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Paper Firms and Formal Payrolls: Registry Unification, Digital Tax-Risk Enforcement, and the Inactive-Enterprise Wedge Across Uzbekistan's Districts and Sectors

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Abstract

When transition states synchronize corporate registries with automated value-added tax risk scoring, does a steep contraction in active enterprise counts reflect proportional formal-payroll contraction or a two-stage administrative purge of dormant registrations? Combining harmonized district-year panels across 147 boundary-consistent parent jurisdictions covering roughly 84% of national commercial entities and formal payrolls (2016–2025, N = 1,470; payroll window 2017–2024, N = 1,176) with population-matched monthly panels across all 14 regions and nine commercial sectors of Uzbekistan (January 2022–September 2026, N = 7,182), we trace the inactive-enterprise wedge across inter-agency database unification, the January 2023 value-added tax rate cut, and compulsory deregistration. Nationally, commercial inactivity rose from 5.83% at year-end 2022 to 44.86% at year-end 2024 as operating entities fell by 31.38% alongside descriptive national growth in formal workbook employment (+2.95%) and real monthly wages (+14.01%), before receding to 32.06% at year-end 2025 during concentrated register removals. Under region-by-sector and region-by-month fixed effects with exact 14-region wild cluster bootstrap inference, invoice-chain-intensive sectors (industry, construction, and trade) exhibit a 5.56-percentage-point wider inactivity differential during the late-reclassification and deregistration phase (bootstrap p = 0.00012; 95% bootstrap confidence set [4.87, 6.26]), whereas saturating sector-by-month shocks leaves predetermined 2022Q1 regional-sector inactivity and specialization gradients statistically unresolved. Across districts, a 10-percentage-point higher 2019 trade-and-construction share yields conditional 2024 differences of -0.0160 log points in formal employment (bootstrap p = 0.4161; 95% confidence set [-0.0590, 0.0227]; 14-region 80% minimum detectable effect 0.0559) and -0.0281 in real wages (bootstrap p = 0.0908; [-0.0665, 0.0044]), surviving Greater Tashkent transfer restoration and pre-2022 district drift controls.

Keywords: enterprise registry synchronization; value-added tax enforcement; inactive business entities; formal employment; Uzbekistan; wild cluster bootstrap

1. Introduction

Modernizing tax administrations across developing and transition economies increasingly combine simplified business registration with automated third-party data cross-checking and digital value-added tax risk scoring (Kleven et al., 2016; Pomeranz, 2015; Slemrod & Gillitzer, 2014; Naritomi, 2019). Stream-

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lined incorporation lowers formal entry barriers for small enterprises (Bruhn & McKenzie, 2014; La Porta & Shleifer, 2014; Hsieh & Olken, 2014), yet fragmented inter-agency registries and delayed exit administration allow non-operating legal entities to accumulate on commercial rolls, distorting headline firm-demography series and creating compliance vulnerabilities along value-added tax invoice chains (de Paula & Scheinkman, 2010; Carrillo et al., 2017; Ulyssea, 2018; Waseem, 2023). When tax, statistical, and registration authorities subsequently synchronize corporate databases, tighten threshold- or risk-based compliance monitoring, and enforce compulsory deregistration of dormant entities, active enterprise counts can contract sharply (Harju et al., 2018; Klimsa & Ullmann, 2023). Distinguishing genuine formal-sector payroll contraction from a two-stage administrative purge of dormant registrations is therefore central to macroeconomic diagnosis and tax-administration design (Ulyssea, 2020; Dix-Carneiro et al., 2026).

Uzbekistan's post-2021 tax and enterprise-registry reforms offer a transparent institutional setting to examine this mechanism. Between late 2021 and 2025, Uzbekistan implemented four intersecting institutional measures: automated value-added tax registration risk segmentation and certificate suspension under Cabinet of Ministers Resolution No. 595 effective 23 December 2021 (Cabinet of Ministers of the Republic of Uzbekistan, 2021); inter-agency unification of tax, statistical, and justice legal-entity registries under Presidential Decree No. PF-113 of 20 April 2022 (President of the Republic of Uzbekistan, 2022); a statutory reduction of the standard value-added tax rate from 15% to 12% on 1 January 2023 under Law No. ZRU-812 (Oliy Majlis of the Republic of Uzbekistan, 2022; Toshmatov et al., 2022; Niyazmetov et al., 2023); and administrative transfer and compulsory deregistration of non-operating commercial entities from the Unified State Register under Cabinet of Ministers Resolution No. 704 (Cabinet of Ministers of the Republic of Uzbekistan, 2019). Across these milestones, Uzbekistan's national commercial inactivity share rose by 39.03 percentage points between year-end 2022 and year-end 2024 as operating commercial counts contracted by nearly one-third alongside continued aggregate growth in formal workbook employment and real wages, before concentrated register removals compressed the inactivity wedge in 2025 (Section 4.1; National Statistics Committee of the Republic of Uzbekistan, 2026; National Statistics Committee of the Republic of Uzbekistan, 2026).

We examine the subnational and sectoral anatomy of this inactive-enterprise wedge by combining two population-consistent official datasets available prior to the 13 November 2026 evidence cutoff (National Statistics Committee of the Republic of Uzbekistan, 2026; National Statistics Committee of the Republic of Uzbekistan, 2026): (i) an annual district-level panel across 147 boundary-consistent parent districts and cities over 2016–2025 (N = 1,470 for commercial counts; N = 1,176 over 2017–2024 for formal workbook employees and employment-weighted real monthly wages), encompassing roughly 84% of national commercial entities and formal employees, supplemented by consolidated Greater Tashkent (148 units) and full 26-transfer-district (149 units) restorations representing all 206 source districts; and (ii) a monthly region-by-sector panel across all 14 first-level regions and nine matched commercial activity sectors (excluding farms, dehkan households, and non-commercial public institutions) over 57 balanced months from January 2022 to September 2026 (N = 7,182). Across all baseline and supplemental specifications, we pair unit-clustered CR1 standard errors with exact restricted Rademacher wild cluster bootstrap inference enumerating the complete regional sign space (8,192 unique two-sided sign assignments across 14 regions; Cameron et al., 2008; MacKinnon & Webb, 2018; Roodman et al., 2019; MacKinnon et al., 2023).

Three empirical findings emerge. First, national and monthly stock accounting establishes a sequential two-stage registry adjustment: operating-entity reclassifications expanded the inactive-entity gap by 261,728 units across 2023–2024 before concentrated register removals—peaking in the 1 September 2025 stock (−96,585 registered entities in a single month)—compressed the gap by 101,929 units in 2025 (Section 4.1). Second, in our monthly two-way interactive fixed-effects model absorbing region-by-sector and region-by-month shocks, invoice-chain-intensive commercial sectors (industry, construction, and whole-

sale/retail trade) exhibit a +2.53-percentage-point wider inactivity differential during active reclassification (exact bootstrap $p = 0.00012$) and a +5.56-percentage-point wider differential during the late-reclassification and deregistration phase (clustered standard error 1.13, exact bootstrap $p = 0.00012$, 95% bootstrap confidence set $[4.87, 6.26]$), persisting across statutory November 2024 (+5.69) and February 2025 (+5.96) phase starts, small-business populations (+5.24), and all 14 leave-one-region-out deletions ($[5.35, 5.71]$, all $p < 0.00025$). In a separate saturated triple-difference equation that absorbs sector-by-month fixed effects, predetermined 2022Q1 regional-sector inactivity (−1.16 percentage points, bootstrap $p = 0.7687$, 95% confidence set $[-8.11, 11.82]$) and regional sector shares (−2.06 percentage points, bootstrap $p = 0.1868$) yield statistically unresolved within-sector exposure gradients (Section 4.2). Third, across the 147 parent districts, a 10-percentage-point higher predetermined 2019 trade-and-construction operating share predicts conditional 2024 differences (relative to 2022, after absorbing national year effects) of −0.0160 log points in formal workbook employment (bootstrap $p = 0.4161$, 95% confidence set $[-0.0590, 0.0227]$, 14-region 80% minimum detectable effect 0.0559) and −0.0281 log points in real monthly wages (bootstrap $p = 0.0908$, 95% confidence set $[-0.0665, 0.0044]$, 14-region minimum detectable effect 0.0506), remaining close to zero when restoring all cross-regional transfer districts or controlling for pre-2022 district employment drift (+0.0029, bootstrap $p = 0.9130$; Section 5.2).

