 firms, 391 locations with 20,637 firms experienced combat. The exposure to active combat in our sample is illustrated in Appendix Figure C.1.

Panel A: Capital

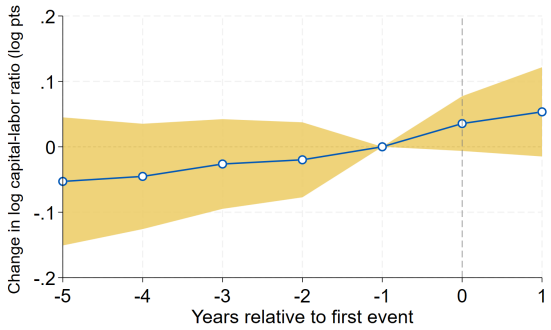


(a) Firms in short-term occupation

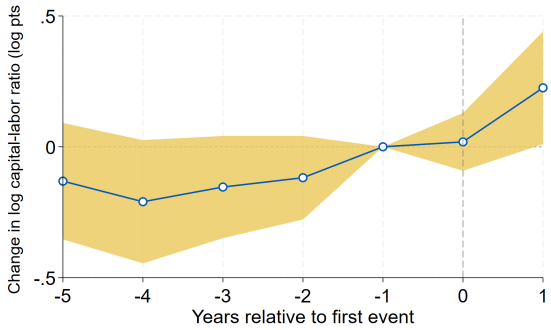


(b) Firms in long-term occupation

Panel B: Capital-labor ratio

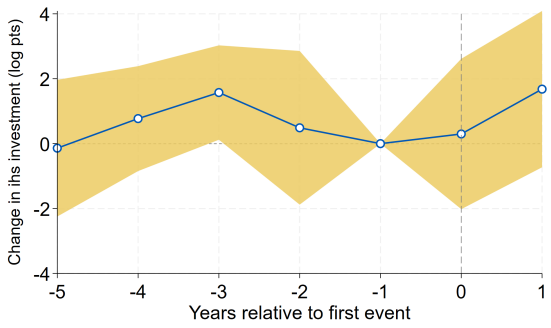


(c) Firms in short-term occupation

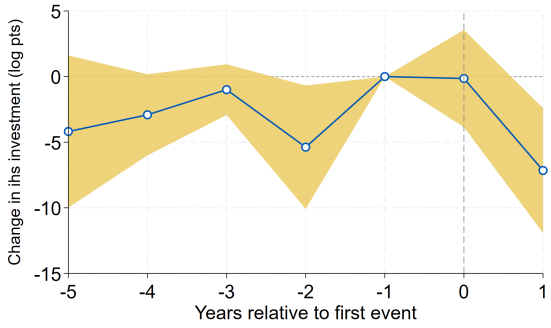


(d) Firms in long-term occupation

Panel C: Capital accumulation rate



(e) Firms in short-term occupation

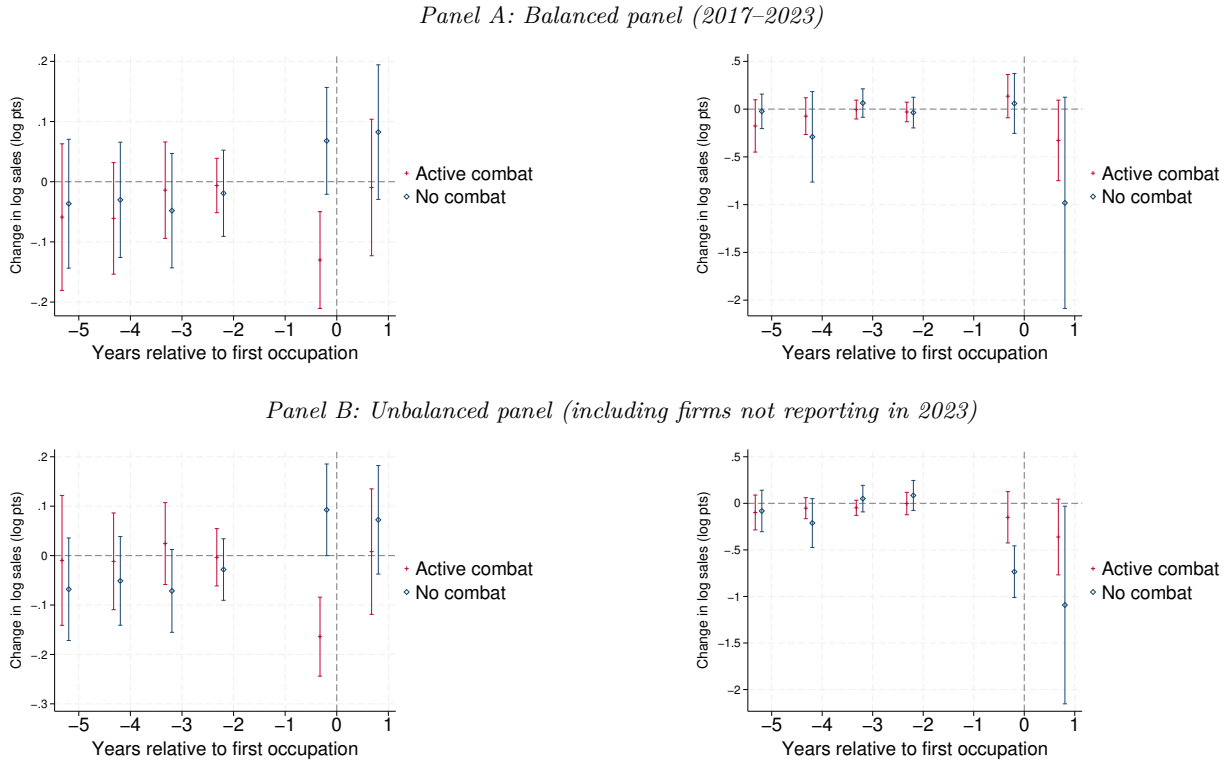


(f) Firms in long-term occupation

Figure 6: Dynamic effects of occupation on firm capital

Notes: Figure plots estimates from equation (1) for the balanced panel of firms continuously present in 2017–2023, where $t = 1$ is the omitted baseline period. Panel A presents results for the logarithm of firm capital. Panel B presents results for the capital-labor ratio (in logs). Panel C reports the capital accumulation rate measured as $K_{t+1}/K_t - (1 - \delta)$ using the inverse hyperbolic sine (IHS) transformation because the capital growth rate can take negative values; IHS-transformed values are approximately interpretable as log-point changes for moderate to large values of the variable. Y-axis units are log points in all panels (Panel C is IHS-transformed; approximately interpretable as log-point changes for moderate to large values of the variable); x-axis plots years relative to the year of first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

emerges in the second year of occupation. However, once we relax the balanced panel restriction (Panel B), firms in occupied areas without combat exposure experience substantially larger sales declines than firms in combat-exposed occupied areas (52% decline in non-combat areas compared to only 14% decline in combat-exposed areas). The difference between balanced and unbalanced panel estimates is particularly pronounced for non-combat areas, consistent with selective exit of the most severely affected firms from the 2023 sample.



(a) Firms in short-term occupation

(b) Firms in long-term occupation

Figure 7: Heterogeneous effects of occupation on sales by combat exposure

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with a dummy variable indicating whether the postal area experienced active combat in 2022, based on Decree No. 910. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Employment responses display a similar pattern: long-term occupation without active combat leads to substantially larger and more persistent employment losses, reaching a 46% statistically significant decline by the second year of occupation, as opposed to 14% decline for long-term occupied firms exposed to active combat (Appendix Figure C.2). Interestingly, the effects on firm capital do not differ substantially between

combat-exposed and non-combat areas (Appendix Figure C.3), suggesting that occupation affects firms primarily through channels other than direct destruction of productive capital.

This evidence suggests that persistent institutional uncertainty and expectations about prolonged occupation may be important channels through which occupation affects firms, beyond direct physical destruction. The negative effects of combat on sales in the occupied areas may have also been partially mitigated by the targeted integration programs for occupied territories that are meant to attract the Russian population from other regions to occupied Ukrainian cities (e.g., Beketova, 2025).

One concern is that firms not exposed to direct combat may nevertheless have been exposed to remote violence, such as missile attacks, potentially biasing the baseline estimates. Heterogeneity in violence exposure may also contribute to the wide confidence intervals around the estimated effects of occupation in areas without direct combat exposure. To address this issue, we examine heterogeneity by exposure to military damage events using ACLED (Armed Conflict Location and Event Data) and VIINA (Violence in Ukraine Network Analysis) conflict-event data.[15] The results are consistent with the main findings: firms exposed to greater military damages do not exhibit systematically larger declines in capital relative to non-occupied firms, while sales and employment deteriorate substantially even in areas with limited direct destruction. These patterns further support the conclusion that occupation affects firms primarily through channels beyond direct capital destruction.

Overall, the larger effects of long-term occupation on sales in areas with limited exposure to combat or other military damage events suggest a crucial role for institutional and geopolitical uncertainty, as well as supply networks, in shaping firm performance under occupation.

4.4 Potential Mechanisms

The previous analysis shows that firms recover relatively quickly after short-term occupation, whereas long-term occupation leads to persistent declines in sales and employment; however, the effects on capital are not statistically distinguishable from those of never-occupied firms (Sections 4.1 and 4.2). These patterns cannot be fully explained by exposure to combat or other direct war-related damages (Section 4.3).

Military occupation may affect firms through several other channels. First, restrictions on the mobility of people and goods, including guarded checkpoints at the entrances of occupied villages and towns, may

15. Military damage events include missile attacks, drone attacks, artillery shelling, armed clashes, and explosions. Firms are grouped according to the cumulative number of events recorded in 2022. Exposure to violent events is visualized in Appendix Figure C.1, Panel B. The results analyzing heterogeneity of occupation effects on firm sales, employment, and capital depending on whether the postal area has experienced no military damage events, 1–7 military damage events, or more than 7 military damage events are presented in Appendix Figures C.4 and C.5. However, they need to be interpreted as descriptive, both due to the presence of pre-trends and because military damages are not randomly assigned conditional on occupation status.

reduce local consumer demand and disrupt supply chains and market access. Second, labor supply may be constrained by population displacement to safer areas. Third, occupation increases institutional and economic uncertainty through disruptions to government services, bank operations, and property rights insecurity, eroding both consumer and investor confidence. These channels imply different patterns across sectors and firm characteristics.

We first examine heterogeneity across sectors. If occupation primarily erodes local purchasing power, the strongest effects should emerge in services. If instead occupation mainly disrupts supply chains and market access, manufacturing and trade firms should experience larger losses (Bernard et al., 2007; Acemoglu et al., 2012). Because construction activity is particularly sensitive to investor confidence and property rights insecurity, disproportionately large effects in this sector would point to investment uncertainty as an important transmission channel.

We additionally examine heterogeneity by firm size and reliance on debt finance, which may influence resilience to occupation through several mechanisms. Larger firms often benefit from greater financial reserves and established business relationships (Camacho and Rodriguez, 2013; Ksoll et al., 2023; Custodio et al., 2025), but may also depend more heavily on formal institutions, external financing, and complex supply networks that become disrupted under occupation. Similarly, reliance on external finance may either help firms smooth occupation-related shocks or amplify vulnerabilities if financial intermediation is impaired (Glick and Taylor, 2010; Shpak et al., 2023).

Table 3: Conceptual framework for interpreting channels of occupation effects on firms

	Local demand	Overall demand	Labor supply shortages	Sales/supply chains	Investor confidence
By Industry					
Services	++		++		+
Trade	+	++	+	++	+
Manufacturing	+	+	+	++	+
Construction	+	+	++	+	++
By Firm Characteristics					
Size	Flexibility, ability to absorb shocks				
Use of debt finance	Financial constraints				
Combat exposure	Capital destruction, local infrastructure, population evacuation				

Notes: Authors' conceptual framework based on qualitative assessments of sectoral and firm-level vulnerabilities. "++" denotes strong relevance of the channel; "+" denotes moderate relevance; blank cells indicate limited or no relevance.

Table 3 summarizes the conceptual mapping between these dimensions of heterogeneity and potential

transmission channels. While we discuss the channels that are consistent with observed heterogeneity evidence, we cannot unambiguously identify them, as multiple mechanisms may operate simultaneously.

