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Article

Determinants of Small Business Competitiveness in Uzbekistan: The Role of Finance, Innovation and the Business Environment

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Abstract: *This study examines the determinants of small-business competitiveness across Uzbekistan's 14 first-level regions, focusing on finance, innovation-enabling capability and the business environment. Competitiveness is operationalized as revealed market performance rather than a composite index: real sales per active small-business entity for the domestic market and small-business exports for external performance. Two-way fixed-effects models use 2013–2022 domestic data (N=140) and 2013–2024 export data (N=168), with one-year-lagged regressors and 9,999-repetition wild cluster bootstrap inference. Lagged capital intensity is positively associated with domestic performance (β=0.2249, wild p=0.0016), while overdue-payables pressure is negatively associated (β=−0.0675, p=0.0376). Human-capital intensity, interpreted as an innovation-enabling capability, is positively associated with exports (β=0.9704, p=0.0108), as is SME employment capacity (β=2.6171, p=0.0246). Net entry is negatively associated with sales per firm, but this relationship is interpreted as market churn rather than evidence against competition. Robustness tests show that capital is the most stable domestic determinant, while institutional policy-exposure proxies do not support causal claims. The findings favor differentiated support combining productive capital, liquidity resilience, skills and capability building.*

Keywords: *small business; competitiveness; financial constraints; innovation capability; business environment; panel data; Uzbekistan*

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1. Introduction

Small businesses are central to employment creation, regional income formation and structural transformation, but their competitiveness cannot be inferred reliably from sectoral shares alone. A large share of small business in output or employment can coexist with low firm-level productivity, weak capitalization or limited ability to reach external markets. For empirical work, competitiveness therefore needs to be tied to observable economic outcomes. This study defines small-business competitiveness as revealed regional market performance: the capacity of the small-business sector in a region to generate real sales per active business in the domestic market and to expand external-market output through exports. This outcome-based definition is consistent with resource-based and dynamic-capabilities arguments that competitive advantage emerges

when firms are able to mobilize productive resources and reconfigure capabilities in changing environments [1,2].

Uzbekistan provides a particularly relevant setting. Recent policy assessments emphasize that the next stage of private-sector-led growth depends less on expanding the number of firms alone and more on improving productivity, access to finance, skills, digital capability and competitive market conditions [3]. The country has undertaken wide-ranging reforms in business regulation and private-sector development, yet regional conditions remain heterogeneous. The same national policy can therefore encounter very different local constraints: one region may face weak capital intensity and liquidity pressure, another may have a relatively strong firm base but insufficient human capital or export capability. A credible empirical design must distinguish these channels rather than compressing them into a single broad "business climate" score.

Three strands of research motivate the empirical framework. First, the finance literature shows that liquidity and funding constraints can depress investment, technology adoption and growth in small firms [4]. Second, work on digitalization and innovation emphasizes that technology adoption is rarely productive in isolation; complementary human capital, organizational capability and access to finance shape whether new technologies translate into performance gains [5]. Third, entrepreneurial-ecosystem and business-environment research stresses that entry, competition, institutional quality and access to complementary resources condition the returns to firm capabilities [6]. These literatures are often studied separately, and evidence for Central Asia remains much thinner than evidence for advanced economies or large emerging markets. A recent comparative analysis centered on Uzbekistan further argues that effective small-business support depends on combining financial, market and institutional mechanisms rather than relying on isolated instruments.

The empirical gap is not simply geographic. Much of the available SME literature relies on cross-sectional surveys, composite indices or conventional standard errors that are not well suited to small regional panels. In a setting with only 14 regional clusters, standard cluster-robust inference can overstate precision. Moreover, institutional reform measures can be targeted toward weaker regions, creating a risk that a statistically significant policy-exposure coefficient is mistakenly treated as causal even when pre-trends or placebo tests fail. This study addresses these problems through a transparent regional panel design, explicit measurement of competitiveness, one-year lags, two-way fixed effects, few-cluster wild-bootstrap inference, leave-one-region-out stability checks and targeted robustness tests [7].