This study contributes to three literatures. First, it extends research on digital tax enforcement and value-added tax invoice chains (de Paula & Scheinkman, 2010; Pomeranz, 2015; Dwenger et al., 2016; Carrillo et al., 2017; Naritomi, 2019; Waseem, 2023) by separating active-status reclassification from compulsory register removal across population-matched monthly commercial series. Second, it informs the firm-demography and informality literature (La Porta & Shleifer, 2014; Hsieh & Olken, 2014; Bruhn & McKenzie, 2014; Ulyssea, 2018; Ulyssea, 2020; Guerrero-Amezaga et al., 2022; Dix-Carneiro et al., 2026) by quantifying how accumulated dormant shells distort headline firm-contraction metrics relative to formal payroll trajectories. Third, it provides subnational empirical evidence on post-Soviet fiscal and enterprise-registry modernization in Central Asia (Borgersen & King, 2016; Pomfret, 2019; Toshmatov et al., 2022; Niyazmetov et al., 2023).

2. Institutional Timeline and Analytical Hypotheses

2.1. Registry Unification, Tax-Risk Scoring, and Compulsory Deregistration

Auditing historical Uzbek- and Russian-language statutory editions establishes the exact enactment and effectiveness calendar governing commercial registration and tax-status administration between 2021 and 2026:

1. **Automated value-added tax risk segmentation (effective 23 December 2021)**: Cabinet of Ministers Resolution No. 595 of 22 September 2021 introduced automated daily risk profiling of value-added tax registrants, three-tier risk classification, and certificate suspension for registrants lacking verified economic activity for more than three months (subject to a seasonal-activity exception), revised on 5 December 2023 around transaction-nomenclature mismatches with a 30-day suspension cap (Cabinet of Ministers of the Republic of Uzbekistan, 2021). Because monthly regional-sector commercial stocks commence in January 2022, our monthly panel observes post-enactment enforcement evolution without a pre-December-2021 monthly baseline.
2. **Inter-agency legal-entity database unification (May–December 2022)**: Presidential Decree No. PF-113 of 20 April 2022 (effective 21 April 2022, Roadmap Item 45) mandated an inter-agency inventory and real-time identifier synchronization across tax, statistical, and justice registries for legal entities and individual entrepreneurs between May and December 2022 (President of the Republic of Uzbekistan, 2022). In first-of-month stock series, 1 June 2022 is the first observation reflecting a completed calendar month of reconciliation.

3. **Value-added tax rate cut and active-status reclassification (from January 2023)**: Law No. ZRU-812 of 30 December 2022 lowered the standard value-added tax rate from 15% to 12% effective 1 January 2023 while strengthening chain compliance incentives (Oliy Majlis of the Republic of Uzbekistan, 2022). In first-of-month data, 1 January 2023 captures the year-end 2022 pre-cut stock boundary, and 1 February 2023 marks the first completed post-cut stock. Throughout 2023 and 2024, synchronized tax-statistical reporting reclassified non-filing and suspended registrants out of operating status while leaving them on the legal register.
4. **Late reclassification and compulsory deregistration under Resolution No. 704 (2024–2026)**: Cabinet of Ministers Resolution No. 704 of 21 August 2019 (effective 1 January 2020) established a two-step administrative procedure: commercial entities exhibiting nine months without financial bank inflows and tax reports are transferred to an inactive register, and removed from the Unified State Register if activity does not resume within three years (Cabinet of Ministers of the Republic of Uzbekistan, 2019). Amendments published on 10 November 2025 introduced shorter three- and six-month bank-account and operational triggers for newly formed entities while preserving the three-year inactive-status deletion interval. Historical edition checks confirm that no new deregistration statute took effect on 1 September 2024: registered commercial stocks continued rising through 1 January 2025 before three-year dormancy expirations produced concentrated removals peaking in the 1 September 2025 stock (−96,585 registered entities). Accordingly, we designate September 2024–January 2026 as the late-reclassification and deregistration phase and evaluate sensitivity across November 2024, February 2025, and September 2025 phase boundaries. Throughout our analysis, non-operating registrants are defined neutrally as administratively inactive commercial entities without attributing illicit invoicing or tax fraud to aggregate stock counts.

2.2. Accounting Identity and Falsifiable Hypotheses

Let R_{it} and O_{it} denote registered and operating commercial entities in jurisdiction or cell i at stock date t. The inactive-enterprise gap $W_{it} \equiv R_{it} - O_{it}$ and administrative inactivity rate $s_{it} \equiv 100 \times (R_{it} - O_{it})/R_{it}$ satisfy the exact intertemporal accounting identity:

$$\Delta W_{it} = \Delta R_{it} - \Delta O_{it}. \tag{1}$$

When database reconciliation and digital tax-risk suspension reclassify dormant registrants before three-year deregistration clocks expire, $-\Delta O_{it} > 0$ drives $\Delta W_{it} > 0$ in a first stage; when compulsory deregistration subsequently purges accumulated inactive records ($\Delta R_{it} < 0$) while surviving entrants operate ($\Delta O_{it} > 0$), both terms compress $\Delta W_{it} < 0$ and lower the ratio $(R_{it} - O_{it})/R_{it}$ from its peak while leaving post-reclassification inactivity elevated relative to the pre-reconciliation baseline. Embedding this accounting structure into sectoral value-added tax chains and local labor markets yields three falsifiable hypotheses:

- **Hypothesis 1 (Two-stage registry adjustment)**: Aggregate and regional commercial stocks exhibit an initial operating-count contraction and inactivity-wedge expansion across 2023–2024 ($\Delta O < 0, \Delta W > 0$), followed by concentrated registered-stock removal and operating-stock recovery in 2025 ($\Delta R < 0, \Delta W < 0$).
- **Hypothesis 2 (Cross-sector invoice-chain divergence and within-sector regional exposure)**: Commercial sectors embedded in multi-stage value-added tax invoice chains (industry, construction, and wholesale/retail trade) exhibit larger post-2022 inactivity differentials and deeper registered-stock contractions than service sectors; in a distinct within-sector estimand absorbing nationwide sector-by-month shocks, we test whether regional-sector cells with higher predetermined 2022Q1 inactivity or sector shares exhibit steeper adjustments.

- **Hypothesis 3 (Conditional district payroll gradients)**: If reclassified and deregistered registrants consist predominantly of zero-payroll dormant shells, districts with higher predetermined 2019 trade-and-construction exposure will exhibit muted conditional post-2022 differences in formal workbook employment and real monthly wages relative to cross-district operating-firm contractions, evaluated against finite-cluster confidence sets, regional minimum detectable effects, and coverage-attenuation bounds.

3. Data Harmonization, Coverage Accounting, and Econometric Specifications

3.1. District Boundary Consolidation, Coverage Shares, and Payroll Denominators

Official annual district releases span 221 rows (1 national total, 14 first-level regions, and 206 districts and cities). Auditing administrative codes and parliamentary boundary decrees identifies 13 post-2017 newly created districts with pre-creation structural zeros alongside cross-jurisdictional territory transfers (National Statistics Committee of the Republic of Uzbekistan, 2026). To ensure geographic invariance within regional inference clusters in the primary panel, we exclude 26 source jurisdictions involved in cross-regional boundary transfers—24 jurisdictions in the Tashkent City–Tashkent Region transfer belt plus the Gijduvan–Kanimekh transfer pair between Bukhara and Navoi—and consolidate the remaining 180 source jurisdictions into 147 time-consistent parent districts (17 multi-district parents uniting 50 source units plus 130 unsplit districts) across 2016–2025 ($N = 1{,}470$). Exact national coverage accounting confirms that the 147 retained parent districts encompass 84.39% (472,491/559,862) of national registered commercial entities in 2022 and 83.62% (548,695/656,161) in 2024, 84.58% and 82.46% of operating commercial entities, and 84.79% (4,334,788/5,112,154) and 84.00% (4,420,884/5,262,733) of formal workbook employees. The 24 Tashkent transfer districts account for 14.37%–16.69% across these six national totals, while Gijduvan and Kanimekh account for 0.79%–0.85%. To verify that excluding the capital agglomeration belt does not drive our subnational conclusions, Section 5.2 restores the 24 Tashkent transfer districts as a consolidated Greater Tashkent unit (148 units, $G = 13$ clusters) and separately restores all 26 transfer districts (149 units, $G = 12$ merged clusters, representing all 206 source districts).