4.4.1 Heterogeneity by Sector

Figure 8 reveals substantial heterogeneity in occupation effects across sectors, consistent with differences in exposure to demand shortages, supply chain disruptions, and uncertainty channels. In particular, manufacturing and services firms exhibit the largest and most persistent losses under long-term occupation, while firms in the trade sector appear to be the most resilient.

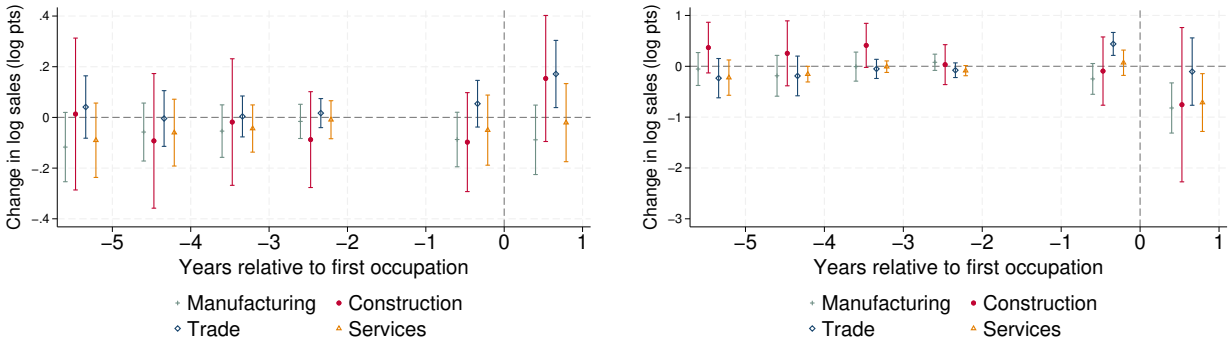


Figure 8: Heterogeneous effects of occupation on sales by sector

Notes: Figure plots estimates from equation (1) for the balanced panel of firms continuously present in 2017–2023, interacting event-time indicators $D^k_{i\ell t}$ with sector dummies for manufacturing, services, trade, and construction. $t = 1$ is the omitted baseline period. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Sales in the services sector remain largely unchanged under short-term occupation but decline persistently under long-term occupation, reaching approximately 45% below the level of never-occupied firms by 2023 in the balanced panel and more than 50% in the unbalanced panel.[16] This pattern suggests positive selection among surviving firms and is consistent with the sector's strong dependence on local demand, which may recover quickly after short disruptions but remains severely depressed under prolonged occupation, particularly amid population displacement. The decline cannot be fully explained by adjustments in factors of production: employment effects are statistically insignificant throughout, and capital effects are both statistically insignificant and quantitatively small. Labor productivity declines under long-term occupation, consistent with revenues falling faster than employment.[17]

16. The unbalanced panel results are reported in Appendix Figure D.1.
17. Results for employment, capital, and labor productivity by sector discussed in this section are reported in Appendix D.

Similar to the services sector, sales in manufacturing firms show no statistically significant change under short-term occupation. However, manufacturing firms experience the largest decline in sales under long-term occupation, up to 56% by 2023 in the balanced panel. Employment also remains largely unchanged under short-term occupation, but declines persistently under long-term occupation, with statistically significant effects emerging in 2023. While capital shows a suggestive decline under long-term occupation, the point estimates are substantially smaller than those for employment, consistent with a more limited role for capital adjustment. The delayed employment response is consistent with firms adjusting labor in response to realized revenue shortfalls rather than anticipating them, a pattern also observed in labor productivity dynamics. Overall, these results suggest long-term occupation affects manufacturing firms primarily through disruptions to input supply and distribution networks due to mobility restrictions.[18] A decline in local demand alone is unlikely to explain these patterns, as manufacturing firms typically serve markets beyond local areas.

The trade sector exhibits substantially greater resilience to occupation than manufacturing and services. Sales show a slight increase on impact and rise significantly after liberation from short-term occupation, consistent with reconstruction activity and the gradual return of population to liberated areas. Even under long-term occupation, trade firms exhibit only moderate declines in sales after an initial increase on impact in the balanced panel. The contrast between sales dynamics in trade, services, and manufacturing points to an important role of consumer uncertainty and local competition. Unlike services firms, which rely heavily on local discretionary consumption, trade firms supply essential goods that households continue to purchase even during occupation. In periods of heightened uncertainty, households may also engage in precautionary stockpiling behavior, temporarily increasing demand for durable and non-perishable goods (Ahmadi et al., 2022). Consistent with this explanation, labor productivity in the trade sector increases on impact, with revenues rising under relatively stable employment. Reduced competition from external suppliers and demand from occupying forces may further support local trade activity (Del Prete et al., 2023). The quick recovery following liberation may reflect restored access to transport routes reconnecting firms to external markets. These effects appear temporary under prolonged occupation, as precautionary demand subsides and uncertainty about the territories' economic and institutional future intensifies.

The construction sector demonstrates a distinct pattern. Sales decline sharply on impact under both short-term and long-term occupation. After liberation from short-term occupation, construction firms exhibit moderate recovery, whereas under long-term occupation sales continue to decline, with point estimates

18. Forced re-registration or expropriation of Ukrainian firms in occupied territories may also sever existing supply and distribution relationships. Manufacturing firms previously integrated into Ukrainian or international supply chains, rather than Russian networks, would likely face particularly severe disruptions to both input procurement and product distribution under occupation (Talanova et al., 2023).

comparable in magnitude to those in manufacturing, though imprecisely estimated. This pattern is consistent with construction activity being highly sensitive to local institutional conditions, particularly uncertainty regarding the future status of occupied territories and security of property rights. Interestingly, declining sales in long-term occupied areas are accompanied by increasing capital stock, which may partly reflect a positive pre-trend in capital among construction firms (Appendix Figure D.3). Alternatively, weak housing demand may lead firms to retain unsold construction stock on their balance sheets as fixed assets, mechanically inflating measured capital stock.

Employment in the construction sector exhibits negative, though statistically insignificant, responses under both short-term and long-term occupation, with larger declines under prolonged occupation (Appendix Figure D.2). Labor productivity shows little change on impact but increases following liberation from short-term occupation, consistent with sales recovering more rapidly than employment during reconstruction periods. Under long-term occupation, labor productivity instead declines, suggesting persistent weakness in demand relative to employment adjustment. Given the long production cycle in construction, changes in employment may affect sales only with a substantial lag. The decline in employment, though imprecisely estimated, could reflect pessimism about future prospects, driven by uncertainty and the risk of property expropriation in occupied territories.[19] At the same time, Russia is promoting forced integration of illegally annexed Ukrainian territories by supporting rapid reconstruction in select cities (e.g., Mariupol) and providing highly discounted 2% mortgage rates to attract Russian citizens to purchase property in occupied areas (Beketova, 2025). Our results suggest that these policies are not sufficient to offset the decline in demand faced by construction firms operating in Ukraine since 2015, as uncertainty about returns on future investment continues to undermine investment incentives.[20]

4.4.2 Heterogeneity by Firm Characteristics

We next examine heterogeneity of occupation effects on sales by firm size and use of debt finance to provide further evidence on firms' adaptability and the role of financial frictions.[21] These characteristics proxy for the degree to which firms rely on formal institutions, external financing, and established supply and business networks that may become disrupted under occupation.

19. According to (OHCHR, 2026) the Russian Federation confiscated "abandoned" property of individuals displaced from occupied territories.

20. We cannot rule out that the benefits of reconstruction activity are concentrated among government-controlled construction companies newly created in the occupied territories (Talanova et al., 2023).

21. Supplementary results on employment and capital are provided in Appendix Figures E.2, E.3, E.5, and E.6.

Firm Size Figure 9 examines heterogeneity by firm size in 2021, measured by total assets. Under short-term occupation, the relationship between firm size and resilience is inverse U-shaped: mid-sized firms (Q3) are the least negatively affected by occupation and show the strongest recovery following liberation, while both the smallest (Q1–Q2) and largest (Q5) firms show weaker performance.[22] This pattern is consistent with small firms lacking the resources to absorb occupation-related disruptions, while the largest firms are disproportionately exposed to disruptions in formal institutions, external finance, and complex supply networks. However, under long-term occupation, the pattern reverses: larger firms fare better on impact but experience the largest sales declines by the second year of occupation.[23] Overall, these patterns suggest that prolonged occupation disproportionately harms firms that rely more heavily on formal institutions, financing, and complex supply networks, while firms retaining sufficient operational flexibility appear better able to adapt under disrupted conditions.

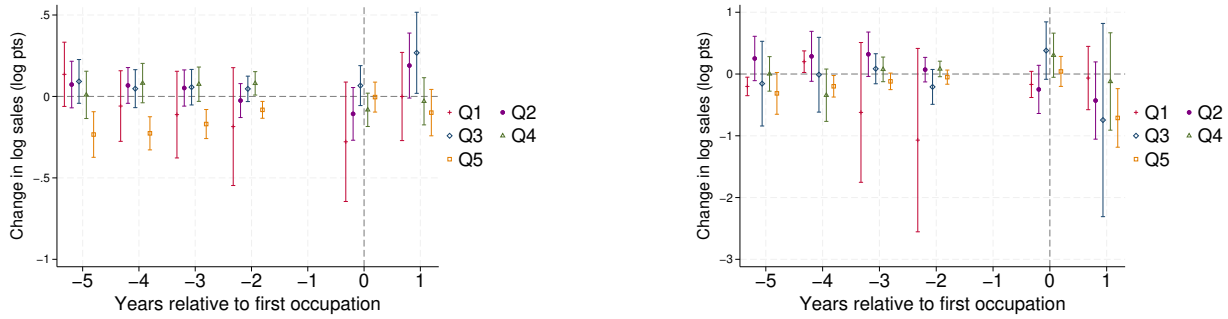


Figure 9: Heterogeneous effects of occupation on sales by firm size

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with firm size quintile in 2021 (Q1=smallest, Q5=largest; measured by total assets) for the balanced panel of firms continuously present in 2017–2023. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. $t = 1$ is the omitted baseline period. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Use of Debt Finance Figure 10 examines heterogeneity by use of external debt finance in 2021. Under short-term occupation, firms relying on debt finance show marginally better performance on impact and marginally worse performance following liberation. However, these firms also display a positive pre-trend, suggesting even weaker post-liberation performance relative to debt-free firms. Under long-term occupation, debt-free firms initially perform somewhat better, but by the second year, both groups show similar, though marginally

22. We focus on the interpretation of Q2–Q4 because Q5 exhibits a positive pre-trend, and Q1 has very wide confidence intervals, making pre-trends difficult to assess. Additionally, firms in Q1 are more likely to be relocated without changing their official registration address, potentially leading to measurement error in their occupation status.

23. In the unbalanced panel, the initial advantage of larger firms disappears, with all size groups showing substantial negative effects (Appendix Figure E.1).

statistically significant, declines.[24] Overall, these patterns suggest that financial frictions may shape firm survival under long-term occupation, even if they play a secondary role relative to broader operational disruptions — restricted market access, displaced labor, and institutional breakdown — in determining the performance of surviving firms.

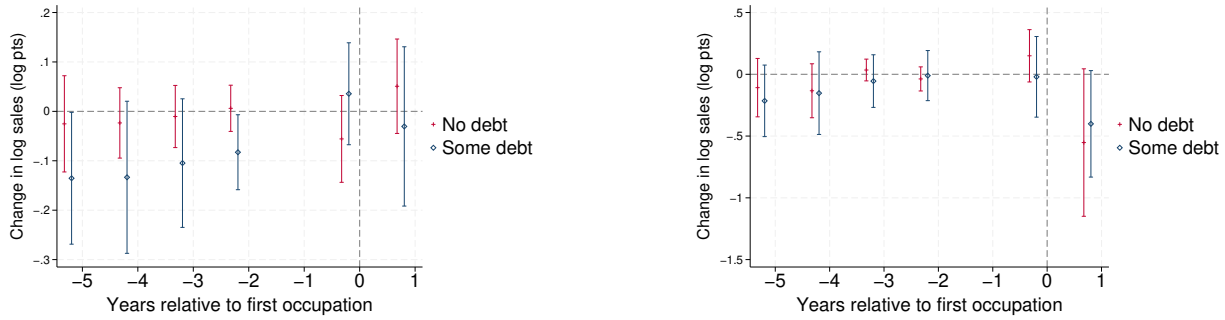


Figure 10: Heterogeneous effects of occupation on sales by use of debt finance

Notes: Figure plots estimates from equation (1), interacting event-time indicators D^k_{ilt} with a binary indicator for use of long-term debt in 2021 (debt-free vs. debt-using) for the balanced panel of firms continuously present in 2017–2023. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

4.5 Comparative Analysis of Long-Term and Short-Term Occupation

Next, we compare the effects of long-term and short-term occupation using the difference-in-differences specification in equation (2). Coefficients δ_{2022} and δ_{2023} capture differential effects for firms remaining under occupation through 2023 relative to firms in de-occupied territories (liberated by the end of 2022).