The study asks three questions. First, which financial conditions are most consistently associated with domestic small-business competitiveness? Second, does innovation-enabling capability, represented by regional human-capital intensity, help explain external-market performance? Third, what do observable business-environment dynamics—especially net firm entry and policy-exposure measures—add to the explanation of performance once persistent regional characteristics and national time shocks are controlled for? The third question is deliberately broader than a causal policy-evaluation question: the available open regional data permit credible conditional-association analysis, but they do not support a clean experiment for the full reform period.

The contribution is fourfold. First, the article operationalizes competitiveness with intensive market outcomes instead of a mechanically weighted composite index. Second, it separates finance, innovation-enabling capability and business-environment dynamics within a single regional framework while preserving the different mechanisms through which they operate. Third, it uses inference designed for a small number of clusters and reports sensitivity to heteroskedasticity, serial correlation and cross-sectional dependence rather than claiming that these features have been "removed." Fourth,

it treats failed policy-identification checks as substantive evidence: institutional exposure variables are retained as contextual results but are not converted into causal policy effects. This distinction improves the credibility of the policy conclusions [8].

1.1. Theoretical framework and hypotheses

The resource-based view predicts that productive assets and financially sustainable resource positions can support superior performance when they are valuable and difficult to substitute. For small firms, this mechanism is especially relevant because internal funds, collateral and working-capital buffers are often limited. Capital intensity can expand productive capacity, improve service quality and facilitate technology adoption, whereas overdue liabilities can interrupt operations and force firms to postpone productive investment. Evidence on SME financial constraints supports the relevance of both investment capacity and liquidity channels.

H1. Higher lagged capital intensity is positively associated with domestic small-business competitiveness.

H2. Higher lagged overdue-payables pressure is negatively associated with domestic small-business competitiveness.

Dynamic-capabilities theory shifts attention from the stock of resources to the ability to sense opportunities, acquire knowledge and reconfigure routines. In SMEs, human capital and digital readiness are common enabling conditions for product adaptation, export management and technology use. The available regional data do not contain a harmonized panel of SME patents, R&D expenditure or product-innovation introductions. Accordingly, the innovation construct is measured conservatively as innovation-enabling capability rather than direct innovation output. The core proxy is university-graduate intensity relative to the working-age population; enterprise internet penetration is treated only as supplementary contextual evidence because its time coverage is shorter and the post-2022 domestic denominator is affected by a classification discontinuity.

H3. Higher lagged human-capital intensity is positively associated with external small-business competitiveness.

External competitiveness also requires scale through which skills, finance and market opportunities can be converted into export activity. SME employment is therefore included as an export-capacity variable. It is not interpreted as a causal return to hiring an additional worker; rather, it captures the regional scale of the small-business production and organizational base after region and year effects are absorbed.

H4. Higher lagged SME employment capacity is positively associated with small-business export performance.

Business-environment dynamics are represented by net firm entry and, in exploratory models, regional exposures to major institutional-policy changes. A priori, the sign of net entry is ambiguous. More entry can intensify competition, increase variety and improve allocative efficiency; it can also temporarily lower average sales per active firm when many young, small or low-productivity firms enter. Informal competition can further change how formal SMEs respond to market pressure. The net-entry coefficient is therefore treated as a secondary market-dynamics test rather than as a directional primary hypothesis. Institutional exposure is interpreted even more cautiously because policy programs may be targeted to lagging areas, producing endogenous treatment intensity.

2. Materials and Methods

2.1. Research setting, data and sample

The empirical unit is the region-year. The panel covers the Republic of Karakalpakstan, 12 regions and Tashkent city, giving 14 first-level territorial units. The core data were assembled from official annual statistics of the National

Statistics Committee of the Republic of Uzbekistan through the Statistical Information and Analytical System (SIAT). The domestic-performance model uses 2013–2022 (14×10=140 observations). The sample ends in 2022 because the data-quality audit identified a post-2022 classification discontinuity in the active-entity denominator used to construct the intensive sales measure. The export model is not affected by this denominator break and therefore uses 2013–2024 (14×12=168 observations).