Additive counts (R_{dt}, O_{dt}, newly created entities, and formal workbook employees L_{dt}) are summed within parent districts prior to forming ratios or logarithms. Accrued nominal annual-average monthly wages are aggregated within consolidated parents using contemporaneous formal workbook employment weights ($\bar{w}_{dt} = \sum_{j \in d} L_{jt} \bar{w}_{jt} / \sum_{j \in d} L_{jt}$) and deflated to constant 2017 Uzbek soums using chained national annual-average consumer price indices (2017 = 100, reaching 187.48 in 2022, 226.03 in 2024, and 245.92 in 2025; National Statistics Committee of the Republic of Uzbekistan, 2026). Because official district formal workbook employment concludes in 2024, primary district payroll regressions span 2017–2024 ($N = 1{,}176$) without extrapolating 2025 employment weights, whereas unsplit districts (130 jurisdictions) require no consolidation weights and extend real-wage sensitivity checks through 2025 ($N = 1{,}170$). In official district labor accounts, formal workbook employment covers all employees holding formal labor workbooks across commercial enterprises, farms, and public-sector budgetary institutions (schools, hospitals, and state administration), because no district-year series cross-classifies workbook holders by private commercial status. If non-commercial payrolls do not respond to commercial-registry enforcement, any true conditional elasticity among private commercial employees equals β_{total}/s_c, where $s_c \in (0, 1)$ denotes the unobserved private-commercial share of formal workbook employment.

Calendar alignment matches measurement dates: 1 January commercial stocks in year $t + 1$ measure year-end stocks for calendar year t (1 January 2023 maps to year-end 2022; 1 January 2026 maps to year-end 2025), aligning with calendar-year t new-entity flows, employment, and annual-average wages. Auditing Kashkadarya's constituent districts identifies an eight-cell row transposition in published operating totals between Kasbi and Kukdala over 2022–2025; because both belong to the consolidated Chi-

rakchi–Kasbi–Kukdala parent unit, additive parent aggregation eliminates internal swap distortion automatically, verified alongside an explicit row-aligned 148-unit check.

3.2. Population-Matched Monthly Commercial Sector Panel

In monthly regional releases from January 2022 to September 2026 (57 balanced months across 14 regions ×9 economic activity sectors, $N = 7{,}182$), we pair first-of-month registered and operating commercial business entities (excluding farms, dehkan households, and non-profit public institutions) one-to-one across nine sectors: industry, construction, wholesale and retail trade, transportation and storage, accommodation and food services, information and communication, health and social services, commercial agriculture/forestry/fisheries firms, and other commercial services (National Statistics Committee of the Republic of Uzbekistan, 2026). Comparing the nine-sector sum against official regional commercial totals across 798 region-month cells yields small statistical reconciliation residuals bounded within 1.35% of registered totals and 1.63% of operating totals. In Information and Communication, 27 region-month cells in Bukhara, Namangan, and Karakalpakstan during 2022–2023M01 display published operating counts exceeding registered counts by 1 to 22 firms (inactivity rates down to −5.64%); we retain published values in the baseline and verify robustness when excluding Information and Communication ($N = 6{,}384$), shifting baseline anchors, and using 58-month small-business panels ($N = 7{,}308$).

3.3. Econometric Specifications, Inference, and Power Calculations

At the district-year level, we estimate dynamic event-study regressions anchored to each parent district's predetermined year-end 2019 share of operating commercial entities in wholesale/retail trade and construction (E_d, scaled per 10 percentage points, omitting 2022 as reference year; de Chaisemartin & D'Haultfœuille, 2020):

$$y_{dt} = \alpha_d + \lambda_t + \sum_{\tau \neq 2022} \beta_\tau \left(\frac{E_d}{0.10} \right) \mathbf{1}\{t = \tau\} + \varepsilon_{dt}. \tag{2}$$

Because year fixed effects λ_t absorb common national macroeconomic and policy shifts, β_τ identifies conditional cross-district differences per 10-percentage-point higher predetermined exposure relative to 2022. At the monthly region-by-sector level, we partition post-May-2022 stocks relative to the omitted January–May 2022 baseline into four institutional windows: registry verification (June 2022–January 2023), active reclassification (February 2023–August 2024), late reclassification and deregistration (September 2024–January 2026, tested alongside November 2024, February 2025, and September 2025 phase starts), and stabilization (February–September 2026). We estimate two distinct, full-rank equations targeting separate estimands. Equation (2), our two-way interactive fixed-effects sector-chain specification, absorbs region-by-sector (μ_{rs}) and region-by-month (λ_{rm}) fixed effects to estimate cross-sector phase differentials for invoice-chain-intensive sectors ($H_s = 1$ for industry, construction, and trade):

$$y_{rsm} = \mu_{rs} + \lambda_{rm} + \sum_p \beta_p (H_s \times D_{pm}) + \varepsilon_{rsm}. \tag{3}$$

Equation (3), our saturated triple-difference specification, additionally absorbs sector-by-month fixed effects (θ_{sm})—which absorb $H_s \times D_{pm}$—and estimates within-sector regional exposure gradients with respect to predetermined 2022Q1 regional-sector inactivity ($B_{rs}/0.10$) and regional sector registration share ($S_{rs}/0.10$):

$$y_{rsm} = \mu_{rs} + \lambda_{rm} + \theta_{sm} + \sum_p \left[\gamma_p \left(\frac{B_{rs}}{0.10} \right) + \delta_p \left(\frac{S_{rs}}{0.10} \right) \right] D_{pm} + \varepsilon_{rsm}. \tag{4}$$

Every projected design matrix is verified to have full column rank. Alongside CR1 standard errors clustered by parent district ($G = 147$) or region-sector ($G = 126$), we conduct null-imposed Rademacher

wild cluster bootstrap inference clustered at the first-level regions, enumerating all 2^{G_r-1} unique two-sided sign assignments (8,192 for $G_r = 14$; 4,096 for $G_r = 13$ region-deletion and Greater Tashkent models; 2,048 for $G_r = 12$ full-restoration models) with orthogonal residual projection and test-inverted 95% confidence sets (Cameron et al., 2008; Roodman et al., 2019; MacKinnon et al., 2023). Approximate two-sided 5%-level, 80%-power minimum detectable effects follow $(t_{0.975,G-1} + z_{0.80}) \times \mathrm{SE}_{\mathrm{CR1}}$ and are reported separately under district clustering ($G = 147$) and regional clustering ($G_r = 14$).

4. Empirical Results

4.1. National Two-Stage Registry Trajectory and Summary Distributions

Figure 1 and Table 1 document the national trajectory of Uzbekistan's commercial enterprise register alongside sample distributions. Consistent with Hypothesis 1, Figure 1 (Panel a) shows that national registered and operating commercial entities tracked closely through 1 January 2023 (559,862 registered vs. 527,222 operating; 5.83% inactive), diverged sharply across 2023–2024 as operating counts fell to 420,772 at year-end 2023 (32.03% inactive) and 361,793 at year-end 2024 (44.86% inactive, a −31.38% operating drop from year-end 2022) while registered counts rose to 656,161 (+96,299), and then reconverged during 2025 to 600,289 registered (−55,872) and 407,850 operating entities (+46,057; 32.06% inactive). Monthly stock decompositions in Figure 1 (Panel c) confirm that $-\Delta O_t$ accounted for the +261,728 inactive-gap expansion over 2023–2024, whereas concentrated register removals peaking in the 1 September 2025 stock (−96,585 registered vs. +3,211 operating) drove the −101,929 gap compression in 2025. Descriptively, national indexed series in Figure 1 (Panel b) move in opposite directions between 2022 and 2024: while operating commercial counts fell by 31.38%, national formal workbook employees increased from 5,112,154 to 5,262,733 (+2.95%) and real monthly wages rose from 1,709,114 to 1,948,491 constant 2017 soums (+14.01%, reaching 2,106,099 in 2025).