The results in Table 4 reveal a clear temporal divergence across outcomes: while firms under long-term and short-term occupation exhibit similar performance in 2022, substantial differences emerge by 2023. For sales, we observe no statistically significant differential effect in 2022, when all locations experienced occupation. However, by 2023, firms experiencing sustained occupation exhibit sales about 61% lower than de-occupied firms ($\delta_{2023} = -0.94$, $p < 0.01$). Employment follows a similar pattern. The 2022 differential effect is modest and only marginally significant in the most saturated specifications, while by 2023, long-term occupation is associated with employment levels 36% lower than in de-occupied firms ($\delta_{2023} = -0.45$, $p < 0.01$). The statistical significance increases as we add more stringent controls. In contrast, we find no statistically significant differential effects on fixed capital in either year. This may reflect measurement

24. Results in the unbalanced panel provide similar but sharper patterns. The main difference is that the balanced panel shows a positive on-impact coefficient for debt-free firms that disappears in the unbalanced panel, potentially consistent with the selective exit of debt-free firms most severely affected by occupation (Appendix Figure E.4).

challenges for capital stocks in conflict-affected areas or the possibility that most capital destruction occurred during the initial occupation period.[25]

Including firms that disappeared from the sample in 2023 yields sharper negative effects: about 37% decline in sales and 16% decline in employment in the most saturated specifications (Appendix Table F.1). This pattern suggests that selective firm exit may mask part of the economic costs of prolonged occupation in the balanced sample. By 2023, the occupation-induced losses more than double, with declines of about 68% in sales and 38% in employment. The effects on capital remain modest and statistically insignificant.

These findings confirm that the economic costs of occupation compound over time: while both groups experienced comparable initial shocks in 2022, firms remaining under occupation through 2023 suffered severe deterioration in sales and employment, with capital remaining the less responsive margin.

Table 4: Differential effects of long-term occupation on firm outcomes

	(1)	(2)	(3)	(4)
Sales				
LR occupation × Year=2022	-0.053	-0.051	-0.051	-0.051
	(0.288)	(0.278)	(0.087)	(0.107)
LR occupation × Year=2023	-0.932**	-0.935***	-0.935***	-0.935***
	(0.288)	(0.278)	(0.174)	(0.230)
Employment				
LR occupation × Year=2022	-0.089	-0.092	-0.092*	-0.092*
	(0.178)	(0.171)	(0.038)	(0.040)
LR occupation × Year=2023	-0.441*	-0.451**	-0.451***	-0.451***
	(0.178)	(0.171)	(0.081)	(0.093)
Fixed Capital				
LR occupation × Year=2022	-0.067	-0.069	-0.069	-0.069
	(0.338)	(0.326)	(0.064)	(0.053)
LR occupation × Year=2023	-0.115	-0.113	-0.113	-0.113
	(0.338)	(0.326)	(0.085)	(0.078)
N	3735	3735	3735	3735
Industry-by-year FE	No	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes
Clustered by firm ID	No	No	Yes	Yes
Double clustering firm ID and postal area	No	No	No	Yes

Notes: Results from estimating equation (2) on the balanced panel of ever-occupied firms continuously reporting from 2017 to 2023 (147 long-term and 1,098 short-term occupied firms). Dependent variables are log sales, log employment, and log fixed capital. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Standard errors in parentheses; column (3) clusters at the firm level, column (4) double-clusters at the firm and postal area levels. * (p<0.10), ** (p<0.05), *** (p<0.01).

25. Appendix Table F.2 extends the analysis to duration of occupation, measured by the number of months under occupation since February 2022. The results are qualitatively similar to those in Table 4: for long-term occupied firms, each additional month under occupation is associated with a decline in sales by 8% and employment by 4% relative to firms that were liberated.

5 Discussion and Conclusions

Military occupation is a complex and multifaceted shock that generates economic isolation, institutional instability, and restrictions on the movement of people and goods, and may additionally be accompanied by combat and physical destruction. It may affect firms through multiple channels, including demand shortages, disruptions to supply chains and market access, heightened institutional and geopolitical uncertainty, and labor displacement.

This paper studies how short-term and long-term exposure to military occupation affects the performance of Ukrainian firms during the full-scale Russian invasion in 2022–2023. Using an event-study methodology applied to firm-level data from Orbis, we document strongly asymmetric effects by occupation duration. Short-term occupation leads to temporary declines in sales and employment, followed by rapid recovery after liberation. Long-term occupation persistently suppresses sales and employment relative to never-occupied areas, with effects compounding over time and no significant recovery observed through 2023. Fixed capital dynamics do not significantly differ from those in never-occupied areas under either occupation type, though capital accumulation rates decline under prolonged occupation, consistent with firms postponing capital expenditure under institutional uncertainty.

Heterogeneity across sectors and firm characteristics aligns with demand shortages, supply chain disruptions, and institutional uncertainty as the main transmission channels. Notably, firms in long-term occupied areas without active combat exposure still experience substantial declines in sales and employment, while capital effects remain considerably smaller than those on sales and labor across most specifications, suggesting that occupation affects firms primarily through channels other than direct physical destruction. While labor supply shortages may contribute to sales declines under occupation, our results are more consistent with firms adjusting labor demand in response to broader demand and supply disruptions.

Several limitations should be kept in mind when interpreting these findings. First, the analysis is conditional on firm survival. Firms experiencing the most severe effects of occupation, including physical destruction, loss of management, or inability to report under occupation authorities, are more likely to exit the Orbis dataset or cease operations altogether. As a result, our estimates capture outcomes of firms that remained operational through at least part of the occupation period, and should be interpreted as a lower bound on occupation-induced losses. We partially address this by relaxing the balanced-panel restriction for 2022, which yields substantially more negative estimates, consistent with survival bias understating the true impact. Nevertheless, our analysis cannot fully capture the extensive margin of firm exit, which likely

accounts for a substantial share of total economic losses in occupied territories.[26]

Second, our data cannot fully capture firms' organizational and governance structures. Differences in ownership and control (*i.e.*, whether a firm is owner-operated, family-run, or integrated into broader corporate networks) can shape responses to occupation independently of firm size. Firms embedded in larger networks may have better access to financing, alternative suppliers, or relocation support, while owner-managed firms may face greater personal and financial exposure, making them more likely to suspend operations or relocate. Because these dimensions are not directly observable in the data, our estimates may combine structurally different adjustment responses. Nevertheless, our results on heterogeneity by firm size and external finance use provide support for the role of these mechanisms. Future work linking firm-level financial data with ownership registries could help disentangle these mechanisms.

An additional concern specific to this context is that some firms in occupied territories were expropriated or transferred to new owners affiliated with occupation authorities (Talanova et al., 2023). If expropriated firms fared better under new ownership, our estimates reflect a weighted average across firms with fundamentally different ownership trajectories. In that case, the effects we document likely understate the losses borne by firms that remained under Ukrainian ownership throughout the occupation.

Third, because our data do not allow distinguishing between investment expenditures and capital destruction, the estimated effects on capital may overattribute war-related damages to occupation. However, the heterogeneity analysis by exposure to military damages suggests that the qualitative patterns of occupation effects are robust to variation in exposure to destructive war events, lending support to the interpretation that institutional and demand channels are the primary drivers.

Fourth, financial variables for firms operating under occupation may be subject to measurement error due to exchange-rate conversion. Firms in occupied territories were required to re-register under Russian administration and report accounts in Russian rubles rather than Ukrainian hryvnias. Because Orbis harmonizes firm accounts across jurisdictions and currencies, part of the observed variation in financial outcomes may reflect exchange-rate distortions rather than underlying economic performance. This concern is particularly relevant because official Russian exchange rates during 2022–2023 diverged substantially from market rates following the introduction of capital restrictions. While this limitation is unlikely to overturn the qualitative patterns documented in the paper, it may affect the magnitude of estimated effects. Importantly, we find qualitatively similar occupation effects on employment, which is not affected by exchange-rate conversion. Future work with access to firm-level reporting currency information could help address this more directly.

26. Exit from Orbis is an imperfect measure of firm closure, as some economically active firms may disappear from the database while continuing to operate, for example by switching reporting jurisdictions or re-registering under occupation authorities.

Finally, our results cannot be straightforwardly extrapolated to the recovery dynamics of firms liberated after prolonged occupation. While firms recover relatively quickly following short-term occupation, recovery after long-term occupation may follow a substantially different trajectory. Evidence from post-Soviet transitions suggests that once institutional and economic structures established under occupation become entrenched, withdrawal may impose substantial adjustment costs on local economies (Krumins and Zhukov, 2026), especially in the absence of local compensatory policies. Although our analysis does not allow us to identify the duration at which these effects become nonlinear or particularly difficult to reverse, our findings suggest that the economic costs of occupation compound over time as institutional disruption becomes increasingly persistent, underscoring the importance of reconstruction and economic reintegration policies to mitigate these costs.

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Appendix

A Additional evidence on firm-level data from Orbis

A.1 Data cleaning

This appendix describes the construction of our firm-year sample from Orbis data used in estimating equation (1). We implement multiple filters to ensure data quality and consistency. All balance sheet variables represent book values downloaded in nominal USD and verified to be in units rather than thousands. Our sample includes only unconsolidated accounts for Ukrainian firms (ISO code "UKR"). We convert all financial variables to real terms using the 2017 USD deflator. We exclude observations and firms based on the following criteria:

1. Remove firm-years with missing data on total assets, sales, employment, or capital.
2. Remove all years for a firm if total assets are ever negative.
3. Remove all years for a firm if employment is ever negative or exceeds 2 million workers (Walmart's employment level) in any year.
4. Remove all years for a firm if sales are ever negative.
5. Remove all years for a firm if the ratio of employment to total assets (in millions) exceeds the 99.9th percentile in any year.
6. Remove all years for a firm if the sales-to-assets ratio exceeds the 99.9th percentile in any year.
7. Remove all years for a firm if tangible fixed assets are ever negative.
8. For time-invariant characteristics (country, company name, city, region, postal code, legal form, incorporation date), fill missing values using available information from other years for the same firm.
9. Restrict the sample to firms operating in manufacturing, construction, trade, transportation and storage, accommodation and food services, information and communication, or research and development sectors.