Monetary domestic variables are expressed in 2024-price equivalents using the CPI conversion factor preserved in the frozen replication panel. The active-entity scale is calculated from official counts of active small-business entities. To reduce sensitivity to a single reference date, the main domestic construction uses the average entity count over the relevant annual interval. Real sales per active entity are then obtained by dividing deflated net sales by this scale. Fixed assets are treated analogously to construct capital intensity. Main explanatory variables are lagged by one year to reduce simultaneity and to match the economic logic that resource conditions at t−1 precede market outcomes at t. Lagging does not eliminate endogeneity, so the estimates are interpreted as conditional within-region associations rather than structural treatment effects.

Table 1. Variable construction and official data sources

Variable	Operational definition	Analytical role	Model period	Official source
Domestic competitiveness	ln(real net sales / active small-business entities)	Outcome	2013–2022	SIAT 1571; active entities SIAT 261
Capital intensity	ln(real fixed assets / active small-business entities), t−1	Finance / productive capital	2013–2022	SIAT 1595; 261
Overdue-payables pressure	ln(1 + overdue payables / total payables), t−1	Finance / liquidity stress	2013–2022	Official small-enterprise financial-statistics block
Net entry rate	Net firm-entry rate (%), t−1	Business-environment dynamics	2013–2022	SIAT business-demography series
External competitiveness	ln(1 + small-business exports, USD million)	Outcome	2013–2024	SIAT 469
Human-capital intensity	ln(1 + university graduates per 1,000 working-age residents), t−1	Innovation-enabling capability	2013–2024	SIAT 694; 2835
SME employment	ln(small-business employment), t−1	Export capacity / scale	2013–2024	Official SIAT small-business employment series
Enterprise internet penetration	Internet-connected enterprises (%), t−1	Supplementary digital-environment proxy	2015–2025 source coverage	SIAT 1284

Source note. Official SIAT links used in the replication source catalog include https://siat.stat.uz/data/261/, /469/, /694/, /1284/, /1571/, /1595/ and /2835/. The innovation variable is an enabling-capability proxy, not a direct measure of patents, R&D or product innovation.

2.2. Econometric specification

The domestic model estimates within-region variation in intensive sales performance as a function of prior-year productive capital, liquidity stress and market-entry dynamics:

$$\ln(SalesPerFirm_{it}) = \beta_1 \ln(CapitalPerFirm_{i,t-1}) + \beta_2 \ln(1 + OverduePayShare_{i,t-1}) + + \beta_3 NetEntryRate_{i,t-1} + \alpha_i + \lambda_t + \varepsilon_{it}$$

The export model estimates external-market performance as a function of prior-year innovation-enabling capability and the scale of the SME employment base:

$$\ln(1 + Exports_{it}) = \gamma_1 \ln(1 + HumanCapital_{i,t-1}) + \gamma_2 \ln(SMEEmployment_{i,t-1}) + \alpha_i + \lambda_t + u_{it}$$

In both equations, i indexes regions, t indexes years, α_i denotes region fixed effects, λ_t denotes year fixed effects, and the idiosyncratic errors are ε_{it} and u_{it}. Region effects absorb time-invariant characteristics such as geography, persistent industrial structure and historical institutional differences; year effects absorb national shocks shared across regions, including macroeconomic, regulatory and pandemic-related shocks. The coefficients are therefore identified from deviations of each region from its own long-run level, net of common year movements.

2.3. Estimator choice and inferential strategy

Estimator choice follows the data-generating features rather than a single conventional specification test. A Mundlak correlated-random-effects diagnostic rejects the orthogonality condition required for random effects in both models, favoring fixed effects. Diagnostic tests also detect groupwise heteroskedasticity, first-order serial correlation and cross-sectional dependence. These properties are not described as corrected or eliminated. Instead, the article adopts an inference hierarchy designed to remain credible under the observed dependence structure.

