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ENTREPRENEURIAL DENSITY AND REGIONAL ECONOMIC PERFORMANCE IN A TRANSITION ECONOMY: PANEL EVIDENCE FROM UZBEKISTAN

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Abstract

This paper estimates the association between entrepreneurial density and regional output per capita using a balanced panel of 14 Uzbek regions over 2015–2025 (154 observations). Fixed-effects estimates place the elasticity at 0.245–0.284 and are significant at the 1 per cent level. The between-region relationship is concave, with the marginal effect declining from 1.91 to 1.04 across the observed range, whereas the within-region relationship is convex; a variance decomposition shows that 96 per cent of the variation in output per capita is between regions. The share of small business in regional employment is strongly negatively associated with output per capita ($r = -0.926$), which cautions against its use as a development target.

Keywords: entrepreneurial density, regional economic performance, panel data, fixed effects, diminishing marginal returns, transition economy, Uzbekistan.

JEL classification: L26, O18, R11, C23.

Relevance and research gap. The relationship between entrepreneurial activity and economic development is well established in the international literature, yet it has been documented predominantly across countries. Wennekers et al. [1] report a U-shaped association between nascent entrepreneurship and per capita

income for 36 economies, and Carree et al. [2] obtain a comparable result for 23 OECD countries over 1976–1996. Audretsch and Keilbach [3] show that entrepreneurship can be modelled as a regional rather than an individual attribute, and introduce the notion of entrepreneurship capital. Acs et al. [4] link this regional attribute to the mechanism of knowledge spillovers, while Baumol [5] argues that the stock of entrepreneurial talent is relatively stable across societies and that institutions determine its allocation between productive and unproductive activity. Fritsch and Wyrwich [6] document the long persistence of regional entrepreneurship levels, which implies that regional differences are structural rather than transitory.

Two gaps remain. First, within-country regional evidence for transition economies is scarce; the main exception is the Russian regional literature [7], which finds that the entrepreneurship–growth link is conditioned by institutional quality. Second, the cross-country income range in which the non-linearity has been identified is far wider than the range observed inside a single country. Whether the same functional form survives at the sub-national level, where institutions are largely common and the income spread is an order of magnitude narrower, is therefore an open empirical question rather than a settled result. Uzbekistan offers a useful setting: the number of small business entities rose from 397.1 to 702.6 thousand between 2015 and 2025 while regional output per capita continued to diverge.

Purpose and hypothesis. The paper quantifies the association between entrepreneurial density and regional output per capita in Uzbekistan and tests whether this association is non-linear. Following the theoretical proposition set out in the dissertation, the expected sign pattern is $\beta_1 > 0$ and $\beta_2 < 0$, that is, an increase in density raises output per capita but at a diminishing rate.

Data. The analysis uses a balanced panel of 14 Uzbek regions observed annually over 2015–2025, giving 154 observations. Data are drawn from the National Statistics Committee of Uzbekistan and the Central Bank. All value indicators are expressed in 2025 constant prices; output and value added are deflated by the GDP deflator and fixed capital investment by the investment price index, since the two series diverge substantially over the period. The dependent variable is the log of gross regional product per capita (mean 10.390, standard deviation 0.465). The key regressor is the log of small business entities per 1,000 inhabitants, centred on its sample mean before squaring in order to attenuate the mechanical collinearity between the linear and quadratic terms; in levels the indicator ranges from 8.4 to 45.8 entities per 1,000 inhabitants, with a mean of 16.9. Controls are log investment per capita, the business survival rate, the share of small business in total employment and, in one specification, the unemployment rate. A dummy captures the 2023 administrative revision of the business register, when inactive entities were removed following a cross-check against tax and justice databases. The correlation matrix reports three results worth noting. Entrepreneurial density is strongly and positively correlated with output per capita ($r = 0.791$). The employment share of small business is strongly and negatively correlated with it ($r = -0.926$). The highest correlation among the regressors is between density and the employment share ($r = -0.766$), followed by density and investment ($r = 0.716$); both remain below the level at which multicollinearity is usually considered critical, which the variance inflation factors reported below confirm.

Model and diagnostics. The estimated equation is $\ln Y_{it} = \beta_0 + \beta_1 z_{it} + \beta_2 z_{it}^2 + \beta_3 \ln I_{it} + \beta_4 SR_{it} + \beta_5 ES_{it} + \beta_6 D_{it} + \mu_i + \varepsilon_{it}$, where z is centred log density, SR the survival rate, ES the employment share, D the structural break dummy and μ_i unobserved regional effects. Four specifications are estimated: pooled OLS,

which compares regions with one another, and three fixed-effects models, which exploit within-region variation over time. Standard errors are clustered at the regional level.