A.2 Firm characteristics by occupation status

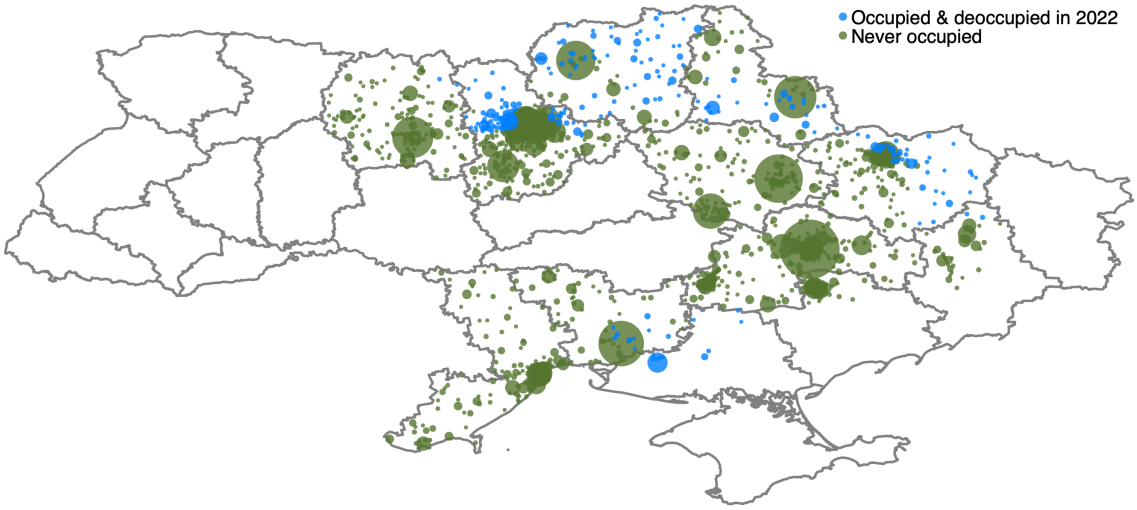
Table A.1: Pairwise t-tests of pre-war firm characteristics by Occupation Status

	Long-term vs Short-term	Long-term vs Never	Short-term vs Never
Sales, in 2017 $			
t-stat	-1.435	-0.626	0.222
p-value	(0.1515)	(0.5313)	(0.8240)
Fixed capital, in 2017 $			
t-stat	-0.903	-0.432	-0.078
p-value	(0.3669)	(0.6657)	(0.9375)
Number of Employees			
t-stat	-3.500	-0.369	0.611
p-value	(0.0005)	(0.7120)	(0.5413)
Total Assets, in 2017 $			
t-stat	-2.466	-0.740	0.138
p-value	(0.0138)	(0.4595)	(0.8903)
Current Assets, in 2017 $			
t-stat	-2.732	-0.965	0.512
p-value	(0.0064)	(0.3347)	(0.6084)
Current Liabilities, in 2017 $			
t-stat	-1.993	-1.026	0.246
p-value	(0.0465)	(0.3049)	(0.8054)
Cash & Cash Equivalent, in 2017 $			
t-stat	-1.411	-0.741	0.204
p-value	(0.1586)	(0.4584)	(0.8381)
EBITDA, in 2017 $			
t-stat	-1.946	-0.513	0.194
p-value	(0.0535)	(0.6082)	(0.8460)
Leverage, ratio			
t-stat	0.592	-0.176	-0.393
p-value	(0.5543)	(0.8607)	(0.6944)

Notes: This table reports pairwise t-test statistics comparing firm characteristics across occupation groups in 2021, the year before the full-scale invasion. Long-term occupation refers to firms in territories that remained occupied through end-2023; Short-term occupation refers to firms in territories that were temporarily occupied and then de-occupied; Never occupied refers to firms in territories that were never occupied. t-statistics test the null hypothesis of equal means between groups, with p-values reported in parentheses; tests assume equal variances (pooled-variance t-test). All monetary values are in constant 2017 USD.

B Occupation effects on sales: Robustness to alternative sample restrictions

(a) Firms in de-occupied locations



(b) Firms in still-occupied locations

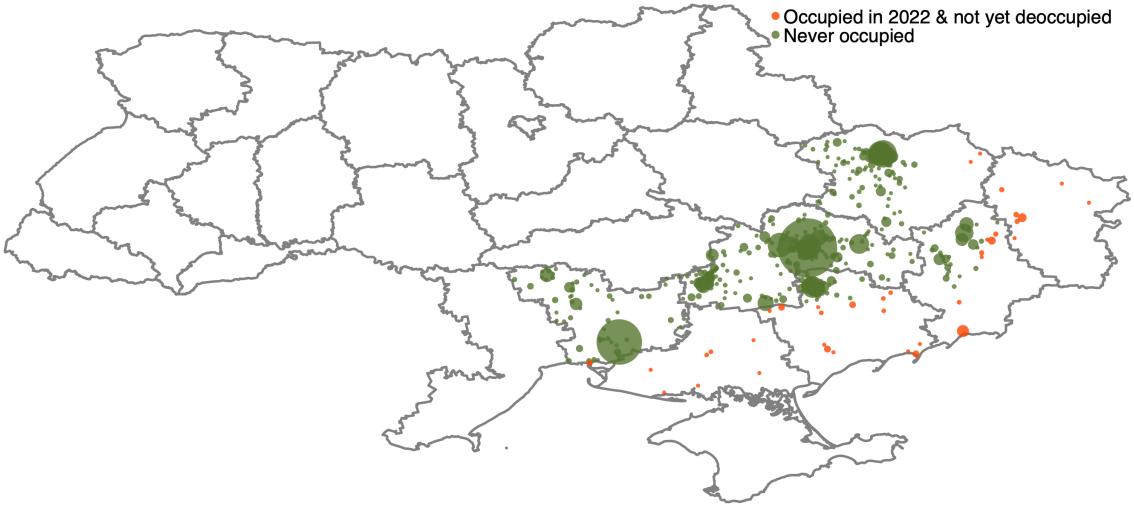
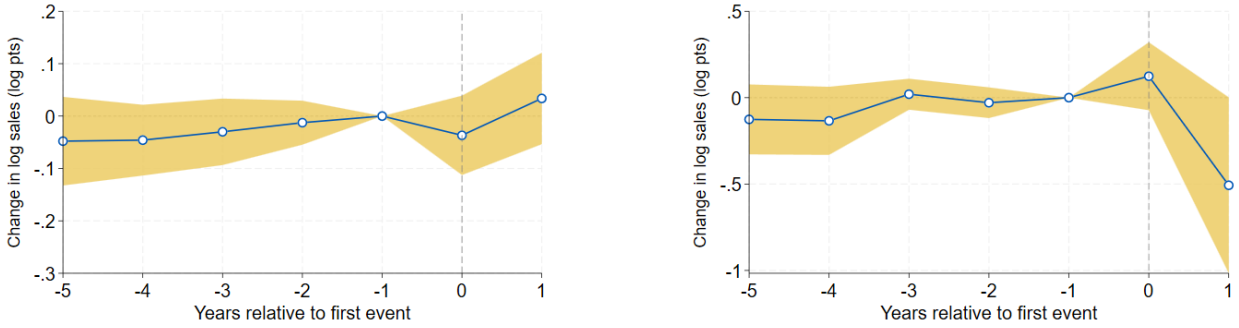


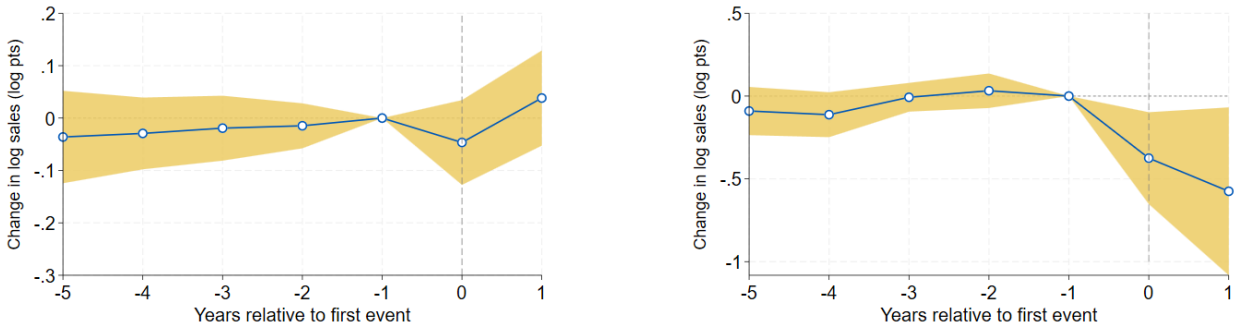
Figure B.1: Sample used in Figure B.2

Notes: The sample is restricted to firms in regions that either directly experienced occupation or neighbored regions that experienced occupation. The control group for de-occupied locations covers 31,583 firms in 1,419 postal areas with a mean of 22 firms and a median of 3 firms per postal area. The control group for still-occupied locations covers 10,549 firms in 586 postal areas with a mean of 18 firms and a median of 4 firms per postal area.

Panel A: Balanced panel (2017–2023).



Panel B: Unbalanced panel (including firms not reporting in 2023).



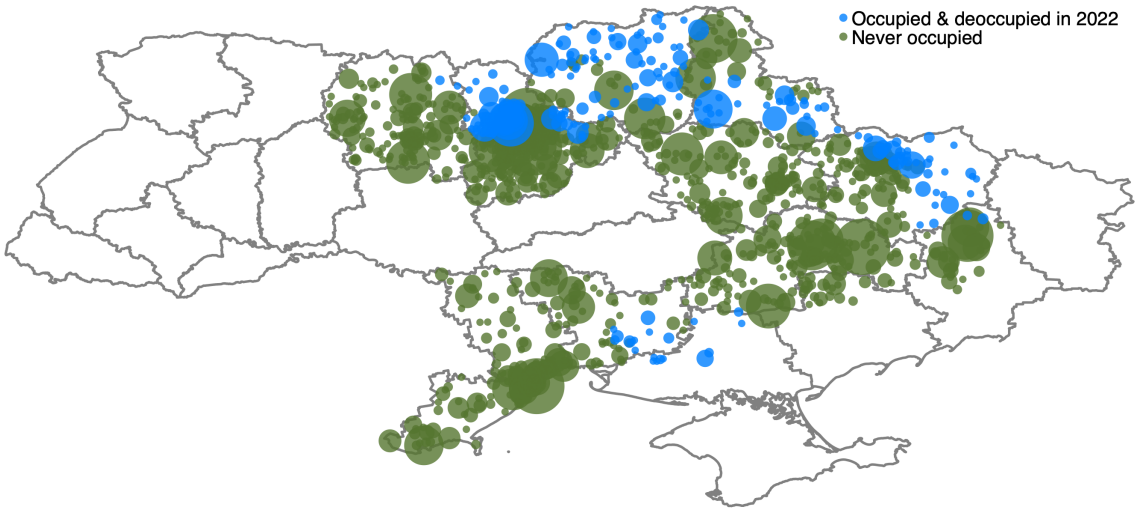
(a) Firms in short-term occupation

(b) Firms in long-term occupation

Figure B.2: Dynamic effects of occupation restricting attention only to regions experiencing occupation in neighboring regions

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period, for a sample with a refined control group as illustrated in Figure B.1. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

(a) Firms in de-occupied locations



(b) Firms in still-occupied locations

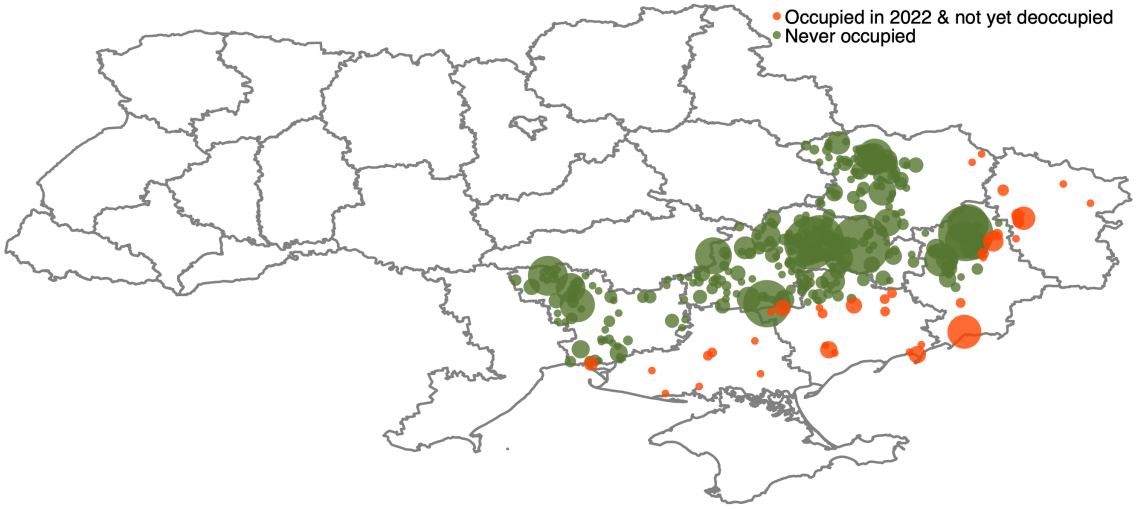
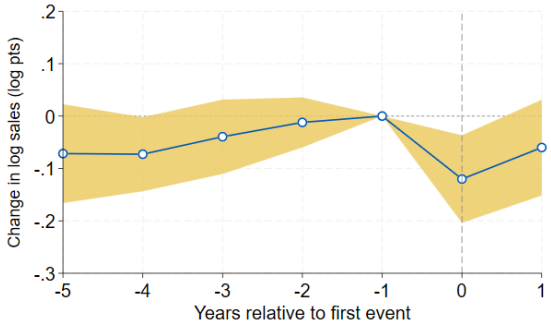


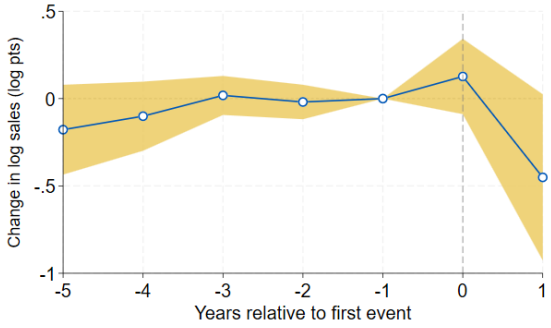
Figure B.3: Sample used in Figure B.4

Notes: The sample is restricted to firms in regions that either directly experienced occupation or neighbored to regions that experienced occupation, excluding top 1% locations by number of firms. The control group for de-occupied locations covers 5,829 firms in 959 postal areas with a mean of 6 firms and a median of 2 firms per postal area. The control group for still-occupied locations covers 1,761 firms in 313 postal areas with a mean of 6 firms and a median of 1 firm per postal area.