The number of regional clusters is only 14. Conventional cluster-robust p-values can be downward biased when the number of clusters is small, so primary hypothesis tests use null-imposed wild cluster bootstrap-t inference with Rademacher weights and 9,999 replications. Region-clustered standard errors are reported for transparency. Driscoll–Kraay standard errors are used as a sensitivity check for the combined serial and cross-sectional dependence. Because four substantive hypotheses are tested jointly, their wild-bootstrap p-values are also adjusted with the Holm step-down procedure to control family-wise error. Finally, every core coefficient is re-estimated after excluding each region in turn; sign stability across all 14 leave-one-region-out (LOO) samples is used as a practical check that no single territory drives the result.

2.4. Identification boundaries and robustness design

The fixed-effects design improves comparability but does not establish causality. Reverse causality may remain if stronger small-business performance induces subsequent capital accumulation, skill formation or firm entry. Omitted time-varying regional shocks may also affect both explanatory variables and outcomes. One-year lags mitigate contemporaneous simultaneity but are not instruments. For this reason, all main results are written as associations conditional on region and year fixed effects.

Robustness tests target specific threats. For the domestic equation, denominator-safe specifications replace sales per firm with total real sales while controlling for the active-firm scale, and a second specification uses total fixed assets rather than per-firm capital. First-difference models test whether the level relationships also appear in short-run annual changes. For exports, alternative outcomes include exports per worker and the SME export share, and a 2013–2022 period restriction tests sample-period dependence. The institutional-policy block uses lagged policy exposures, future-policy placebo leads and baseline-specific trends. A policy variable is not treated as causal if the lead is significant or the coefficient disappears once differential trends are allowed.

3. Results

3.1. Diagnostic evidence

The diagnostics support two-way fixed effects and confirm that robust

inference is necessary. The Mundlak test rejects random-effects exogeneity in the domestic model (p=0.0005) and export model (p=0.0199). Two-way-within VIF values are 1.08 and 1.00, indicating no material multicollinearity among the core regressors. By contrast, the Modified Wald test rejects homoskedasticity in both models (p<0.001), the Wooldridge test identifies AR(1) serial correlation (p<0.001 domestic; p=0.0019 export), and Pesaran CD statistics reject cross-sectional independence at the 5% level [9]. These results motivate the use of region clustering, wild-bootstrap primary inference and Driscoll–Kraay sensitivity checks.

Table 2. Panel diagnostics and inferential response

Diagnostic	Domestic model	Export model	Implication
Mundlak correlated-RE test	p=0.0005	p=0.0199	Fixed effects preferred
Two-way-within VIF (max)	1.08	1.00	No material collinearity
Modified Wald heteroskedasticity	p<0.001	p<0.001	Use heteroskedasticity-robust inference
Wooldridge AR(1)	p<0.001	p=0.0019	Cluster by region; sensitivity checks
Pesaran CD	−2.058 (p=0.040)	−2.354 (p=0.019)	Driscoll–Kraay sensitivity

3.2. Core fixed-effects estimates

The core estimates support all four primary hypotheses after few-cluster wild-bootstrap inference and Holm adjustment. In the domestic model, lagged capital intensity is positively related to real sales per active small-business entity. The coefficient is 0.2249 (cluster SE=0.0837; wild p=0.0016; Holm-adjusted p=0.0064). Because both variables are in logarithms, a 1% within-region increase in lagged real fixed assets per active business is associated with approximately 0.225% higher real sales per active business, conditional on region and year fixed effects. A 10% increase therefore corresponds to roughly 2.25% higher real sales, as a local semi-elastic approximation. The sign remains positive in every LOO re-estimation, with coefficients from 0.1804 to 0.2738.

Overdue-payables pressure enters with the expected negative sign (β=−0.0675; cluster SE=0.0277; wild p=0.0376; Holm p=0.0492) and remains negative in all 14 LOO samples. Because the regressor is ln(1+overdue-payables share), direct percentage-point interpretation is less transparent [10]. Using the within-panel standardized magnitude, a one two-way-within standard-deviation increase in overdue-payables pressure is associated with about 1.85% lower sales per active business. The result is statistically credible in the core model, although the denominator-safe robustness tests below show that it is less stable than the capital relationship.