Table 1. Summary statistics across the harmonized district-year panel (2016–2025) and monthly region-by-sector commercial panel (January 2022–September 2026).

Panel & variable (unit)	*N*	Mean	SD	P25	Median	P75	Min	Max
District-year: Registered commercial entities	1,470	2,552.29	3,199.35	832.0	1,534.0	2,573.5	90	23,558
District-year: Operating commercial entities	1,470	2,080.94	2,591.40	735.5	1,233.5	2,010.8	78	19,513
District-year: Newly created entities	1,470	427.53	488.22	153.0	279.0	473.0	11	4,203
District-year: Administrative inactivity rate (pp)	1,470	15.28	16.12	3.44	6.78	27.10	0.00	61.54
District-year: Inactive entity gap, $R - O$ (entities)	1,470	471.36	1,001.85	37.0	116.0	496.0	0	10,726
District-year: Formal workbook employees (persons)	1,176	28,056.3	31,781.9	12,427.3	17,830.5	25,420.3	2,431	194,710
District-year: Real monthly wage (2017 UZS)	1,176	1,297,424	473,357	1,046,521	1,165,943	1,330,502	721,162	4,410,077

(continued)

Table 1 (continued)

Panel & variable (unit)	*N*	Mean	SD	P25	Median	P75	Min	Max
District: 2019 trade & construction share (proportion)	147	0.419	0.060	0.385	0.422	0.457	0.168	0.580
Monthly cell: Registered commercial entities	7,182	4,781.03	6,008.57	1,227.3	2,999.5	5,492.8	153	50,870
Monthly cell: Operating commercial entities	7,182	3,416.29	4,479.44	904.3	2,078.5	3,886.0	129	37,966
Monthly cell: Administrative inactivity rate (pp)	7,182	26.98	15.22	12.62	28.64	38.34	-5.64	69.39
Monthly cell: 2022Q1 baseline inactivity (proportion)	126	0.052	0.023	0.037	0.052	0.066	-0.037	0.113
Monthly cell: 2022Q1 regional sector share (proportion)	126	0.111	0.100	0.034	0.087	0.155	0.010	0.382

Notes. District-year commercial series cover 147 boundary-consistent parent jurisdictions over 2016–2025 (N = 1,470, representing 84.39% of national registered commercial entities in 2022); formal workbook employees and employment-weighted real monthly wages cover the balanced 2017–2024 window (N = 1,176). Monthly commercial cells cover 14 regions ×9 matched commercial sectors over 57 months (N = 7,182); negative minimum monthly inactivity reflects 27 published Information and Communication cells in 2022–2023M01 where operating counts slightly exceeded registered counts.

4.2. Sector-Chain Divergence, Within-Sector Exposure Gradients, and District Payroll Bounds

Table 2 and Figure 2 report our primary econometric estimates. In the monthly two-way interactive fixed-effects specification absorbing region-by-sector and region-by-month shocks (Table 2 Panel B and Figure 2 Panel b), invoice-chain-intensive commercial sectors (industry, construction, and trade) exhibit a modest negative differential during initial 2022 database verification (−0.434 percentage points, exact 14-region bootstrap p = 0.00024), followed by a sharp upward differential of +2.531 percentage points during the 2023M02–2024M08 active reclassification window (p = 0.00012), +5.557 percentage points during the 2024M09–2026M01 late-reclassification and deregistration window (cell-clustered standard error 1.130, exact bootstrap p = 0.00012, 95% bootstrap confidence set [4.869, 6.265]), and +6.193 percentage points during 2026M02–2026M09 stabilization (p = 0.00012). Component count regressions confirm that invoice-chain sectors experienced both steeper operating-entity contractions (−0.083, −0.203, and −0.271 log points across the three post-2022 phases, all p = 0.00012) and deeper registered-stock contractions (−0.047, −0.113, and −0.183 log points, all p = 0.00012), demonstrating that elevated inactivity differentials persisted relative to early 2022 even as compulsory removals compressed registered stocks from late 2025 onward.

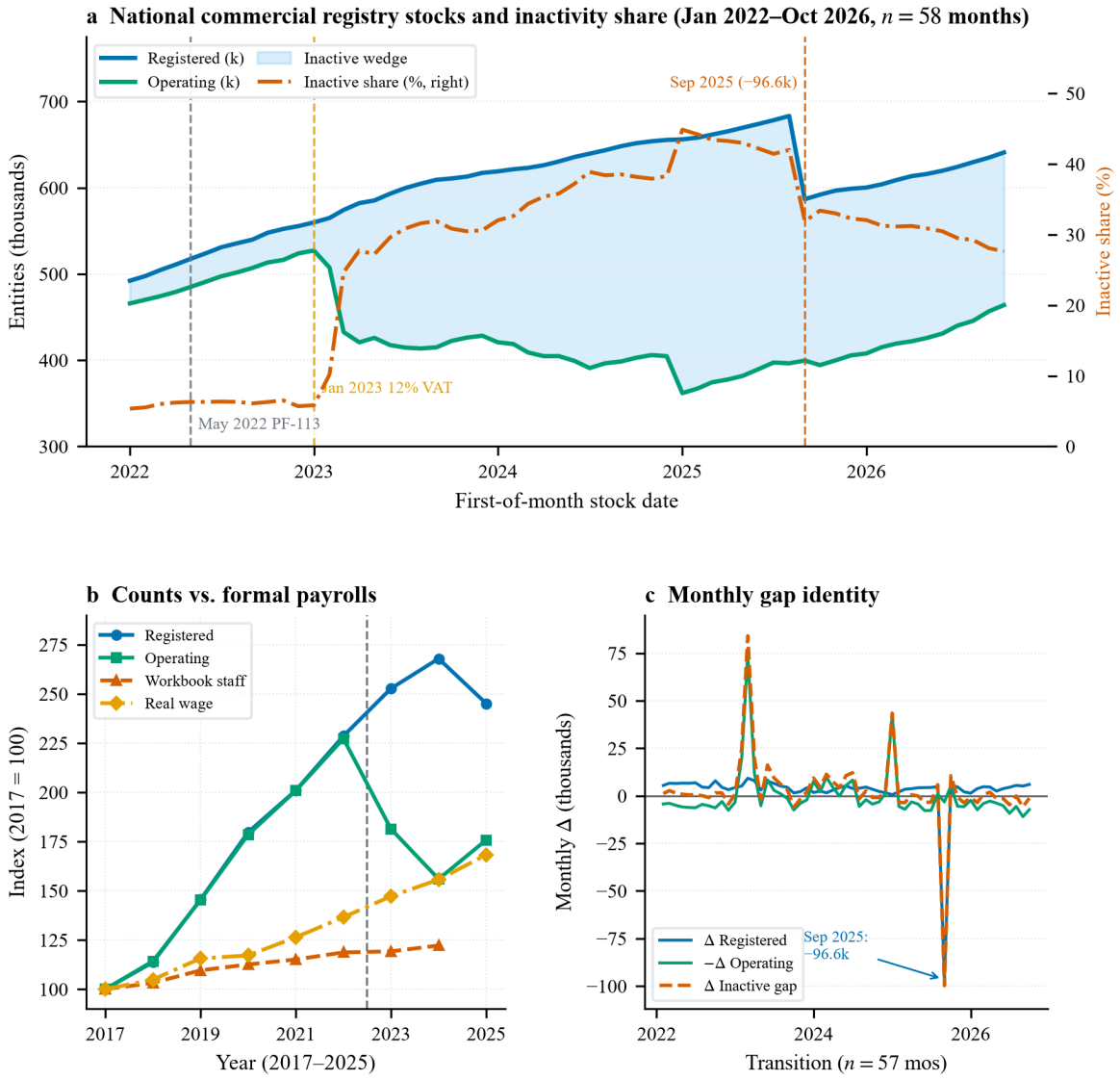


Figure 1. National commercial registry stocks, formal payroll indices, and monthly gap accounting.