Panel A: Balanced panel (2017–2023).

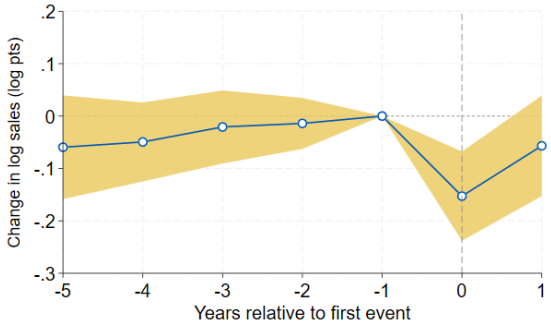


(a) Firms in short-term occupation

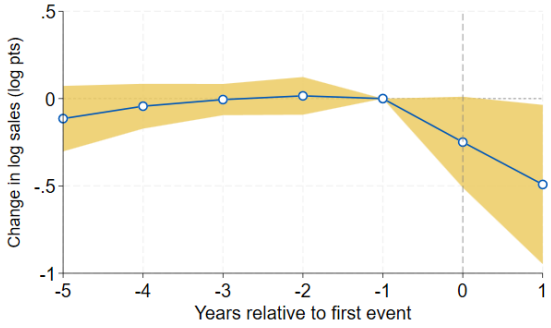


(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023).



(c) Firms in short-term occupation

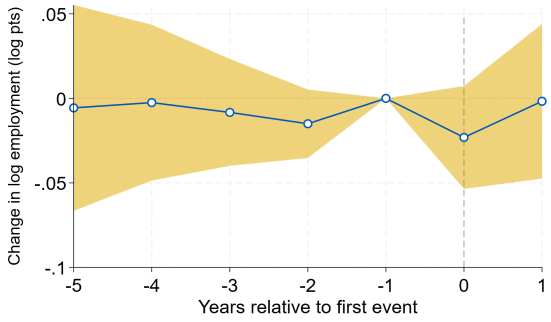


(d) Firms in long-term occupation

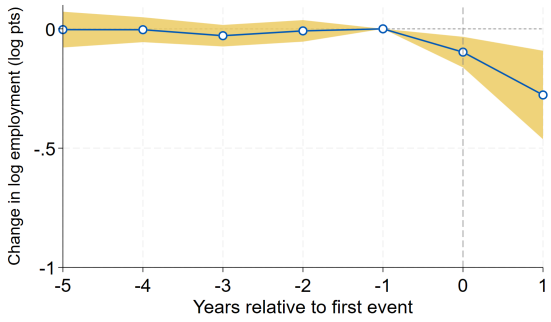
Figure B.4: Dynamic effects of occupation restricting attention only to regions experiencing occupation in neighboring regions excluding big cities

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period, for a sample with a refined control group as illustrated in Figure B.3. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Employment

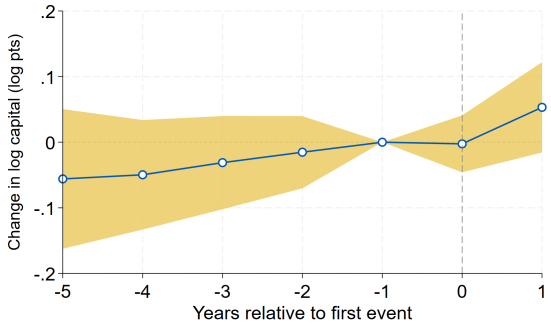


(a) Firms in short-term occupation

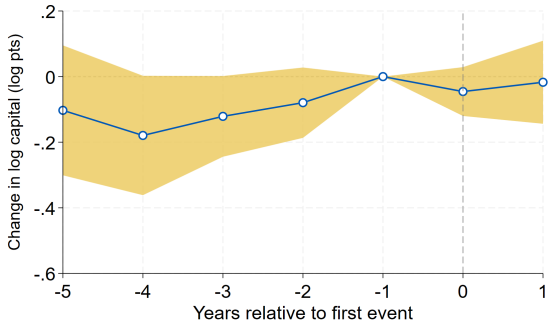


(b) Firms in long-term occupation

Panel B: Capital

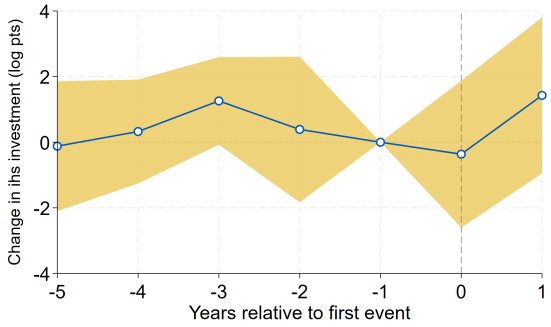


(c) Firms in short-term occupation

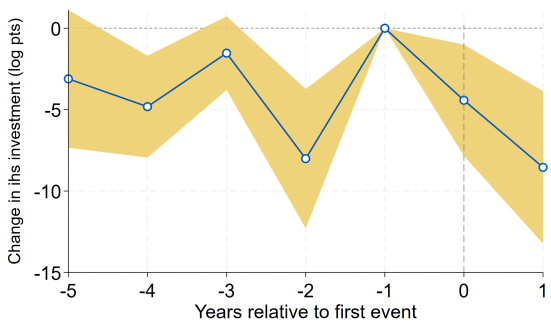


(d) Firms in long-term occupation

Panel C: Capital accumulation rate



(e) Firms in short-term occupation



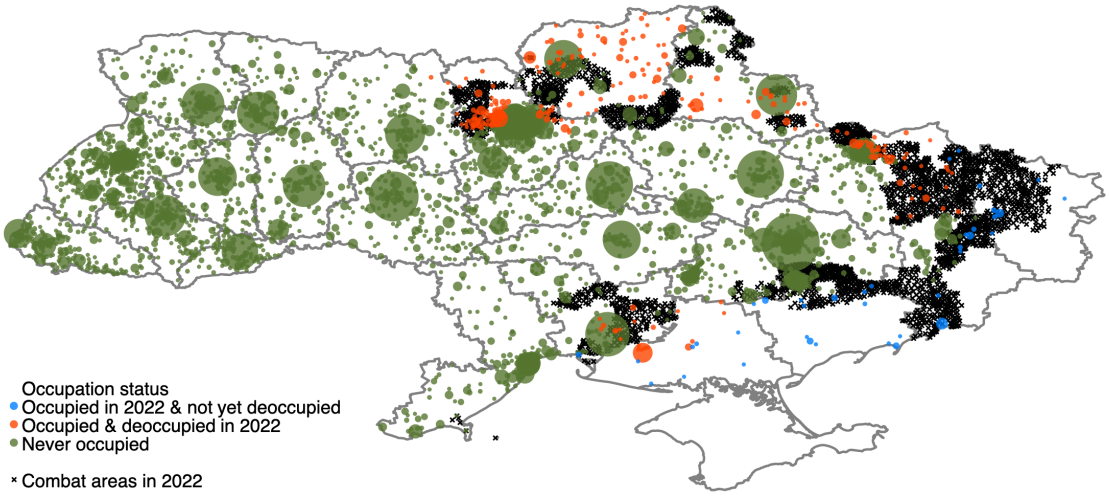
(f) Firms in long-term occupation

Figure B.5: Dynamic effects of occupation on firm employment, capital, and capital accumulation rate (unbalanced panel)

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period, for an unbalanced panel of firms reporting in 2017–2022, including those missing in the 2023 sample. Panel A presents results for the logarithm of firm employment. Panel B presents results for the logarithm of firm capital. Panel C reports the capital accumulation rate measured using the inverse hyperbolic sine (IHS) transformation because the capital growth rate can take negative values; IHS-transformed values are approximately interpretable as log-point changes for moderate to large values of the variable. Y-axis units are log points in all panels (Panel C is IHS-transformed; approximately interpretable as log-point changes for moderate to large values of the variable); x-axis plots years relative to the year of first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

C Occupation effects by exposure to military damages

Panel A: Exposure to active combat



Panel B: Exposure to active combat and other violent war events

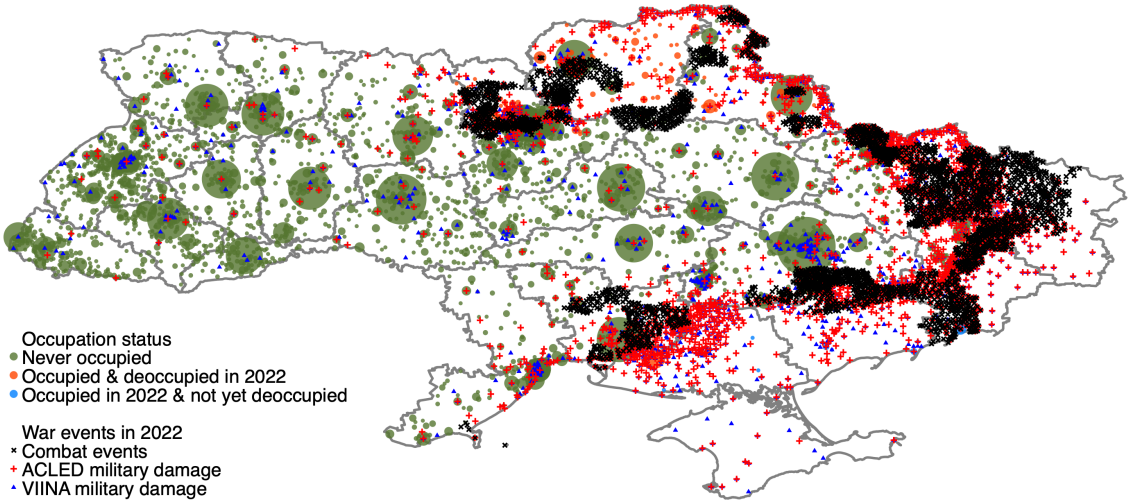
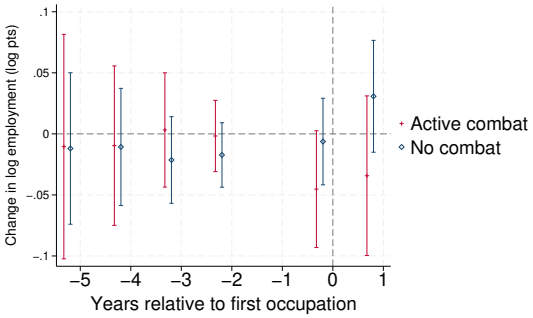


Figure C.1: Analysis sample by occupation status, exposure to active combat and other violent war events

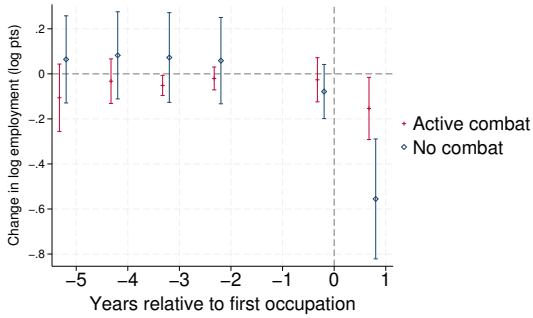
Notes: Map overlays postal areas with firms in our 2017–2023 analysis sample (circle size proportional to number of firms per postal area) with combat and violence exposure. Panel A shows areas with active combat per Decree No. 910. Panel B overlays active combat (black 'x') with violent events in 2022 (armed clashes, missile/drone attacks, artillery shelling, explosions) from ACLED (red '+') and VIINA (blue '△'); ACLED and VIINA events are layered to highlight violent events outside combat areas.