The diagnostics are as follows. An F-test rejects the pooled model in favour of regional effects ($F(13; 135) = 24.61$, $p < 0.001$). The Hausman test does not reject random effects ($\chi^2(6) = 5.58$, $p = 0.471$); fixed effects are nevertheless retained as the conservative choice, since they remain consistent whether or not the regional effects are correlated with the regressors. Variance inflation factors lie between 1.3 and 4.3. A Wooldridge test detects first-order serial correlation ($\rho = 0.635$, $t = 10.25$, $p < 0.001$), which is what justifies clustering. The Breusch–Pagan statistic ($LM = 10.91$, $p = 0.091$) does not reject homoskedasticity at the 5 per cent level, and the Jarque–Bera test rejects normality of the residuals ($JB = 118.29$, $p < 0.001$), so the coefficient estimates are read as consistent while inference is treated as asymptotic. A panel ADF test does not reject a unit root ($\bar{t} = -1.383$), which is the reason a first-difference specification is reported among the robustness checks.

Results. In the three fixed-effects specifications the coefficient on entrepreneurial density is positive and significant at the 1 per cent level, ranging from 0.245 (standard error 0.072) to 0.284 (0.093). Evaluated at the sample mean, a 10 per cent increase in density is associated with a 2.5–2.8 per cent increase in output per capita. The coefficient on investment is positive and significant in all fixed-effects models (0.062–0.071), supporting the interpretation that access to resources conditions the realisation of entrepreneurial potential. The within R^2 lies between 0.700 and 0.716.

The quadratic term yields a result that requires careful statement. In the pooled specification the coefficient is negative (−0.256, standard error 0.129) and

significant at the 10 per cent level, indicating concavity in the cross-section. However, the implied turning point on the centred log scale is 3.08, whereas observed values range only from −0.644 to 1.050. The turning point therefore lies well outside the sample and the association remains positive throughout the observed range. What the data support is not the descending branch of an inverted U, but diminishing marginal returns: the marginal effect falls from 1.91 at the lower end of the sample to 1.04 at the upper end. In the fixed-effects specifications the quadratic term is positive (0.260 to 0.347) and significant, that is, convex rather than concave. A variance decomposition clarifies the divergence: 96 per cent of the variation in output per capita is between regions, leaving the fixed-effects estimator to work with the remaining 4 per cent. The two coefficients thus describe different phenomena — a cross-sectional comparison of regions and a within-region time path — and should not be read as contradicting one another.

A separate result concerns the share of small business in regional employment. Its correlation with output per capita is strongly negative ($r = -0.926$) and the pooled coefficient is −0.042 ($p < 0.001$), implying that a region with a one percentage point higher share has output per capita about four per cent lower. The share is highest in Andijan (81.9 per cent), Samarkand (81.7) and Namangan (81.3), and lowest in Tashkent city (49.8) and Navoi (54.8). In the fixed-effects models the coefficient keeps its sign but is not statistically significant. The indicator therefore reflects the absence of large high-productivity sectors rather than entrepreneurial capability, and is not a valid development benchmark — a point of direct relevance for regional programmes in which it is currently used as a target.

Three robustness checks were performed. Restricting the population to registered legal entities, which excludes individual entrepreneurs whose early-period data

are partly estimated, leaves the result unchanged in sign and significance (0.137, p = 0.004). In first differences the coefficient remains positive but loses significance (0.054, p = 0.107), which is consistent with a long-run rather than a short-run relationship and with the unit-root result reported above. Adding year effects absorbs most of the remaining variation, as expected with eleven time periods and a common macroeconomic environment.

Conclusions and policy implications. Three conclusions follow. First, entrepreneurial density is positively associated with regional output per capita in Uzbekistan, and the association is robust in sign and significance across specifications. Second, in the cross-section the marginal contribution of an additional entity declines as density rises, which provides an efficiency argument for directing support measures towards regions with lower coverage rather than distributing them uniformly; because the result is between-region, it applies to the allocation of resources across regions and not to the time path of any single region. Third, share-based indicators are not valid measures of entrepreneurial capability; a value added per entity indicator is proposed instead, since it is computable from existing statistics and cannot be improved by simply registering more entities. These findings are consistent with the institutional reading of entrepreneurship [5; 8], in which the composition of entrepreneurial activity matters more than its volume.

The contribution of the paper is threefold. It provides within-country regional evidence for a transition economy, a setting in which the entrepreneurship–development relationship has rarely been estimated. It shows that the functional form identified in cross-country work does not carry over unchanged to the sub-national level: within the observed range the relationship is monotonic, and what the data identify is a declining marginal effect rather than a turning point. And it

demonstrates that the between-region and within-region dimensions of the same panel yield opposite curvature, which is a methodological caution for the applied literature: reporting a single quadratic coefficient without stating which dimension it comes from can be misleading.

Limitations. Causality is not established: reverse causation, whereby higher income supports entry, is plausible, and no instrument is available at the regional level for this period. Fourteen clusters is below the number usually recommended for cluster-robust inference, so significance levels should be read with caution. The 2023 revision of the business register creates a structural break that is controlled for by a dummy but cannot be fully removed. Extending the analysis to district-level data would raise the number of clusters and is the natural direction for further work.

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