Notes. Panel a plots monthly first-of-month national registered and operating commercial entities (left axis, excluding farms and dehkan households) and the administrative inactivity share (right axis) from January 2022 to October 2026 (n = 58 months), annotating Decree No. PF-113 database reconciliation (May 2022), the 12% value-added tax rate cut under Law No. ZRU-812 (January 2023), and the 1 September 2025 compulsory deregistration stock break (−96.6 thousand registered entities). Panel b compares annual national indices (2017 = 100, n = 9 years) for commercial entity stocks, formal workbook employees (through 2024), and real monthly wages (constant 2017 soums). Panel c decomposes monthly inactive-gap changes into ΔR_t and $-\Delta O_t$ across n = 57 transitions.

Table 2. District-year predetermined exposure estimates and monthly regional-sector phase differentials.

Model specification & outcome	Phase/Window	Estimate (SE)	Conv. p	WCB p	95% CS
Panel A: District exposure (+10 pp 2019 trade & construction, ref. 2022)					
Administrative inactivity rate (pp, N = 1,470)	2023	2.020 (0.968)	0.0387	0.1750	[-0.735, 5.029]
Administrative inactivity rate (pp, N = 1,470)	2024	0.603 (0.809)	0.4571	0.5923	[-1.664, 3.063]

(continued)

Table 2 (continued)

Model specification & outcome	Phase/Window	Estimate (SE)	Conv. p	WCB p	95% CS
Administrative inactivity rate (pp, N = 1,470)	2025	1.639 (0.939)	0.0830	0.2799	[-1.356, 4.482]
Log operating commercial entities (N = 1,470)	2023	-0.038 (0.018)	0.0424	0.1746	[-0.101, 0.014]
Log operating commercial entities (N = 1,470)	2024	-0.010 (0.020)	0.6221	0.7081	[-0.067, 0.044]
Log registered commercial entities (N = 1,470)	2025	0.005 (0.017)	0.7778	0.7579	[-0.033, 0.040]
Log formal workbook employees (N = 1,176)	2024	-0.016 (0.013)	0.2055	0.4161	[-0.059, 0.023]
Log real monthly wage (N = 1,176)	2024	-0.028 (0.016)	0.0752	0.0908	[-0.067, 0.004]
Panel B: Monthly two-way sector-chain model (N = 7,182, ref. 2022M01–M05)					
Administrative inactivity rate (pp)	Verification	-0.434 (0.138)	0.0022	0.0002	[-0.603, -0.267]
Administrative inactivity rate (pp)	Reclassification	2.531 (0.970)	0.0102	0.0001	[2.063, 3.001]
Administrative inactivity rate (pp)	Late/Dereg.	5.557 (1.130)	<0.0001	0.0001	[4.869, 6.265]
Administrative inactivity rate (pp)	Stabilization	6.193 (0.913)	<0.0001	0.0001	[5.358, 7.064]
Log operating commercial entities	Late/Dereg.	-0.203 (0.036)	<0.0001	0.0001	[-0.229, -0.176]
Log registered commercial entities	Late/Dereg.	-0.113 (0.021)	<0.0001	0.0001	[-0.136, -0.090]
Panel C: Monthly saturated triple-difference model (N = 7,182)					
Inactivity rate: 2022Q1 inactivity (+10 pp)	Late/Dereg.	-1.163 (3.675)	0.7523	0.7687	[-8.110, 11.815]
Inactivity rate: 2022Q1 sector share (+10 pp)	Late/Dereg.	-2.062 (1.140)	0.0730	0.1868	[-4.509, 0.800]
Log operating: 2022Q1 inactivity (+10 pp)	Late/Dereg.	-0.151 (0.139)	0.2804	0.3429	[-0.625, 0.200]
Log operating: 2022Q1 sector share (+10 pp)	Late/Dereg.	0.034 (0.036)	0.3470	0.4204	[-0.062, 0.113]

Notes. Panel A absorbs parent-district (G = 147) and year fixed effects; standard errors are clustered by parent district, and exact wild cluster bootstrap p-values (WCB p) and test-inverted 95% confidence sets (95% CS) enumerate all 8,192 Rademacher sign patterns across 14 regions. Panel B absorbs region-by-sector (G = 126) and region-by-month fixed effects; Panel C additionally absorbs sector-by-month fixed effects. Late/Dereg. denotes September 2024–January 2026 late reclassification and deregistration. Individual p-values are unadjusted for multiplicity across secondary outcomes; exact 14-region bootstrap p-values displayed as 0.0001 equal $1/8{,}192 = 0.000122$.

In Equation (3), which absorbs common nationwide sector-by-month fixed effects to evaluate a distinct within-sector regional exposure estimand (Table 2 Panel C and Figure 2 Panel c), none of the six late-reclassification and deregistration interactions with predetermined 2022Q1 regional-sector inactivity or regional sector shares is statistically resolved (p = 0.1868 to 0.9935). Because the test-inverted 95% confidence set on baseline 2022Q1 inactivity remains wide ($[-8.110, 11.815]$ percentage points), Equation (3) does not establish strict within-sector homogeneity; instead, Hypothesis 2 is strongly supported across invoice-chain versus non-invoice-chain sectors in Equation (2), while within-sector gradients across initial regional dormancy or specialization remain statistically unresolved once common sector-month trajectories are removed.

Evaluating Hypothesis 3 across the 147 harmonized parent districts (Table 2 Panel A and Figure 2 Panel a) highlights the discipline of regional wild bootstrap inference and explicit power bounds. In 2023, a 10-percentage-point higher 2019 trade-and-construction share predicts +2.020 percentage points higher district inactivity and −0.0376 log points lower operating entities under district clustering (p = 0.0387 and