C.1 Heterogeneity of occupation effects by exposure to combat

Panel A: Balanced panel (2017–2023)

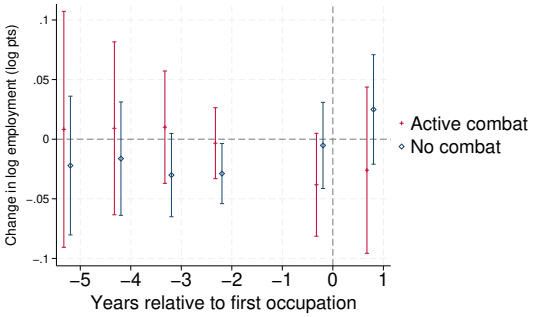


(a) Firms in short-term occupation

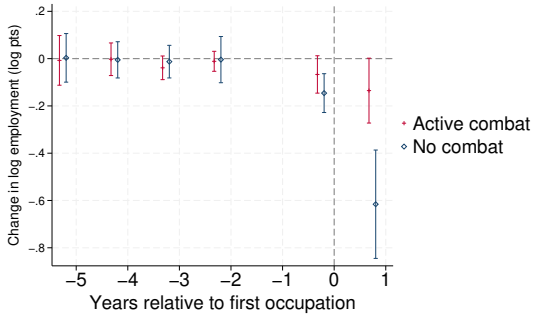


(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)



(c) Firms in short-term occupation

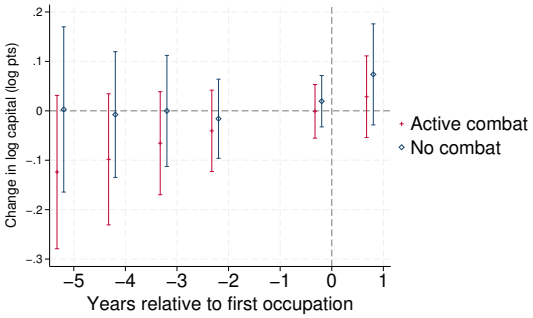


(d) Firms in long-term occupation

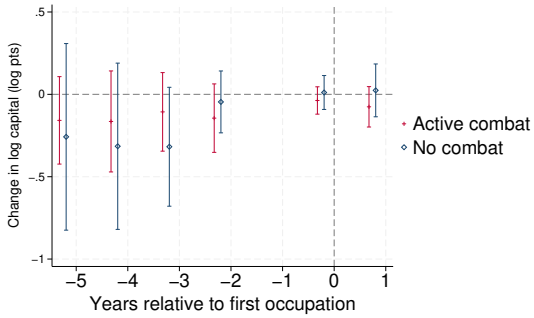
Figure C.2: Heterogeneity of dynamic effects of occupation on firm employment by exposure to combat

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

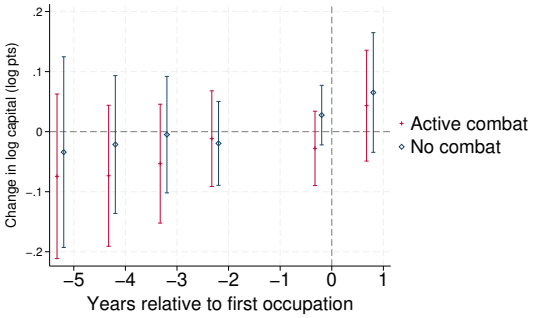


(a) Firms in short-term occupation

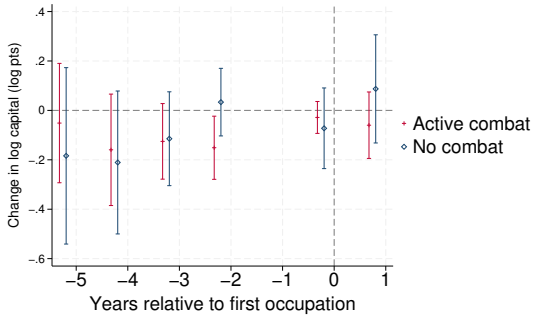


(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)



(c) Firms in short-term occupation



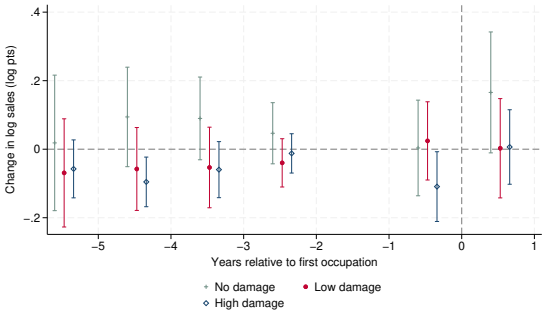
(d) Firms in long-term occupation

Figure C.3: Heterogeneity of dynamic effects of occupation on firm capital by exposure to combat

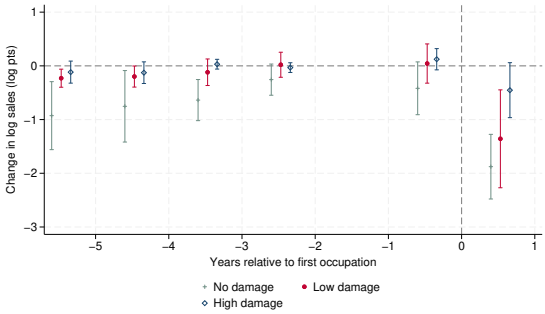
Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

C.2 Heterogeneity of occupation effects by exposure to military damages

Panel A: Firm sales

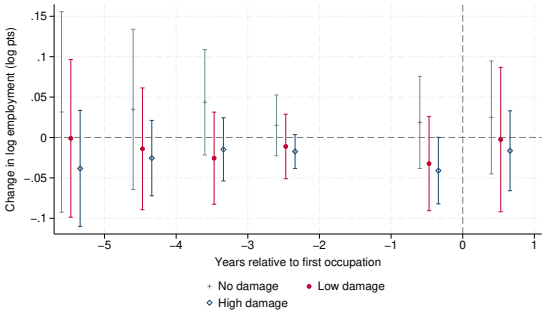


(a) Firms in short-term occupation

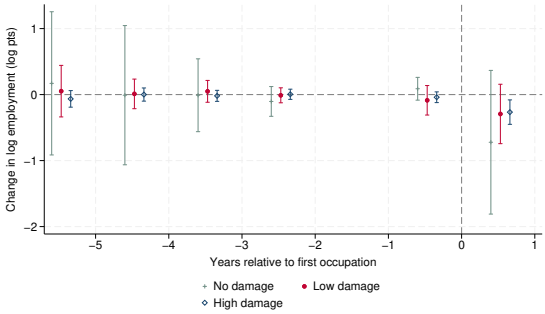


(b) Firms in long-term occupation

Panel B: Firm employment

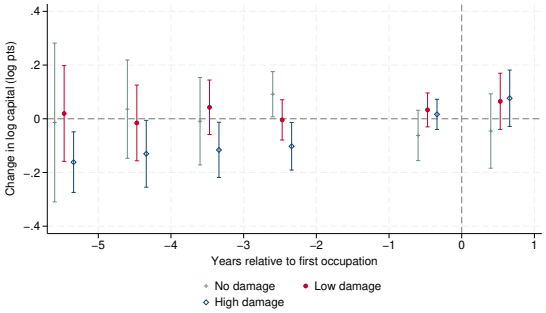


(c) Firms in short-term occupation

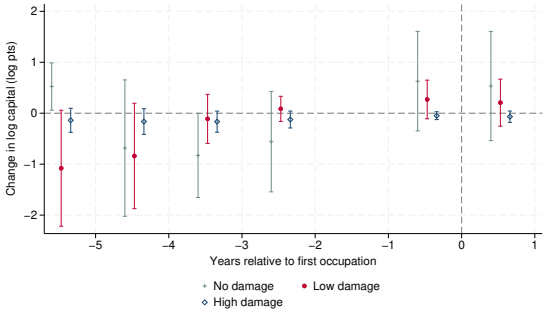


(d) Firms in long-term occupation

Panel C: Firm capital



(e) Firms in short-term occupation

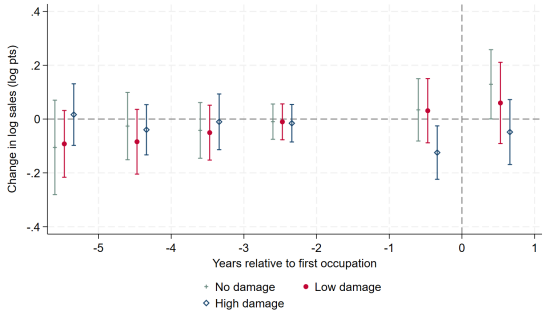


(f) Firms in long-term occupation

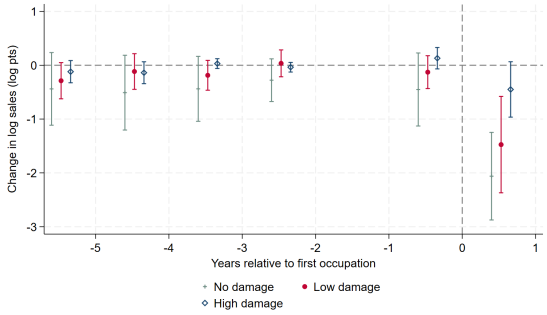
Figure C.4: Heterogeneity of dynamic effects of occupation on firm outcomes by exposure to military damage events in the ACLED dataset

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Left (right) panels report results for firms in short-term (long-term) occupation. Each subfigure plots separate estimates for three groups defined by the cumulative number of military damage events recorded in ACLED: no damage (zero events), low damage (1–7 events, covering 90% of firms), and high damage (more than 7 events). Panels A, B, and C report results for firm sales, employment, and capital, respectively, on a balanced panel of firms continuously present in 2017–2023. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at the 95% level. Results should be interpreted as descriptive, as military damages are not randomly assigned conditional on occupation status.