Net entry has a coefficient of −0.00664 (cluster SE=0.00196; wild p=0.0026), implying that a one-percentage-point increase in the prior-year net-entry rate is associated with about 0.66% lower sales per active firm, holding fixed persistent regional differences and common year effects. The sign is negative in every LOO re-estimation. This coefficient is not entered into the Holm family because it is a secondary business-environment control rather than a directional primary hypothesis. Most importantly, it is not interpreted as evidence that competition or entrepreneurship reduces competitiveness. A rising entry rate can increase the denominator with young or initially small firms, create temporary market dilution, or reflect registry and formalization dynamics [11]. The estimate is therefore evidence of a market-churn channel, not a policy recommendation to restrict entry.

In the export model, innovation-enabling human capital has a positive coefficient of 0.9704 (cluster SE=0.2637; wild p=0.0108; Holm p=0.0324). Its LOO range is 0.8294–1.0806, so no single region changes the sign. SME employment capacity is also positive (β=2.6171; cluster SE=0.9051; wild p=0.0246; Holm p=0.0492), with a positive LOO range of 2.2210–3.4940. Because the employment elasticity is large and employment itself is an outcome of regional economic development, it should be read as a conditional scale association rather than a

causal claim that increasing employment mechanically generates exports. Standardized within-region magnitudes are approximately +8.24% for human capital and +14.71% for SME employment.

Table 3. Core two-way fixed-effects estimates and primary inference

Model	Regressor	Coef.	Cluster SE	Cluster p	Wild p	Holm p	LOO coefficient range
Domestic	Capital intensity, t−1	0.2249	0.0837	0.0186	0.0016	0.0064	0.1804 to 0.2738
Domestic	Overdue-payables pressure, t−1	−0.0675	0.0277	0.0301	0.0376	0.0492	−0.0803 to −0.0531
Domestic	Net entry rate, t−1	−0.00664	0.00196	0.0049	0.0026	—	−0.00833 to −0.00590
Export	Human capital, t−1	0.9704	0.2637	0.0028	0.0108	0.0324	0.8294 to 1.0806
Export	SME employment, t−1	2.6171	0.9051	0.0126	0.0246	0.0492	2.2210 to 3.4940

Notes. Both models include region and year fixed effects. Domestic model: N=140, within R^2=0.8811; fixed-effects-only within R^2=0.8279. Export model: N=168, within R^2=0.6335; fixed-effects-only within R^2=0.5231. Primary inference uses 9,999 null-imposed wild cluster bootstrap-t replications. Holm adjustment applies to the four primary hypotheses; net entry is a secondary control.

3.3. Model fit and economic significance

The domestic model's within R^2 is 0.8811, compared with 0.8279 for a specification containing only region and year effects [12]. The economic regressors therefore add 0.0532 to the within-region explanatory share. For the export equation, the within R^2 increases from 0.5231 with fixed effects alone to 0.6335 with the economic regressors, an increment of 0.1104. These increments are more informative than the overall R^2 in a fixed-effects context because the identification question is how much additional within-region variation is explained beyond persistent territorial differences and common annual shocks.

Economic magnitudes also differ across channels. The standardized domestic associations are +3.38% for capital intensity, −1.85% for overdue-payables pressure and −3.14% for net entry. On the export side, the standardized within-region associations are +8.24% for human capital and +14.71% for SME employment. The comparison should not be read as a ranking of policy returns because the variables are not randomized treatments. It does, however, show that export performance is strongly connected to changes in regional capability and scale, whereas the most stable domestic correlate is productive capital intensity [13].

3.4. Robustness and identification limits

The domestic robustness pattern is asymmetric. Driscoll–Kraay inference confirms the signs and precision of capital, overdue-payables pressure and net entry. When the common per-firm denominator is removed and total real sales are modeled with the active-firm scale included separately, the capital coefficient remains positive and significant under the wild bootstrap (β=0.1494; p=0.0136), but the overdue-payables coefficient attenuates (β=−0.0357; p=0.1689). A second alternative based on total fixed assets yields a positive capital coefficient of 0.1689 (wild p=0.0335) while the debt coefficient again loses precision (−0.0280; p=0.2232). Capital is therefore the most robust domestic determinant; the liquidity result is meaningful in the intensive core model but should be treated as less invariant to denominator choice.