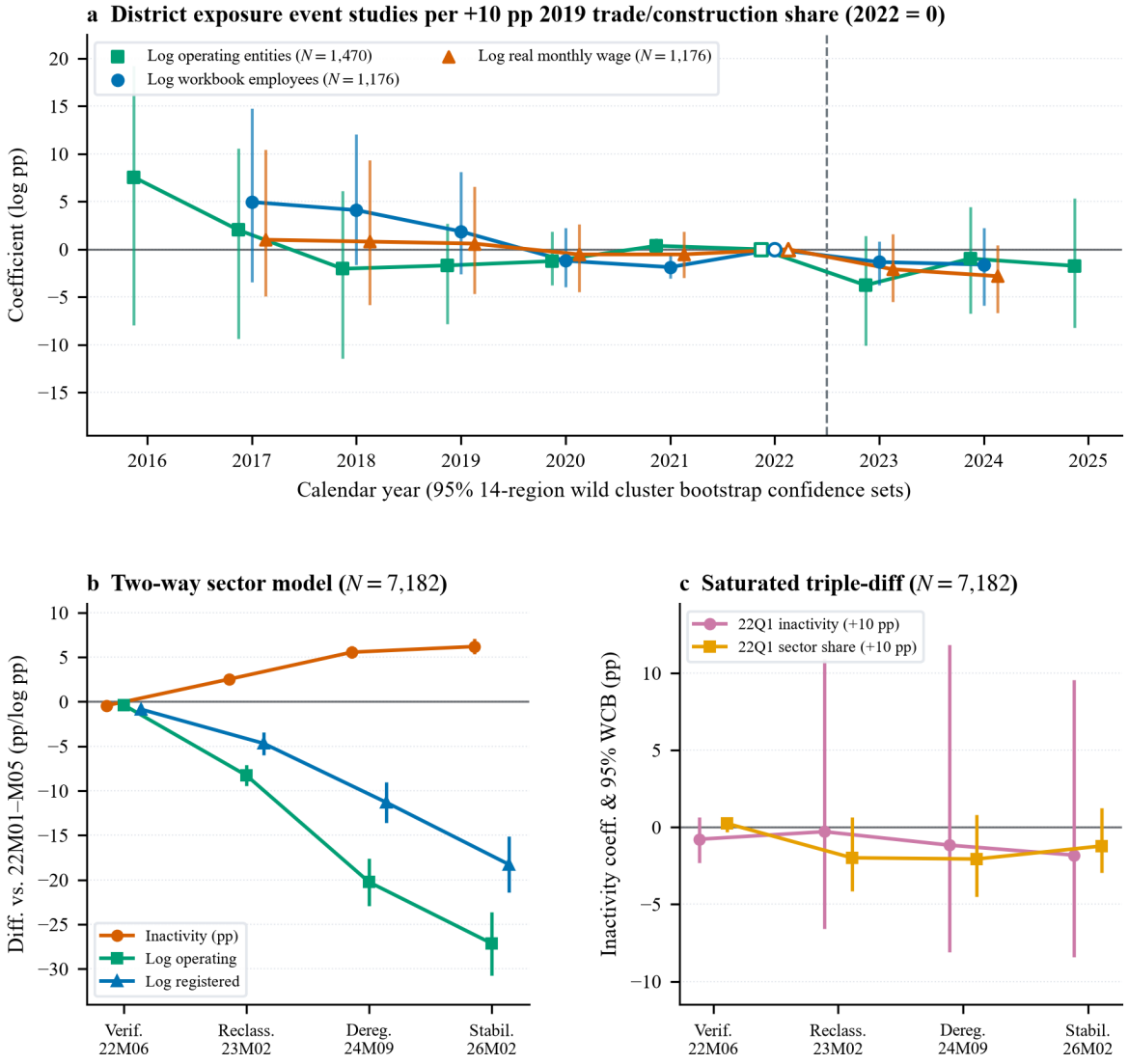


Figure 2. District dynamic exposure event studies and monthly regional-sector regression estimates.

Notes. Panel a plots district-year event-study coefficients (scaled in log percentage points per 10-percentage-point higher 2019 trade-and-construction share; open white-filled markers denote the omitted 2022 reference year) with exact 95% 14-region wild cluster bootstrap intervals. Panel b plots phase differentials from the two-way interactive fixed-effects model (N = 7,182) for invoice-chain sectors (industry, construction, and trade) relative to January–May 2022. Panel c plots phase interactions from the saturated triple-difference model (N = 7,182) absorbing region-by-sector, region-by-month, and sector-by-month fixed effects.

0.0424), whereas exact 14-region wild bootstrap p-values widen to 0.1750 and 0.1746 due to within-region correlation of administrative status updates. For formal labor-market outcomes in 2024 relative to 2022, a 10-percentage-point higher 2019 exposure yields conditional differences of −0.0160 log points (−1.59%) for formal workbook employees (district CR1 standard error 0.0126, region CR1 standard error 0.0186, exact 14-region bootstrap p = 0.4161, 95% bootstrap set [−0.0590, 0.0227] or [−5.73%, +2.30%]) and −0.0281 log points (−2.77%) for real monthly wages (district CR1 standard error 0.0157, region CR1 standard error 0.0169, exact bootstrap p = 0.0908, 95% bootstrap set [−0.0665, 0.0044]). Approximate 80%-power minimum detectable effects equal 0.0355 log points (employment) and 0.0442 log points (wages) under 147-district CR1 uncertainty, and 0.0559 log points (5.59%) and 0.0506 log points (5.06%) un-

der 14-region CR1 uncertainty. While year fixed effects absorb aggregate national employment changes, these cross-district exposure bounds rule out steep exposure-proportional payroll contractions while remaining compatible with single-digit local employment or wage adjustments (scaled by $1/s_c$ for private commercial payrolls).

5. Mechanisms, Variance Anatomy, and Robustness Diagnostics

5.1. Separate Exposure Channels, Realized Reclassification Associations, and Variance Shares

Table 3 evaluates separate within-sector exposure channels, alternative predetermined district anchors, and descriptive associations with realized operating-stock contractions. Entering 2022Q1 regional-sector inactivity and sector specialization separately in Equation (3) leaves all late-reclassification and deregistration interactions statistically unresolved ($p = 0.2242$ to 0.8096), confirming that regressor collinearity does not drive the null triple-difference estimates. At the district level, replacing the 2019 trade-and-construction share with year-end 2021 shares or 2019 registered entities per formal employee yields small, statistically unresolved 2024 coefficients (+0.039 log points for employment, bootstrap $p = 0.2888$; +0.036 for real wages, $p = 0.2694$). When year indicators are interacted descriptively with each district's realized 2022–2024 log operating-entity contraction, a 0.10 deeper realized log operating contraction is associated in 2024 with −0.0174 log points lower formal workbook employment (bootstrap $p = 0.0073$, accompanied by one significant pre-2022 lead indicating prior trajectory differences) and +0.0026 log points in real monthly wages (bootstrap $p = 0.6360$, 95% bootstrap confidence set $[-0.0110, 0.0126]$). Thus, even along endogenous realized contractions, the conditional formal-employment association is less than one-fifth of the operating-firm drop, and real-wage differences remain tightly bounded around zero within $[-1.1\%, +1.3\%]$.

Table 3. Separate triple-difference exposure channels, alternative predetermined district anchors, and realized-contraction associations.

Specification, outcome & exposure term	Window	Estimate (SE)	Conv. p	WCB p
Saturated monthly inactivity (N = 7,182): 2022Q1 inactivity only	Late/Dereg.	-0.881 (3.629)	0.8086	0.8096
Saturated monthly log operating (N = 7,182): 2022Q1 inactivity only	Late/Dereg.	-0.155 (0.138)	0.2621	0.3119
Saturated monthly inactivity (N = 7,182): 2022Q1 sector share only	Late/Dereg.	-2.032 (1.135)	0.0759	0.2242
Saturated monthly log operating (N = 7,182): 2022Q1 sector share only	Late/Dereg.	0.038 (0.036)	0.2894	0.3645
District annual inactivity (N = 1,470): Year-end 2021 trade/constr. share	Year 2024	0.464 (0.883)	0.6003	0.7228
District annual log operating (N = 1,470): Year-end 2021 trade/constr. share	Year 2024	-0.009 (0.021)	0.6674	0.6013
District annual log formal staff (N = 1,176): 2019 entities per worker	Year 2024	0.039 (0.033)	0.2431	0.2888
District annual log real wage (N = 1,176): 2019 entities per worker	Year 2024	0.036 (0.033)	0.2777	0.2694
District descriptive log formal staff (N = 1,176): Realized 2022–24 drop (+0.10)	Year 2024	-0.017 (0.004)	0.0002	0.0073
District descriptive log real wage (N = 1,176): Realized 2022–24 drop (+0.10)	Year 2024	0.003 (0.005)	0.5891	0.6360

Notes. Monthly models include region-by-sector, region-by-month, and sector-by-month fixed effects (G = 126 cell clusters; 14-region exact Rademacher bootstrap WCB p). District models include parent-district (G = 147) and year

fixed effects. Realized 2022–2024 operating-contraction interactions reflect contemporaneous selection and common local shocks and are reported as descriptive benchmarks.

Figure 3 (Panels a–b) displays the distributional and variance shifts underlying these regression patterns. Across all 126 region-sector cells, the empirical cumulative distribution of administrative inactivity shifted from a tight cluster near 5% in January 2022 and January 2023 to a median near 45% in January 2025 before shifting left by September 2026 (Figure 3 Panel a). Monthly cross-cell sum-of-squares decompositions (Figure 3 Panel b) confirm that in January 2022 regional differences accounted for 46.35% of cross-cell inactivity variance, sector differences for 29.24%, and region-by-sector interactions for 24.41%; after January 2023, between-sector differences expanded to account for the largest share of cross-cell variation prior to the September 2025 deregistration cliff.