Panel A: Firm sales

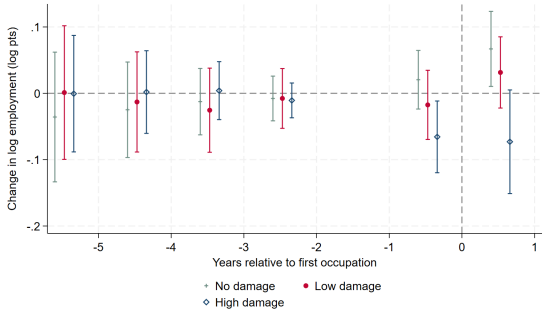


(a) Firms in short-term occupation

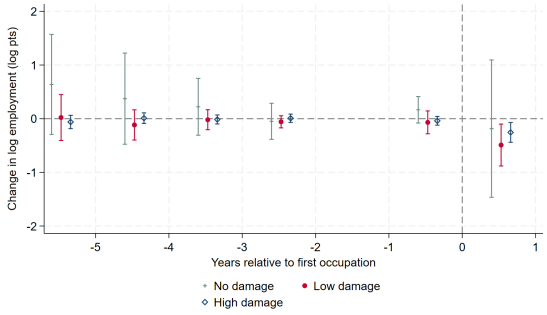


(b) Firms in long-term occupation

Panel B: Firm employment

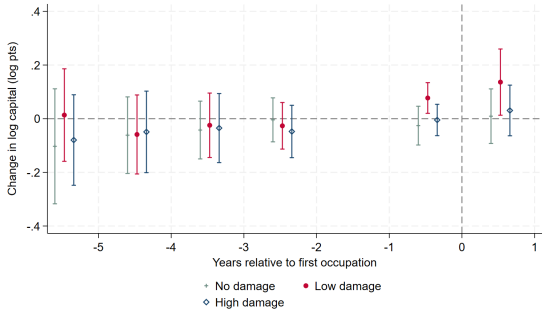


(c) Firms in short-term occupation

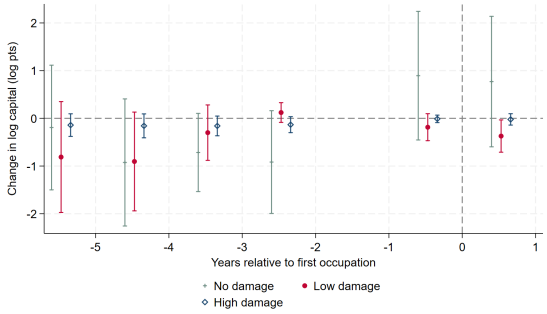


(d) Firms in long-term occupation

Panel C: Firm capital



(e) Firms in short-term occupation

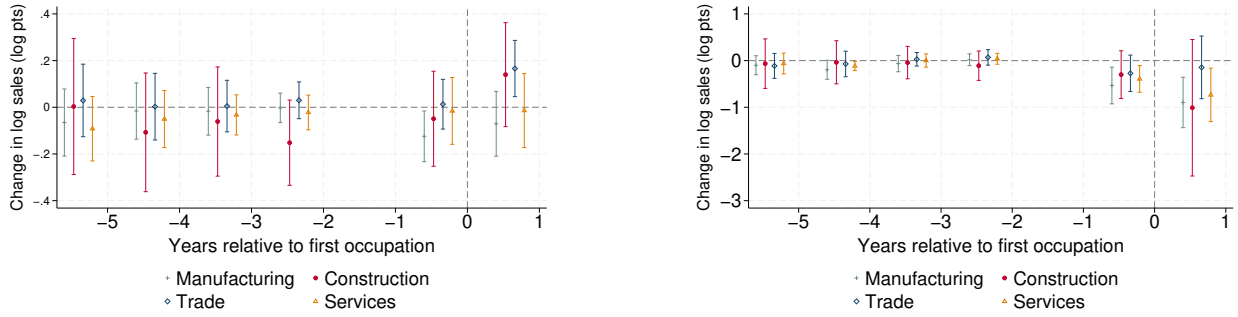


(f) Firms in long-term occupation

Figure C.5: Heterogeneity of dynamic effects of occupation on firm outcomes by exposure to military damage in VIINA dataset

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Left (right) panels report results for firms in short-term (long-term) occupation. Each subfigure plots separate estimates for three groups defined by the cumulative number of military damage events recorded in VIINA: no damage (zero events), low damage (1–7 events, covering 90% of firms), and high damage (more than 7 events). Panels A, B, and C report results for firm sales, employment, and capital, respectively, on a balanced panel of firms continuously present in 2017–2023. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at the 95% level. Results should be interpreted as descriptive, as military damages are not randomly assigned conditional on occupation status.

D Heterogeneity of occupation effects by sector



(a) Firms in short-term occupation

(b) Firms in long-term occupation

Figure D.1: Heterogeneous effects of occupation on sales by sector (unbalanced panel)

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with sector dummies for manufacturing, services, trade, and construction, on an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

(a) Firms in short-term occupation

(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)

(c) Firms in short-term occupation

(d) Firms in long-term occupation

Figure D.2: Heterogeneity of dynamic effects of occupation on firm employment by sector

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

(a) Firms in short-term occupation

(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)

(c) Firms in short-term occupation

(d) Firms in long-term occupation

Figure D.3: Heterogeneity of dynamic effects of occupation on firm capital by sector

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

(a) Firms in short-term occupation

(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)

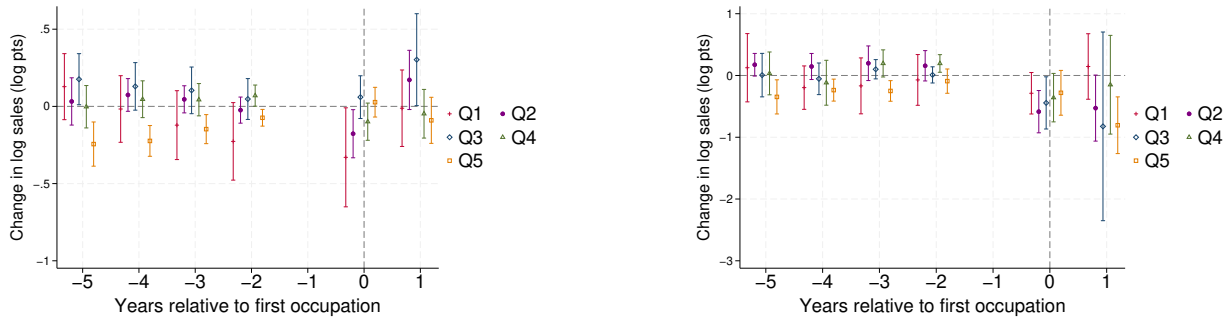
(c) Firms in short-term occupation

(d) Firms in long-term occupation

Figure D.4: Heterogeneity of dynamic effects of occupation on labor productivity by sector

Notes: Figure plots estimates from equation (1), where $t = 1$ is the omitted baseline period. Y-axis units are log points (IHS-transformed; approximately interpretable as log-point changes for moderate to large values of the variable) and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

E Heterogeneity of occupation effects by firm size and external finance use



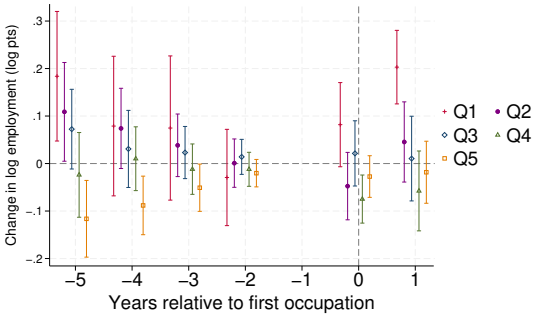
(a) Firms in short-term occupation

(b) Firms in long-term occupation

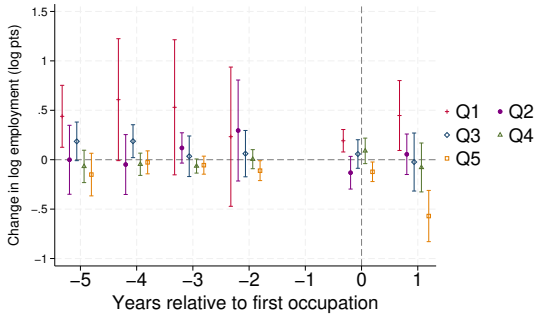
Figure E.1: Heterogeneous effects of occupation on sales by firm size (unbalanced panel)

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with firm size quintile dummies (Q1=smallest, Q5=largest; measured by total assets in 2021) for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

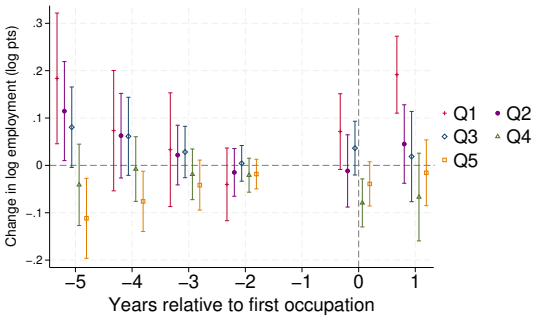


(a) Firms in short-term occupation

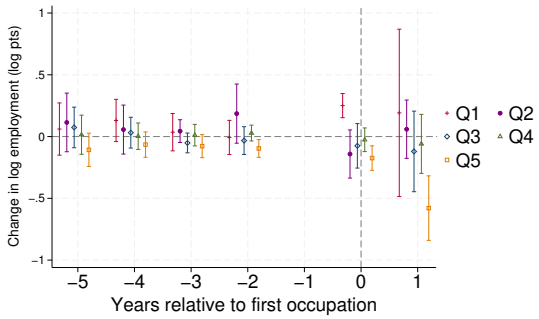


(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)



(c) Firms in short-term occupation

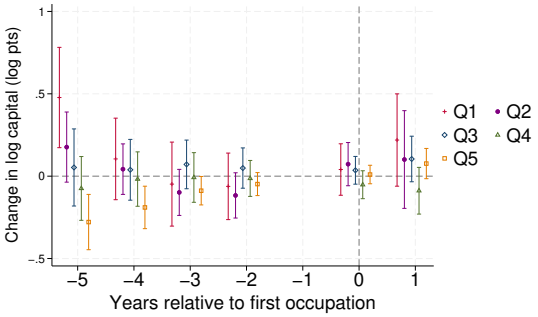


(d) Firms in long-term occupation

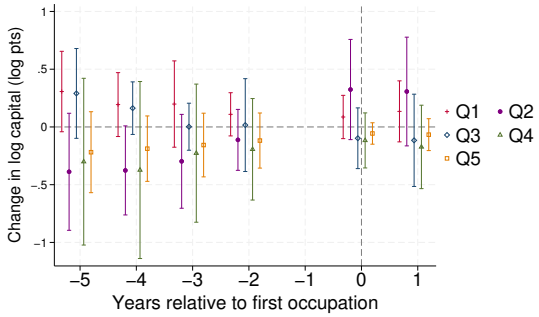
Figure E.2: Heterogeneity of dynamic effects of occupation on firm employment by firm size

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with firm size quintile dummies (Q1=smallest, Q5=largest; measured by total assets in 2021) for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

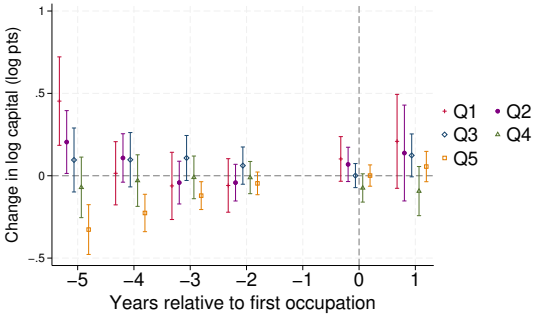


(a) Firms in short-term occupation

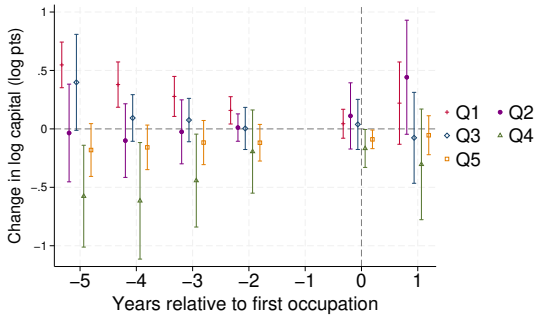


(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)



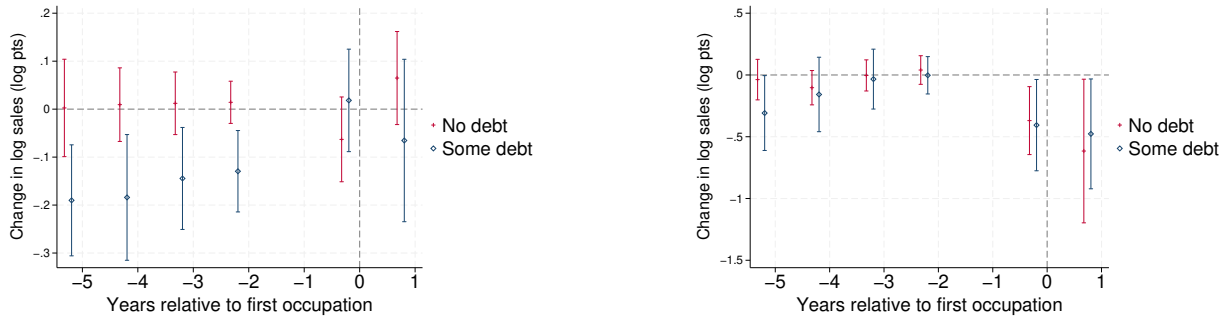
(c) Firms in short-term occupation



(d) Firms in long-term occupation

Figure E.3: Heterogeneity of dynamic effects of occupation on firm capital by firm size

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with firm size quintile dummies (Q1=smallest, Q5=largest; measured by total assets in 2021) for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.