First differences provide an important boundary. Annual changes in domestic performance are not significantly related to annual changes in capital, debt pressure or net entry at conventional levels [14]. This indicates that the main domestic results are medium-run level associations rather than short-run causal responses. The result is substantively plausible: fixed assets, balance-sheet repair and market structure may take more than one year to translate into sales, but the

data cannot distinguish adjustment lags cleanly enough to identify causal timing.

The export results are also differentiated. Driscoll–Kraay inference supports both human capital and SME employment. SME employment remains statistically precise when the export equation is estimated only through 2022 and in first differences. Human capital is more period-sensitive: it remains strongly associated with exports per worker and with SME export share, but loses precision in the 2013–2022 restriction and in first differences [15]. The appropriate conclusion is therefore not that human capital has a universal short-run causal effect, but that it is a stable full-period correlate of export capability whose precision depends on the time window and outcome definition.

Table 4. Selected robustness, alternative-outcome and dynamic checks

Check	Outcome/model	Key estimate(s)	Inference	N	Interpretation
Driscoll–Kraay	Domestic sales per firm	Capital 0.2249; debt −0.0675; entry −0.00664	p<0.001; p=0.045; p<0.001	140	Core signs survive dependence-robust sensitivity
Denominator-safe	Total real sales + active-firm scale	Capital 0.1494; debt −0.0357; scale 0.2808	wild p=0.0136; 0.1689; 0.3706	126	Capital survives; debt attenuates
Alternative capital scale	Total real sales + total fixed assets	Capital 0.1689; debt −0.0280	wild p=0.0335; 0.2232	126	Capital not driven by per-firm scaling
First differences	Δ domestic sales per firm	Capital 0.0517; debt −0.0077; entry −0.0030	cluster p=0.427; 0.678; 0.169	126	No short-run causal interpretation
Driscoll–Kraay	Exports	Human 0.9704; employment 2.6171	p=0.002; p=0.003	168	Core export signs survive dependence sensitivity
Period sensitivity	Exports, 2013–2022	Human 1.0191; employment 2.8360	wild p=0.1313; 0.0252	140	Human capital period-sensitive; employment stable
Alternative outcome	Exports per worker	Human 1.0698; industry/worker −0.1481; freight/worker −0.9558	wild p=0.0008; 0.6774; 0.4201	168	Human capital survives intensive export outcome
First differences	Δ exports	Human 0.2563; employment 3.1002	cluster p=0.420; 0.002	154	Employment survives short-run differencing
Institutional exposure	Policy-exposure diagnostics	M1 lag 0.0482; lead 0.0435; trend-adjusted −0.0069; M2 lag 0.0412	wild p=0.0409; 0.0418; 0.8579; 0.2153	112 – 154	Placebo/trend evidence rejects causal institutional interpretation

3.5. Business-environment and institutional evidence

The business-environment results require the strongest interpretive discipline. Net entry is a statistically stable negative correlate of sales per active firm, but the coefficient mixes competition, formalization, business churning and denominator composition. It cannot identify the welfare effect of "more competition." The institutional-policy block is even clearer about the limits of causal inference. A lagged domestic policy-exposure measure is significant in a simple fixed-effects specification, but a future-policy placebo lead is also significant, and the coefficient disappears after allowing baseline-specific trends [16]. The export policy-exposure coefficient is not significant under wild-bootstrap inference. These tests indicate differential pre-trends and/or policy targeting, so the institutional coefficients are excluded from causal claims.

This non-result is economically informative. In transition and reform settings, government support is often targeted toward regions or firms that are already weaker. A negative or positive policy-exposure coefficient can therefore reflect selection rather than program effectiveness. The evidence supports using business-environment variables as contextual or diagnostic indicators unless implementation intensity, eligibility rules or quasi-experimental variation can be observed. It does not justify concluding that institutional reform is ineffective [17].