5.2. Transfer-District Restorations, Phase-Timing Checks, Pretrend Drift Controls, and Leave-One-Out Bounds

Table 4 and Figure 3 (Panel c) report comprehensive sensitivity checks across boundary definitions, statutory phase dates, and pretrend adjustments. For the monthly invoice-chain differential (+5.557 percentage points in the baseline), excluding Information and Communication yields +6.182 ($p = 0.00012$), estimating on the 58-month small-business population yields +5.240 ($p = 0.00012$), extending five sectors through October 2026 yields +3.661 ($p = 0.00098$), shifting the phase start to November 2024 (+5.686, $p = 0.00012$) or February 2025 (+5.958, $p = 0.00012$) or isolating the September 2025 stock-break window (+5.847, $p = 0.00012$) strengthens the point estimate, and omitting each of the 14 regions one at a time ($G_r = 13$, 4,096 sign patterns) yields estimates tightly bounded between +5.349 (excluding Syrdarya) and +5.709 (excluding Navoi; +5.681 when excluding Tashkent City), with every exact 13-region bootstrap $p = 1/4{,}096 = 0.000244 < 0.00025$.

Table 4. Sensitivity checks, transfer-district restorations, statutory phase-boundary alternatives, pretrend drift controls, and leave-one-region-out bounds.

Sensitivity check or pretrend diagnostic	*N*	Parameter	Estimate (SE)	WCB *p*	95% CS
Exclude Information & Communication (8 sectors)	6,384	Chain (Late/Dereg.)	6.182 (1.246)	0.0001	[5.368, 6.984]
Small-business commercial population (58 mos.)	7,308	Chain (Late/Dereg.)	5.240 (1.119)	0.0001	[4.547, 5.955]
Extended 5-sector panel through Oct 2026	4,060	Chain (Late/Dereg.)	3.661 (0.976)	0.0010	[1.974, 5.327]
Alternative phase start: Nov 2024 (24M11–26M01)	7,182	Chain (Late/Dereg.)	5.686 (1.126)	0.0001	[4.985, 6.405]
Alternative phase start: Feb 2025 (25M02–26M01)	7,182	Chain (Late/Dereg.)	5.958 (1.118)	0.0001	[5.259, 6.684]
Observed September 2025 stock-break phase	7,182	Chain (Break)	5.847 (1.005)	0.0001	[5.037, 6.731]
Exclude Tashkent City (monthly, $G_r = 13$)	6,669	Chain (Late/Dereg.)	5.681 (1.173)	0.0002	[4.989, 6.395]
Leave-one-region-out envelope (14 runs, $G_r = 13$)	6,669	14-run range	[5.349, 5.709]	<0.00025	14/14 sig.
Saturated model: 1 April 2022 inactivity anchor	7,182	22M04 Inact.	1.373 (2.823)	0.6277	[-6.510, 9.081]
Saturated model: Control 2022 inactivity drift	7,182	22Q1 Inact.	-0.743 (3.742)	0.8579	[-7.741, 12.138]
Greater Tashkent restored (148 units, $G_r = 13$)	1,184	2024 Staff	-0.017 (0.013)	0.4041	[-0.060, 0.023]

(continued)

Table 4 (continued)

Sensitivity check or pretrend diagnostic	*N*	Parameter	Estimate (SE)	WCB *p*	95% CS
All 26 transfers restored (149 units, $G_r = 12$)	1,192	2024 Staff	-0.017 (0.013)	0.4087	[-0.065, 0.022]
Pre-2022 district drift control: Formal employees	1,176	2024 Staff	0.003 (0.016)	0.9130	[-0.045, 0.049]
Pre-2022 district drift control: Real monthly wage	1,176	2024 Wage	-0.023 (0.018)	0.2450	[-0.065, 0.019]
Unsplit districts only (130 jurisdictions)	1,300	2024 Inact.	0.529 (0.856)	0.6714	[-1.976, 3.295]
Unsplit districts: Log formal employees (2017–24)	1,040	2024 Staff	-0.018 (0.014)	0.4099	[-0.071, 0.025]
Unsplit districts: Log real wage (2017–25)	1,170	2024 Wage	-0.034 (0.018)	0.0626	[-0.079, 0.002]
Kashkadarya row-alignment adjustment (148 units)	1,480	2024 Inact.	0.630 (0.809)	0.5767	[-1.657, 3.117]
Monthly pre-2023 VAT-cut trend (22M01–23M01)	1,638	Chain Trend	-0.034 (0.016)	0.0024	[-0.052, -0.015]

Notes. Standard errors in parentheses are unit-clustered CR1 ($G = 126$ or 112 region-sector cells; $G = 147, 148, 149$, or 130 district units). Chain denotes the invoice-chain sector indicator interacted with the indicated window; district rows interact 2019 trade-and-construction exposure with 2024. Exact wild cluster bootstrap p-values (WCB p) and 95% confidence sets (95% CS) enumerate 8,192 sign patterns for $G_r = 14$, 4,096 for $G_r = 13$ (exact minimum $p = 1/4{,}096 = 0.000244$; all 14 leave-one-out sets exclude zero), and 2,048 for $G_r = 12$. Individual diagnostic p-values are unadjusted for multiplicity.

Subnational boundary restorations and pretrend drift controls directly address potential selection and trajectory concerns in the district panel. Appending the 24 Tashkent City–Tashkent Region transfer districts as a single boundary-invariant Greater Tashkent unit (148 units, $G_r = 13$) yields 2024 exposure estimates of +0.651 percentage points for inactivity ($p = 0.5720$), −0.0166 log points for formal workbook employees ($p = 0.4041$, 95% confidence set $[-0.060, 0.023]$), and −0.0288 for real wages ($p = 0.1038$); restoring Gijduvan and Kanimekh as well (149 units covering all 206 raw districts, $G_r = 12$) yields +0.673 ($p = 0.5542$), −0.0167 ($p = 0.4087$), and −0.0288 ($p = 0.1250$). Restricting to the 130 unsplit districts (extending real wages through 2025, $N = 1{,}170$) or applying the Kashkadarya row-alignment adjustment ($N = 1{,}480$) likewise leaves 2024 coefficients statistically unresolved ($p \geq 0.0626$).

Pretrend diagnostics reinforce conditional interpretation. Over January 2022–January 2023 (overlapping Decree No. PF-113 database reconciliation), invoice-chain sectors exhibited a slight downward inactivity slope of −0.034 percentage points per month ($p = 0.0024$), opposite in sign to the post-January-2023 upward divergence. In the district panel, pre-2022 lead tests do not reject flat trajectories for inactivity (joint $F(6, 146) = 0.50$, $p = 0.8088$; minimum individual 14-region bootstrap lead $p = 0.4506$) or log real wages ($F(5, 146) = 0.25$, $p = 0.9395$; minimum lead bootstrap $p = 0.6102$), whereas log formal workbook employees exhibits pre-2022 convergence ($F(5, 146) = 3.60$, $p = 0.0043$; 2021 lead = −0.0187, 14-region bootstrap $p = 0.0178$). When we augment the 2017–2024 district event study with each district's 2017–2021 linear slope interacted with $(t - 2022)$ (conditional on estimated pre-period slopes), the 2024 formal-employment exposure coefficient attenuates from −0.0160 to +0.0029 (bootstrap $p = 0.9130$, 95% confidence set $[-0.045, 0.049]$) and the 2024 real-wage coefficient moves to −0.0227 (bootstrap $p = 0.2450$, $[-0.065, 0.019]$).