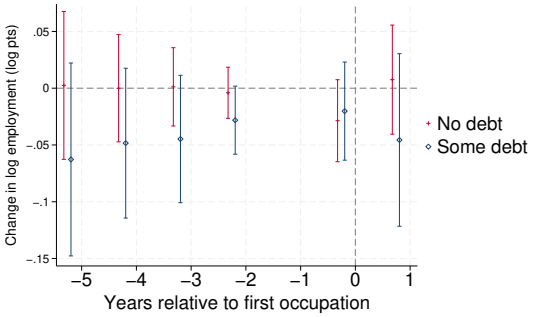
(a) Firms in short-term occupation

(b) Firms in long-term occupation

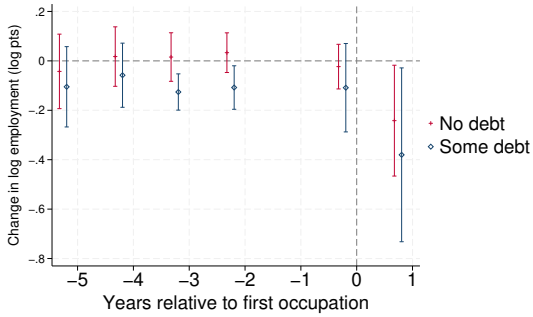
Figure E.4: Heterogeneous effects of occupation on sales by external finance use (unbalanced panel)

Notes: Figure plots estimates from equation (1), interacting event-time indicators D^k_{ilt} with a binary indicator for use of long-term debt in 2021 (debt-free vs. debt-using) for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

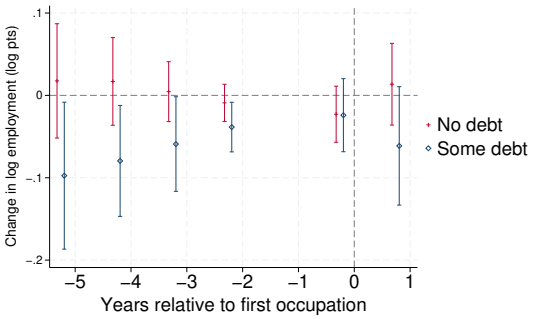


(a) Firms in short-term occupation

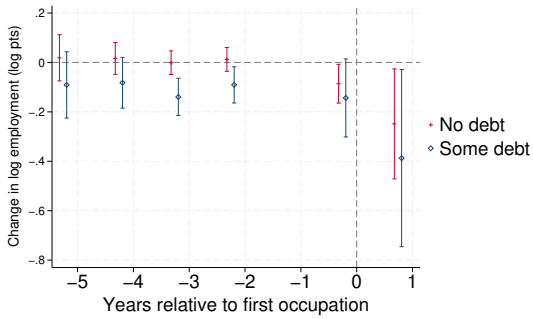


(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)



(c) Firms in short-term occupation

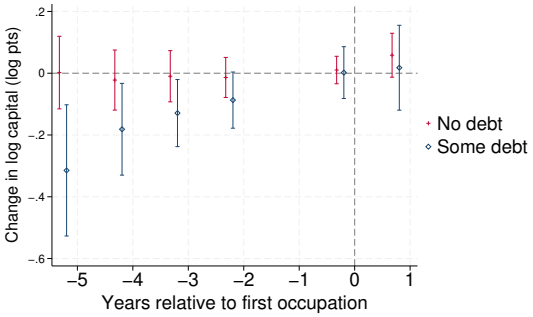


(d) Firms in long-term occupation

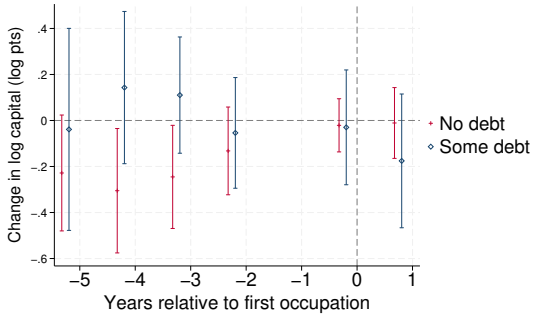
Figure E.5: Heterogeneity of dynamic effects of occupation on firm employment by use of debt finance

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with a binary indicator for use of long-term debt in 2021 (debt-free vs. debt-using) for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

Panel A: Balanced panel (2017–2023)

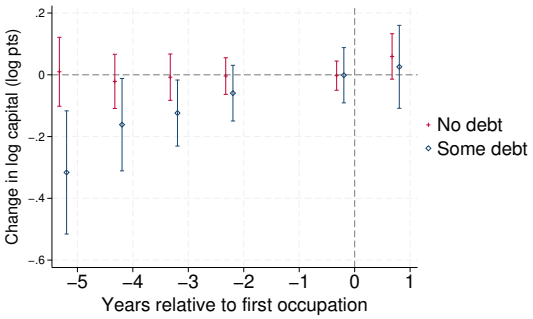


(a) Firms in short-term occupation

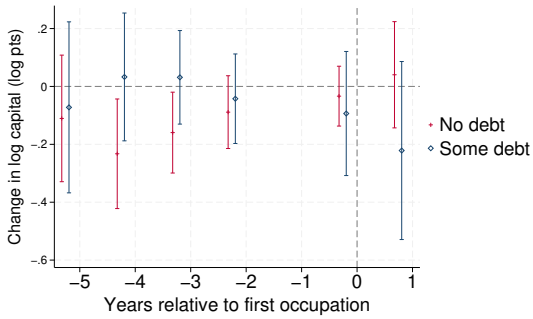


(b) Firms in long-term occupation

Panel B: Unbalanced panel (including firms not reporting in 2023)



(c) Firms in short-term occupation



(d) Firms in long-term occupation

Figure E.6: Heterogeneity of dynamic effects of occupation on firm capital by use of debt finance

Notes: Figure plots estimates from equation (1), interacting event-time indicators $D^k_{i\ell t}$ with a binary indicator for use of long-term debt in 2021 (debt-free vs. debt-using) for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. $t = 1$ is the omitted baseline period. Y-axis units are log points and x-axis plots years relative to the year of the first occupation. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Panel A reports results for the balanced panel of firms continuously present in 2017–2023. Panel B reports the results for an unbalanced panel of firms reporting through 2022, including firms missing in the 2023 sample. Fixed effects include firm, industry-by-year, and region-by-year fixed effects, as described in the text. Standard errors are clustered at the firm and postal area level. Confidence intervals are at 95% level.

F Heterogeneity of effects by occupation duration

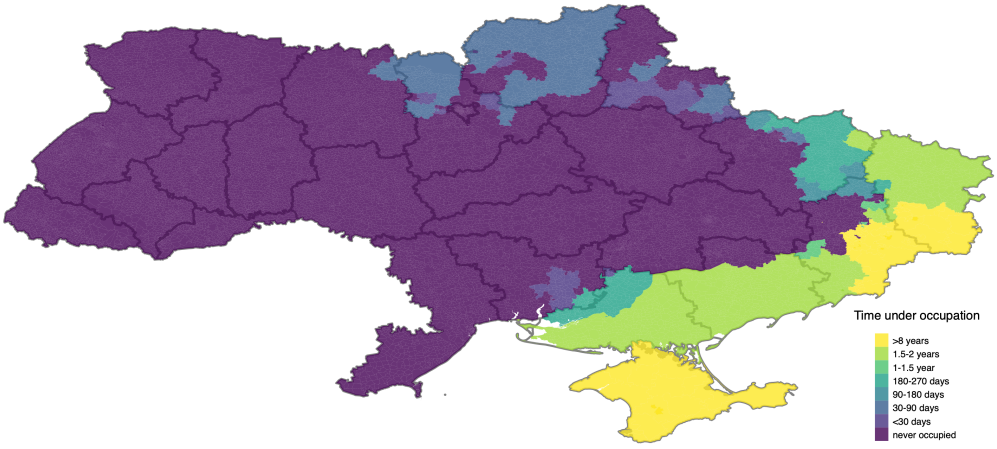


Figure F.1: Time spent under military occupation by postal area

Notes: This map shows the time spent under Russian occupation for each postal area in Ukraine according to Decree No. 910 "On approval of Amendments to the List of Territories that Experience (Have Experienced) Combat or are Temporarily Occupied by the Russian Federation."

Table F.1: Differential effects of long-term occupation on firm outcomes (unbalanced panel)

	(1)	(2)	(3)	(4)
Sales				
LR occupation × Year=2022	-0.469*	-0.465*	-0.465***	-0.465***
	(0.226)	(0.218)	(0.083)	(0.128)
LR occupation × Year=2023	-0.651*	-0.691**	-1.142***	-1.142***
	(0.265)	(0.257)	(0.170)	(0.234)
Employment				
LR occupation × Year=2022	-0.167	-0.173	-0.173***	-0.173***
	(0.136)	(0.132)	(0.036)	(0.035)
LR occupation × Year=2023	-0.375*	-0.413**	-0.491***	-0.491***
	(0.160)	(0.155)	(0.078)	(0.090)
Fixed Capital				
LR occupation × Year=2022	-0.025	-0.027	-0.027	-0.027
	(0.262)	(0.252)	(0.046)	(0.044)
LR occupation × Year=2023	0.084	0.034	-0.092	-0.092
	(0.308)	(0.297)	(0.076)	(0.075)
N	4417	4417	4417	4417
Industry-by-year FE	No	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes
Clustered by firm ID	No	No	Yes	Yes
Double clustering firm ID and postal area	No	No	No	Yes

Notes: Results from estimating equation (2) for firms experiencing short-term or long-term occupation. The analysis sample is the unbalanced panel of firms continuously reporting from 2017 to 2022, including firms missing in the 2023 sample. Dependent variables are log sales, log employment, and log fixed capital. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Standard errors in parentheses; column (3) clusters at the firm level, column (4) double-clusters at the firm and postal area levels. * (p<0.10), ** (p<0.05), *** (p<0.01).

Table F.2: Differential effects of occupation duration on firm outcomes

	(1)	(2)	(3)	(4)
Sales				
Months occupied × Year=2022	0.001	0.001	0.001	0.001
	(0.028)	(0.027)	(0.008)	(0.010)
Months occupied × Year=2023	-0.084**	-0.085**	-0.085***	-0.085***
	(0.028)	(0.027)	(0.017)	(0.023)
Employment				
Months occupied × Year=2022	-0.007	-0.007	-0.007*	-0.007
	(0.017)	(0.017)	(0.004)	(0.004)
Months occupied × Year=2023	-0.038*	-0.039*	-0.039***	-0.039***
	(0.017)	(0.017)	(0.008)	(0.009)
Fixed Capital				
Months occupied × Year=2022	-0.006	-0.006	-0.006	-0.006
	(0.033)	(0.032)	(0.006)	(0.005)
Months occupied × Year=2023	-0.009	-0.010	-0.010	-0.010
	(0.033)	(0.032)	(0.008)	(0.008)
N	3735	3735	3735	3735
Industry-by-year FE	No	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes
Clustered by firm ID	No	No	Yes	Yes
Double clustering firm ID and postal area	No	No	No	Yes

Notes: Results from estimating a variant of equation (2) for firms experiencing short-term or long-term occupation, with the LR indicator replaced by the number of months under occupation since February 2022. The analysis sample is the balanced panel of ever-occupied firms continuously reporting from 2017 to 2023. Dependent variables are log sales, log employment, and log fixed capital. Percent changes in outcome variables can be calculated as $100 \times (e^{\beta} - 1)$. Standard errors in parentheses; column (3) clusters at the firm level, column (4) double-clusters at the firm and postal area levels. * (p<0.10), ** (p<0.05), *** (p<0.01).