4. Discussion

4.1. Finance and domestic competitiveness

The strongest domestic finding is the positive association between capital intensity and real sales per active business. This result is consistent with the view that SMEs need a minimum stock of productive assets to adopt technology, expand capacity and meet market-quality requirements. It also complements evidence that short-term financial constraints can suppress investment through the working-capital channel and that the severity of financing constraints varies across space [18]. The robustness exercises strengthen this interpretation: capital remains positive when the common per-firm denominator is removed and when total fixed assets replace per-firm capital. The finding therefore appears less likely to be a mechanical artifact of ratio construction.

Overdue-payables pressure is negatively associated with sales per active firm in the core specification, supporting a liquidity-resilience mechanism. Yet its loss of statistical precision in denominator-safe models is a substantive warning. The result should motivate further research using direct regional or firm-level measures of credit constraints, loan rejection, interest costs and working-capital shortages rather than a claim that a particular percentage reduction in arrears would mechanically raise sales. This cautious reading aligns with recent research showing that financial constraints and borrower discouragement interact with innovation and investment decisions [19].

4.2. Innovation-enabling capability and external competitiveness

Human-capital intensity is positively associated with export performance and survives alternative intensive export outcomes. The result fits dynamic-capabilities arguments: export participation requires market intelligence, quality compliance, digital communication, contract management and the ability to adapt products or processes to external demand [20]. Recent SME research likewise emphasizes that digitalization produces stronger performance outcomes when firms possess complementary capabilities rather than when technology is treated as a stand-alone input [21].

At the same time, the article deliberately avoids equating human capital with observed innovation. The regional graduate-intensity variable captures the local supply of advanced skills, not whether a particular SME introduced a new product, adopted a process innovation, invested in R&D or registered intellectual property. The finding is therefore best described as evidence on innovation-enabling capability. This distinction matters because direct innovation-output data would be needed to test mediation from finance through innovation to competitiveness. Firm-level evidence from developing countries suggests such channels are plausible, but the present panel does not identify them directly.

4.3. Business environment: entry, competition and institutional reform

The negative net-entry coefficient is initially counterintuitive only if entry is assumed to be a monotonic measure of business-environment quality. Entry can be beneficial for competition and long-run reallocation while simultaneously lowering average sales per active firm in the short or medium run when new firms are small. In addition, formalization drives can increase the registered-firm denominator faster than aggregate sales. The result is therefore compatible with an entrepreneurial-ecosystem perspective in which the quality, capability and survival of entrants matter alongside entry quantity. Evidence that informal competition can affect formal SME job creation further cautions against reading formal entry as a complete measure of competitive pressure [22].

The failed institutional placebo and trend checks are equally important. Uzbekistan has experienced substantial regulatory and support reforms, and current policy reviews continue to emphasize a better business climate, skills, finance and stronger private-sector competition [23]. However, the present regional panel cannot identify the causal effect of these reforms because policy

exposure is partly endogenous to regional conditions [24]. A publication-quality conclusion must therefore separate two statements: reforms may be economically important, while this particular observational design does not provide credible causal estimates of their effect. Conflating these statements would overstate the evidence.

4.4. Policy implications

The results support a differentiated rather than uniform SME-support architecture. First, capital constraints should be addressed through instruments that expand productive capacity rather than only short-term credit volumes: investment lending, leasing, partial credit guarantees tied to productive assets, and technology-upgrading facilities are natural candidates. Because the estimates are associations, program design should use eligibility and monitoring rules that allow subsequent causal evaluation.

Second, liquidity resilience deserves separate treatment from capital investment. Overdue liabilities can indicate working-capital stress, weak payment discipline or delayed receivables. Factoring, supply-chain finance, restructuring tools and payment-discipline reforms may therefore complement fixed-investment support [25]. The weaker robustness of the overdue-payables coefficient means that these instruments should be targeted based on direct firm diagnostics rather than on the regional coefficient alone.