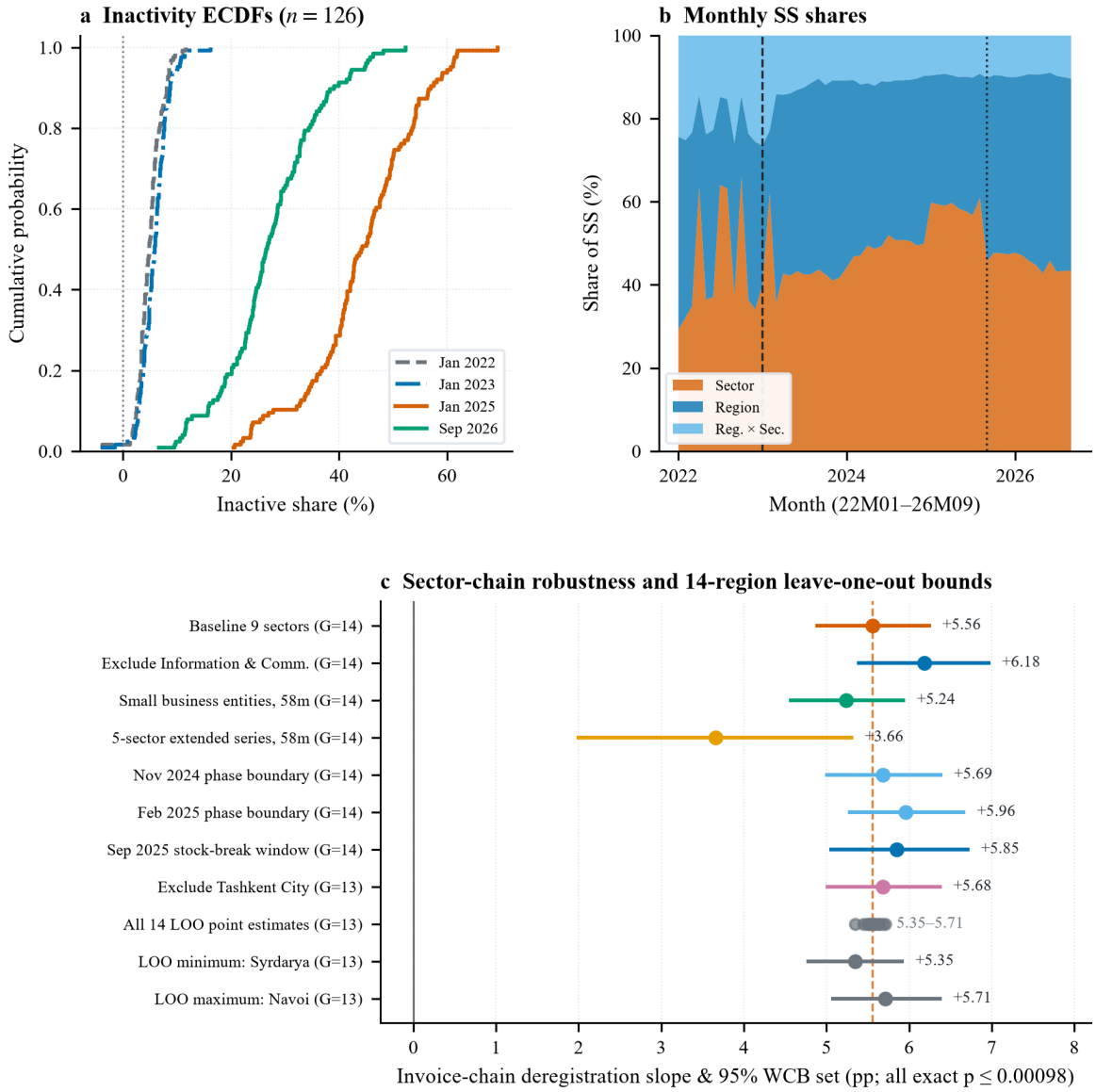


Figure 3. Regional-sector inactivity distributions, monthly variance decomposition, and sensitivity bounds.

Notes. Panel a plots empirical cumulative distribution functions of administrative inactivity across $n = 126$ region-sector cells at four milestone dates (retaining negative Information and Communication cells on the left tail). Panel b decomposes monthly cross-cell inactivity sum of squares ($n = 126$ cells across 57 months) into sector differences, regional differences, and region-by-sector interaction shares, marking January 2023 and September 2025. Panel c displays exact test-inverted 95% wild cluster bootstrap sets across 21 distinct sector-chain specifications (7 fourteen-region specifications enumerating 8,192 sign patterns plus 14 thirteen-region leave-one-region-out deletions enumerating 4,096 sign patterns, where excluding Tashkent City corresponds to one of the 14 deletions).

5.3. Methodological Scope and Limitations

Four methodological boundaries govern interpretation. First, because registry reconciliation, risk-scoring revisions, and the 2023 value-added tax rate reduction unfolded nationwide alongside macroeconomic expansion, our fixed-effects specifications absorb aggregate national shifts and identify conditional cross-sector and cross-district differentials as distinct from standalone causal effects of individual statutes. Second, administrative inactivity is a regulatory and statistical status; aggregate stocks neither isolate illicit invoice mills from benign entrepreneurial dormancy nor separate gross entry from gross exit within net stock transitions. Third, district formal workbook employment concludes in 2024, is unlinked at the enterprise level to deregistered firms, and pools public-sector budgetary institutions and farms alongside commercial enterprises; consequently, private-commercial employment bounds scale inversely with the unobserved commercial share s_c of formal workbook employment. Fourth, across 14 regional clusters, 80%-power minimum detectable effects equal 5.59% for district formal employment and 5.06% for real wages (3.55% and 4.42% under 147-district clustering), while wide confidence sets in the saturated triple-difference model preclude equivalence claims of strictly zero local heterogeneity.

6. Conclusion and Policy Implications

Combining harmonized district-year panels across Uzbekistan's subnational jurisdictions (2016–2025) with population-matched monthly commercial-sector panels (2022–2026) shows that the post-2022 contraction in operating enterprise counts unfolded as a two-stage administrative cleanup concentrated in value-added tax invoice-chain sectors alongside continued national growth in formal workbook employment and real wages. In two-way regional-sector models, industry, construction, and trade experienced a +5.56-percentage-point wider inactivity differential during the late-reclassification and deregistration phase ($p = 0.00012$), robust across statutory timing windows and region deletions, whereas within-sector regional exposure gradients in saturated triple-difference models and cross-district formal payroll exposure gradients in 2024 remain statistically unresolved across baseline, Greater Tashkent, and drift-adjusted specifications.

Two institutional design implications merit consideration by transition statistical and fiscal authorities. First, central banks and statistical offices should separate active enterprise registry counts from real business-cycle indicators during inter-agency database unification waves, publishing decomposed commercial-demography series that distinguish newly formed operating enterprises, tax-suspended registrants, and three-year compulsory deregistrations (Slemrod & Gillitzer, 2014; Ulyssea, 2020). Second, if tax administrations evaluate linking automated inactivity or value-added tax certificate-suspension clocks to zero-payroll social-contribution records in order to compress multi-year registry overhangs, such linkage rules should incorporate multi-quarter seasonal zero-payroll grace windows and pre-suspension notice-and-cure verification—a safeguard particularly relevant in construction and wholesale/retail trade, where winter operational lulls are routine and our district real-wage confidence bounds do not rule out localized compliance friction (Pomeranz, 2015; Waseem, 2023).

Statements

Data availability. Subnational enterprise demography series, formal workbook employment and wage records, consumer price indices, and historical statutory editions examined in this study were obtained from public portals of the National Statistics Committee of the Republic of Uzbekistan and the National Database of Legislation of the Republic of Uzbekistan prior to 13 November 2026. The archived primary inputs, district and regional-sector concordances, estimation panels, and reproduction code are publicly available through Zenodo under https://doi.org/10.5281/zenodo.24199904.

AI declaration. OpenAI Codex provided strictly bounded technical support for translating and proofreading Russian- and Uzbek-language statutory and statistical sources, cleaning administrative series, and auditing estimation scripts at

the implementation level. Each author independently verified all assisted materials; all conceptual design, econometric analysis, and manuscript writing were performed by the authors, who accept full responsibility for this work.

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