Third, export-oriented support should combine human-capital development with the capacity to scale. Relevant instruments include export-management training, technical standards and certification support, digital trade skills, foreign-language and contract capability, and links to logistics and business-service providers. This interpretation is consistent with OECD assessments emphasizing digital skills and private-sector capability building in Uzbekistan [26].

Fourth, policy should not use the number of new firms as a stand-alone success indicator. A region can record rapid entry while average sales per active firm fall temporarily. Monitoring should therefore combine entry with survival, productivity, employment quality, export intensity and innovation outcomes. Similarly, institutional reform should be evaluated with implementation data and credible counterfactual designs where possible. The failure of the policy-exposure placebo tests in this study demonstrates why program evaluation needs information on eligibility, take-up, timing and actual support intensity, not merely national policy dates.

4.5. Limitations and research agenda

Four limitations define the scope of the findings. First, the analysis is regional rather than firm-level, so the coefficients describe changes in the average performance of regional small-business sectors and cannot be transferred mechanically to individual firms. Second, competitiveness is measured through market outcomes—domestic sales intensity and exports—not profitability, survival, product quality or total factor productivity [27]. Third, the innovation dimension relies on enabling-capability proxies because a comparable regional panel of SME R&D and innovation outputs is unavailable. Fourth, fixed effects and lags reduce some forms of omitted heterogeneity and simultaneity but do not solve endogeneity.

Future work should therefore link the regional panel to firm-level data such as the World Bank Enterprise Survey, administrative tax records or harmonized business-support registries where access permits [26]. The highest-value extension would combine direct measures of credit constraints, digital adoption and product/process innovation with longitudinal firm identifiers. A second extension would exploit eligibility thresholds or staggered implementation rules in specific support programs to build quasi-experimental designs. These extensions would allow the mechanisms proposed here—finance, innovation capability and the business environment—to be tested at the firm level rather than inferred from regional aggregates.

5. Conclusion

This article evaluates small-business competitiveness across Uzbekistan through observable market performance rather than a composite index. Using a two-way fixed-effects regional panel and few-cluster robust inference, the study finds that lagged productive-capital intensity is the most stable domestic correlate of real sales per active business. Overdue-payables pressure is negatively associated with domestic performance in the core model, although the relationship weakens under denominator-safe specifications. On the external side, regional human-capital intensity—interpreted as an innovation-enabling capability—and SME employment capacity are positively associated with exports. These relationships remain sign-stable across leave-one-region-out estimations, but human capital is more sensitive than employment to period and dynamic specifications.

The business-environment evidence is deliberately more qualified. Higher net entry is associated with lower average sales per active firm, a pattern consistent with market churn, formalization or dilution by young firms rather than an argument against competition. Institutional policy-exposure coefficients fail placebo and differential-trend checks and are therefore not presented as causal. This distinction is central to the paper's contribution: a statistically interesting coefficient is not automatically a policy effect. The practical implication is a differentiated support strategy. Productive-capital deepening, liquidity resilience, human-capital and innovation-enabling capability, and export-oriented scale should be diagnosed separately and matched with appropriate instruments. Success metrics should move beyond firm counts toward productivity, survival, sales intensity, export outcomes and direct innovation indicators. The results provide a reproducible empirical basis for such targeting while leaving causal program evaluation to designs with stronger treatment and implementation data.

Data Availability Statement. The study uses official regional statistics published by the National Statistics Committee of the Republic of Uzbekistan through SIAT. The source catalog identifies indicator codes and URLs for the core series. The frozen analytical panel, transformation formulas and estimation code should be deposited as supplementary replication materials upon submission, subject to journal file-size rules and any official-data redistribution restrictions.

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Ethics Statement. The study uses aggregated, publicly reported regional economic statistics and does not involve human participants, personal data or experimental interventions. Generative AI Disclosure. AI-assisted tools were used for language and structural support during manuscript preparation. The underlying data, econometric estimates, source verification, interpretation and final scholarly responsibility remain with the authors. The authors should ensure that the final submitted version complies with the journal's current generative-AI policy and accurately reflects the extent of tool use.

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